PALMER

Research and Students' Apparatus

for

Physiology, Pharmacology, Psychology,
Bacteriology, Phonetics, Botany,
etc.,

Manufactured by

C. F. PALMER (London) LTD.

Myographic Works, 63a, Effra Road,
Brixton, London, S.W.2,
ENGLAND.

1934 EDITION

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1934 CATALOGUE.

IN presenting this, our latest Catalogue, the loose-leaf system has been abandoned in favour of the bound volume, but Supplementary Lists or Leaflets will be prepared and sent out as new pieces of apparatus are produced.

The rough classification of instruments into groups is retained, and to each instrument has been assigned a group letter and number to facilitate ordering, especially for our customers abroad who, by making use of the A.B.C. Code, 5th Edition, will be able to shorten a Cablegram very considerably.

ALL apparatus shown, with very few exceptions, is manufactured by us at these Works. We are glad of criticism, and welcome suggestions for improvements, which we are always pleased to make. Designing and making new Instruments for research work has long been our speciality.

Instruments bearing our name are guaranteed as to material and workmanship. Should anything prove unsatisfactory we will do our utmost to remedy defects free of cost, charging only transport and such-like expenses, if any.

We are at all times pleased to oblige our clients abroad by procuring apparatus or materials of any kind and to ship same with our goods.

ORDERS.

To avoid unnecessary delay and possibility of error, will customers kindly quote the Section and Number shown against each item in this list.

If any modification of the standard instrument is required, a rough sketch with full details will prevent any misunderstanding.

Where electrical apparatus or appliances are ordered please give full particulars of the electric supply ; if alternating current, it is essential to give the number of cycles per second.

PACKING.

Every care is taken in packing, but we cannot hold ourselves responsible for loss or damage in transit. Claims for breakage should be made at once to the Carriers.

Cases and Packing charged extra, full price being allowed if returned in good condition, carriage paid, within thirty days.

DELIVERY.

Unless we are otherwise instructed, small packages within the various limits of weight will be sent per parcel post, large packages for Overseas orders will be despatched, carriage and insurance forward, through Messrs. Sutton & Co., Ltd., 22, Golden Lane, London, E.C.1, who attend to our transport business.

PAYMENT.

Prices of apparatus shown are nett prices at these Works and payment is expected within thirty days of receipt of goods.

Remittances from Overseas customers should be made in Sterling, by Cheque drawn on a London Bank or by Money Order.

Please cross all cheques " Barclays Bank Ltd., South Brixton Branch."

ENGRAVING APPARATUS.

We are prepared to engrave new apparatus, when possible, with name of Department, etc., if requested at time of ordering.

Name plates also can be supplied, to fix to existing apparatus, at small cost.

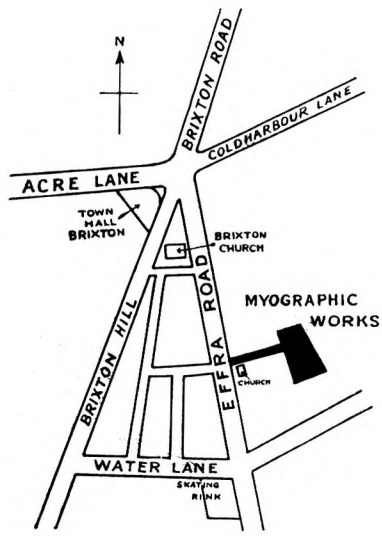
REPAIRING AND RECONDITIONING.

Worn or damaged apparatus can be repaired or reconditioned quickly and at reasonable charges.

ELECTROS.

We are at all times pleased to loan Electros of any apparatus shown in this catalogue to Authors for illustrations in text-books and papers which they are publishing.

HOW TO REACH US FROM THE CITY OR WEST-END.



The following public vehicles stop within a few yards of our Works.

No. 3 Bus. From Camden Town, Euston Road, Oxford Circus, Piccadilly, and Charing Cross.

No. 33 Tram. From "The Angel," Holborn, Embankment.

No. 78 Tram. From Victoria, Vauxhall, Stockwell.

Underground Trains from all parts of London run to Stockwell, from there by **No. 78 Tram.**

Buses Nos. 35, 37, 45, 59, 133, 134, and Trams Nos. 10, 16, 18, 20, 24 stop at the Town Hall, Brixton, which is but a few minutes walk from the Works, as shown on the accompanying map.

SECTION

A

RECORDING CYLINDERS

Kymographs for Long Papers

Recording Drums

Electric do.

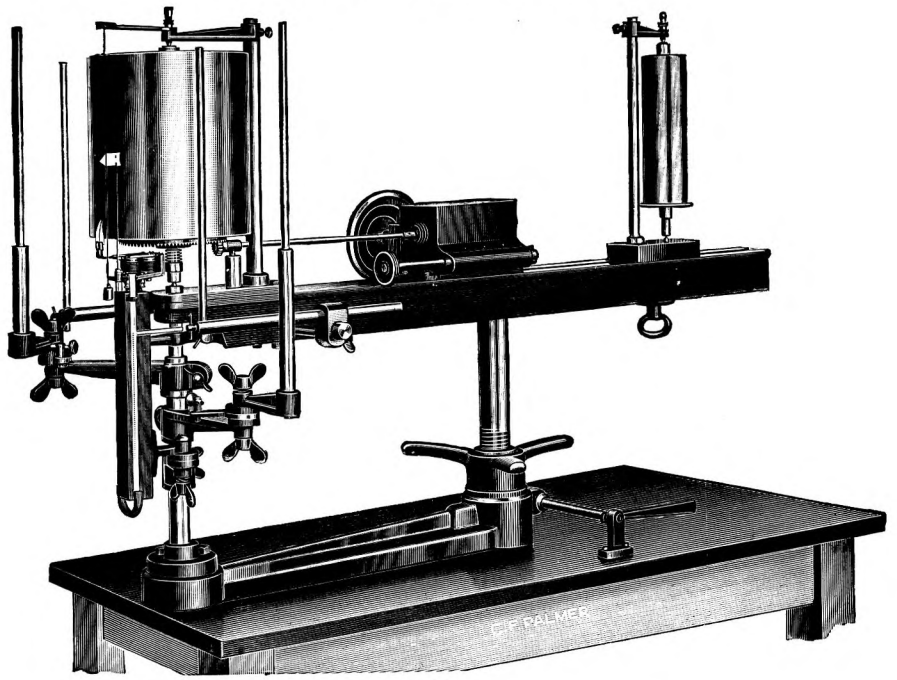
Clockwork do.

Smoking, Varnishing & other accessories

Glazed Papers

THE BRODIE-STARLING KYMOGRAPH

FOR SMOKED PAPER.



A1.

THIS Kymograph is a great advance upon the older instrument made for the late Professor Brodie many years ago, although in general outline it is similar. Many improvements have been embodied, the most important being the new three-speed driving gear, which was designed to meet the requirements of the late Professor Starling, and carried out under his personal advice. There are three speeds, having ratios of 1, 10 and 100, or 1, 5 and 25, see notes on speed variation A2. (Intermediate speeds can be obtained by altering the band on the cone driving pulley).

The recording drum is 9″ (228 mm.) diameter by 10″ (254 mm.) high, and will take papers from 6′ 3″ (190 cm.) to 9′ 4″ (284 cm.). The general plan can be seen from the above illustration. It is mounted on a substantial bed of cast-iron, supported centrally by a large steel screw of 1 cm. pitch, by means of which it is raised or lowered. The nut is divided to read to 0.5 mm. The small drum slides along the bed, and can be clamped at any point.

The starting and stopping is by simply turning the small wheel seen in the illustration (now fitted on the other side) projecting out of the gear box towards the large drum. This wheel has three positions, indicated by the letters S. M. F. (slow, medium and fast), and may be turned in either direction, thereby jumping from any one speed to either of the others. There are three " off " or " stop " positions between the three letters. The recording drum is driven from the gear box by a positive drive, consisting of a shaft and pinion driving a crown wheel, thereby doing away with all string bands, etc. It can at any time be turned by hand in either direction.

Concentric with the recording drum and fixed to the under side of the bed is a guide rod, sliding into a hollow pillar fixed to the table ; thus the rise and fall of the drum is directed and kept central over the pillar which carries the arms ; to one of these the manometer, with three-way glass cock, is fitted, while two others are provided for apparatus.

The arms are jointed and provided with long vertical rods of Stainless Steel, ⅜″ diameter (or other size if preferred). The joint in these arms serves the following purposes: When bent it brings the rod nearer the drum, and so is adjustable for various lengths of recording levers; the joint is provided with a stop screw fixed to the inner portion of each arm; this also serves as a fine adjustment, and ensures the return of the outer arm to exactly the same position after it has been rotated away from the drum for the purpose of putting on a new paper. As the arms rotate round the pillar, and consequently round the axis of the recording drum, the writing points can be readily brought vertically over one another. When necessary, the Kymograph may be raised so that the guide rod under the large drum is clear of the pillar; and in this position the Kymograph can be swung round and the recording drum brought directly over the operating table. There are two vertical adjustable rods for apparatus which move with the recording drum and are supported from arms fixed to the bed. These rods are held by a new form of " X " block, which, while permitting full adjustment, does not allow the rods to fall over when the single clamping nut is loosened.

A double time-marker or signal is fitted, which will be seen conveniently placed under the large drum.

The whole instrument is mounted on a very strong pitch-pine table, with teak top 51″ x 24″, having a large drawer fitted underneath. The table is mounted on wheels, and handles are provided so that the Kymograph can be easily moved.

SPEED VARIATION.

Some find that the great acceleration in speed of 1 x 10 x 10 as designed for the late Prof. Starling is too great for their work. It has therefore been decided to fit a similar gear box, but having speeds of 1 x 5 x 5 or an acceleration in speed from the slowest to the fastest of 1 to 25 instead of 1 to 100.

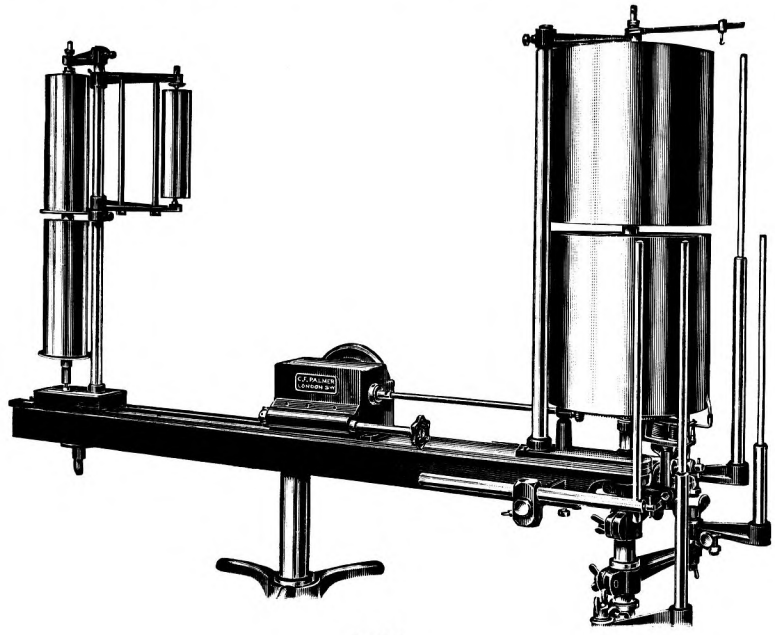
This gear will however not be fitted unless specially asked for—mention A2.

PRICE.

		£	s.	d.
The Complete Kymograph, with gear box 1, 10 and 100, Double Time-marker, Mercury Manometer, separate Smoking and Varnishing Drums and Smoking Burner (*see* note on speed variation below) **A1**		110	0	0
(Approximate weights: nett, 350-lbs.; gross, 600-lbs. Shipping dimensions: 4′ 9″ x 2′ 8″ x 3′).				
The Kymograph with gear box 1, 5 and 25, complete as above **A2**		110	0	0
The Kymograph as A1 or A2, but without Smoking and Varnishing outfit **A3**		100	0	0
(Approximate weights: nett, 308-lbs.; gross, 575-lbs. Shipping dimensions: 4′ 9″ x 2′ 8″ x 3′).				
The Kymograph as A1 or A2, but without table and Smoking and Varnishing outfit .. **A4**		90	0	0
(Approximate weight 188-lbs. Shipping dimensions: 4′ 5″ x 2′ 4″ x 2′ 1″).				
The Kymograph as A1 or A2, with Smoking and Varnishing outfit, but without table. **A5**		100	0	0
(Approximate weights: nett, 225-lbs.; gross, 440-lbs. Shipping dimensions: 5′ 4″ x 2′ 4″ x 2′ 1″).				
The Smoking and Varnishing Drums only **A290**		10	10	0
Smoking Burner only **A292**		2	2	0

For suitable driving gear, see Section G.

DOUBLE PAPER BRODIE-STARLING KYMOGRAPH.



A1X.

THIS modification of the Standard Instrument was designed by Prof. I. de Burgh Daly, and is described in the " Journal of Physiology " (Vol. 69, No. 4, June, 1930, page 34).

The purpose of the arrangement is of course to provide a wide surface so that a number of writing levers can be accommodated without the tracings overlapping.

Two full size 10″ papers can be used, the lower paper being cut about 2″ shorter than the upper paper ; the correct adjustment of the upper paper is made by moving the small jockey cylinder shown attached to the slide upright.

An extended $\frac{3}{8}$″ diameter upright is fixed to the main column to carry the writing levers, etc., to the upper paper.

Existing Brodie-Starling Kymographs of the three-speed gear box type can be altered, it being only necessary to return to us the Large Cylinder with its base plate and upright, and the complete Sliding Cylinder assembly.

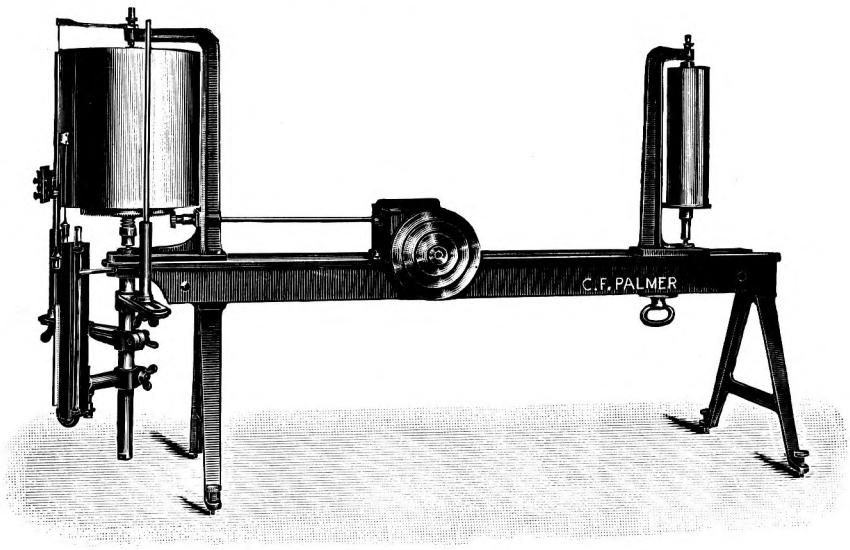
		£	s.	d.
PRICE.	If specified when ordering Kymographs A1, A2, A3, A4 or A5 .. extra, **(Add the letter X after Kymograph number).**	12	10	0
,,	of complete alteration to existing Brodie-Starling Kymographs, provided the parts mentioned above are returned to these Works	15	0	0

SPECIAL NOTE.

The papers are smoked and afterwards replaced for varnishing on a separate pair of drums (see A290, A292, A265 and A295. This transfer is easily accomplished, and has the advantage of preventing the recording drums becoming dirty from soot and varnish. For this reason the late Professor Brodie was very adverse to having the paper smoked and varnished on the same drum as those used for recording. It has therefore been decided not to recommend such a Kymograph with lift-off frame and drums, although one similar to either the Brodie-Starling Kymograph or the " Demonstration " Kymograph could be easily constructed.

THE PALMER
"DEMONSTRATION" KYMOGRAPH.

ORIGINAL MODEL.



A13.

THE Kymograph shown in the above illustration, although possessing many of the features of the original Brodie Kymograph, is not intended to supersede the Brodie-Starling Kymograph, but it is thought that it will be very useful for demonstrations and for practical work done by advanced students.

As shown in the illustration, this Kymograph is not supplied with a table (unless specially ordered) or the large lifting screw, but is intended to stand on the laboratory table. A two-speed gear box is fitted, having a ratio of 1 to 30, or 1 to 10 (optional, please indicate which, when ordering) driving the large drum through a crown wheel and pinion. The arms to carry the recording apparatus are of simple construction ; they rotate round the axis of the large drum, and have slots in which the uprights slide, the latter are of Stainless Steel $\frac{3}{8}$" diam.; other sizes can be fitted, however, if required. The drums are of the same size as in the more complete instrument and take the same length of paper.

The double time-marker or signal is now fitted below the large cylinder and not as shown in illustration.

			£ s. d.
PRICE.	The "Demonstration" Kymograph with gear box 1 to 30 or 1 to 10, Double Time-marker, and Mercury Manometer .. (Nett weight 94-lbs. Shipping dimensions 4' 6" x 1' 8" x 1' 6").	**A13**	55 0 0
,,	The Kymograph, as above, but with suitable pitch pine and teak top table, as supplied with the Brodie-Starling Kymograph..	**A14**	65 0 0

This Kymograph can also be fitted with a three-speed gear, having ratios of 1, 5 and 25 or 1, 10 and 100 as on the Brodie-Starling Kymograph, together with adjustable uprights on both arms to carry the recording tambours, etc., for an extra £15.

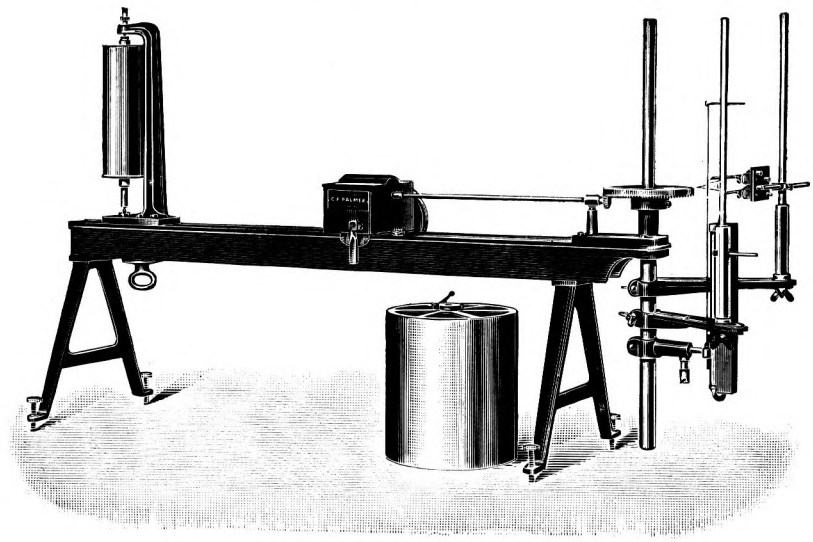
PRICE, together (either ratio) **A15** £70 0 0

(*Please state which gear is required when ordering.*)

SMOKING. The Smoker and Varnisher A290, as supplied with the Brodie-Starling Kymograph, together with the Smoking Burner A292, is suitable for use with the "Demonstration" Kymograph. The Long Paper Varnisher A295 can also be used with this instrument.

THE PALMER
"DEMONSTRATION" KYMOGRAPH.

OPEN SPINDLE TYPE.



A18.

IN using the "Demonstration" Kymograph, a long paper is not always required; provision is, therefore, made in the above instrument for using not only a long paper, but the 9″ diameter cylinder being of the lift-off type can have a paper attached and smoked precisely as is done with the Standard Students' Drum. Moreover, as the spindle is ¾″ diameter, any standard cylinder such as A54 or A55 can be used.

The essential difference in this new Kymograph is the open top spindle, which has been made possible by incorporating ball bearings, thereby making it very rigid and, at the same time, "free running."

Provision is made for the Manometer guide. All other particulars are precisely the same as those describing the Palmer "Demonstration" Kymograph, original model, including the alternative ratios for the two-speed gear box. Please therefore indicate, when ordering, which ratios are required.

		£ s. d.
PRICE, with Mercury Manometer and Double Time-marker	**A18**	56 10 0
Like the original model, this Kymograph can be supplied complete with table, or fitted with a three-speed gear (*see* A14 and A15).		
,, with table	**A19**	66 10 0
,, with three-speed gear (but without table)	**A20**	71 10 0
,, Spare Cylinder, 9″ diameter x 10″ long, taking ordinary 9⅞″ paper	**A56**	4 15 0

SMOKING. The Smoker and Varnisher A290, as supplied with the Brodie-Starling Kymograph, together with the Smoking Burner A292, is suitable for use with the "Demonstration" Kymograph. The Long Paper Varnisher A295 can also be used with this instrument.

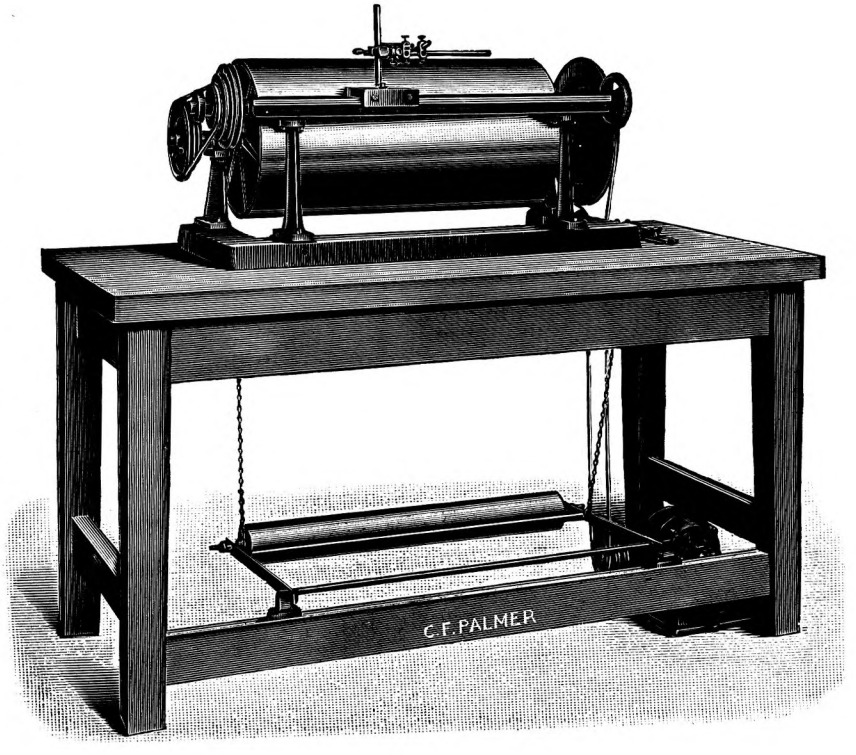
When it is desired to use paper round the large cylinder only, the special Smoking Spindle A251 will be found most convenient.

For suitable driving gear, see Section G.

THE PALMER
24-in. HORIZONTAL KYMOGRAPH.

THE Horizontal Kymograph illustrated here is the outcome of some years of experience, and was made under the direction of Mr. STEPHEN JONES, of the Phonetics Laboratory, University College, London, and is a great advance upon a much older drum made many years ago for the department.

The recording cylinder is 24″ long x 12″ diameter, and has a 12″ three-speed cone wheel, whereby it may be driven from the laboratory shafting or from one of the small geared motors (*see* Section G). This driving cone is provided with a friction clutch by which the drum may be started or stopped without interfering with the source of power.



A24.

In front of the drum is a sliding carriage actuated by a screw, capable of being turned by hand or driven from the main spindle by a pair of speed cones seen to the left of the illustration. The cone on the screw has a simple but effective clutch similar to the main cone for starting the carriage in motion or stopping it at will. This automatic movement of carriage gives a spiral tracing round the drum, the width of which is governed by the three speed cones, three widths being possible and dependable upon the length of paper used.

The ⅜″ rod, for carrying the recording instruments seen in position on the upright, deserves a few words of description. It not only has a fine and quick movement similar in principle to our adjustable "X" Block (D35), and adjustable stands, etc., but, in addition, is held in position upon a double row of balls, which allow it to be screwed up reasonably tight, thereby eliminating looseness and, at the same time, allowing it to move freely.

The whole Kymograph is seen mounted upon a very substantial table with teak top.

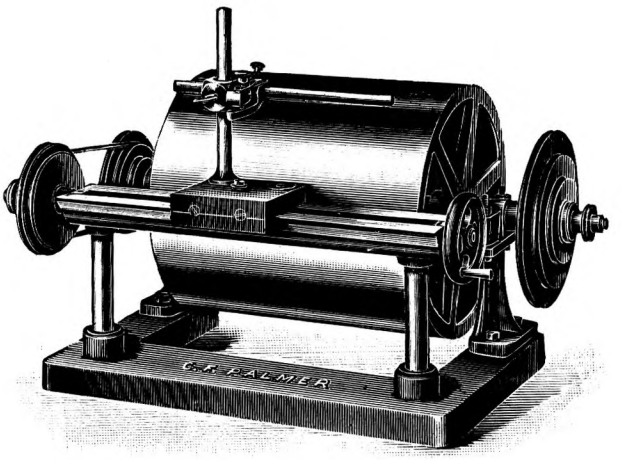
		£	s.	d.
PRICE of Instrument, complete, with table and extension for long paper..	**A24**	78	10	0
,, ,, only, without table or extension	**A25**	63	0	0

Approximate weight of instrument, 140-lbs.; or with table, 265-lbs.

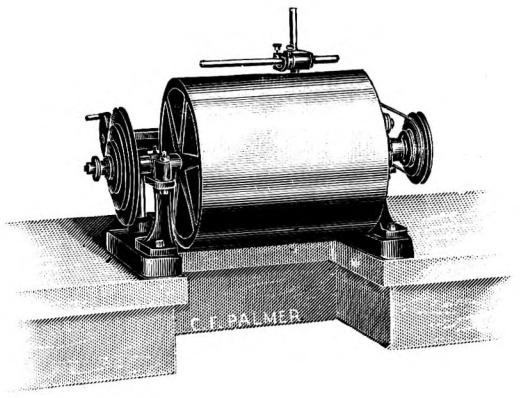
For Motors, Shafting, and other Driving Gear, see Section G.

THE PALMER
10-in. HORIZONTAL KYMOGRAPH.

THIS instrument resembles No. A24, but has a cylinder 10″ long x 9″ diameter, and is usually supplied without a table. Like the larger instrument, the main cone wheel has a friction clutch, whereby the drum can be started and stopped, a similar clutch being fitted to the end of the screw which actuates the sliding carriage—this screw is connected to the main spindle by a pair of three-speed cones to obtain long spiral tracings, as in the larger instrument.

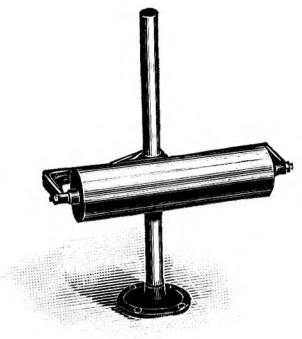


A30.



The illustrations represent the Kymograph viewed from both sides, while the one shows the extension for long paper; this latter is intended to be fixed to the floor, as indicated, care being taken to see that both drums are parallel. Of course, when this extension is used, a piece has to be cut out of the table, unless the special table is ordered.

An extension similar to the one illustrated can be fitted on the legs of the table, if mentioned at time of ordering, for the same price.



A31.

PRICE.

		£ s. d.
Kymograph, with ball bearing adjustable rod to carry tambours, etc. (as supplied with the 24″ Kymograph) . .	**A30**	35 10 0
Extension for long paper . .	**A31**	2 7 6
Suitable pitch pine and teak topped table	**A32**	9 5 0

Approximate weight of instrument, 50-lbs.; or with table, 150-lbs.

For Tambours and other recording instruments, see Sections C and W.

ACCESSORIES FOR
LONG PAPER KYMOGRAPHS.

COUNTERSHAFT PULLEY. 6″ diameter, for use with the Light Bench Kymograph.

This fitment will be found most useful when it is desired to run the paper at a slower speed than that provided by the direct drive from the motor.

The clamp fits in the slotted bed of the instrument, and thus provides ample adjustment for the driving belt.

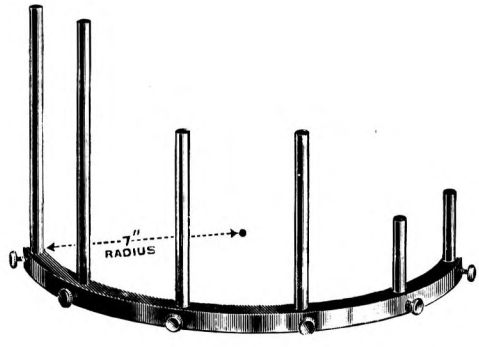
PRICE **A40** £1 1 0

Similar Countershaft Pulley, but with different clamp, for use with the Brodie-Starling Kymograph.

PRICE **A41** £1 7 6

GUIDE PULLEY COUNTERSHAFT. In Laboratories where shafting is not fitted the motor driving the Brodie-Starling Kymograph usually stands on the table, and when the Kymograph is raised or lowered the Motor has to be moved to maintain the correct tension of the driving belt. If, however, this Guide Pulley Countershaft is used, it is only necessary to slide the countershaft along the bed until the correct adjustment is obtained.

PRICE **A42** £1 18 6



A43.

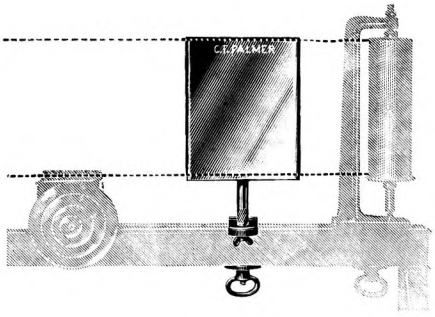
MULTIPLE UPRIGHT. In circumstances where it is necessary to arrange a number of Manometers or writing levers at different heights around the circumference of the large cylinder of the Brodie-Starling or " Demonstration " Kymographs, the upright illustrated will be found most convenient.

Two of the rods are removed and the unit fixed in position on the main Kymograph Uprights, this will be found to hold the assembly rigid enough for most purposes. Supplied complete with six $\frac{3}{8}$″ diameter rods as shown.

PRICE .. .. **A43** Each, £1 5 0

ACCESSORIES FOR
LONG PAPER KYMOGRAPHS.

FLAT WRITING SURFACE ATTACHMENT.



A47.

THIS fitment will be found most convenient when it is desired to arrange the writing levers, etc., on one side of the Brodie-Starling Kymograph or the " Demonstration " Kymographs.

As the illustration shows, the attachment is fitted in the slot of the Kymograph bed and can be easily moved to suit different lengths of paper.

A swivelling movement is also provided to the flat plate itself so that the flat surface can always be made to face the same direction irrespective of its actual position along the Kymograph bed.

We are indebted to Professor I. de Burgh Daly for giving us particulars of this useful accessory.

PRICE. Flat Writing Surface Attachment, complete, as shown in black in illustration **A47** £2 8 0

ELECTRIC MOTORS FOR DRIVING KYMOGRAPHS.

A very suitable machine is our 1/40 H.P. Motor, fitted with worm and worm wheel reduction gear, as shown in Section G, No. 151, and priced at £8 10 0. Whilst this type of Motor is convenient for all general purposes, we are always pleased to supply motors of a design and type to suit the actual requirements of our customers.

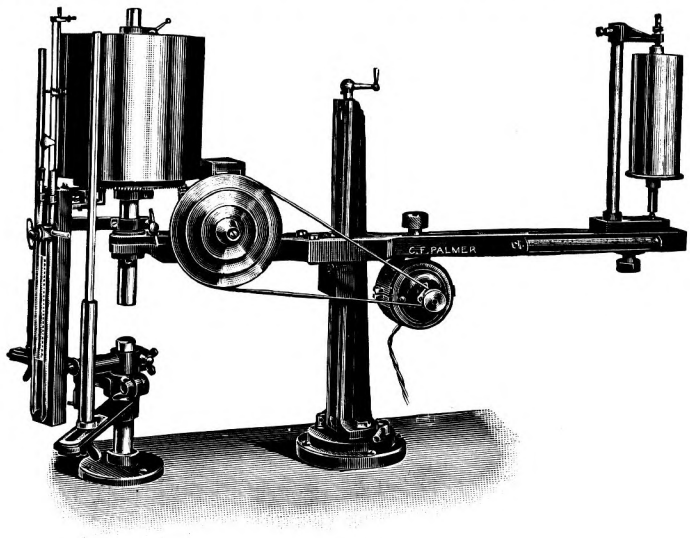
Please give particulars of Electric Supply.

WHITE GLAZED PAPER.

Superfine quality, with special surface for smoking, supplied in Rolls for use with Long Paper Kymographs.

				s.	d.
PRICE.	Per roll.	$5\frac{3}{4}''$ wide x 50-yds.	**A305**	4	0
,,	,,	$7\frac{1}{2}''$,, x 50-yds.	**A307**	6	0
,,	,,	$9\frac{7}{8}''$,, x 50-yds.	**A306**	7	6
,,	,,	22″ ,, x 12-yds.	**A308**	4	6

LIGHT BENCH KYMOGRAPH.



A36.

THE outstanding feature of this instrument is that it can be raised or lowered a distance of 8″ without the necessity of providing a special table. It can, in fact, be screwed to any convenient bench or table, and if fitted to suitable wooden base-board can be carried from place to place with little trouble. A clamping base plate is fitted so that the large cylinder can be swung over the operating table if required.

Another feature is the self-contained electric driving gear, it only being necessary to plug into the nearest electric supply point.

The Kymograph will take a paper 7½″ (19 cm.) wide and up to 7′ (210 cm.) long.

The driving motor is of the universal type, mounted in rubber, and as it is fitted with suitable governor and series resistance can be used on A.C. or D.C. supplies. The surface speed of the paper with single-speed gear box and normal setting of resistance is from ·5mm to 5mm. per second. Slower speeds are possible when a countershaft pulley is run between the motor and the gear box. A clutch is fitted to the gear box, and is operated by a lever on the left-hand side of the instrument. Whilst no trouble should be experienced with the leather driving belt, a spare belt is provided and is conveniently housed in the tubular metal container shown clipped to the end of the bed.

The large cylinder, 7½″ diameter, is of the lift-off type, so that when short records are required it is only necessary to place a paper around the cylinder and smoke on an ordinary smoking stand. When it is desired to turn the cylinder backwards or forwards by hand the short lever shown on top of the cylinder should be pressed towards the spindle, and when re-starting should be pressed downwards towards the cylinder.

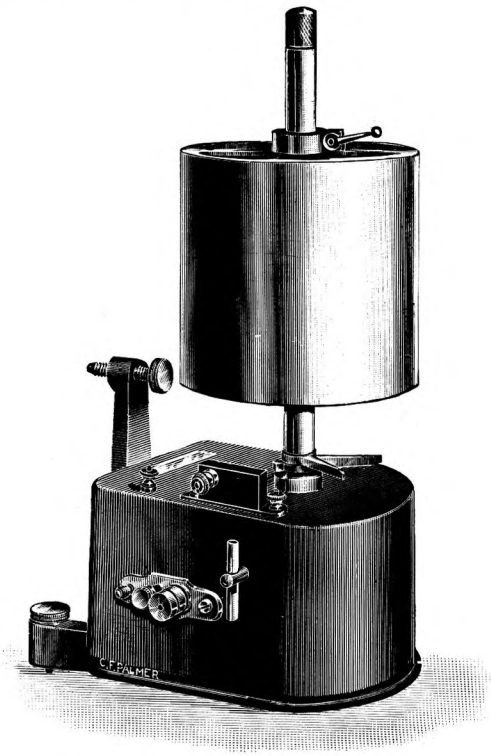
The upright assembly being a complete unit can be fixed in any convenient position on the bench or table, and consists of two fully adjustable stainless steel uprights, ⅜″ diameter, and an adjustable arm to take a manometer.

A double time-marker and also mercury manometer can be supplied if required.

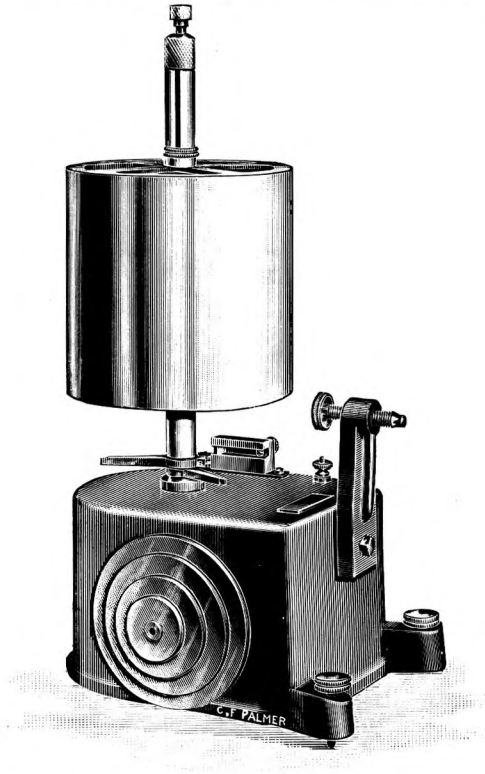
		£	s.	d.
PRICE of Kymograph	**A35**	36	0	0
,, ,, complete with Manometer and Time-marker, as illustrated	**A36**	40	0	0

Please give particulars of Electric Supply.

SHERRINGTON-STARLING RECORDING DRUM.



STANDARD DRUM **A50.**



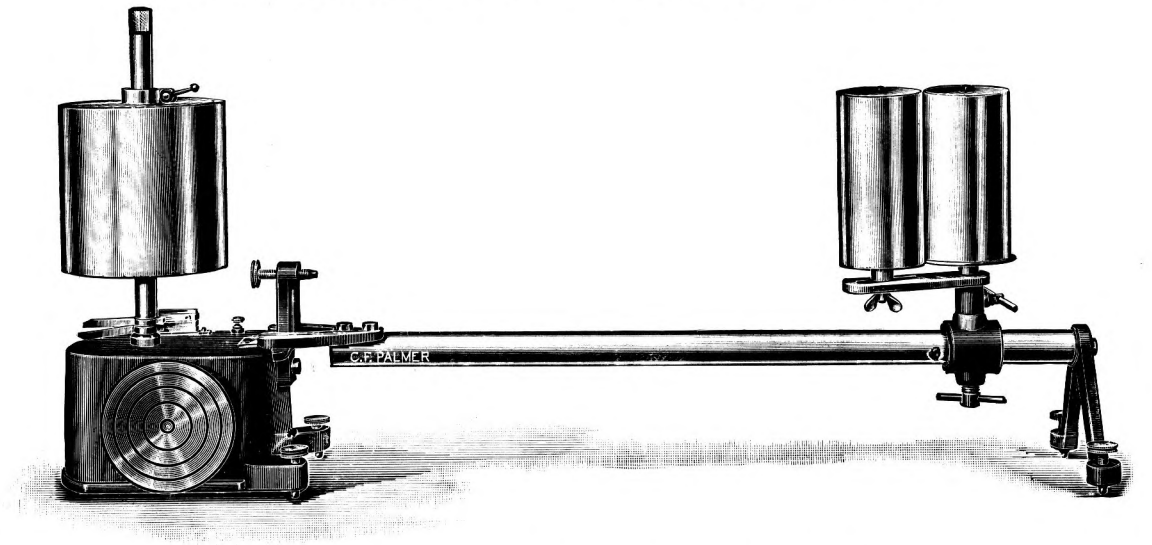
STANDARD DRUM (fitted with Screw-lift) **A52.**

AT the suggestion of Professor Starling, in 1911, the No. 5 Sherrington Drum was largely remodelled by placing all the working parts inside the base, so that they are kept clean and are not liable to injury. Since the above date, many minor improvements have been made. The driving gear for the slow speed consists of a worm and wheel, as in the older pattern ; but for the fast speed a volute gear is used, which runs smoothly and with little friction. Another great improvement, by which this drum may be started or stopped, is the friction clutch, actuated by turning the T-headed knob shown in the left-hand illustration. The driving cone is now of larger diameter than formerly, so that in conjunction with the change speed gear mentioned above, a larger range of speeds may be obtained, varying from 1 to 870 revolutions in a given time, the driving shaft being kept at a constant speed. The standard cylinders are 6″ x 6″ (152 x 152 mm.), but 12″ diameter cylinders can be had. They are lifted up or down the spindles, and locked in position by the lever shown on the top of the standard drum, or a screw-lift can be fitted, if preferred (*see prices*). Electric contact arms are provided, which make contact at any one or two points in the revolution.

The Drum can be used either vertically or horizontally, and has levelling screws for both positions. It may be conveniently smoked when placed horizontally on its own stand, being either driven from the shafting, or turned by hand, in which case the side plate must be put in the neutral (middle groove) position, and the starting T-headed knob to " on " ; or the special smoking stand A250 can be used.

When a longer tracing is required than that obtained by the 12″ cylinder, the extension shown in A57 can be used. This consists of a bar upon which two 6″ x 3″ cylinders slide, taking paper up to two meters in length. The object of the second small cylinder is that it can be used either as a paper tightener or set at a convenient angle and used to form a " flat paper " device, instead of writing on the single cylinder in the usual way.

EXTENSION FOR LONG PAPER.



STANDARD DRUM, with long paper extension, **A57.**

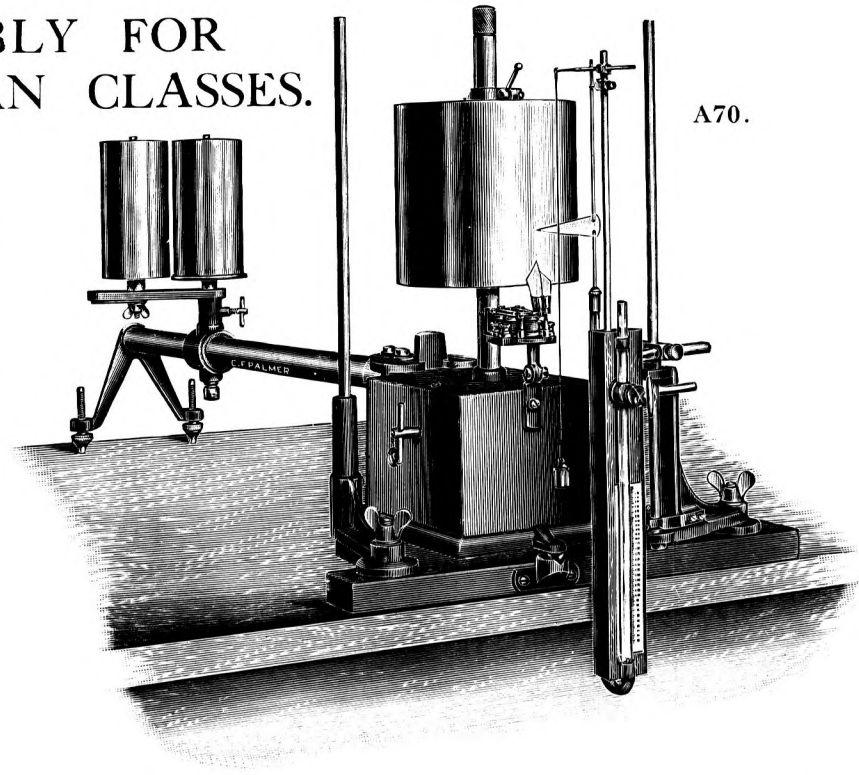
		£ s. d.
Standard Drum, with Cylinder, 6″ diameter x 6″ high	**A50**	10 10 0
,, ,, 12″ ,, x 6″ ,, ...	**A51**	13 10 0
,, screw lift, with Cylinder, 6″ diameter x 6″ high ..	**A52**	11 5 0
,, ,, ,, ,, 12″ ,, x 6″ ,, ..	**A53**	14 5 0
Cylinder only, 6″ diameter x 6″ high	**A54**	1 10 0
,, 12″ ,, x 6″ ,, ...	**A55**	4 10 0
,, 9″ ,, x 10″ ,, for use on A18	**A56**	4 15 0
,, 12″ ,, x 12″ ,, (aluminium)	**A58**	8 0 0
Extension for long paper	**A57**	6 10 0
Stand for Drum..	**A150**	3 0 0
Platform for Drum	**A160**	2 7 6
Smoking Stand for Drum	**A250**	2 12 6
Varnisher for paper	**A280**	2 10 6
Smoker for long paper	**A290**	10 10 0
Varnisher for long paper, can also be used for smoking	**A295**	6 10 0
Gas Smoking Burner, 5½″	**A291**	1 17 6
,, ,, 9″	**A292**	2 2 0
,, ,, 5½″ with By-pass	**A293**	2 17 6
Kerosene Smoking Burner, 3″ wick	**A265**	2 5 0

			Per 100.	Per 1,000.
Paper for above, in cut pieces,	20″ x 5¾″, gummed one end.	**A300**	3/6	£1 12 6
,, ,,	40″ x 5¾″ ,,	**A301**	7/-	£3 5 0
,, in rolls,	50-yds. x 5¾″ ,,	**A305**	Per roll, 4 0	

Nett weight of Standard Drum 25-lbs.

SHERRINGTON-STARLING RECORDING DRUMS, A50–A53. The above Drums can now be fitted with rubber feet, to avoid slipping on or scratching bench tops, at no extra cost if specified at time of ordering.

ASSEMBLY FOR MAMMALIAN CLASSES.



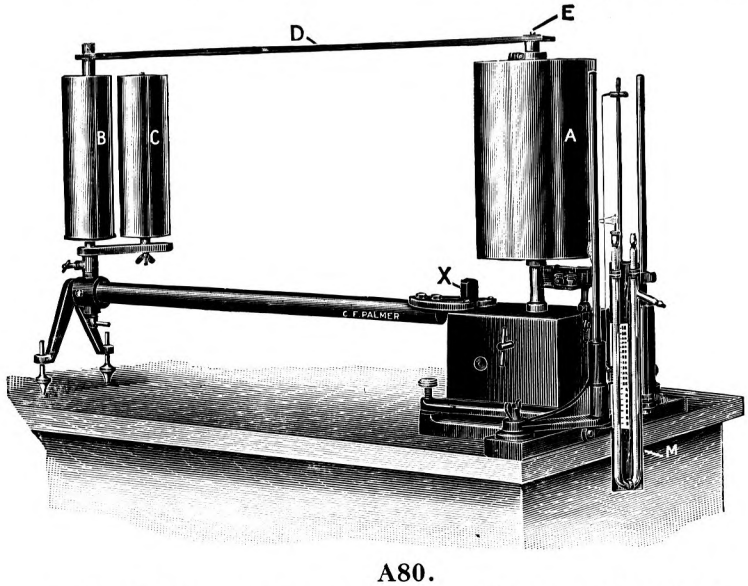
A70.

THIS is composed of a Single-speed Drum (A200) with Extension for Long Paper (A57) and a special Drum Stand similar to figure A150, but so constructed that it allows for use of a wedge-shaped Mercury Manometer. The Stand, like the original model, is fitted with *A* and *B* pattern arms or otherwise if specially mentioned (see A150). It will be noticed that the Time-marker and Signal (B24) is of special design and fits up under the drum similarly to that on the large Brodie-Starling Kymograph.

PRICE.

		£	s.	d.
Drum	**A200**	6	10	0
Extension	**A57**	6	10	0
Mercury Manometer wedge-shape	**C26**	1	7	6
Time-marker	**B24**	2	2	6
Special Drum Stand for use with Mercury Manometer ..	**A153**	3	0	0

		£	s.	d.
PRICE of the Assembly as above, if ordered at one time	**A70**	18	10	0
,, with Double Spring Clockwork Drum (A219)	**A76**	23	0	0
,, ,, ,, ,, ,, (A220)	**A77**	23	10	0



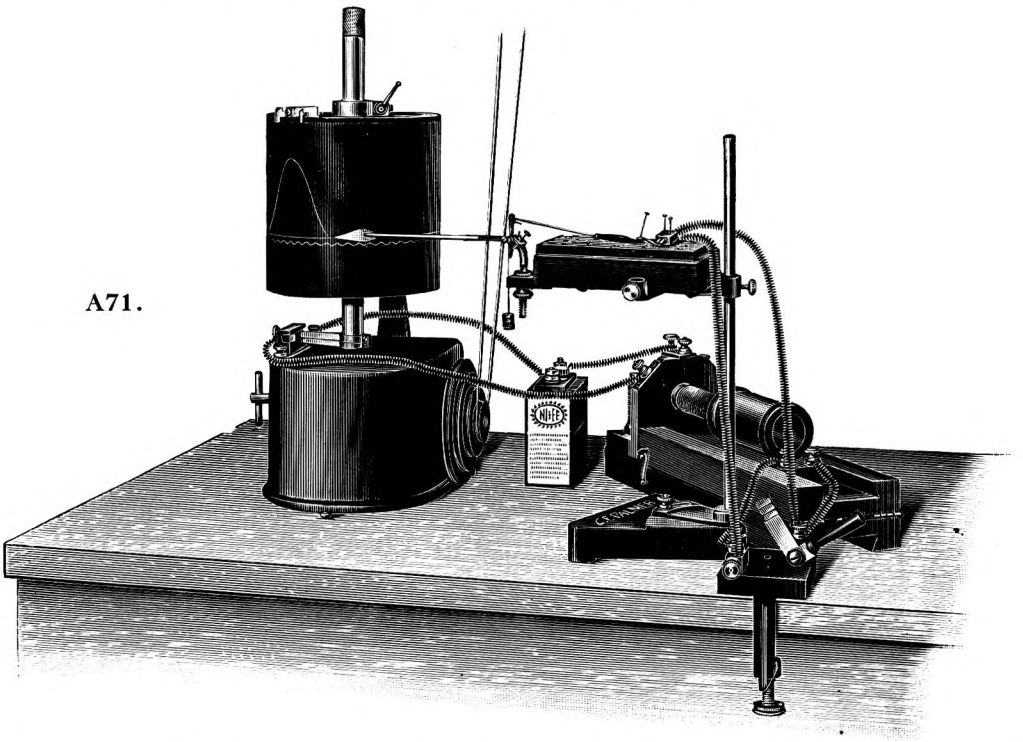
A80.

THE ASSEMBLY illustrated is similar to A70, but modified to take the standard paper 10″ wide x about 6′ in length ; a ball-bearing tie-bar *D* is fitted to take the increased pressure of the wide paper on the spindles, the tension of the paper being adjusted by means of the swivelling cylinder *C*, as it is not possible to slide the small Drum along the rod. An improved wedge-shaped Mercury Manometer frame is fitted as standard.

		£	s.	d.
PRICE of the complete assembly, as illustrated, if ordered at one time ..	**A80**	22	10	0
,, Single Slow Speed Drum, extension and tie-bar only	**A81**	16	10	0

ASSEMBLY FOR TAKING
A SIMPLE MUSCLE TWITCH.

A71.



THIS shows a Standard Sherrington-Starling Drum (A50), Prof. Starling's Crank Myograph (C112) mounted on a quick adjustable stand (D2), Standard Pattern Du Bois Reymond Coil (H30), Key (H1), and to complete the set a " Ni + Fe " Battery (H. J.O—4).

PRICE.

		£	s.	d.			£	s.	d.
Drum	**A50**	10	10	0	Coil	**H30**	5	17	6
Crank Myograph	**C112**	1	0	0	Key	**H1**		13	0
Stand	**D2**		13	0	Battery	**H. J.O.—4**		8	6
Price of the Assembly ..	**A71**	£19	2	0					

The above assembly shows the arrangement of standard apparatus suitable for students' use; we are always pleased to build up and quote for assemblies to be used for all classes of work.

DOUBLE SPRING CLOCKWORK DRUMS.

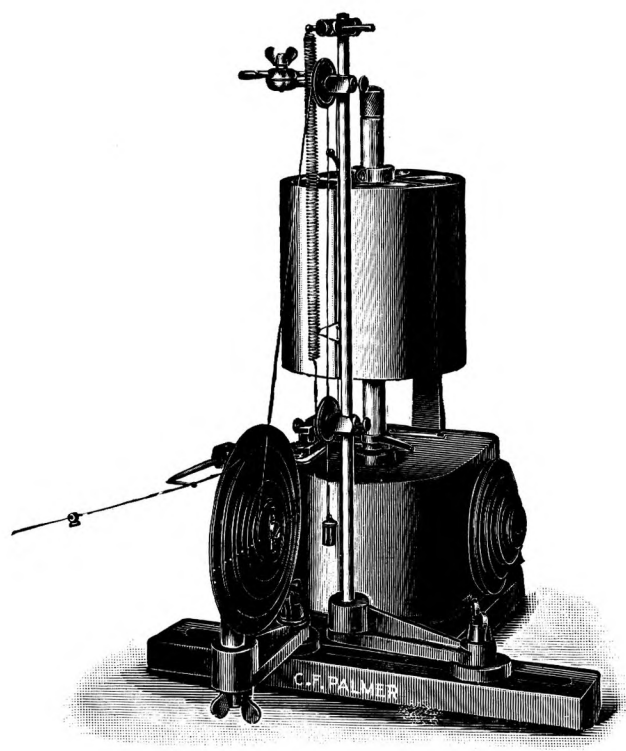
These Recording Drums (similar in appearance to the Slow Speed Drum A200) are more powerful than the ordinary Clockwork type, A210–215, and can be used with the Long Paper Extension, as fitted to the Mammalian Assemblies, etc.

A close ratio three-speed gear is fitted, giving the standard model with 6″ cylinder a surface speed of approximately 1mm., 1·5 mm., 2·5 mm. per sec.

For work such as that with isolated organs requiring very slow speeds, a special slow speed model is made, with a surface speed range of approximately ·1 mm., ·15 mm., ·25 mm. per sec., with a 6″ diameter cylinder.

PRICE.			£	s.	d.
	Double Spring Clockwork Drum, surface speed 1, 1·5 and 2·5 mm. per sec.	**A219**	11	0	0
,,	Double Spring Clockwork Drum, surface speed ·1, ·15, and ·25 mm. per sec.	**A220**	11	10	0

Apparatus for Recording Reflex and other Involuntary Movements in Cases of Nervous Diseases.



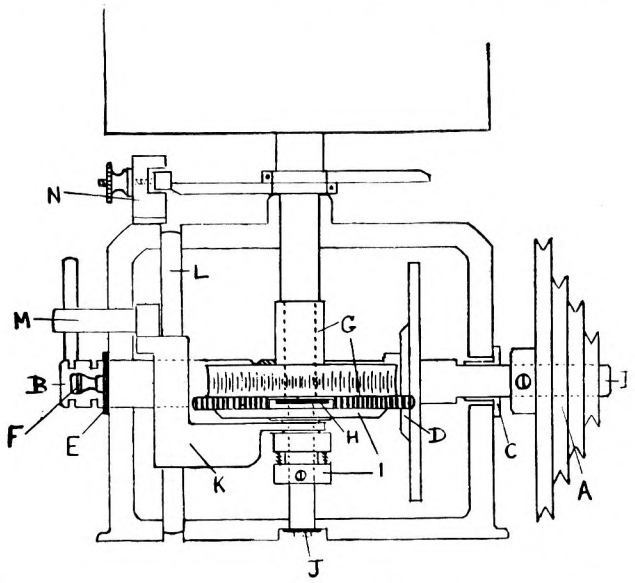
A74.

THE above instrument consists of a Standard Sherrington-Starling Drum, mounted on a Drum Stand fitted with two special arms, the one having two light grooved pulleys round which runs a thread carrying a writing point, and terminating in a long spiral spring at one end, the other being fastened to one of the four speeds of a large coned vulcanite pulley. From the latter another thread is led off to the limb or group of muscles under investigation. The excursion of the writing point may be varied in amplitude, as required, according to the groove selected on the vulcanite pulley, on which are clips for securing the threads. The length of the thread leading to the subject can be adjusted in the well-known manner adopted to tighten tent ropes, and the tension of the spring can be varied by vertical adjustment of either of the pulleys on the upright arm. The apparatus has been made to the order of Dr. F. M. R. Walshe, and shows one of the many uses to which the Sherrington-Starling Drum may be put.

		£	s.	d.
PRICE of the special Drum Stand, with Recording Apparatus	**A73**	6	10	0
,, Complete with Standard Sherrington-Starling Drum	**A74**	17	0	0
,, As above, but with 12″ cylinder	**A75**	20	0	0

SHERRINGTON-STARLING RECORDING DRUM.

LIST OF PARTS FOR REPLACEMENT.



FOR the convenience of our customers, we have compiled a Price List of parts suitable for replacement in case of damage. These parts can be readily fitted if the services of a skilled mechanic are available.

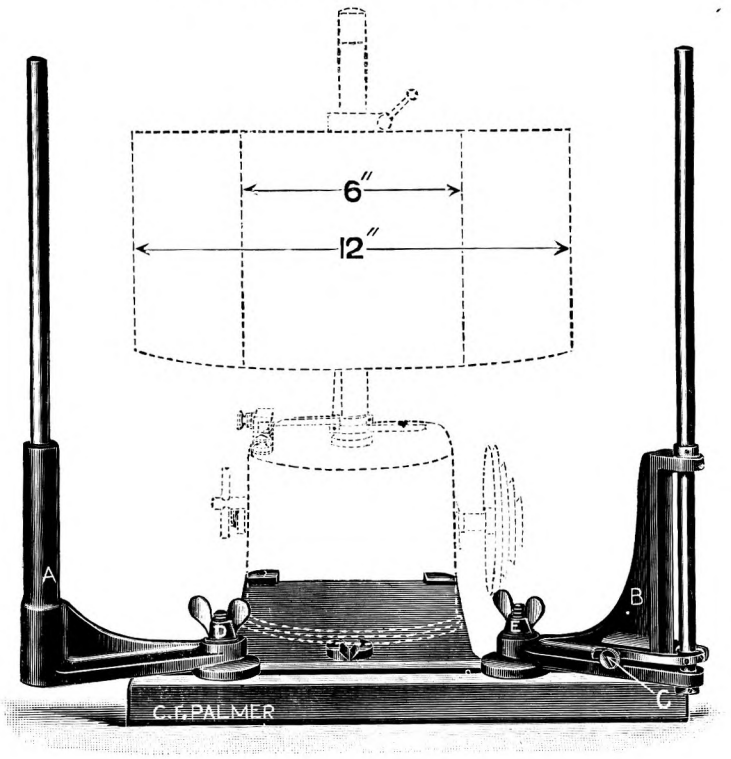
When ordering, it is always advisable to return damaged parts, as slight modifications of design are made from time to time.

LIST OF PARTS.

			£	s.	d.
A.	**Driving Pulley,** 4-speed ; gunmetal, with Fixing Screws	**A100**	0	10	6
B.	**Driving Shaft,** with low Gear Worm and Gear Locating Slots ..	**A101**	0	12	6
C.	**Adjustable Side Bearing**	**A102**	0	4	0
D.	**High Gear** Fibre Driving Disc, with Brass Collar and Fixing Screws	**A103**	0	10	6
E.	**Side Plate,** with Knob	**A104**	0	3	6
F.	**Side Plate Locking Screw**..	**A105**	0	0	6
G.	**High and Low Gear** assembly for main Spindle	**A106**	0	18	6
H.	**Position Washer** for above	**A107**	0	0	1
I.	**Clutch,** complete	**A108**	0	16	6
J.	**Screw and Washer for Main Spindle**	**A109**	0	0	2
K.	**Clutch Fork**	**A110**	0	6	0
L.	**Clutch Fork Guide Rod**	**A111**	0	0	4
M.	**Clutch Operating Cam with Cross Rod**	**A112**	0	3	0
N.	**Electric Contact,** complete	**A113**	0	7	6
	Contact Spring only, new type, phosphor bronze	**A121**	0	0	6
	Lacquered Milled Terminals (Binding Posts) for Contact & Base, *each*	**A114**	0	0	6
	Levelling Screws for Drum Base Feet, vertical and horizontal, *each*	**A115**	0	2	6
	Steel Screws for Side Bearing and Side Plate .. .. .. *each*	**A116**	0	0	1
	,, Contact .. .. *each*	**A117**	0	0	1
	Lacquered Brass Cylinder, 6″ diameter, complete with Locking clamp	**A54**	1	10	0
	New Pattern Locking Clamp only	**A119**	0	5	6
	Fixing Screws for Locking Clamp .. .. *each*	**A120**	0	0	1

STAND FOR THE RECORDING DRUMS.

Nos. **A50–53.** **A200–205.**



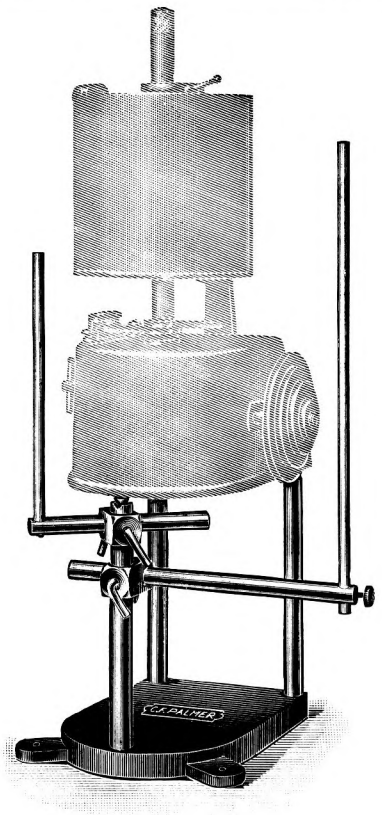
A150.

IT has been found in practice that the student often wants to move his drum, either to tighten the driving band or to make room for other instruments—this means that any writing levers adjusted to the drums have to be re-arranged. To obviate this, the above Stand has been designed. It consists of a cast-iron base, upon which the drum rests. There is a long slot in which slide two arms, each carrying a ⅜″ upright rod. They not only slide along the slot, but they can be rotated on the fixing screws, and so placed in any desired position either on the same or opposite sides of the cylinder. These arms are made in two forms: the form *A* has a ⅜″ upright rigidly fixed in it, while the form *B* has an upright which can be rotated through an arc of about 10° by the screw *C*. Furthermore, this upright can at any time be rotated so as to move the writing lever away from the writing surface, where it remains until it is pushed back, when it returns to its former position. This has many advantages, the chief of which is that the drum can be removed from the Stand and a new paper put on; and on replacing the drum, it takes up exactly the same position as before, the Stand being fitted with the well-known dumps, *i.e.*, "V" slot, centre and flat, devised by Lord Kelvin for this purpose.

The illustration represents the Stand with an outline of a standard drum in position, showing the relative sizes of a 6″ and a 12″ cylinder.

		£	s.	d.
PRICE of Stand with one each *A* and *B* pattern arms (as illustrated)	**A150**	3	0	0
,, ,, ,, two *A* pattern arms	**A151**	2	15	0
,, ,, ,, ,, *B* ,, ,, ...	**A152**	3	5	0
,, ,, for Mammalian Assembly, with forward foot and one each *A* and *B* arms	**A153**	3	0	0

The model as illustrated will be sent unless otherwise ordered.



A160.

DRUM PLATFORM

THE Platform illustrated has been designed, after a suggestion by Prof. McDowall, to take the place of the blocks of wood which are often used when it is desired to raise a Recording Drum or Drum and Extension to the level of the operating Table. At the same time the assembly provides a useful pair of uprights to take the Manometer, etc.

Standard height of platform 9″. Long ⅜″ upright rod 15″. Short ⅜″ upright rod 9″.

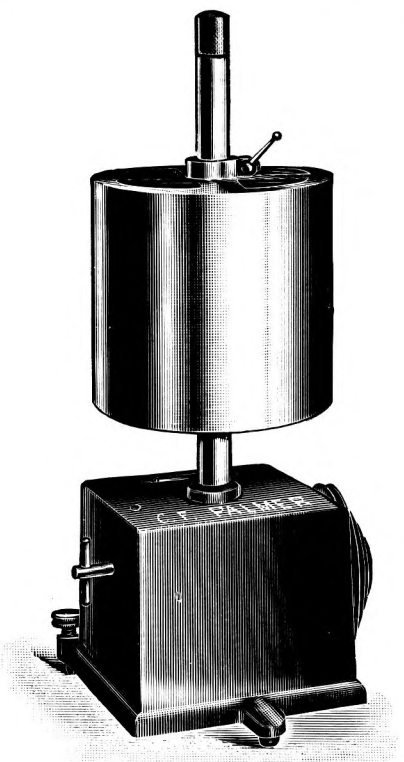
PRICE.			£	s.	d.
	Complete as illustrated, with piece for the extension foot..	**A160**	2	7	6
,,	Stand only	**A161**	1	5	0

SINGLE (SLOW) SPEED DRUM.

WE have often been asked if we can supply a Drum for slow speeds only, and in response have designed the above. In size it is similar to our standard Sherrington-Starling Drum, taking the same cylinders and fitting the Drum Stand (*see* A150). For gearing a worm and wheel are used, the reduction being such that the driven cone pulley has to be turned approximately 220 times to revolve the Drum one complete turn.

A friction clutch has been incorporated in the base, so that the Drum can be started or stopped at will. There is a cone pulley, having four speeds, for connecting the Drum to the laboratory shafting, small motor, or other source of power.

PRICE of Drum, with			£	s.	d.
	standard 6″ x 6″ cylinder (as illustration)	**A200**	6	10	0
,, ,,	if fitted with cylinder 10″ high x 6″ diameter	**A201**	7	10	0
,, ,,	if fitted with cylinder 6″ high x 12″ diameter	**A202**	9	10	0



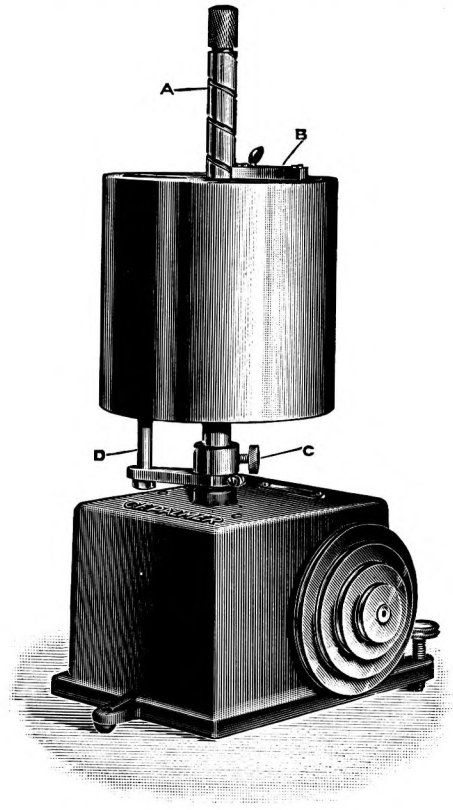
PALMER **A200.**

This Drum can be fitted with electric contacts similar to those on the Standard Drum for 15/- extra,

Please mention "contacts" when ordering.

Net weight of Drum with 6″ x 6″ cylinder .. 20-lbs.

DRUM FOR TAKING SPIRAL TRACINGS.



A205.

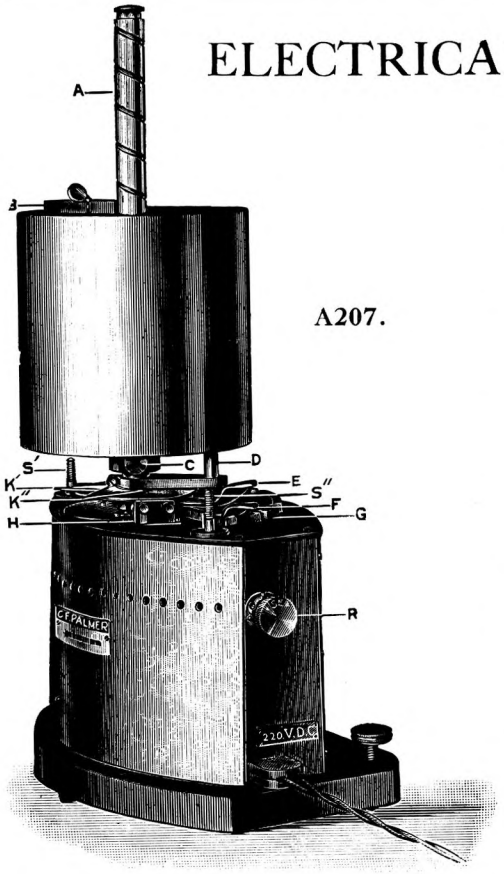
THIS is a slow single-speed Drum, as No. A200, but constructed in such a manner that tracings extending up to five times round the cylinder can be taken. This is accomplished in the following manner: the main spindle does not revolve as in the above mentioned drum, but is stationary, and has a spiral groove *A* of 1″ pitch cut upon its upper length. On the top of the cylinder is a bolt *B* which engages with the groove, but is capable of being withdrawn so that the cylinder can be raised or lowered by hand. Below the cylinder, and revolving on the main spindle, is an arm carrying an upright rod *D*, passing freely through a hole in the cylinder end. Now it is obvious that when the bolt is engaging with the groove and the cylinder is turned by the arm and upright rod, the cylinder will rise 1″ for each complete turn and so a continuous tracing upwards of eight feet long can be obtained, which is useful for tracings of small amplitude.

This drum can also be used to take ordinary (one turn) tracings. For this purpose there is a collar, *C*, which can be fixed at any convenient height and upon which the cylinder revolves, the bolt, of course, being withdrawn.

		£ s. d.
PRICE of Drum with 6″ x 6″ cylinder	**A205**	11 5 0
,, Extra Cylinders, as A54, but fitted with bolt in place of the clamp	**A206**	1 12 0 each

For long tracings of greater amplitude, where a large Kymograph is not available, we recommend the Standard Drum A50 with Extension A57. (*See* also the complete assembly for Mammalian class work).

ELECTRICALLY DRIVEN DRUM.



A207.

THIS Drum is complete with self contained built-in motor to run off the lighting mains and can be supplied for any one voltage 50 to 250, either D.C. or A.C. single phase.

There are nominally five speeds which, measured on the surface of a standard 6″ drum, are approximately ·18, 1·6, 15, 135 and 1215 cm. per min. Further, by adjusting the speed regulating knob *R*, these speeds can be raised gradually to about double or cut down to half, which is useful when exact rates are required.

An alternative range of five speeds can be supplied, these give an approximate surface speed with a 6″ diameter cylinder of 1·94, 9·72, 48·6, 243 and 1215 cm. per min. Please indicate this speed range by ordering A207a.

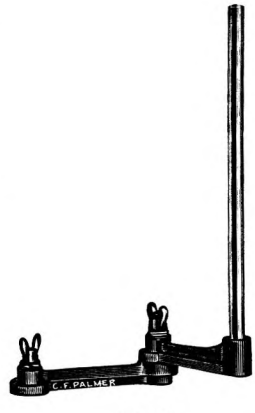
To change the speed it is only necessary to raise the lower lever *F* out of the notch in the quadrant *G* and swing it round until it is over the notch required. Each notch being marked with the respective speed, as above. Raising the lever *F* does two things. It not only stops the drum instantaneously by putting a brake on, but also prevents the drum from turning while changing gear. This is of importance should it be desirable to alter the speed during an experiment. There is an extra notch marked *N* (neutral). When the control lever *F* is in this, the drum is free to be turned by hand.

Electrical contacts *K′* and *K″* are provided which make contact with a shielded spring in the block *H*. These contacts are adjustable to any position round the axis of the cylinder.

On the top of the base at *S′* and *S″* are studs, so that at any time arms, as in the side illustration, can be had. These arms are jointed and are similar to, but smaller, than those on the Brodie-Starling Kymograph.

Incorporated in this drum is the upward spiral movement, as in drum No. A205, giving a continuous tracing up to 1″ wide and five times round the cylinder in length. Such movement is valuable at times, but it in no way detracts from its usefulness as an ordinary drum, means being provided to run the cylinder at any height on the spindle.

For reference to the letters *A*, *B*, *C* and *D*, see description of drum No. A205.



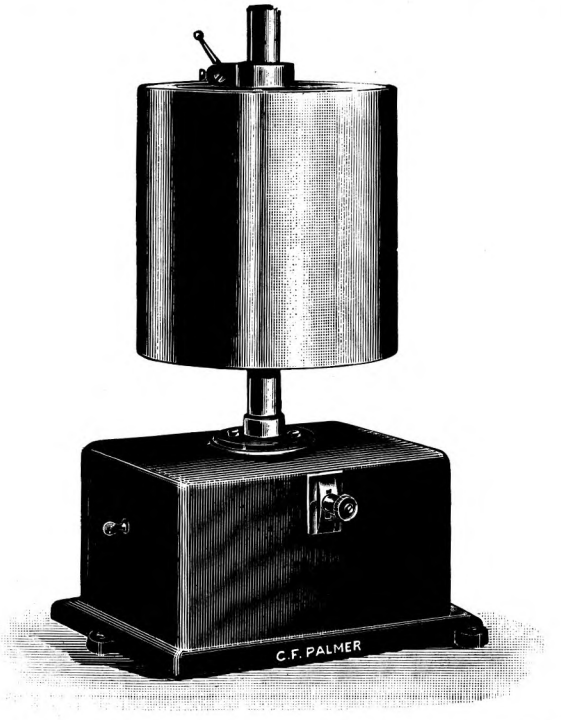
A208.

ELECTRICALLY DRIVEN DRUM, with Extension for Long Papers. We are now able to supply this Drum fitted with a special extension and tie-bar, so that papers 6″ wide x about 6′ in length may be used satisfactorily at all speeds, with the exception of the fastest.

		£	s.	d.
PRICE of Drum with speed range ·18 to 1215 cm. per min.	**A207**	20	0	0
,, ,, ,, ,, 1·94 to 1215 ,, ,, ...	**A207a**	20	0	0
,, Drum A207 or A207a fitted complete with Long Paper Extension and Tie-bar	**A209**	27	0	0
,, Jointed arms to fit above Drums, as illustrated, per pair ..	**A208**	1	5	0

Please give full details of your Electric Supply.

CLOCKWORK DRUMS.



A210—215. Weight (with 6″ cylinder) 19-lbs.

FAST SPEEDS.

THESE can be made to revolve at practically any speed from one revolution in about five seconds. They are fitted with adjustable fan escapements, giving a wide range, as will be seen from the following table of speeds and prices.

All have standard 6″ x 6″ cylinders (interchangeable with the Standard Drums, A50), and the gears being of robust character will carry 12″ cylinders, with the exception of the fastest speed drums, when the starting would be somewhat sluggish. A friction device is fitted to these drums so that it is possible to turn the cylinder by hand without fear of damage to the gears.

The Drums run from one to five hours with one winding. We cannot, however, guarantee them to run at so uniform a speed as the power-driven drums.

The following are the standard approximate speeds :—

PRICE.	Clockwork Drum. Revolving once in 5 to 15 seconds ..	**A210**	each	£ 8	s. d. 10 0
,,	,, ,, ,, ,, ½ to 3 minutes ..	**A211**			
,,	,, ,, ,, ,, 15 to 60 ,, ..	**A212**			
,,	A two-speed drum having speeds as A210 and 211 ..	**A213**	,,	10	10 0
,,	,, ,, ,, ,, A211 and 212 ..	**A214**			
,,	A three-speed ,, ,, ,, A210, 211 and 212	**A215**	,,	12	10 0
,,	If this drum is required to be used on the base A150, a special adapter is supplied with levelling screws ..	**A216**	,,	0	7 6

On the two and three-speed drums there is a neat change speed lever, the cylinder remaining in the same position.

A simple starting and stopping device is fitted to all.

See page 19 for Double Spring Clockwork Drums.

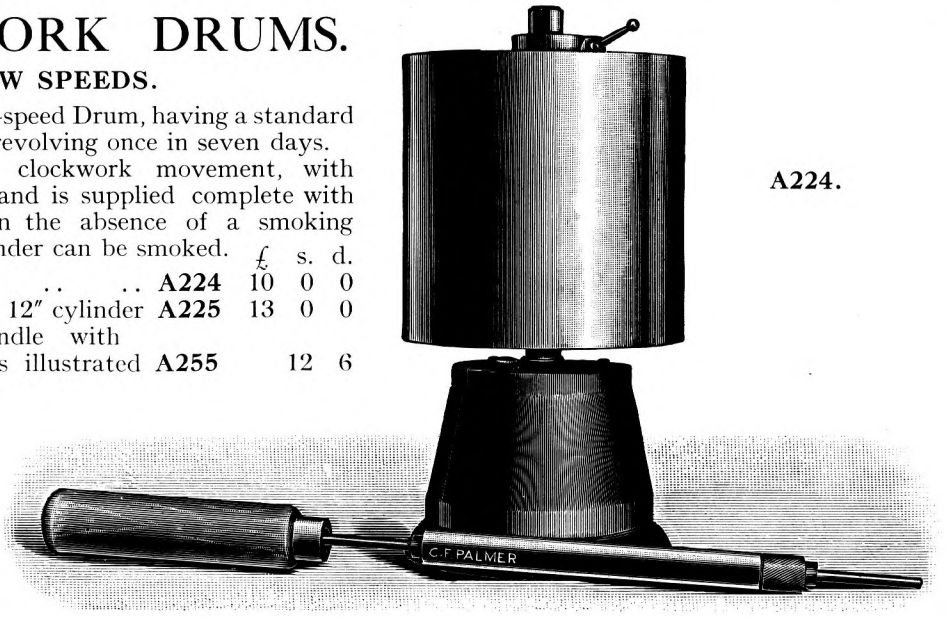
CLOCKWORK DRUMS.

SLOW SPEEDS.

A224 represents a slow-speed Drum, having a standard 6″ x 6″ cylinder, and revolving once in seven days.

It has superior clockwork movement, with jewelled escapement, and is supplied complete with handle upon which, in the absence of a smoking stand (A250), the cylinder can be smoked.

		£	s.	d.
PRICE	**A224**	10	0	0
,, If fitted with 12″ cylinder	**A225**	13	0	0
,, Smoking Spindle with handle, as illustrated	**A255**		12	6



A224.

WEIGHT :
(With 6″ cylinder)
10-lbs.

CLOCKWORK DRUM, with Lever Movement.—When it is necessary to have a recording Cylinder which makes a revolution in a definite time, as for instance when using lined paper with a recording Spirometer, the above will be found satisfactory. Standard speed, one revolution in 20 mins. clockwise or anti-clockwise ; running time approximately 30 hours with one winding. Light Aluminium lift-off Cylinders are fitted, the standard sizes being 6″ diameter x 6″, 9″ or 12″ long.

		£	s.	d.
PRICE, with 6″ x 6″ cylinder	**A226**	8	0	0
,, 6″ x 9″ ,, ...	**A227**	8	10	0
,, 6″ x 12″ ,, ...	**A228**	9	0	0

A similar Drum making one revolution in 15 minutes can also be supplied.

A231.

A231 is a Drum having a speed of one revolution in five hours. It is supplied with the standard size of cylinder, but will quite successfully carry one of 12″ diameter, as the illustration shows. The clockwork is of a more robust design than that in A224, and is fitted with the adjustable fan escapement. A friction device is incorporated in this drum so that it is possible to turn the cylinder by hand without fear of damage to the gears. The small knob shown at the side is used for stopping and starting.

PRICE.

		£	s.	d.
With standard 6″ x 6″ cylinder	**A230**	8	10	0
,, 12″ x 6″ cylinder	**A231**	11	10	0
Extra cylinder only, 6″ x 6″ ..	**A54**	1	10	0
,, ,, 12″ x 6″ ..	**A55**	4	10	0

Weight (with 6″ cylinder) : 19-lbs.

A similar Drum can be supplied to run at any one faster speed up to one revolution in fifteen minutes.

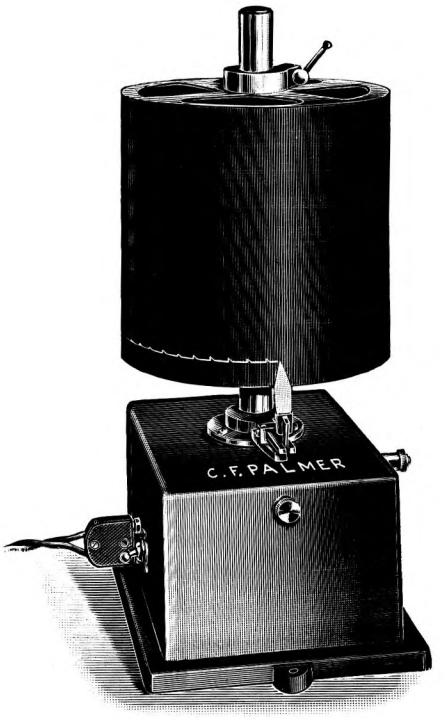
SYNCHRONOUS RECORDING DRUM

(A.C. MAINS).

AS the name suggests, this Drum is driven by a Synchronous Motor direct from the A.C. electric light mains, and owing to the fact that the frequency of most supplies is accurately controlled, the surface speed of the paper is constant.

Another convenient feature in connection with the use of Synchronous Motors for driving Recording Drums is that it is possible by means of a simple mechanical lever operated by the Motor to record intervals of time on the paper.

The Drum illustrated is a Two-speed model, giving speeds of 1 mm. per second and 5 mm. per second on a Standard 6″ Cylinder, the Time-marker recording 10-second intervals, the speed is changed by means of the small lever shown on the right, a neutral position is also provided so that the Cylinder may be turned by hand if necessary.



A240.

Similar Recording Drums are also made having only one of the speeds mentioned above, and these can be supplied with or without the mechanical Time-marker.

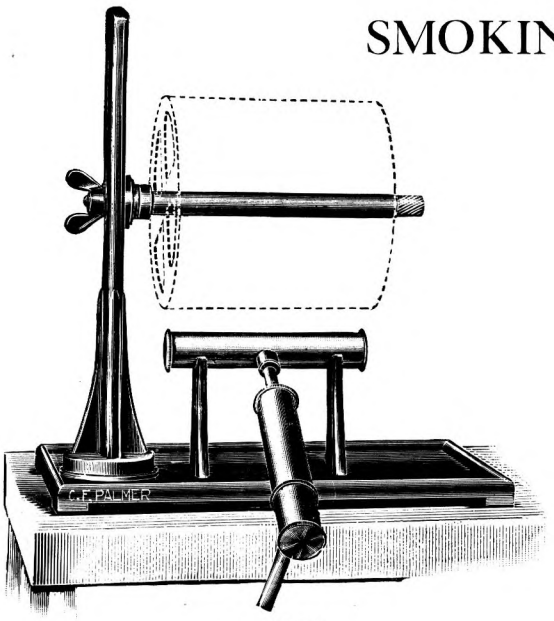
A quick-break switch and an insulated two-pin connecting socket are fitted to all models.

PRICES, with 6″ diameter x 6″ high Cylinder.		£	s.	d.
Synchronous Drum, Single-speed, 1 mm. per sec.	**A235**	9	0	0
,, ,, ,, 5 mm. per sec.	**A236**	9	0	0
,, ,, ,, 1 mm. per sec., with Time-marker	**A237**	10	0	0
,, ,, ,, 5 mm. per sec., with Time-marker	**A238**	10	0	0
,, ,, Two-speed model	**A239**	11	0	0
,, ,, ,, ,, with Time-marker	**A240**	12	0	0

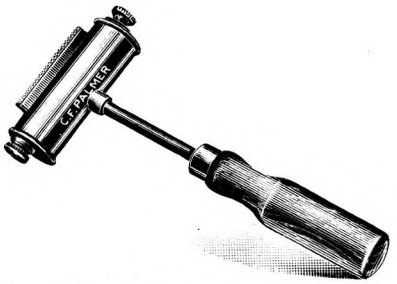
Synchronous Drums giving different surface speeds will be available shortly. Kindly enquire for details.

Please give full particulars of voltage and frequency of Electric Supply when ordering.

SMOKING STAND.



A250.



KEROSENE BURNER.

A265.

IT is pointed out on the page relating to the Sherrington-Starling Drums that no separate smoking stand is necessary, as the drums can be easily smoked on their own stand. Nevertheless, we have frequently been asked to supply such ; and, moreover, where a number of drums have to be smoked, it is much better to have this done on a special stand. That illustrated above will be found excellent for this purpose.

The drum cylinder is taken off its stand, and when a paper has been fixed on, it is slipped on to the horizontal spindle as shown. This spindle is mounted on ball bearings and therefore runs very easily, and can be kept in motion by the fingers of the right hand while the burner is held by the left, or the burner can be laid on the supports on tray and the drum lowered to it ; this, however, necessitates either removing the burner or turning the gas down while putting the cylinder on the spindle.

The Stand will take either the 6″ (as indicated) or 12″ cylinders as fitted on the Standard Sherrington-Starling Drums.

It may here be pointed out that this Stand, fitted with a standard 6″ cylinder, makes quite a useful horizontal drum for occasional work where a hand-turned drum is permissible ; or a 4½″ cone pulley can be fixed direct to cylinder (*see* A270).

			£	s.	d.
PRICE.	Stand with spindle for Drums 6″ high x 6″–12″ diameter	**A250**	2	12	6
,,	,, ,, ,, ,, 7½″, 10″, 12″ high x 6″–12″ diameter	**A251**	3	2	6
,,	Smoking Spindle with handle (illustrated with A224)	**A255**		12	6
,,	,, ,, ,, Ball Bearing Type	**A256**		17	6
,,	Burner for gas, as shown in position above	**A291**	1	17	6
,,	,, Kerosene, with a 3″ wick and winding-up gear, as illustrated at side	**A265**	2	5	0
,,	6″ Cylinder	**A54**	1	10	0
,,	,, fitted with cone	**A270**	2	0	6

See also No. 280 for special Varnishing Tray for Drum Papers.

WHITE GLAZED PAPER.

Superfine quality with special surface for smoking, supplied in cut sheets gummed one end or in rolls.

PRICE.

				£	s.	d.
Glazed Paper, 20″ x 5¾″ Sheets.	**A300**	per	100	0	3	6
,, ,, ,, ,,	,,	,,	1000	1	12	6
,, 40″ x 5¾″ ,,	**A301**	,,	100	0	7	0
,, ,, ,, ,,	,,	,,	1000	3	5	0

				£	s.	d.
Glazed Paper, in rolls, 50-yds. x 5¾″	**A305**	per	roll	0	4	0
,, ,, 50-yds. x 7½″	**A307**	,,	,,	0	6	0
,, ,, 50-yds. x 9⅞″	**A306**	,,	,,	0	7	6

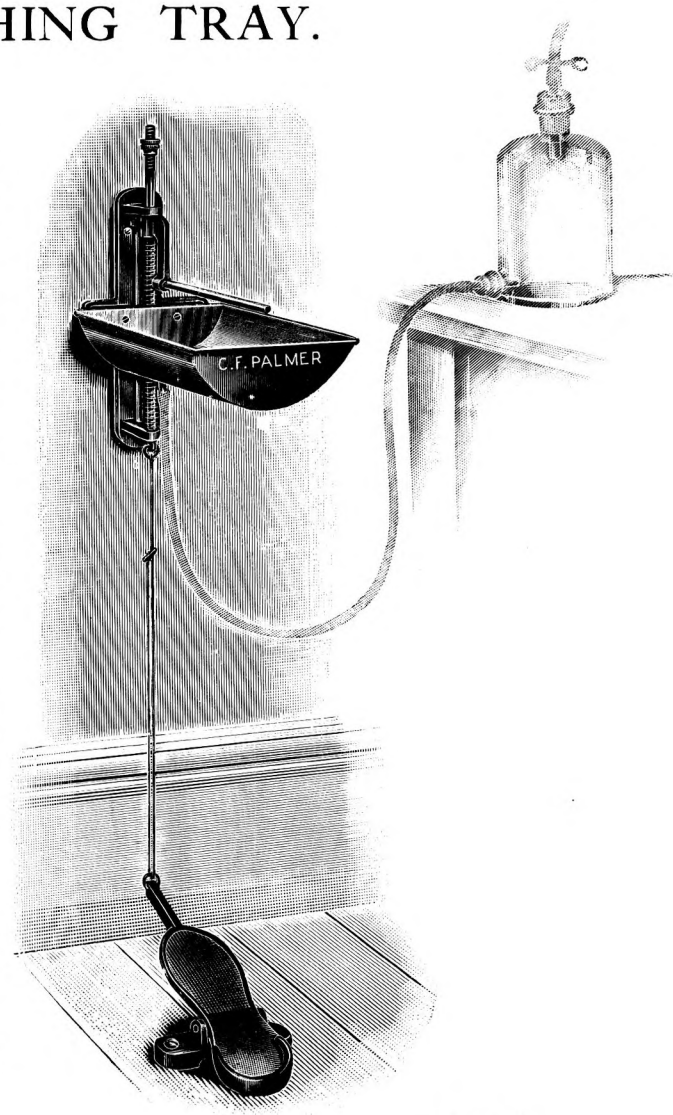
VARNISHING TRAY.

THE Varnishing Tray here shown will be found to be a very useful piece of apparatus for varnishing cut papers, up to 3 or 4′ in length, and any width not exceeding 10″.

The paper to be varnished is held by the two ends and passed under the round arm seen projecting above the tray. This arm is carried on a sliding rod, which is supported by a spring and controlled by a foot lever ; upon depressing the latter the paper is immersed in the varnish to a depth regulated by a milled screw on the top of the rod. The paper is then drawn through and out of the varnish.

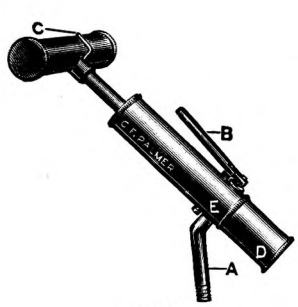
A convenient method of filling the tray is to have the varnish contained in a bottle as shown. This bottle normally stands on the floor or shelf below the level of the tray. Upon raising the bottle and opening the pinchcock or vent at top of the bottle, varnish will flow into the tray and back again when the bottle is again lowered. It may here be mentioned that if there is a T or extra tube at the top of the bottle with a pin-hole, it will not be necessary to wait for the varnish to run back before closing the pinch-cock. Where there is not a table or other convenient support for the bottle, two suitable bracket shelves can be had.

Almost any quick-drying spirit varnish can be used if sufficiently diluted. That known as " white hard," when diluted to 10 or 12 times its bulk with methylated spirit and a very minute quantity of castor oil added gives good results. The use of oil is to render the varnish pliable ; too much will prevent it drying and leave it sticky.



			£	s.	d.
PRICE.	Tray, with foot lever	**A280**	2	10	6
,,	Bracket Shelf for Bottle	**A285**	0	5	6

Bottle and tubing extra if required.



A293.

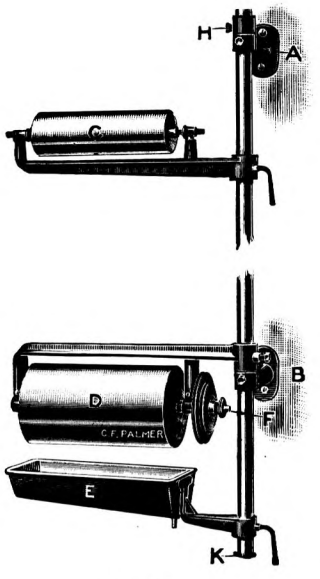
BY-PASS SMOKING BURNER.—In large Laboratories where a number of Drums have to be smoked, the above Burner is a convenience suggested to us by Prof. C. Lovatt Evans. There is a small pilot light at *C*, the full gas supply being obtained when the lever *B* is depressed by grasping it together with the body of the Burner.

In other features it is similar to our standard Burners A291/2.

PRICE, 5½″ long **A293** £2 17 6

THE SMOKER.

For Smoking Long Paper for the BRODIE-STARLING KYMOGRAPH and the SHERRINGTON-STARLING DRUM EXTENSION, Etc.

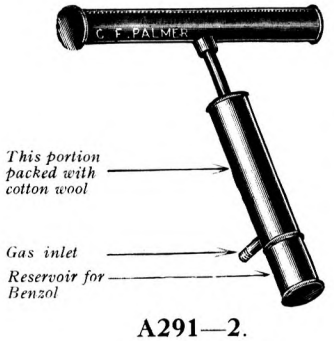


A290.

THIS consists of a pair of cylinders mounted on a stout upright rod 5′ long, with a pair of brackets (*A* and *B*) for fixing to the wall. It will take the longest papers that can be used on either of the above instruments. The lower cylinder is 11″ long by 6″ diameter, and is provided with a cone pulley intended to be driven from the laboratory shafting. This pulley has a friction clutch for starting or stopping. It should be caused to revolve clockways, when it is only necessary to screw up the nut *F* to start the cylinder or grasp it suddenly to stop.

A wheel for turning by hand is provided at the opposite end (not shown in illustration).

The varnishing tray fits up under the lower cylinder, and should be connected by means of a flexible tube to a large bottle having a bottom opening to contain the varnish. At the extreme end of the rod there is a pin *K* to prevent the varnishing tray being accidentally slipped off. When fixing the apparatus, the distance from *A* to *B* should be about 4′, and from *B* to *K* about 1′. Fitting on the top of the rod is the collar *H*. The object of this is that, if the set screws in the brackets *A* and *B* be left loose, the whole may be turned out from the wall like a gate, which is sometimes convenient in putting on or taking off a paper. *See* also A295 and A296.



A291—2.

The **Gas Smoking Burner** gives a very fine black when used with gas only. A more smoky flame can be obtained by filling the reservoir with some hydrocarbon, such as benzol ($H_6 C_6$). It is then only necessary to hold the burner down occasionally, when some of the benzol will run through to the cotton wool.

The following instructions may be of assistance to those not familiar with the Brodie Kymograph.

To Prepare and Smoke a Paper.—Having cut off the desired length lay it face down on the table, and bring the two ends over to meet in the middle and gum together, using the edge of the lower portion of the paper as a guide for straightness. When dry, place the band over cylinders, raising *C* till paper is taut. Start the paper moving at a good speed, say, 3′ per second, and if it does not run true on the cylinders, loosen the screw in arm carrying the top cylinder *C* and move it sideways either towards or from the wall till paper runs true on cylinders. Now it may be blackened, and when a satisfactory surface has been obtained, stop by gripping the knob *F*; lower *C* slightly; grip paper by diametrically opposite points, when it can be slipped off and put on the Kymograph cylinders.

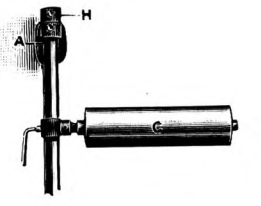
To Varnish a Paper.—Replace paper on cylinders as for smoking or on the special varnishing cylinders; bring varnishing tray under, and raise up as high as possible without fear of touching. Start paper revolving as for smoking. It is then only necessary to lift the bottle of varnish up (having previously removed the top cork) to a height above the level of tray, when the varnish will run into the latter. As soon as it touches the paper, the bottle should be replaced on the floor, and when the varnish has all run back into the bottle, the top cork may be replaced. Let paper revolve for a few minutes to dry before taking off.

The complete Smoker, together with the Smoking Burner, is included with the Brodie-Starling Kymograph. If wanted separately, the price is:—

		£	s.	d.
Smoker, with Varnishing Tray (as illustrated)	**A290**	10	10	0
Gas Smoking Burner, 5½″, for papers for Drum Extension	**A291**	1	17	6
,, ,, 9″, for papers for the large Kymograph	**A292**	2	2	0
Kerosene Smoking Burner, 3″	**A265**	2	5	0

THE VARNISHER.

For Varnishing Long Papers.



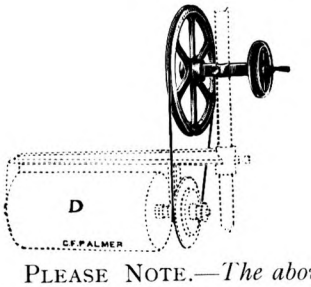
IT has been suggested to us, the inadvisability of smoking and varnishing papers on the same pair of cylinders ; we have, therefore, designed a slightly modified form to that described on the preceding page, for varnishing only.

As will be seen, it is very similar in construction, and all the remarks relating to the Smoker apply equally, except that it is intended to be worked by hand, and the brackets *A* and *B* should be about 3" further apart.

PRICE **A295** £6 10 0

In cases where it is only necessary to smoke few papers the Varnisher can be successfully used for both smoking and varnishing.

HAND DRIVE FOR THE SMOKER.



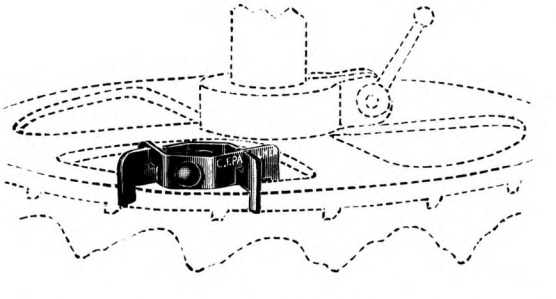
IT is often difficult to arrange to drive the Smoker usually supplied with the Brodie-Starling and "Demonstration" Kymographs from the laboratory shafting or other source of power. To overcome this difficulty, we are supplying the Hand Drive here illustrated. It fits all the Smokers supplied since 1919, and is easily fitted on.

PRICE **A296** £1 15 0

PLEASE NOTE.—*The above Hand Drive can be supplied to fit Smokers made prior to 1919, at the same cost, if so ordered, the difference being in the size of the main upright rod, which is now* 1" *; previously* $\frac{3}{4}$".

DRUM PAPER CLIP.

HITHERTO trouble has been experienced by the papers slipping down off the cylinders of the ordinary recording drums, and many expedients have been tried to obviate this, such as inserting sharp-pointed pins, sticking paper on with bits of gummed paper, etc., all of which methods are very unsatisfactory.



The clip illustrated above has been specially designed to fix the paper, and so prevent it slipping down the cylinder, as often happens in humid weather, owing to the heat of the smoking flame drying the paper, which afterwards absorbs a certain amount of moisture, causing it to swell and slip.

The clip has simply to be pressed together and clipped on the top of drum, gripping the paper as shown.

PRICE (in dull nickel finish) .. .. **A297** 1/6 each ; 16/- per doz.

SECTION

B

TIME RECORDING

A.C. Time Clocks

Pendulum Clocks Metronomes

Stop Watches Tippers

Time Markers or Signals

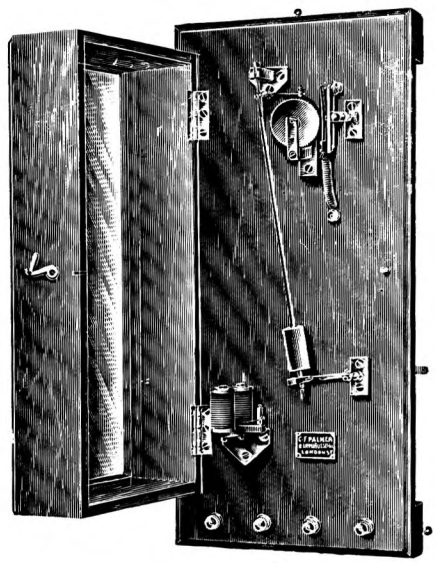
Tuning Forks Vibrators

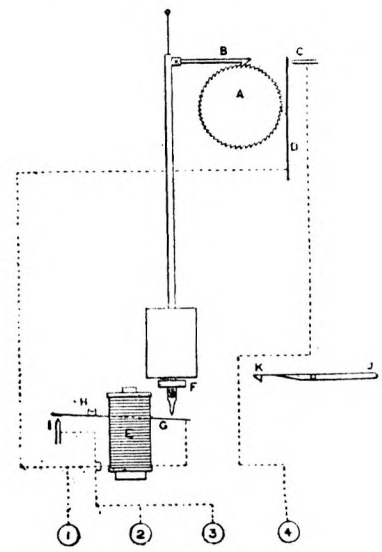
Drop Counters

Outflow Recorders

THE LATE PROF. BRODIE'S PENDULUM TIME-MARKING CLOCK.

See Proceedings of the Physiological Society, December 8th, 1900.





B1.

THE Clock consists of a half-second pendulum, the swing of which is maintained electromagnetically. The pendulum acts by means of a pawl *B* upon a ratchet wheel *A*. This wheel has 60 teeth, and is moved forward one tooth for each double swing of the pendulum. As it moves, one of the teeth at the side of the wheel is made to depress a spring, and thus close the electric circuit of the writing signal. The contact is very short, so that a sharp tracing is given by the chronograph. On the same axis are other ratchet wheels, each with a different number of teeth, 12, 6, 2 and 1 respectively, and the spring contact is mounted on an axis, so that it may be moved into position to be acted upon by any one of these wheels. By this means the Clock can be used to record each second, or every two, ten, thirty, or sixty seconds.

The swing of the pendulum is maintained by the electro magnet *E*, acting upon an armature *F*, attached to the end of the pendulum, for an instant, when the pendulum is at the extreme left end of its swing. This is effected by means of a small metal tongue hanging from the end of the pendulum, which engages in the notched piece fixed on the upper surface of the spring *G*. When the pendulum begins to swing back the spring is depressed, thus closing the circuit of the electro magnet. The pendulum receives a pull, which, however, is only of momentary duration, for by the time the pendulum is over the electro magnet, the tongue has left the notch and the circuit is broken. The electro magnet is sufficiently powerful to increase the amplitude of the swing to such an extent that for the next two or three swings the tongue passes completely over the notch, and it is only when the swing begins to die down that the electro magnet is again called into play in the manner described.

The same battery (connected to terminals 1 and 2) is used to maintain the pendulum and to work the recording signal (connected to terminals 3 and 4). Two or three Leclanché batteries are sufficient for the purpose, as the current is only required for such short instants of time.

A very simple device is employed for starting and stopping the Clock. This consists of a spring hook *K*, on which the pendulum is hooked. By raising the lever to which the hook is fixed, the pendulum is released. By lowering the lever, the pendulum is again caught automatically, since the hook is fixed in such a position that it will catch the pendulum when its swing has been reinforced by the electro magnet. This lever has now been made to act as a switch to break the time-marker circuit 1—4 (not shown in above diagram).

Supplementary Notes.

SINCE the preceding page was written many years ago it has come to our notice that the Brodie Clocks are often required to give time signals, not only in the laboratory where they are fixed, but in one or more distant rooms, and for this purpose the comparatively weak Leclanché Batteries have been discarded, and a battery or accumulator of 4 to 6 volts to overcome the resistance of the long leads to the extra room, has been substituted. This extra power has the effect of upsetting the proper working of the pendulum originally made for 2 or 3 Leclanché Cells. We therefore think it advisable to give the following hints which we trust will be of use.

To drive the clock, 3 Leclanché Cells, as stated in the original instructions, are ample, and these should be connected to terminals Nos. 1 and 2, as numbered in the diagram, say the — pole to No. 1 and the + to No. 2. Now it is clear that No. 3 being directly connected to No. 2 becomes the + pole of the signal circuit. If a greater voltage than the driving battery gives is required, terminal 3 must be ignored and a larger battery added with the — pole connected to terminal No. 1, and the + pole taken direct to the signal circuit, the return wire coming back to terminal No. 4, the circuit being completed via the contact *C*. to terminal No. 1 and so to the battery.

In modern practice accumulators have to a very great extent replaced the older batteries. Instead therefore of using two separate batteries, a single 2 or 3 cell accumulator may be connected to terminal No. 1, and a 2 volt tapping taken to terminal No. 2. The opposite pole of the battery being then led to the signal circuit as stated above. Here a word of CAUTION. If by accident the wires at the signal become " shorted " considerable damage may be done, it is therefore advisable to have a pair of fuses of a maximum capacity of 2 amperes inserted in the circuit near the clock.

A very much better, if more expensive way is to have a relay in each position where signals are required, working a local battery circuit. An accidental " short " then would not upset the whole of the system but would only interfere with the local circuit. This is of very great consideration where important research work is being carried on simultaneously in more than one room taking time signals from the same clock.

If specially ordered, this Clock will be sent out so that every tenth mark is missed in the one-second tracing, to facilitate counting.

MULTIPLE-CONTACT WITH DISTRIBUTING PANEL.

Devised by A. R. SMELLIE.

(Journal of Scientific Instruments, Vol. IX, No. 1, January, 1932).

THE Brodie Clock can be supplied fitted with the above, and will be found most convenient when a number of similar or different time intervals are required to be taken from one Clock.

Briefly, the arrangement is as follows: in place of the single contact *C* a five spring contact is fitted, leads being taken from each spring to a distributing panel provided with holes for plugs, so that any number, up to three, different lines can be operated from each time-interval; of course it is necessary to connect one lead from each line to a common terminal

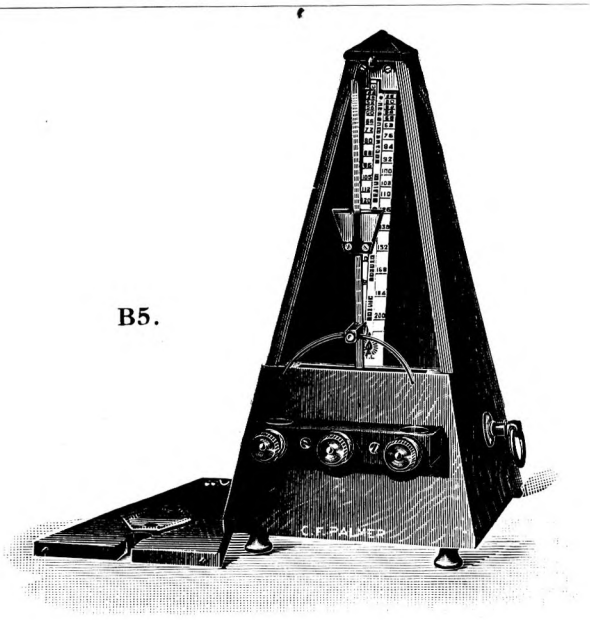
When using the Multiple-Contact with several lines, it may be advisable to connect a larger battery in the circuit, as described in Supplementary Notes.

			£ s. d.
PRICE.	Brodie Clock in Polished Mahogany case with Glass front	**B1**	10 10 0
,,	Brodie Clock fitted with Multiple-contact and Distributing Panel ..	**B2**	13 5 0
,,	Multiple-Contact and Distributing Panel only	**B3**	2 15 0

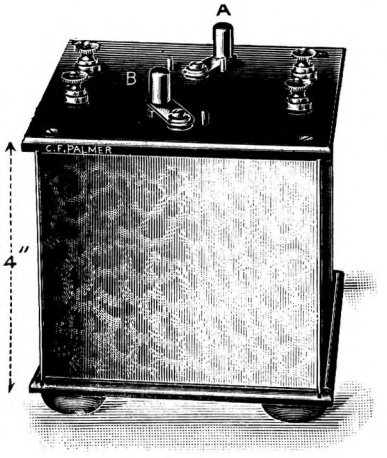
METRONOME.

THOSE requiring an interrupter that can be adjusted from about 40 to 200 contacts per minute will find the well-known instrument of the musical world very suitable. The Metronome here illustrated is of good reliable French make, upon which we fit double mercury contacts. By connecting to one mercury cup only, half the number of contacts as above are made, or it can be used to give an impulse to two circuits alternately.

PRICE .. **B5** £1 15 0



B5.



B6.

CLOCK TIME-MARKER.

IT is sometimes a convenience to have a more compact and easily transportable instrument to give time signals than the Brodie Time-marking Clock, and the Time Clock can be recommended.

An ordinary clock movement with lever escapement and 4-V. battery provide the necessary impulse to actuate an electro magnet, which in turn imparts a rotary movement to a notched wheel; this, by means of spring contacts closes the circuit to the signal. The standard intervals of time provided are 1 sec., 10 secs. and 1 min., but the clock can be supplied to give other times if required. Switch *A* stops the clock movement and disconnects the battery, whilst switch *B* is set to the time interval indicated.

		£ s. d.
PRICE, giving 1 sec., 10 secs. and 1 min.	**B6**	6 15 0
,, ,, 15 secs., 30 secs. and 1 min	**B7**	6 15 0

Any three of the following time intervals, 2, 3, 4, 5, 6, 12 or 20 secs. can be substituted for those given in B6.

B8.

TUNING FORK suitable for Students and experimental work of short duration.

Like the other standard Timing Forks, this gives 100 double vibrations or periods per second and it has a $\frac{3}{8}$" standard stem, fitting the ordinary " X " Blocks.

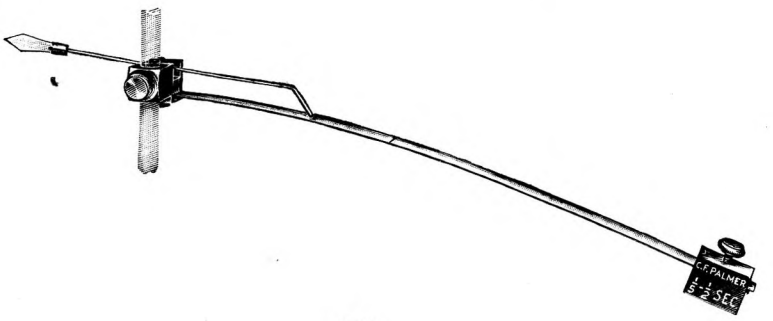
PRICE .. .. **B8** 17/6 each; £10 4 0 per doz.

SPRING TIME-MARKER, Lever Type.

THE steel vibrating reed with heavy adjustable weight can, by carefully applied pressure, be maintained to give a practically continuous marking, clearly indicating time intervals of $\frac{1}{5}$ and $\frac{1}{2}$ sec. By using half the wave-form time intervals of $\frac{1}{10}$ and $\frac{1}{4}$ sec. are shown.

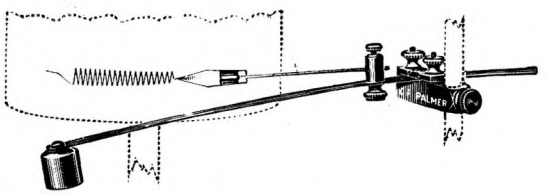
PRICE.

B9 19/- each. £11 2 0 per doz.



B9.

STUDENTS' SPRING TIME-MARKER.



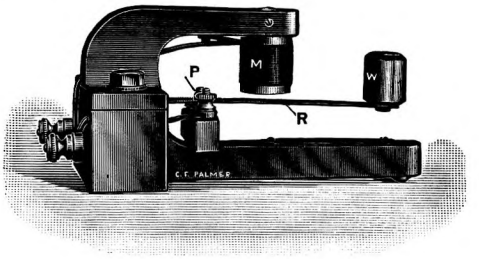
PRICE.

B10 16/6 each. £9 12 0 per doz.

THIS is a simple vibrating spring, heavily weighted, and with arm writing direct on the drum (as shown). It vibrates long enough for many experiments, or, with a little practice, an occasional few well-timed pressures with the finger, near the fixed end of the spring, will keep it going indefinitely. It is adjustable (to two marks) for quarter and half seconds.

ELECTRICALLY MAINTAINED $\frac{1}{10}$ sec. VIBRATOR.

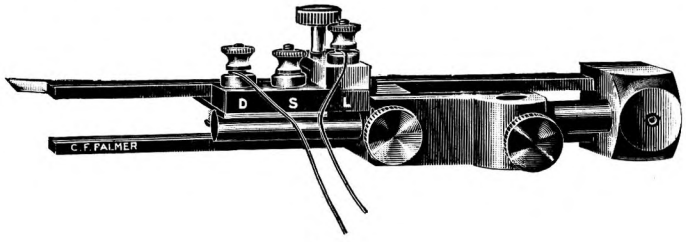
THE steel reed *R*, having a weight *W* at one end and being firmly clamped at the other, is set to vibrate at 10 per second. The electro magnet *M*, when connected in a battery circuit causes these vibrations to be maintained, thus making and breaking the circuit at the platinum points *P*. Any standard type of signal can be used with the Vibrator.



B11.

			£	s.	d.
PRICE.	$\frac{1}{10}$ sec.	**B11**	3	5	0
,,	$\frac{1}{20}$ sec.	**B11a**	3	10	0

ELECTRICALLY MAINTAINED TUNING FORK.



B12.

FOR measuring small intervals of time not exceeding fractions of a second, a vibrating fork is the most convenient instrument to use.

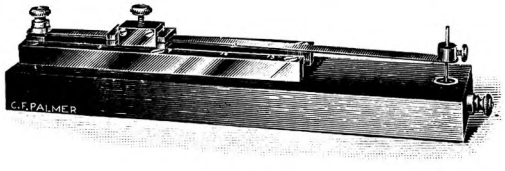
The fork illustrated is designed to write either direct on the recording cylinder (having a $\frac{3}{8}$" hole to fit the standard upright, and a screw to regulate the pressure of the writing point) or it can be used as an ordinary interrupter, in which case it is placed upon the stand provided (not shown in illustration).

For most purposes the fork having 100 double vibrations per second is suitable, and has therefore become " standard " ; nevertheless, we are sometimes asked for and supply forks giving 200 double vibrations per second.

It will be noted that the instrument has three terminals. When used by itself to write direct on the cylinder, the battery wires are connected to the outer terminals marked *D* (direct), *L* (line), or when used in conjunction with a time-marker (such as B25), the battery should be connected to *L*—*S* (series) being connected to the time-marker, the circuit being completed by a third wire taken from this back to the battery.

		£ s. d.
PRICE with stand for 100 D.V.	**B12**	4 10 0
,, ,, ,, 200 D.V.	**B14**	5 0 0
,, ,, ,, 256 D.V.	**B13**	5 5 0

ADJUSTABLE VIBRATING REED.



B15.

THE above Reed is calibrated to vibrate at approximately, 5, 7, 10, 15 and 20 vibrations per second.

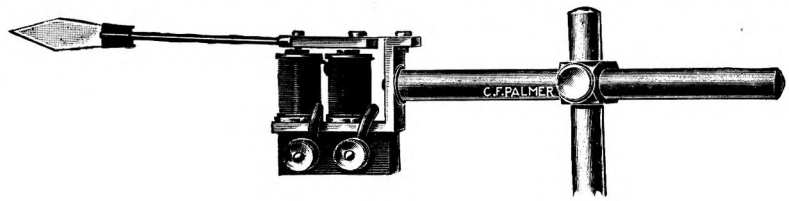
The adjustment is accomplished by sliding the clamping plate along metal guides fixed to the baseboard. One thumb screw only is necessary to securely lock the Reed to the guides.

An adjustable platinum tipped wire is used to make contact with the mercury cup.

This Vibrating Reed is very convenient for Students' use, and by an occasional pressure of the finger can be maintained for long periods.

PRICE .. .. **B15** £1 5 0 each. £12 12 0 per doz.

TIME-MARKERS or SIGNALS.



B16.

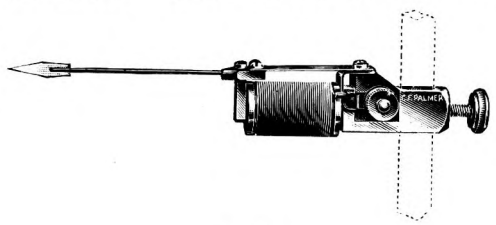
B16 shows a useful form for general work and students' use, for recording time not less than one-fifth of a second. It has a double magnet, mounted upon an iron frame, with vulcanite terminal block. The renewable writing point is cut from thin white celluloid and slips into a brass clip. The stem is $\frac{3}{8}$" and therefore fits all standard " X " Blocks.

PRICE .. **B16** 18/6 each. £10 10 0 per doz.

X Block and Stand *see* section D. For extra writing points *see* C181.

D.C. Resistance of Standard winding 2.5 ohms. Special windings up to 1,000 ohms, at extra cost.

SIMPLE TIME-MARKER.



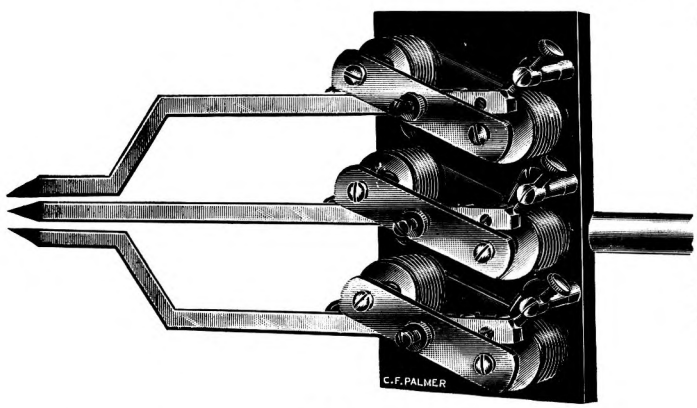
B17.

THIS Marker is of the single magnet type with extended pole piece, adjustment is provided to enable the movement of the stylus to be varied. As these markers fit directly on the standard $\frac{3}{8}$" diameter upright, two or more can be placed on the same support and so form a multiple Time-marker. Connecting terminals are located on opposite sides of the insulating blocks.

PRICE .. **B17** 14/6 each. £8 2 0 per doz.

D.C. Resistance of Standard winding 3 ohms.

MULTIPLE TIME-MARKERS.



B22.

THE general construction of these markers can be followed from the illustration, the magnets being mounted on a vulcanite back plate with the connecting terminals on the reverse side, they are made up as Double, Triple, and Six Lever instruments. The latter can be made with the writing points arranged to occupy a space of one inch wide only.

The nickel silver writing points are independently adjustable, and Ink Pens can be fitted if desired.

The holding stems are all $\frac{3}{8}$" diameter. Standard resistance of each pair of bobbins 1.5 ohms.

			£ s. d.
PRICE.	Double Lever	**B21**	2 5 0
,,	Triple ,, (as illustrated)	**B22**	3 10 0
,,	Six ,, ...	**B23**	5 17 6

HIGH SPEED TIME-MARKER.

B25

FOR a Time-marker that will record short periods of time, the one illustrated above is recommended. The writing-point is an integral part of the armature, which is very light and works between fixed stops. Each one is tested at varying speeds up to 120 per second. It is, therefore, useful to work off (and in connection with) the standard tuning-forks of either 50 or 100 vibrations per second, or in series with the primary of an induction coil, etc.

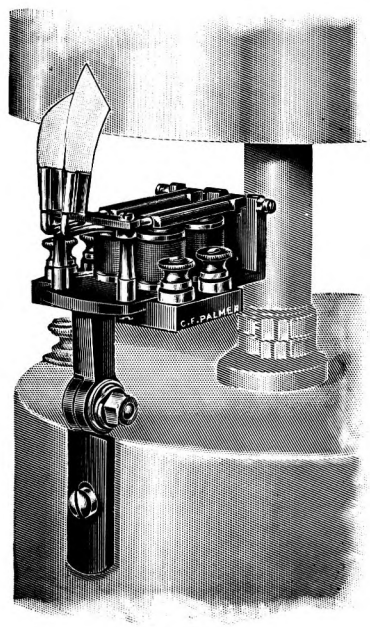
Although it can be used for recording long intervals of time, it is not intended that it shall replace the more robust instrument B16.

PRICE **B25** £2 5 0

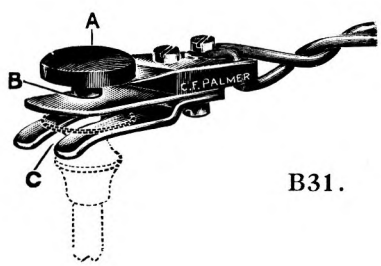
COMBINED TWO-WAY TIME-MARKER.

SPECIALLY made for use on the Sherrington-Starling Standard Drum (*see* the complete assembly for Mammalian class work). It is similar to, but smaller than, the time-marker and signal supplied with the Brodie-Starling Kymograph. All drum-bases sent out since 1st January, 1930, are drilled and tapped to receive this useful adjunct. Other drums require a hole to be drilled only, and tapped No. 2 B.A. Standard.

			£	s.	d.
PRICE.	**B24**	2	2	6	
,, When the Two-way Time-marker is to be used with a 12″ diameter Cylinder, a special extension fitment is necessary ..	**B26**		3	6	each.



B24



B31.

SYRINGE SIGNAL.

THIS can be slipped over the top of the plunger of most standard syringes, and when connected in circuit with a signal and battery will record the moment when an injection is given.

The idea was suggested to us by Prof. McDowall.

		s.	d.
PRICE, complete, fitted with 6-ft. Flex	**B31**	5	6
,, ,, without Flex	**B32**	4	0

PNEUMATIC SIGNAL.

THE Signal illustrated herewith is for use during experimental work. It is operated by means of the rubber ball, which can be held in the hand or placed on the floor and worked by the foot. It is so constructed that the barrel containing the piston can be reversed in the holder, thus making a right or left hand instrument at will.

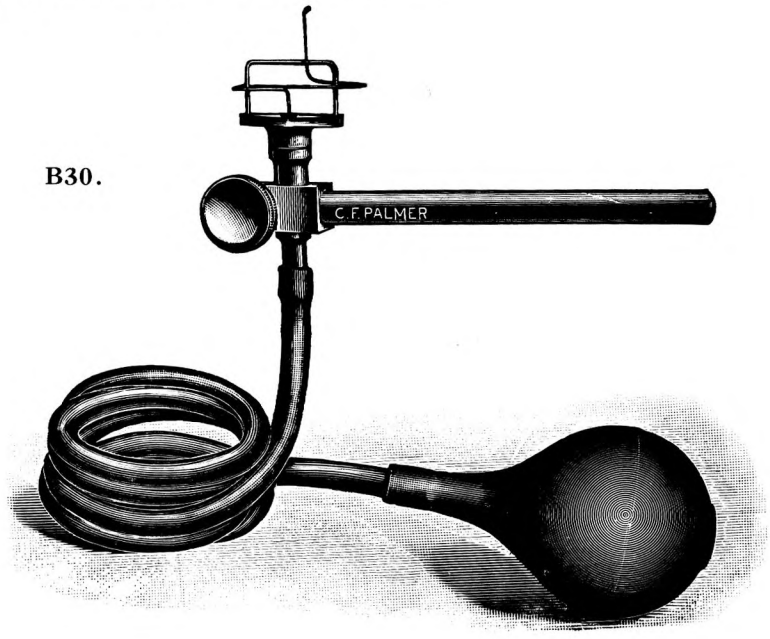
The spring wire seen at the top of the illustration can be used as the writing point without any addition.

PRICE, complete with india-rubber ball and 6′ of tube,

B30 .. £1 1 0

The above is fitted with a standard $\frac{3}{8}$″ stem 5″ long.

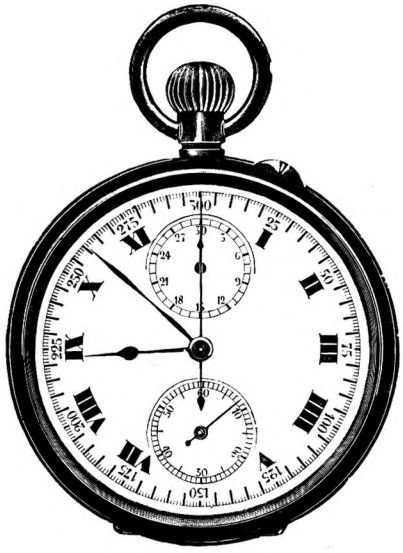
B30.



POCKET CHRONOGRAPHS.

FOR the convenience of our clients we can supply Swiss made Stop Watches which have been tested by ourselves and found to be quite satisfactory, and therefore have no hesitation in recommending them.

FULL TIME CHRONOGRAPHS as illustrated, having superior jewelled movement with " fly-back " action, it being only necessary to press the knob to start the timing action. A second pressure to stop, while a third pressure on the knob causes the hand to fly back to zero. This is a good pocket watch with the advantage of having " stop action " recording up to 30 minutes.



B50.

PRICE.

In black oxydised or nickel case.

B50 .. £5 5 0

(Price subject to exchange rate).

For timing experiments in the Laboratory up to 30 mins. duration by 1/5th seconds, this is an excellent instrument at a moderate price. It has " fly back " action similar to above.

PRICE.

In black oxydised or nickel case.

B52 .. £1 15 0

(Price subject to exchange rate).

B52.

CONDON'S DROP COUNTER.

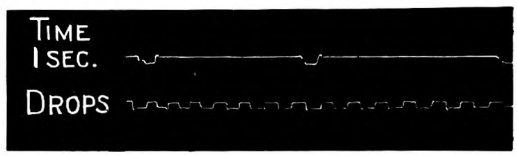
B75.

THIS instrument, devised by Mr. N. E. Condon and described by him in 1921 (*see* " Proceedings of Physiological Society," December 17th), is represented about half the actual size. It consists of a spiral of thin wire, which is supported on a pivot with a counter balance weight. The whole stands upon a brass rod carrying an electric contact screw. Between the spiral and the pivot is a projecting wire which dips into an isolated mercury cup when the spiral is depressed and thus closes an electric circuit. The spiral is fairly open and is protected by a transparent celluloid shield. A drop of fluid falling from the pipette above depresses the spiral and completes the circuit. The drop runs through the spiral and may be collected in a dish below.

The advantages of the recorder are :—

(1) That it acts when the spiral is only 5—10 mm. from the point of discharge.
(2) That it records accurately the number of drops.
(3) There is no loss of fluid caused by splashing.

This instrument will easily record up to 200 drops per minute. With one of the latest improved instruments, and with careful adjustment, Mr. Condon has successfully recorded 420 drops per minute, and below is given a reproduction of an actual tracing secured by him.



These instruments are now sent out with three nickel silver spirals, with weights attached.

		£ s. d.	
PRICE	**B75**	0 15 0	
,, Platinum Wire Spiral	**B76**	5 0	each extra.
,, Nickel Silver Spiral	**B77**	6	,,

The latter are suitable for most experiments, and when bent or corroded can be discarded.

An adjustment is necessary with fluids of varying viscosity, and is made by bending the wire so as to place the weight nearer to, or farther from, the axis.

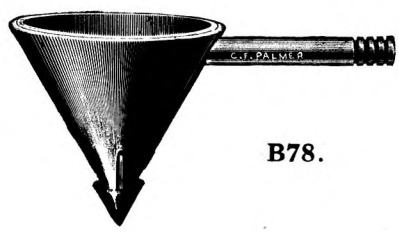
Mr. Condon in a letter dated May 16th, 1922, points out that the drop counter makes an excellent interrupter for muscle work when placed in series with the primary of an induction coil.

PROF. INCHLEY'S DROP RECORDER.

THIS consists of a double walled funnel, open at the bottom and dipping into a small conical cup, which, when filled with fluid, seals the internal space. This may be connected to a light tambour through the tube, which also forms the support and through which the impulse of a drop falling into the cup is communicated to the tambour. A like drop overflows from the cup, making the process continuous.

See " Journal of Physiology," Jan. 21st, 1928.

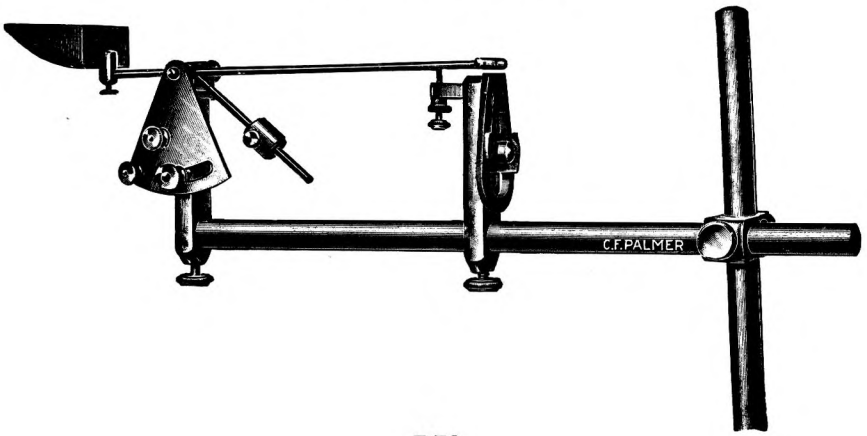
PRICE **B78** 11/6



B78.

A MAGNET-TIPPER
FOR RECORDING OUTFLOW.

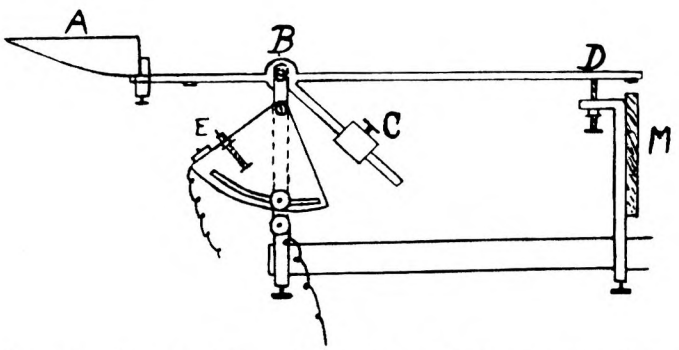
By N. E. CONDON.



B72.

The following is Reprinted from "Phys. Proceedings," June 28th, 1913:

"THIS tipper consists of a small spoon on the end of a rod, which is supported on a pivot at *B* and balanced by a counter-weight at *C*, which can be moved away from or towards the pivot. The rod is continued beyond the pivot to a support *D* and ends in an iron expansion. Below this is fixed a horseshoe magnet *M*, acting on the iron expansion, but prevented from actually touching it by the screw support *D*. As the water to be measured flows into the spoon, the latter is held in position by the counter-weight and magnet, but when these are overcome, the spoon descends suddenly and a platinum point on the rod strikes on the platinum point *E*, thus closing the circuit connected to an electric signal on the drum.

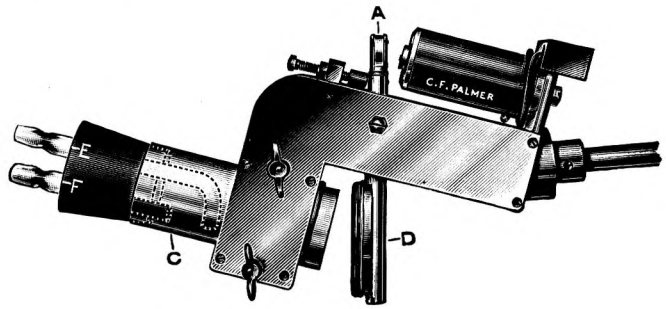


The point *E* may be moved upwards or downwards when necessary by moving the triangular plate on which it is supported, and which is isolated by vulcanite from the rest of the apparatus. When the spoon is emptied, the weight swings back into position, where it is held by the magnet. The latter is the essential feature of the apparatus, as, when its attraction is overcome, the bar moves with a sudden jerk, which is not present in a merely counter-weighted bar. The amount of fluid sufficient to move the spoon may be varied considerably (1—5 c.c.) by moving the weight and adjusting the distance between the magnet and the bar by means of the screw at *D*."

PRICE **B72** £1 18 6

X Block extra.

GADDUM'S OUTFLOW RECORDER.



B80.

Designed by **Dr. J. H. GADDUM,** and described in
" Journal of Physiology " (Vol. 67, No. 1, February 28th, 1929, Proceedings XVI.)

THE above illustration shows a modified form of the apparatus. The principle employed is different from most Outflow Recorders, as the instrument measures the volume of liquid that flows out in a known interval of time.

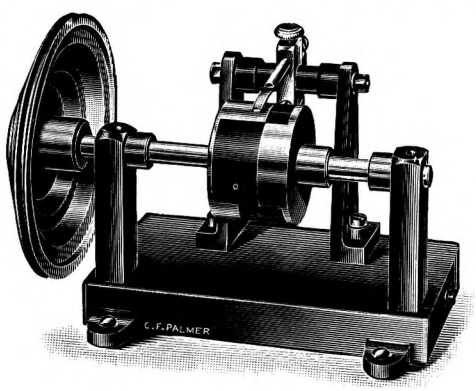
The tube *C* is of silver and is easily detachable for cleaning, a spring collar indicates the position when replacing and also prevents the tube from being pushed backwards by *D*.

The electro magnets can be wound for different resistances, so that they can be energised from accumulators or from the D.C. lighting mains, provided a lamp is connected in the circuit.

In order to actuate the electro magnets of the above Outflow Recorder at regular intervals, it is necessary to use some form of Rotary Key driven at a constant rate, we have, therefore, made the three-segment key B83, which for work that does not require great accuracy can be driven from the laboratory shafting or small geared motor, provided the speed is fairly constant.

For work requiring greater accuracy, a geared motor with governor or motor driven from a large accumulator should be used.

When the Rotary Key is driven at 30 R.P.M. the electro magnets controlling the Outflow Recorder can be operated from the three segments as follows :—



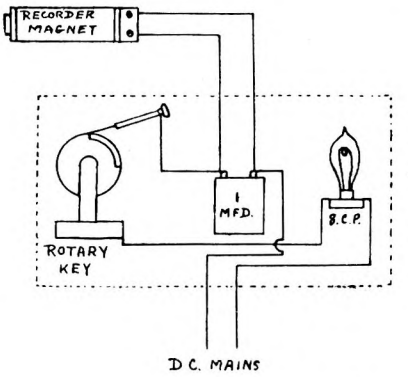
B83.

Open for ½ sec., closed for 1½ secs.
,, 1 ,, ,, ,, 1 ,,
,, 1½ ,, ,, ,, ½ ,,

This range allows the Recorder to be successfully used for various kinds of outflow.

Rotary Keys, similar to B83, can be supplied with segments to give different opening and closing periods.

GADDUM'S OUTFLOW RECORDER—*contd.*



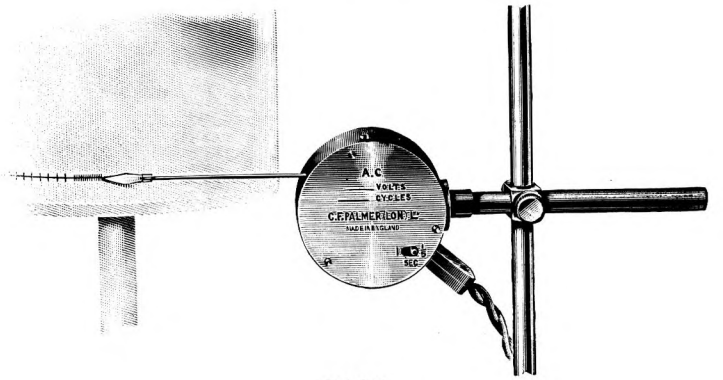
In laboratories where D.C. mains are available, the Rotary Key can be set up as shown in the print herewith. If A.C. mains only are available it is advisable to use accumulators, unless a good rectifier is installed.

Please state if required for use with accumulators or D.C. mains. If the latter, please give voltage.

			£	s.	d.
PRICE.	Outflow Recorder for use with Accumulators or D.C. mains. ..	**B80**	4	10	0
,,	Three-Segment Rotary Key	**B83**	3	5	0
,,	,, ,, ,, mounted on Base Board, with lamp and condenser for use on D.C. mains	**B84**	4	4	0

DIRECT WRITING TIME-MARKERS

FOR A.C. MAINS.



B102.

THE general introduction of alternating current, the frequency of which is accurately controlled, has made it possible to employ small synchronous motors as precision time-keepers.

The direct writing instrument illustrated above shows a motor, suitably geared, to actuate a writing lever at intervals of $\frac{1}{5}$ second and 1 second, the time interval being selected by means of the small lever shown at the front.

The body of the Marker measures $2\frac{1}{2}$" diameter x $1\frac{7}{8}$" wide, the holding stem being standard $\frac{3}{8}$" diameter; a small flat 2-pin socket is provided for connecting to the mains.

As it is possible to supply the above instrument to give time intervals other than those listed, please let us know your requirements.

			£	s.	d.
PRICE.	A.C. Time-marker marking $\frac{1}{5}$ second only	**B100**	3	7	6
,,	,, ,, 1 ,, ...	**B101**	3	7	6
,,	,, ,, $\frac{1}{5}$th and 1 second only (as illustrated)	**B102**	3	15	0

Please give particulars of voltage and frequency of supply when ordering.

TIME CLOCK FOR A.C. MAINS.

B112.

IN circumstances where the direct writing Time-markers, B100–102, do not give a sufficiently wide range of time intervals, or where it is desirable to operate a signal or other small electro-magnetic appliance, the clock shown above will be found most suitable.

A small Synchronous Motor is used, but instead of actuating a single lever, a multiple toothed wheel is made to rotate at one revolution per minute, five platinum spring contacts are closed at intervals of 1 sec., 5 secs., 10 secs., 30 secs., and 1 min., and when a battery is connected to the clock, one or more signals can be operated by connecting to the terminals shown for the different time intervals.

In place of the five double pairs of terminals, a clock can be supplied with one pair of terminals and a five-point switch, with this it is possible to change from one time-interval to another without altering connecting wires at the terminals.

An insulated connecting socket and quick-break double switch is fitted to the front panel, so that when the mains are switched off the battery circuit is also disconnected.

			£	s.	d.
PRICE.	A.C. Time Clock with standard range of time-intervals (1, 5, 10, 30 secs. and 1 min.) and terminals, as illustrated	**B112**	6	0	0
,,	A.C. Time Clock with standard range of time-intervals (1, 5, 10, 30 secs. and 1 min.), but with five-point selection switch ..	**B113**	6	5	0

The following time-intervals can be substituted for any of the standard range given above : 2, 3, 4, 6, 12 or 20 secs., without extra charge, if advised at time of ordering.

Please give particulars of voltage and frequency of supply.

SECTION

C

RECORDING INSTRUMENTS

Tambours Levers

Manometers Volume Recorders

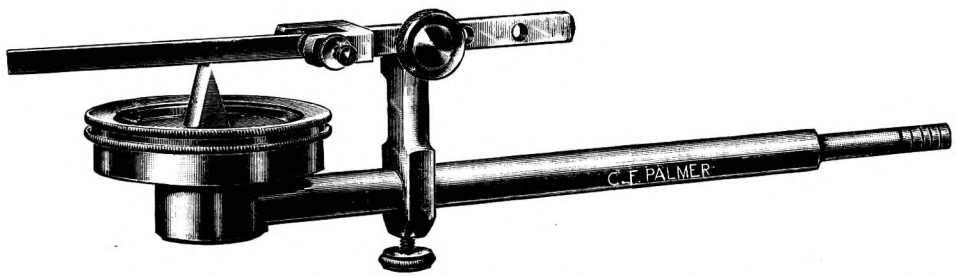
Myographs Ergometer

Light Pulleys

Weights

Writing Points

TAMBOURS.

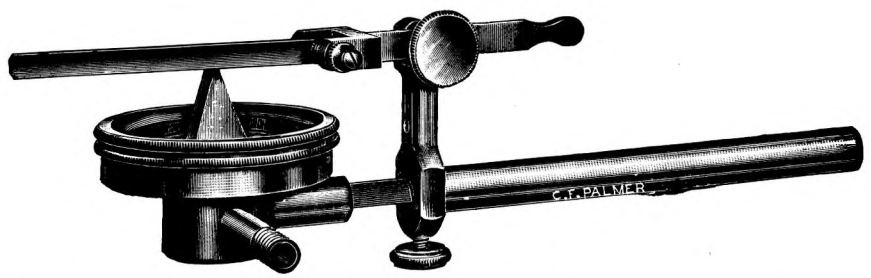


C1.

THE BRODIE TAMBOUR is similar to an ordinary Tambour, but the base, or cup, is made much heavier, which gives it steadiness in action. Its chief feature is the simple but effective means of fixing the rubber diaphragm. Each instrument has two interchangeable diaphragm rings of 1″ and 1⅜″ opening respectively.

To put on a diaphragm : first remove the recording lever and its support by slipping it off the stem ; then, holding the cup in the left hand, slip the screwed cap over the left thumb ; next, lay a piece of thin sheet rubber over the cup and the selected diaphragm ring (large or small), and upon these the metal plate with knob in centre ; hold this down with the left thumb, and trim off the surplus rubber with a small pair of scissors ; screw on cap, remove metal plate, and all that remains to be done is to re-assemble the lever and cement one of the small triangular pieces of cork to centre of diaphragm—on this the lever rests.

PRICE **C1** £2 10 0

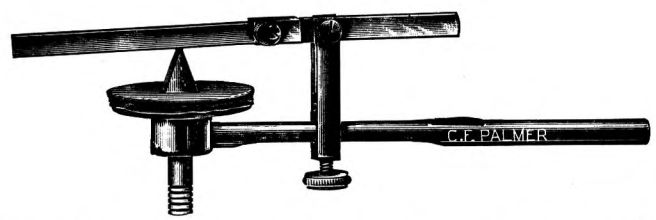


C2.

THE NEW PATTERN BRODIE TAMBOUR is similar to the original as regards the method of fixing the diaphragm (the distinctive feature of the Brodie Tambour), but, instead of the lever support sliding along the stem, it is fixed, the cup being the movable part. The inlet can be either at the side as shown, or at the bottom. The Brodie Tambour can also be fitted with similar connections if wished.

Tambours with connections, as illustrated, sent unless otherwise ordered.
Both the above have ⅜″ stems and fit the standard as well as the Adjustable " X " Block (*see* Section D).

PRICE **C2** £2 15 0

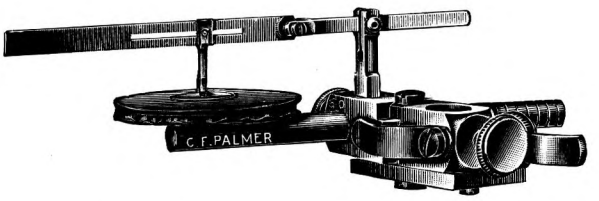


C3.

STUDENTS' TAMBOUR of simple but efficient design, with " tie-on " diaphragm, 1½″ diameter. The stem of this instrument is smaller than the above, being only ¼″.

PRICE, with diaphragm fitted **C3** 17/6

ADJUSTABLE TAMBOUR.



C5.

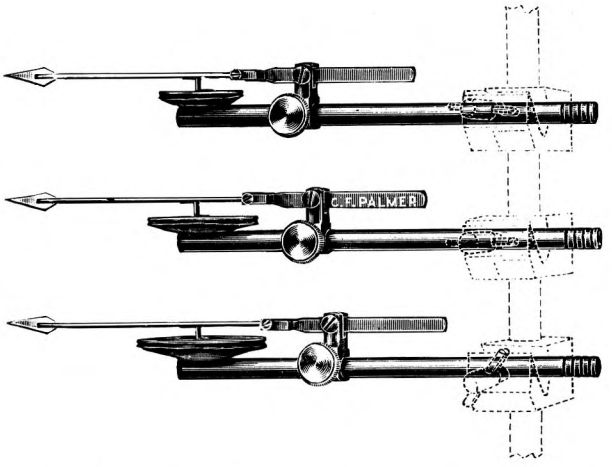
THE above represents the old form of Tambour with tie-on diaphragm, which is still preferred by many, mounted on and incorporated with one of the adjustable " X " Blocks. The great advantage of this Tambour over the usual Continental form lies in the fact that the cup with the connecting tube is detachable from the rest, so that it is a comparatively easy matter to tie on a new diaphragm. The adjustable " X " Block (*see* D35) gives not only fine adjustment, but a quick outward movement of the writing-lever from writing surface, and the whole forms a very compact and good Tambour, having all the necessary movements as on the much more expensive instrument, at a reasonable price.

PRICE (fitted with diaphragm complete) **C5** £2 2 0

C8.

OVAL TAMBOUR. For some purposes a Tambour with an oval diaphragm may be found more satisfactory than the usual circular diaphragm, we therefore offer the above which has a diaphragm measuring 23 mm. x 18 mm., the hollow stem being $\frac{3}{8}$" diameter.

PRICE (fitted with diaphragm complete) **C8** £1 5 6



C10.

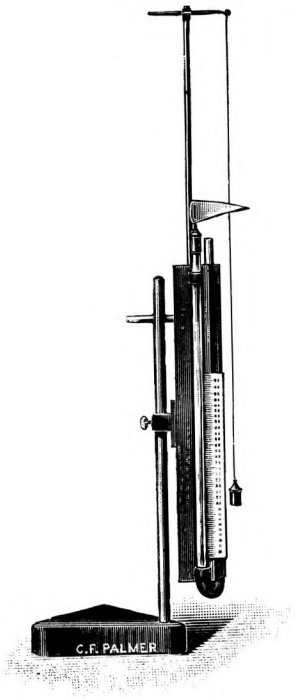
C11.

C12.

SMALL ROUND TAMBOUR, originally designed for Phonetic work, but of general utility. The lever is a steel needle on which can be slipped a fine straw as shown.

Made in three sizes, 22 mm. (**C10**), 28 mm. (**C11**), and 35 mm. (**C12**), either size, each, £1 1 0

MERCURY MANOMETERS.



C21.

THESE we are prepared to supply in any form, or bore, with or without cocks, etc.

The glass tubes can be either the ordinary bent " U " tubes, or two straight tubes joined together at the lower ends by a short length of rubber " pressure " tubing, as those supplied for many years with the Brodie and later with the Brodie-Starling Kymograph. This latter form is recommended on account of there being less likelihood of fracture and the possibility of cleaning the inside of the tubes. On the other hand, if this form is used for measuring a large rise in pressure, it is obvious that there will be a slight and equal drop of the Mercury in both legs of the Manometer, due to the expansion of the rubber tube under the extra pressure, which will need a slight adjustment of the scale, but it in no way affects the accuracy of the Manometer. The difference, however, is so slight as to be negligible in most experiments.

All tubes are approximately 5 mm. bore unless ordered otherwise.

Manometer mounted on teak wood block, with tubes 30 cm. long reading to 250 mm., complete with scale (adjustable by sliding), float with aluminium wire, cap for tube, writing point, suspension for and guide weight, also fitting for $\frac{3}{8}$" upright, as illustrated :—

		£ s. d.
PRICE, without stand	**C20**	1 7 6
,, with stand	**C21**	1 12 6

Standard Manometer similar to that supplied with the Brodie-Starling Kymograph but with fitting for $\frac{3}{8}$" rod. This Manometer has tubes 30 cm. long, with three-way glass cock *C*, adjustable scale, float and wire, writing point, weight *W*, and suspension for same *S*, and in addition to the cap on the tube, this Manometer has a guide *G* for the top of the aluminium wire.

		£ s. d.
PRICE	**C22**	1 15 0
,, with stand	**C23**	2 0 0

Manometer similar to the above but having tubes 38 cm. long, reading up to 300 mm. of Mercury. In all other respects as C22.

		£ s. d.
PRICE	**C24**	1 17 6
,, with stand	**C25**	2 2 6

" Bell " shaped floats for 5 mm. tubes with aluminium wire	**C30**	2/- each.

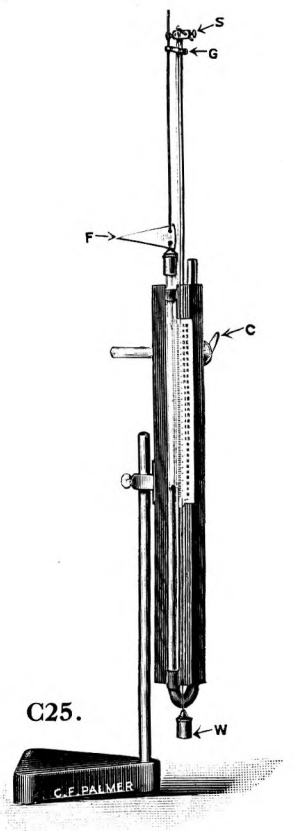
Please state exact size when ordering.

White Celluloid writing points, or flags	**C31**	1/- per doz.
Celluloid in sheets 10/1000" from which writing points may be cut	**C180**	2/- sq. ft.
White Manometer Scales, double reading, to 250 mm.	**C45**	3/-
,, ,, ,, ,, 300 mm.	**C46**	3/6

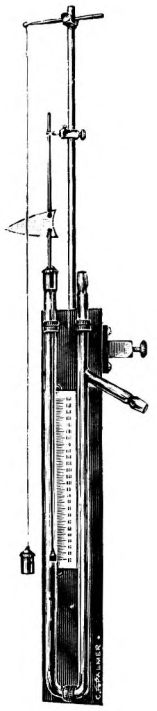
The above are fitted with clips to slide behind Manometer tube.

If without clips, 6d. each less.

Any scales cut and engraved to order.



C25.



C26.

MERCURY MANOMETER

(With Wedge-shaped Support).

THE general design of this Manometer was suggested to us by Prof. D. T. Harris, who found that the Standard Manometer was not very convenient when used with a Recording Drum on the Drum Stand A153, owing to the distance of the stylus from the paper. The special wedge-shaped support of this Manometer allows the stylus to be brought much nearer to the paper, and is therefore more satisfactory in use. Standard size of the tubes 32 cm. long x 5 mm. bore, approximately.

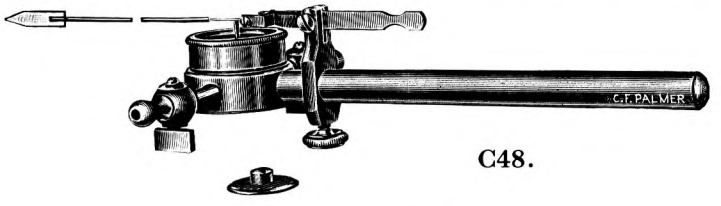
		£	s.	d.
PRICE, Wedge-shaped Manometer as illustrated ..	**C26**	1	7	6
,, ,, ,, with 3-way Cock	**C27**	1	15	0

WATER MANOMETER.—Similar in design to our Standard Mercury Manometer C20, but with tubes 6 mm. bore and a specially designed vulcanite float, this manometer has been used successfully for recording venous pressure.

PRICE, with tubes 30 cm. long **C36** £1 12 6

Water Manometers with other lengths of tube can be supplied.

MEMBRANE MANOMETER.



C48.

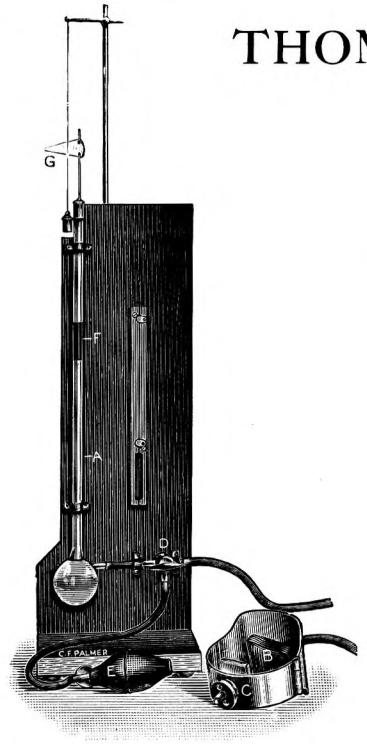
Similar to that described by Prof. Sherrington (*see* " Mammalian Physiology," C. S. Sherrington, 1919, page 52). This is a small tambour, with diaphragm $\frac{9}{16}$" diameter, made on the principle of the Brodie Tambour, but having two cocks, as will be seen from the illustration. There is a small thumb-piece shown immediately below, as with the Brodie Tambour, to aid in fixing the diaphragm.

PRICE **C48** £3 3 0

For instructions *re* fitting rubber diaphragms, *see* No. C1.

The Membrane Manometer can be supplied with different sizes of diaphragm, if required.

THOMPSON SPHYGMANOGRAPH.



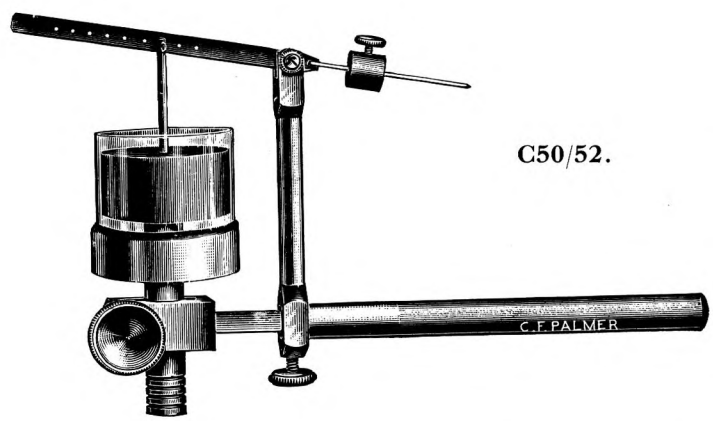
C40.

THE illustration at side shows a more compact form of Sphygmanograph than that described by J. H. Thompson in "The Journal of Pharm. and Exp. Therapeutics" (Vol. 39, No. 4, June, 1930), and consists of a rubber pressure bag *B* fitted in a quickly adjustable armlet *C*, connected through the **T**-bore glass cock *D* to a single limb water manometer *A*, in which floats a light vulcanite float *F*, carrying the writing point or ink pen which is held to the paper by the overhead hanging weight. Pressure is applied to the system by means of a pressure bulb *E*, fitted with screw release valve. The whole Manometer assembly is mounted on stout teak frame.

A light Clockwork Drum can be supplied to fit at the top of the frame.

		£	s.	d.
PRICE, as illustrated	**C40**	5	15	0
,, Complete with Clock-work Drum	**C41**	9	10	0
,, Armlet and pressure bag only ..	**C42**	2	2	0

PISTON RECORDERS.



C50/52.

THE Piston Recorder, as illustrated, is a much better instrument than those usually made from glass tube, which is never round, straight, or parallel. The tubes of the above are specially drawn and annealed for us, after which we grind them perfectly true in a universal internal grinding machine. In place of the vulcanite pistons formerly fitted, we now fit pistons turned from light aluminium alloy. These are not affected by the extreme heat of hot countries as were the vulcanite ones.

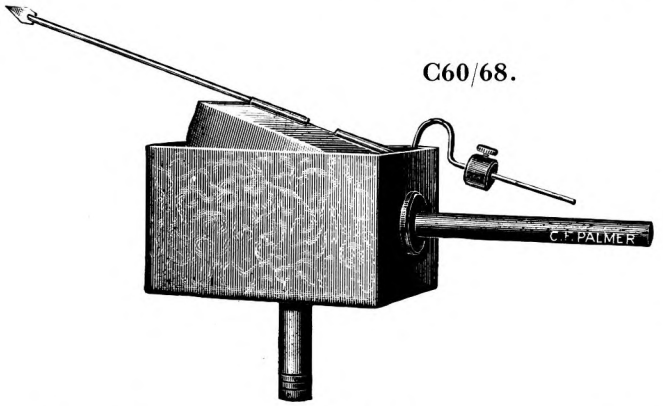
The pistons and cylinders of these recorders must be kept perfectly clean and with no lubricant applied other than air. When stowed away, it is well to place them upside down so that no dust will settle in them.

It will be noticed that the cylinder can be adjusted up and down or in and out, in relation to the fulcrum of the lever, without disturbing the position of the writing point.

Made in three sizes, approximately 18 mm., 31 mm. and 42 mm. internal diameters; all fitted with $\frac{3}{8}$" stems.

			£	s.	d.
PRICE.	18 mm.	**C50**	3	15	0
,,	31 mm.	**C51**	4	4	0
,,	42 mm.	**C52**	5	10	0

FLOAT RECORDERS.



C60/68.

THE Float Recorder, as illustrated, consists of a chamber made of copper-foil open at the bottom, and floating in a tank over a central tube. The chamber is so shaped that the movement is directly proportional to the volume. It is pivoted at one end, and has an adjustable balance weight, provision being made for fixing the writing lever.

Can be made in any size to order, the standard sizes being as follows :—

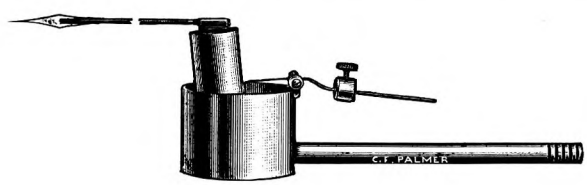
Size of Float.	Capacity.	Size of Tank.		PRICE. £ s. d.
5 x 3 cm. ..	20 cc. ..	7 x 5 cm. ..	**C60**	2 10 0
7 x 5 cm. ..	80 cc. ..	9 x 7 cm. ..	**C61**	2 12 6
10 x 7 cm. ..	225 cc. ..	12 x 9 cm. ..	**C62**	3 12 0
15 x 10 cm. ..	600 cc. ..	17 x 12 cm. ..	**C63**	5 2 0
The largest Recorder can be fitted with double outlets and tray for soda lime			**C64**	5 15 0

We also have had a demand for Float Recorders, similar to Nos. C60 to C64, but of much smaller capacity, and should therefore like to offer the following, the respective maximum volume recording capacity being 10 cc., 7·5 cc. and 5 cc.

One size of tank only is made, in which either of the three floats is interchangeable.

			£ s. d.
PRICE.	Tank with one 10 cc. Float	**C65**	2 0 0
,,	,, ,, 7·5 cc. ,, ...	**C66**	2 0 0
,,	,, ,, ,, 5 cc. ,, ...	**C67**	2 0 0
,,	,, ,, three Floats, one each as above	**C68**	3 15 0

If desired, the floats can be gold plated with the view to arresting corrosion, for 5/– to 10/– each extra, according to the amount of gold deposited.



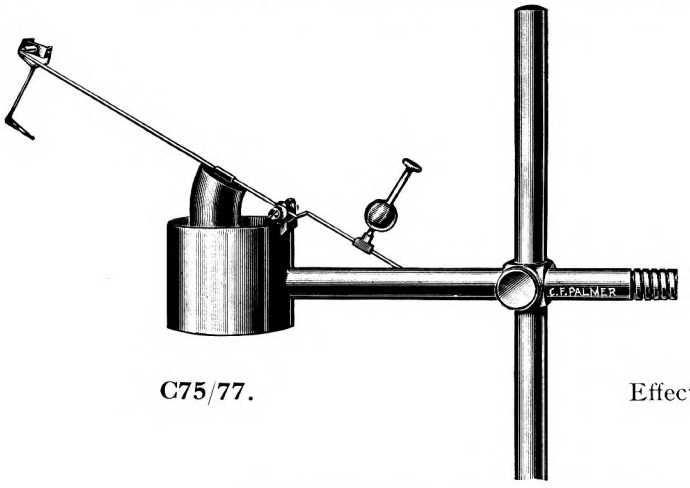
C70.

A still smaller Recorder is made, having a tubular float, as in illustration. These are made in the following capacities : 5 cc., 2·5 cc. and 1·5 cc. respectively.

			£ s. d.
PRICE.	Recorder with one 5 cc. Float	**C70**	1 15 0
,,	,, ,, ,, 2·5 cc. ,, ...	**C71**	1 15 0
,,	,, ,, ,, 1·5 cc. ,, ...	**C72**	1 15 0
,,	,, ,, with three interchangeable Floats (one each size)	**C73**	3 10 0

(Gold plating as above).

PROF. McDOWALL'S RECORDER.

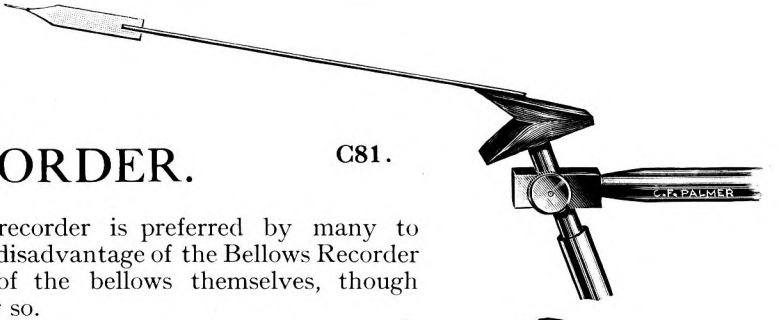


C75/77.

IN a recorder as No. C70, there is a slight error, owing to the tilting of the floating chamber. In this instrument the chamber is curved with the view of obviating this. There is a balance weight with screw adjustment, and a special writing point consisting of a swinging wire pendulum with a glass writing point. For full particulars, *see* Proceedings of the Physiological Society, October 13th, 1928.

			£	s.	d.
Effective Maximum Capacity,	3 cc.	**C75**	1	17	6
,, ,,	5 cc.	**C76**	1	17	6
,, ,,	8 cc.	**C77**	2	0	0

BRODIE BELLOWS RECORDER.



C81.

THIS form of sensitive volume recorder is preferred by many to the Piston and Float types, one disadvantage of the Bellows Recorder however, is the fragile nature of the bellows themselves, though with care they should last for a year or so.

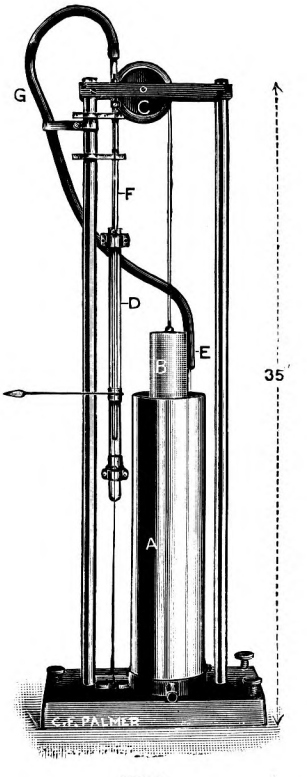
In order to protect the membrane and to avoid straining the hinge, the bellows are enclosed in a light metal open-top box, with celluloid window (this is not shown in the illustration).

Three sizes are made, having a maximum capacity of 2·5 cc., 10 cc., and 20 cc., all being fitted with standard $\frac{3}{8}$" diameter holding rods.

			£	s.	d.
PRICE.	2.5 cc.	**C80**	2	2	0
,,	10 cc.	**C81**	2	5	0
,,	20 cc.	**C82**	2	10	0

SPIROMETER,

WITH SYPHON COUNTERPOISE.

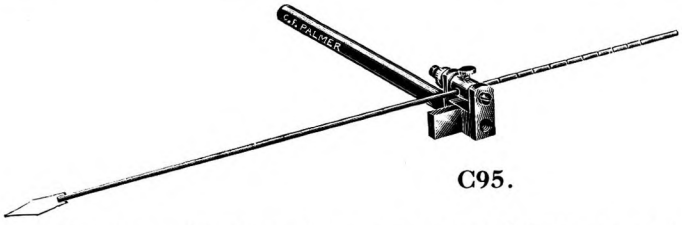


C90.

THIS illustration shows a Spirometer, embodying the Syphon Counter poise principle devised by Tissot, arranged for use in the Bio-chemistry Department of the Middlesex Hospital.

A light float *B* is connected by a cord over the pulleys *C* to the Counterpoise *D*, which slides on guide wires ; a Syphon runs from the main water tank *A*, through tubes *E*, *G* and *F* into the Counterpoise *D*. It therefore follows, that as the float *B* is raised the Counterpoise *D* falls, and water is syphoned from *A* into *D* until it is level in both, this having effect of making the Counterpoise *D* weigh heavier the greater the distance Float *B* is out of the water. By carefully determining the bore and weight of the Counterpoise in relation to the float, an almost exact balance can be obtained for the full movement of the Float.

PRICE, with Float of 700 c.c. capacity **C90** £10 15 0



C95.

SIMPLE LEVER.

THIS consists of a light aluminium rod mounted in a stout brass frame, with a stop-piece at one end and a $\frac{1}{4}$" dia. supporting stem, which can be fitted to either side.

The Lever fits through an axle pivoted between centres, a thumb-screw located on the axle midway between the centres permits the aluminium Lever to be adjusted for length as required. Grooves are cut in the Lever to hold threads, etc.

A very light celluloid writing point is fitted as standard, but the All-Metal Frontal Writing Point, C171, can be supplied if required.

			s.	d.
PRICE.	Lever, as illustrated	**C95**	7	6
,,	,, with All-Metal Frontal Writing Point ..	**C96**	10	0

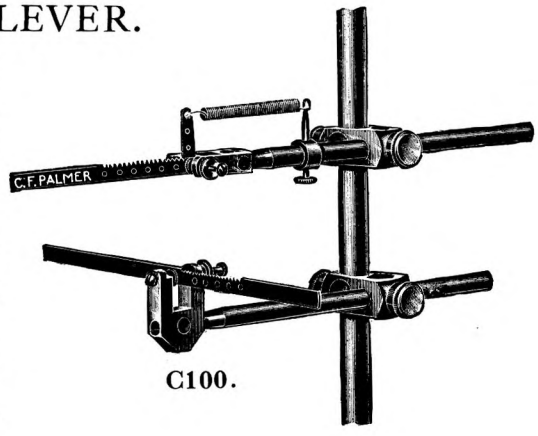
The "BRODIE" UNIVERSAL LEVER.

This was designed for the late Prof. Brodie as a lever of general utility. In the upper illustration it is shown with the levers arranged to form a bell-crank lever, with adjustable spring support. In the lower, it is shown with two levers to form a double-ended straight lever. The axis is screwed, and has two nuts between which the interchangeable lever, or levers, are clamped. There is a simple device for holding the axis central while screwing up the centre screw on which it rotates. It will be noticed that the stem screws into the head in various positions as is common to many of our levers.

PRICE, with one plain lever, one notched lever with holes, and one short lever.

C100 8/– each. £4 10 0 per doz.

"X" Block and Stand extra.



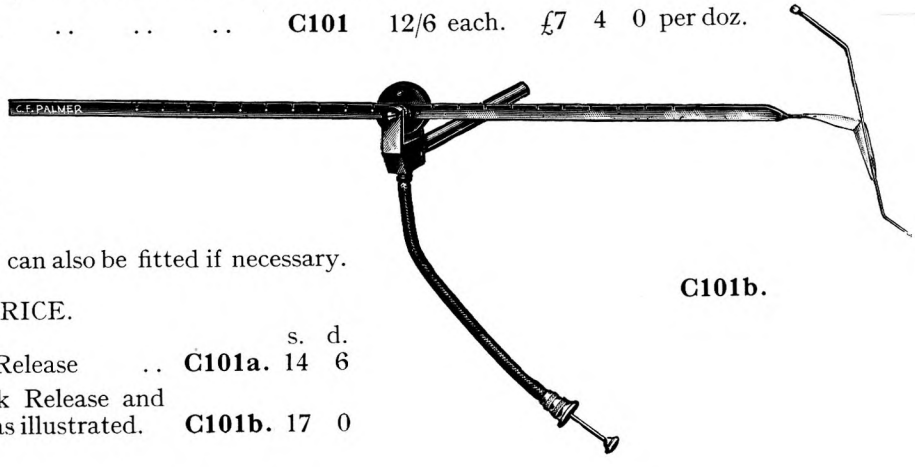
C100.

The "FIXIT" LEVER.

This is similar to the "Brodie," and has various levers that can be fixed to the spindle, in the centre of which is a vulcanite roller having three pins set at an angle of 90°. On the centre spindle and one of these pins the levers fit, a nut holding them in position. Sliding through the frame is a rod carrying a spring that can be caused to bear against the roller to resist its turning, so that the lever is held in a fixed position while other adjustments are made—hence its name.

PRICE .. .. **C101** 12/6 each. £7 4 0 per doz.

THE "FIXIT" LEVER can be supplied with a Kodak camera shutter release, to hold the lever firmly when required, in place of the standard sliding rod, at an extra cost. The Frontal Writing Point, C170, can also be fitted if necessary.



C101b.

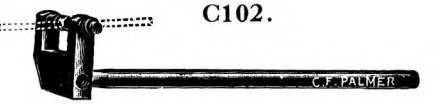
PRICE.

		s.	d.
"Fixit" Lever with Kodak Release ..	**C101a.**	14	6
"Fixit" Lever with Kodak Release and Frontal Writing Point, as illustrated.	**C101b.**	17	0

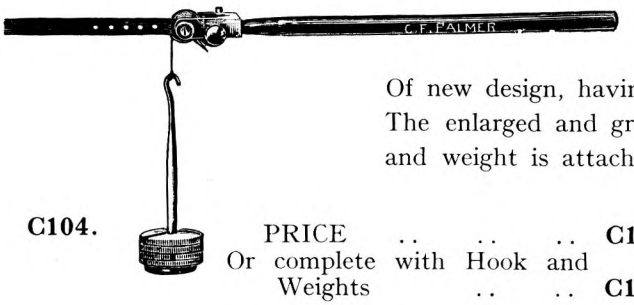
THE STRAW HOLDER.

Consists of a spindle mounted on centres, and having a spring collar for gripping straws, and such-like to form light levers.

PRICE .. .. **C102** 8/– each. £4 10 0 per doz.



C102.



C104.

ISOTONIC LEVER.

Of new design, having a cam in place of the usual after-loading screw. The enlarged and grooved portion of the spindle to which the cord and weight is attached is of three diameters, viz., 5, 7·5 and 10 mm.

		s.	d.
PRICE	**C103**	10	6
Or complete with Hook and Weights	**C104**	14	0

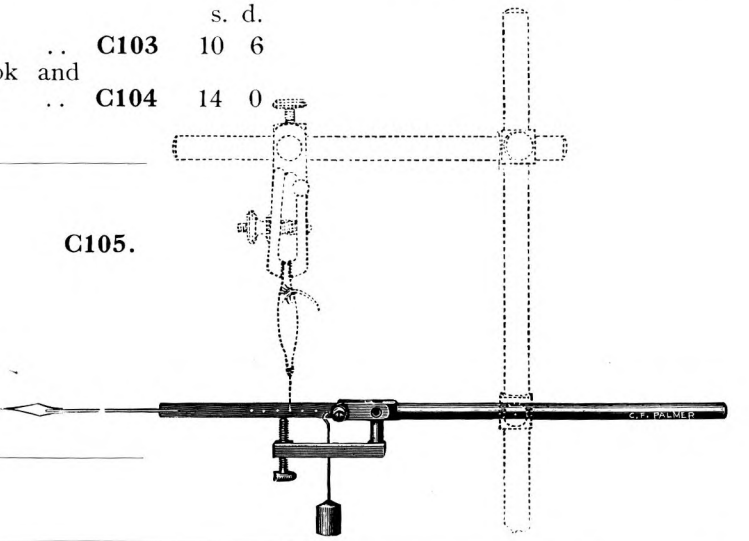
AFTER-LOAD LEVER.

With supporting screw and holes for attaching muscle.

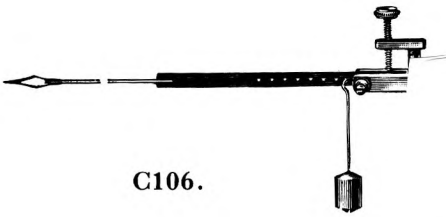
PRICE, complete with one weight.

C105 7/6 each. £4 4 0 per doz.

For Muscle Grip, "X" Block, etc., *see* Section D.



C105.



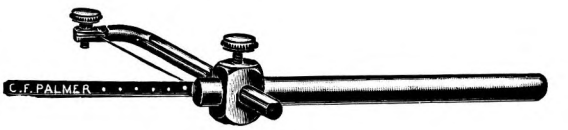
C106.

It will be noticed that all the foregoing have supporting frames that can be fixed in various positions in relation to the stem, as on the original Brodie Lever.

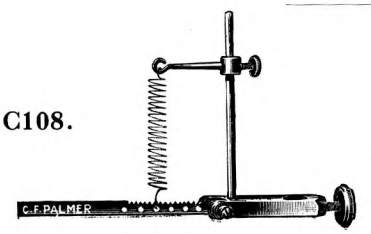
ISOMETRIC LEVER.

Consisting of holder carrying a length of spring steel wire, and a flat steel lever with holes for attaching the thread. The length of the wire is adjustable.

PRICE .. **C107** 13/– each. £7 4 0 per doz.



C107.



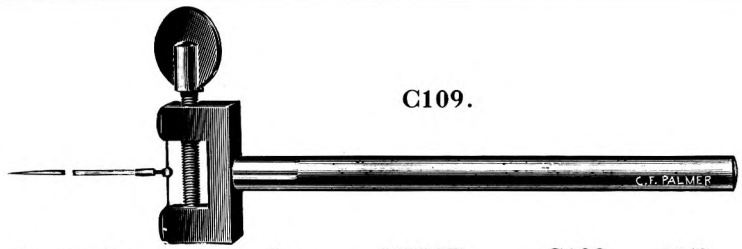
C108.

Prof. STARLING'S HEART LEVER.

Consists of a frame carrying a light steel lever, with holes and notches, supported by a fine adjustable nickel silver spring.

PRICE .. **C108** 9/6 each. £5 8 0 per doz,

ISOMETRIC LEVER.



C109.

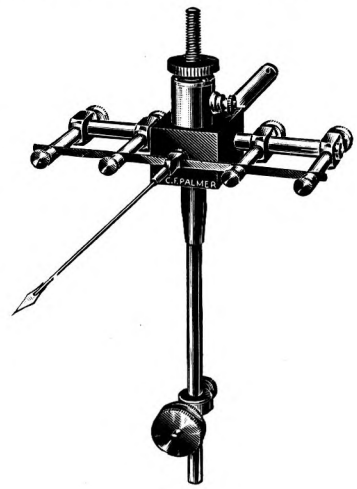
Similar to that fitted on the Ergometer, C201. It consists of a heavy brass frame with a piece of watch-spring securely fixed to the two horns and carrying the lever from its centre. The screw is so arranged that it forces the horns apart and so increases the tension on the spring.

PRICE .. **C109** 12/6

LARGE ISOMETRIC LEVER.

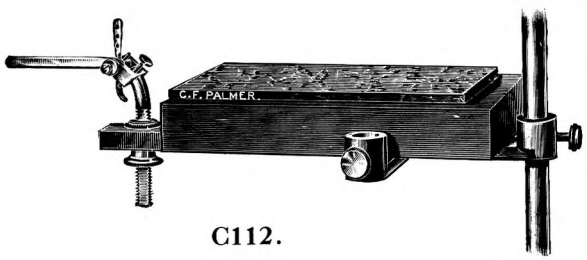
This lever was described by Prof. O. Meyerhof in Pflug. Arch. 191, page 133, 1921, and consists of a strong flat steel spring $5\frac{1}{4}$" long, held firmly by four adjustable clamping rods; a lever holder with holes for a wire from the muscle is located in the centre, the muscle being attached at the other end between the large milled nuts. Approximate tension is applied by sliding the lower boss head along the insulated depending rod; fine adjustment of tension is carried out by means of the large adjusting screw shown at the top. Terminals are provided for the central adjusting rod, also at the end of the supporting rod, which is of $\frac{3}{8}$" dia. Six steel springs of various thickness are supplied with each instrument.

PRICE **C110** £2 10 0



C110.

MYOGRAPHS



C112.

PROF. STARLING'S CRANK MYOGRAPH.

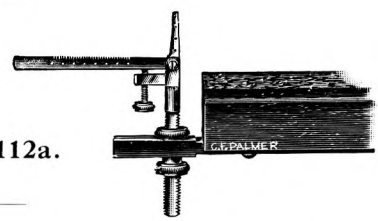
With after-load screw, complete with double clamp, frog board and cork top, $4\frac{3}{4}$" x $3\frac{1}{4}$".

PRICE. **C112** 18/6 each. £10 10 0 per doz.

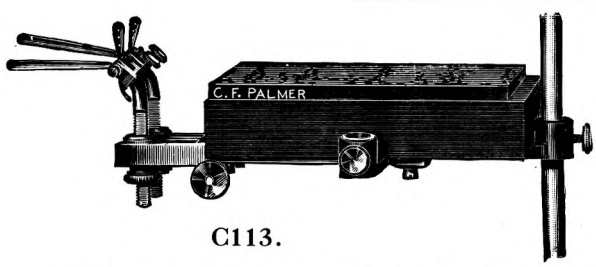
CRANK MYOGRAPH,

Complete with Frog Board, similar to the Starling Myograph but fitted with lever, as shown in illustration.

PRICE. **C112a** 18/6 each. £10 10 0 per doz.



C112a.



C113.

DOUBLE STARLING MYOGRAPH.

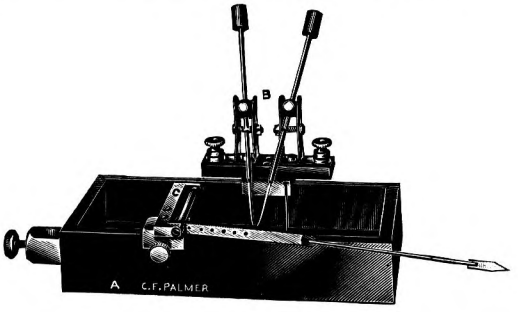
As C112, but with two Recording Levers, the second lever having an independent screw adjustment.

PRICE .. **C113** £1 12 6 each.

CRANK LEVER fitting only (as used in C112), with screwed stem and nuts.
PRICE .. .. **C114** 10/- each. £5 14 0 per doz.

CRANK LEVER fitting only (as used in C112a), with screwed stem and nuts.
PRICE .. .. **C114a** 10/- each. £5 14 0 per doz.

FROG'S MUSCLE CHAMBER.



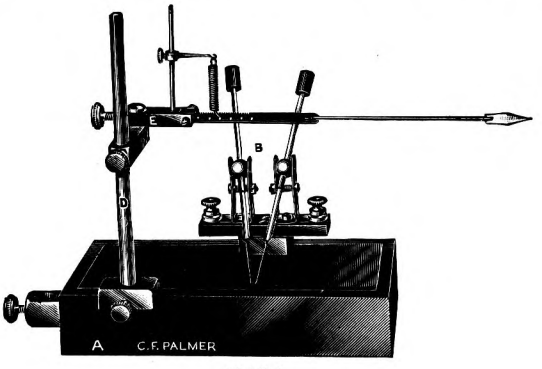
C122.

THE general construction of the Chamber resembles that described by Prof. B. A. McSwiney in the "Journal of Physiology" (Vol 67, No. 3, Jan., 1929), and consists of an ebonite Bath, *A*, 6″ x 3″, in which the muscle can be completely immersed in Ringer solution.

A pair of silver electrodes, *B*, ball and socket mounted, are fitted to a clamp which can be adjusted along the side of the Chamber. The horizontal writing lever, *C*, with hook depending into the Chamber, is also capable of full adjustment. The muscle is fixed to the bottom of the Bath by means of a stout pin, a drain plug is also provided.

PRICE .. .. **C122** £1 15 0 each. £19 16 0 per doz.

FROG'S HEART CHAMBER.

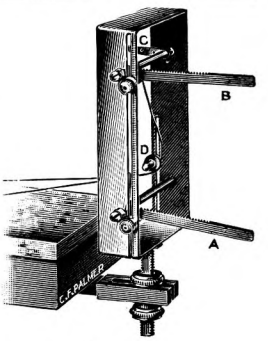


C124.

SIMILAR to the Muscle Chamber described above, but with a simple form of heart lever in place of the horizontal lever, the silver electrodes being the same. A special upright, *D*, is supplied so that levers already in use in the Laboratory can be fitted. The illustration shows a standard Starling Heart Lever, *E*, in position.

			Each. £ s. d.	Per doz. £ s. d.
PRICE,	complete as illustrated	**C124**	2 1 0	23 2 0
,,	As above, without Starling Heart Lever, *E*, but with Upright, *D*, to take any ordinary type Heart Lever	**C125**	1 12 6	18 18 0
,,	Chambers, complete with all fitments, *C*, *D* and *E*, for both Muscle and Heart work ..	**C126**	2 8 6	27 0 0
,,	Chamber, complete with fitment *C*, for Muscle, and *D*, for Heart work, but without Starling Heart Lever *E*	**C127**	1 19 0	21 18 0

DOUBLE MYOGRAPH.



C115.

The fitment shown herewith was designed by H. Zwarenstein and B. McManus (*see* " Transactions of the Royal Society of South Africa," Vol. 19, Part 1, 1930), and can be fitted to the standard Myograph Board, in place of the single lever, when it is desired to record simultaneously the contractions of the two gastrocnemei of a frog.

		£ s. d.
PRICE, complete with Frog Board	**C115**	2 0 0
,, Double lever fitment only	**C116**	1 13 0

FROG BOARDS, for use with heart levers, etc., having cork top 6″ x 4″, and clamp to fit a ⅜″ stand. These have steel rods inserted to prevent warping.

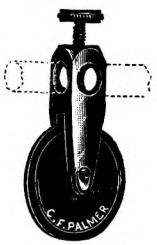
PRICE .. **C120** 5/6 each. £3 0 0 per doz.

C130/2 C140.

HOOK AND WEIGHTS.

Hook and Weights, for use with levers :—

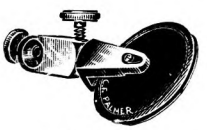
		s. d.
Brass Hook & Pan with 10 weights (total 110 grammes)	**C130**	4 0 per set.
Leaden Weights only (10 grammes)	**C131**	2 0 per doz.
Brass Hook and Pan (10 grammes)	**C132**	2 6 each.
A similar set but with 1 gramme weights (total 11 grammes)	**C135**	2 6 per set.
Single Leaden Weights, with long wire hook (10 grammes)	**C140**	4 0 per doz.



C150/2.

LIGHT PULLEYS

(For use in connection with Writing Levers).



C153/5.

BESIDES the ordinary Pulleys in fixed holders, these are now mounted in swivel holders, allowing the Pulley to be turned to any angle, as shown (C153/5). They are very light, and, running as they do on hard steel spindles, have little friction.

		Ordinary Mounting.		Swivel Mounting.	
		£ s. d.		£ s. d.	
PRICE: Diameter of Pulley, ⅝″	**C150**	12 6	..	**C153**	14 6
,, ,, ,, 1″	**C151**	17 6	..	**C154**	19 6
,, ,, ,, 1½″	**C152**	1 0 0	..	**C155**	1 2 0

Any of the above pulleys can be fitted with ⅜″ diameter or ¼″ diameter Brass stems at a small extra cost.

MINIATURE GUIDE PULLEYS.

These small Guide Pulleys were first made to the order of Professor Vincent. They will be found to be very handy when rigging up apparatus to record by means of levers worked by threads.

C160.

The two Pulleys are approximately $\frac{7}{16}$″ in diameter, and the steel arm upon which they slide to any position is 4½″ long. PRICE (as illustrated) **C160** 6/6

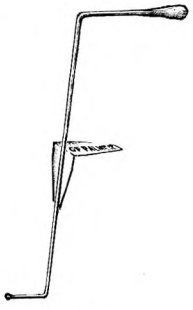
LIGHT METAL PULLEY.

C165.

Although the Pulley illustrated is useful for many purposes, it is not so " light running " as the Vulcanite Pulleys C150–155.

The grooved Pulley is 1″ diameter, and the supporting stem 4½″ long x ¼″ diameter. PRICE .. **C165** 8/-

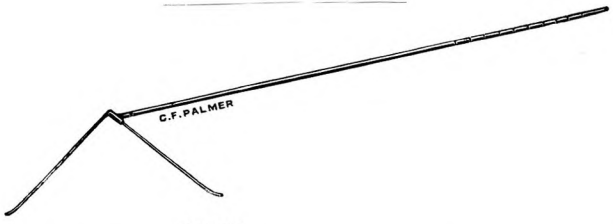
FRONTAL or VERTICAL WRITING POINTS.



C170.

On the principle described by Professor Lovatt Evans in the "Journal of Physiology." These are usually made in the Laboratory, but for the convenience of our clients, can be supplied separately, or fitted to almost any of our levers, at 2/6 each extra. **C170.**

The " Fixit " Lever (C101), having the end specially shaped, is the most suitable.



C172.

ALL-METAL FRONTAL WRITING POINTS.

Following a suggestion by Dr. W. H. Newton we have made these points of aluminium they have been found more durable than those made of glass. The points can be attached to of levers, or if required, can be supplied fitted complete with light round aluminium lever (9 standard).

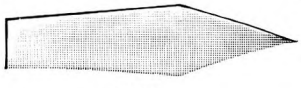
		s.	d.
PRICE. All-Metal Frontal Writing Point only	**C171**	2	6
,, ,, ,, ,, ,, complete with Lever (as illustrated)	**C172**	3	0

Milk-white Celluloid, 10/1000″ thick, for writing points **C180**

,, ,, ,, 5/1000″ ,, ,, ,, ,, ... **C180a**

CELLULOID WRITING POINTS, as on our Time-markers (B16), stamped to size, as illustrated (actual size). .. **C181** 6d. per doz.

For Manometers, *see* C31.



C181.

THIN CELLULOID WRITING POINTS, as illustrated (actual size).

PRICE .. .. **C182** 3d. per doz.

C182.

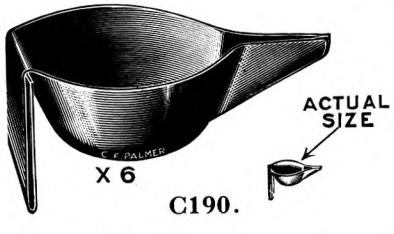
LIGHT ROUND ALUMINIUM LEVER, fitted with thin celluloid point 9-ins. long, as used in the simple lever C95.

PRICE .. .. **C185** 9d. each. 8/– per doz.

STRAWS for Levers .. .. **C187** 1/6 per bundle.

STRAW LEVER, fitted with thin celluloid point .. **C188** 2/– per doz.

VERY LIGHT INK PENS.



C190.

)m sheet brass or copper, and, weighing as they do only one grain, can s except those requiring extremely light or rapidly moving levers. Each that will fit on to an ordinary celluloid writing point.

The friction on ordinary glazed paper (as commonly used for smoking) is very slight, not only because of the smooth surface, but owing to the ink forming a lubricant.

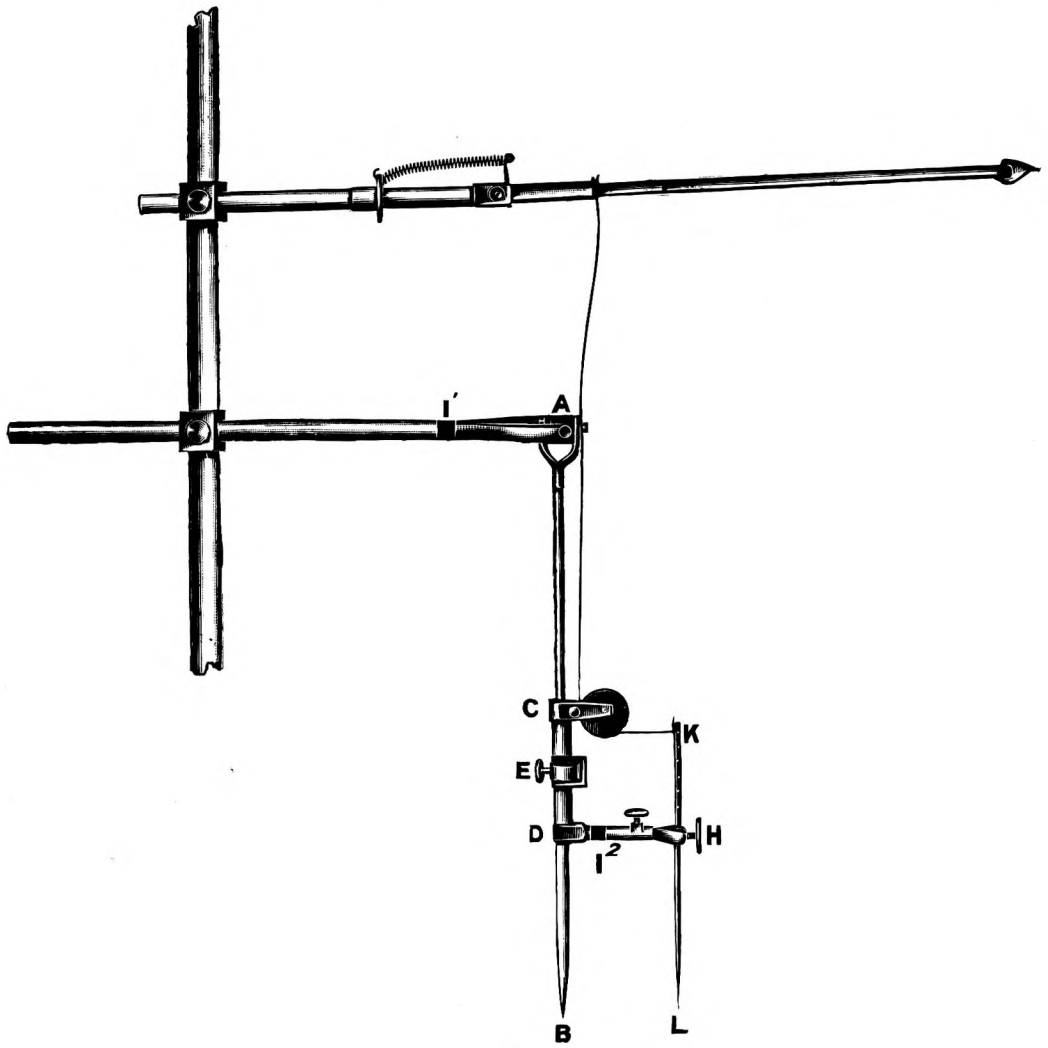
The Pens are easily filled with a glass dipping rod, and if the experiment is of prolonged duration, about 10% of glycerine should be added to ordinary ink to retard evaporation.

To start the Pen, it is sometimes necessary to draw the corner of a piece of paper along the capillary spout after filling with ink.

PRICE .. .. **C190** 1/3 each. 12/– per doz.

PROF. CUSHNY'S MYOCARDIOGRAPH.

For Recording Movements of the Mammalian Heart.



C200.

DESIGNED by Prof. A. R. Cushny and fully described in " Heart " (Vol. II, No. I, July, 1910). The above Myocardiograph is most convenient to record changes in the distance between two points on the surface of the heart, without being affected by other movements. Whilst the apparatus shown is best suited for the dog's heart, it can also be used for cats.

To record the movement of two chambers of the heart simultaneously, the whole apparatus has to be duplicated, and for this reason the Myocardiographs are usually sold in pairs. The Brodie Universal Lever, C100, is very suitable for use with this instrument.

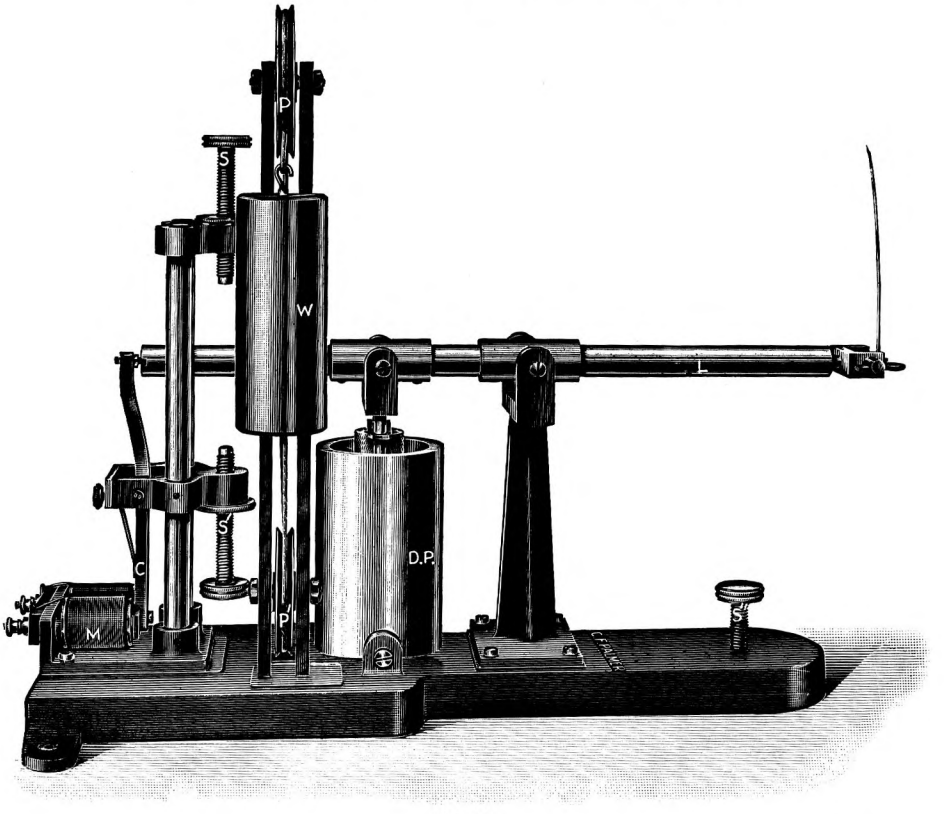
PRICE. Cushny Myocardiograph only, **C200** .. £5 5 0 per pair.

For Stands and " X " Blocks, *see* Section D.

ERGOMETER.

For investigating the "Viscous Elastic" Properties of Muscle.

See Royal Society Proceedings, B. Vol. 101, 1927.



C201.

THIS instrument was originally designed by A. Levin and J. Wyman, working in Prof. A. V. Hill's Laboratory, and in its present form has been slightly modified in consultation with Prof. Hill. It consists of a rigid lever, to the one end of which is fixed an Isometric Recorder which takes the form of a piece of watch spring, the lateral tension of which is controlled by a screw, whilst to its middle is fixed the short arm for attaching to the muscle under examination, and also a light writing lever.

The main lever *L* is pivoted about its centre, and in the opposite end from the recorder is a notch engaging with the lever *C*. This in turn is held in position against the force of a spring by the electro magnet *M*. Upon breaking the electric circuit the spring bearing against this lever at *C*, causes it to disengage with the notch, and thus *L* is set in motion.

The weight *W* is so arranged that it can be made to exert force upon the lever in either direction. This is accomplished by taking a cord from the lever directly over the pulley *P*, or down under the pulley *P'*, and then up over the pulley *P*, as in the illustration.

The extent of the movement of the lever *L* can be controlled by the stop screws *S*, and *S'*.

Near the fulcrum is a large dashpot (filled with light machine oil) with a regulating valve, allowing the force to be exerted either quickly, or extending over a long period of time.

The whole is mounted upon a cast iron base with an adjusting screw *S''*, the opposite end having two lugs which should be screwed down between the rubber washers provided, thus forming a pliable joint, allowing the screw *S''* to operate.

PRICE **C201** £17 10 0

Nett weight 28-lbs.

SECTION

D

Stands Uprights

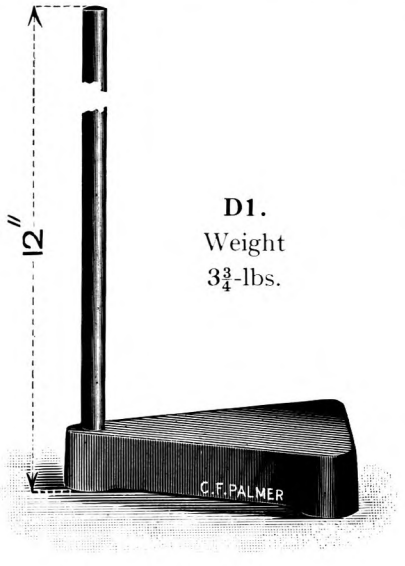
Clamps Rods

Adjustable and other "X" Blocks

Universal Joints

Muscle Clamps

STANDS.



D1.
Weight
$3\frac{3}{4}$-lbs.

PLAIN STAND.

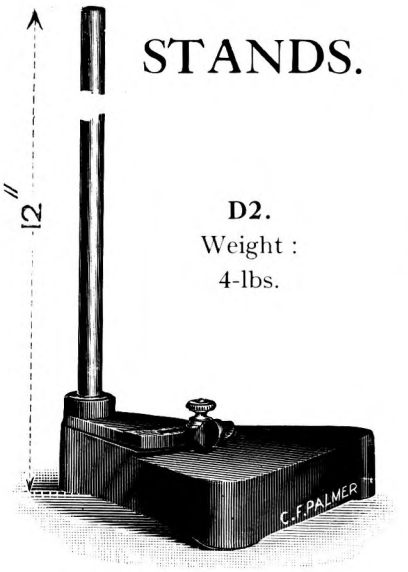
With C.I. base and brass upright, $\frac{3}{8}$" diameter, 12" high.

PRICE.

D1 5/- each. 54/- per doz.

Fitted with 3-claw base (as H57).

D1a 5/- each. 54/- per doz.



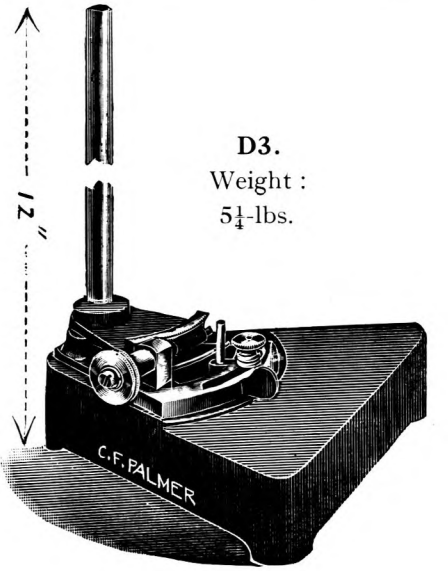
D2.
Weight :
4-lbs.

PLAIN STAND.

With quick adjustment and clamping nut.

PRICE.

D2 13/- each. 150/- per doz.



D3.
Weight :
$5\frac{1}{4}$-lbs.

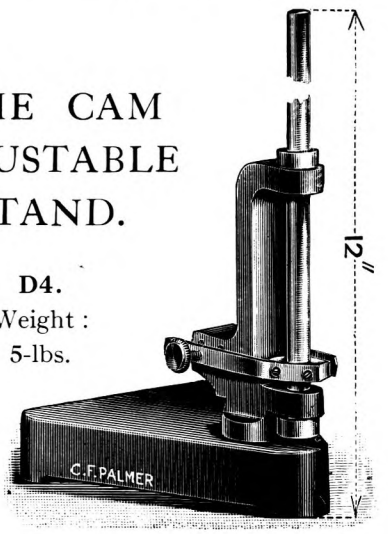
PLAIN STAND.

With quick and tangent screw adjustment.

PRICE.

D3 25/- each. 288/- per doz.

THE CAM ADJUSTABLE STAND.



D4.
Weight :
5-lbs.

Following the success of the adjustable upright on the Drum Stand (see A150b) and that on the large Stand (D12), it has been decided to make an ordinary Stand on this principle.

The fine adjustment obtainable, together with the power of moving the writing-point away from the writing surface, makes this Stand a very useful piece of apparatus.

PRICE (with standard upright, 12" x $\frac{3}{8}$") :

D4 20/- each. 228/- per doz.

DETACHABLE STAND.

D5.
Weight :
7-lbs.

As the illustration shows, this Stand is of the " Three Claw Type " and of medium weight. The upright rod can be detached by simply loosening the fly nut and unscrewing the rod.

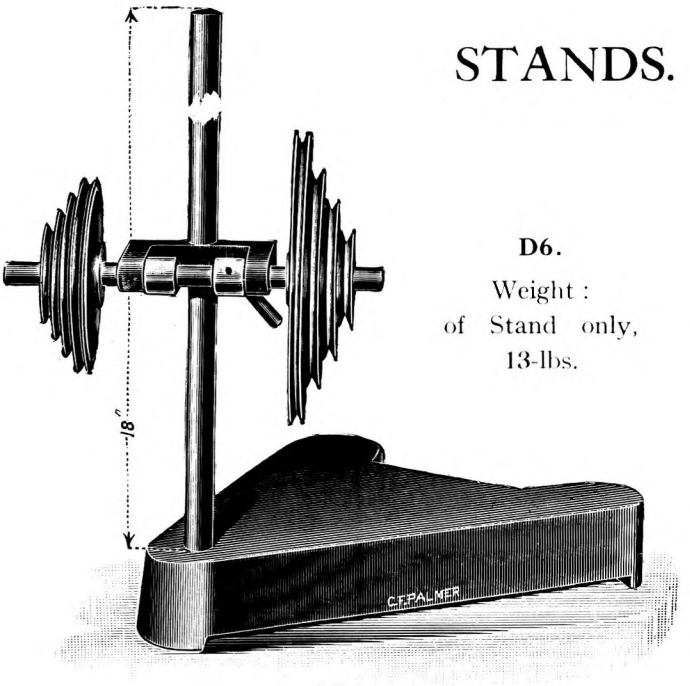
This is often a convenience for storage, etc.

PRICE (with upright, $\frac{1}{2}$" dia. x 18" long) :

D5 8/6 each.

Any of the above Stands can be fitted with longer, or Continental size, uprights to order.

STANDS.



D6.
Weight :
of Stand only,
13-lbs.

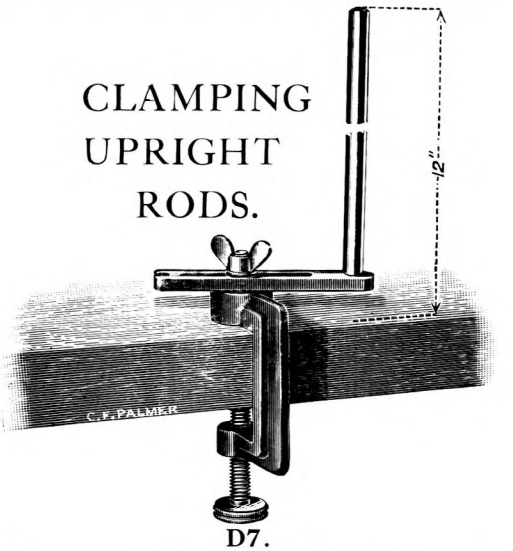
PLAIN HEAVY STAND.

With ½" upright, 18" high.

PRICE .. **D6** 10/– each.

Small Countershaft (as shown on this stand) from 15/–, according to size of the pulleys. The spindle is ⅜" (see G135).

CLAMPING UPRIGHT RODS.



D7.

These are very handy when extra uprights are required for any of the smaller Kymographs, etc. They are not so liable to be accidentally moved as the ordinary stand with heavy base.

PRICE. **D7** 7/6 each.

Higher or other size of Rod fitted if required.

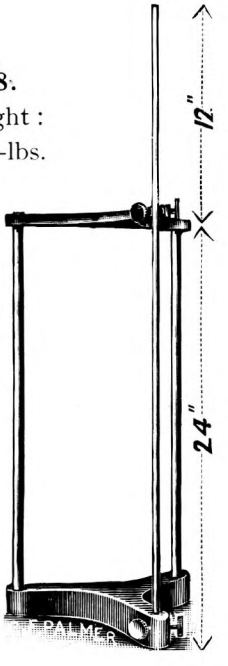
THE BRODIE STAND.

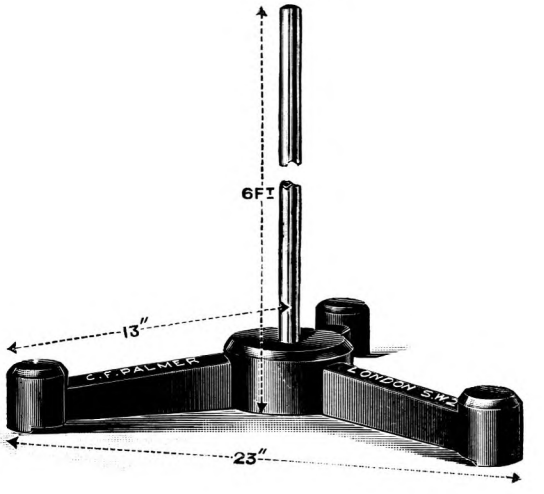
With interchangeable ½" and ⅜" uprights.

PRICE.

D8 47/6 each.

D8.
Weight :
20-lbs.





D9.

MAMMOTH STAND.

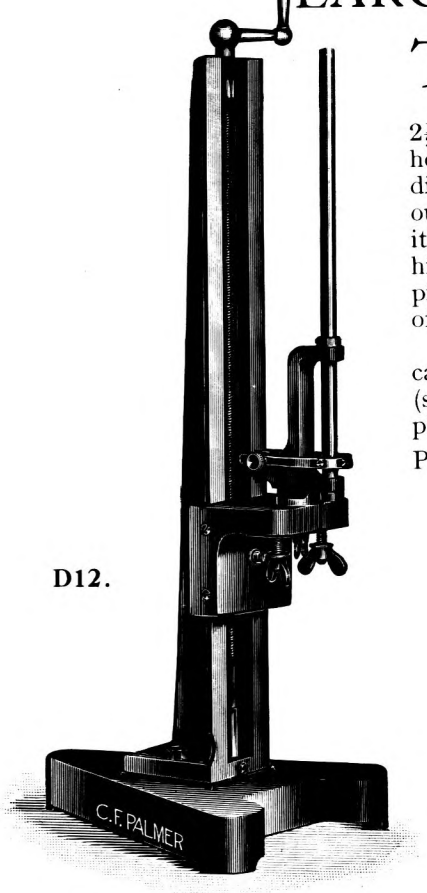
This Stand will be found very useful when it is desirable to support heavy apparatus. The three-arm base is a massive casting, weighing approximately 56-lbs.; the upright is of steel, 1" dia. x 6' high, and is secured to the base by means of a screw and nut—it is therefore easily dismantled for packing.

Uprights of other lengths can be supplied if required.

PRICE .. **D9** £2 0 0 each.

For Special Stands, suitable for Recording Drums, Mammalian Assemblies, etc., see Section A.

THE PALMER LARGE ADJUSTABLE SCREW STAND



D12.

THIS is a massive piece of apparatus, suitable for research work. The upright slide is of cast iron, similar to a lathe slide, and carries the adjustable platform, which is $3\frac{1}{4}$" wide and projects $2\frac{1}{2}$" from the face of the slide. In the platform are two eye bolts which hold rods or the stems of instruments of any size up to and including $\frac{1}{2}$" diameter. These eye bolts drop down into the thickness of the platform, out of the way, when not in use, and so are not liable to be mislaid. At its lowest position the height of the top of the platform is $5\frac{1}{4}$", and at its highest $20\frac{3}{4}$"; thus it has $15\frac{1}{2}$" of movement. The screw is of ·5 cm. pitch and therefore moves the platform 5 mm. for each complete turn of the handle, the collar of which is graduated.

Fitted on the platform is a $\frac{3}{8}$" upright (or other size of rod if ordered), carried in an adjustable support similar to *B* arm on the Drum Stand (see A150b). This upright is easily and quickly detached from the platform.

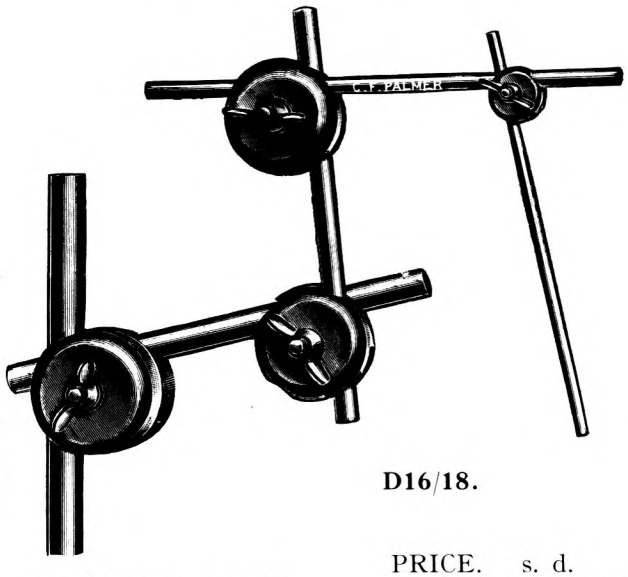
PRICE of Stand, with platform, two eye bolts, one *L* and one straight $\frac{3}{8}$" rod and adjustable upright as shown in position.

D12 £5 5 0

Weight : 24-lbs.

THE UNIVERSAL JOINTS.

These are two cup-like pieces, with two grooves in each, and having a flat washer between them. There is a screw and fly nut for holding them together, with a spring washer under the fly nut. Any two rods, within their capacity, can be held and rotated through an angle of 360°. Lacquered finish.

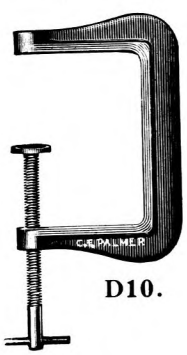


D16/18.

Made in four sizes :—

To hold rods, on the one side, either	on the other side, either		PRICE.	s.	d.	
$\frac{5}{8}$" or $\frac{1}{2}$" ;	$\frac{1}{2}$" or $\frac{3}{8}$"	..	**D16**	6	0	each.
$\frac{1}{2}$" or $\frac{3}{8}$" ,,	$\frac{3}{8}$" or $\frac{1}{4}$"	..	**D17**	5	0	,,
$\frac{1}{4}$" or $\frac{3}{16}$" ,,	$\frac{1}{4}$" or $\frac{3}{16}$"	..	**D18**	4	0	,,
Small size, holding $\frac{3}{16}$" rods on both sides		..	**D19**	3	6	,,

Other sizes to order. Nickel-plated extra.



D10.

LARGE CLAMP.

The Clamp illustrated is a strong well-finished article with a maximum capacity of 4", the frame being of malleable iron and the screw having an accurate machine-cut thread.

PRICE 4" size .. .. **D10** 4/– each.

D20.

"X" BLOCKS or BOSSHEADS.

THE STANDARD "X" BLOCK.

D20.

These hold either two $\frac{3}{8}$" rods, or one $\frac{3}{8}$" and one $\frac{1}{4}$" at right angles.

PRICE .. .. **D20** 2/3 each. £1 5 0 per doz.

THE OPEN-SIDED "X" BLOCK.

D21.

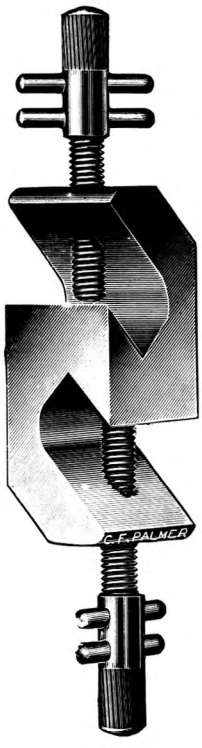
Unlike the ordinary cast "X" block, these are machined from the solid bar, and hold any two rods, within their respective capacity, truly square with each other.

Hitherto one disadvantage of this form has been the tedious process of turning the fixing screw the necessary number of turns to allow the rod to enter. The screws now fitted have a small milled head by which they can be twirled in quickly, the final tightening being done by gripping the two transverse pins.

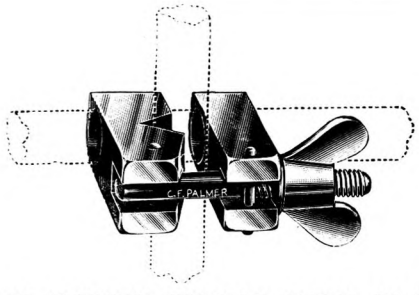
PRICE of Blocks, Nickel-plated, holding any size from $\frac{1}{8}$" to $\frac{3}{8}$".

D21 4/6 each. £2 8 0 per doz.

,, Ditto, holding any size from $\frac{1}{8}$" to $\frac{1}{2}$" **D22** 5/6 each. £3 2 0 per doz.



D21/22.

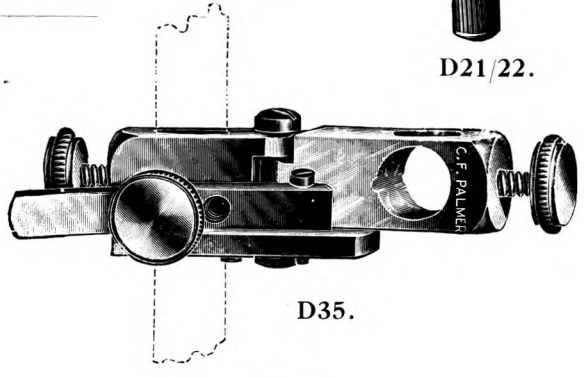


D30.

ONE SCREW FIXING "X" BLOCK.

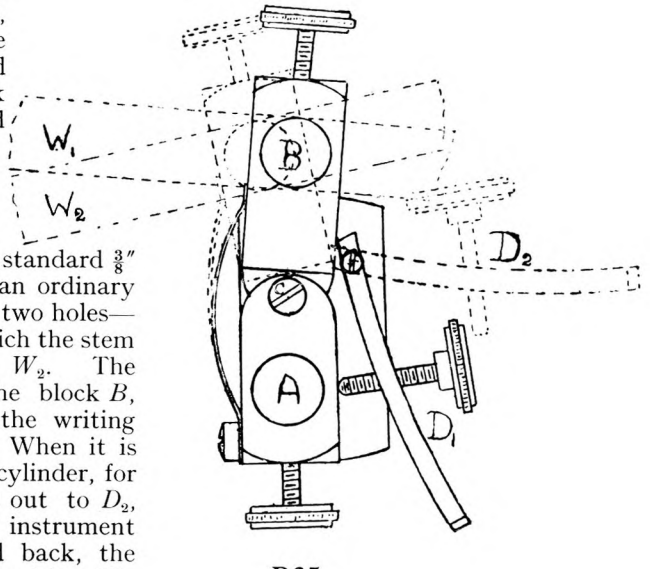
Designed by Dr. A. Hemingway, and described in the Journal of Physiology (Vol. 77, No. 2, Jan., 1933), this "X" Block has the advantage that it can be moved to any position and the rods securely clamped by tightening only one screw. The "X" Block illustrated will take rods $\frac{1}{4}$" to $\frac{1}{2}$" dia. in the *V*, and the standard $\frac{3}{8}$" dia. rod through the holes.

PRICE .. .. **D30** 4/6 each.



D35.

THE ADJUSTABLE "X" BLOCK.

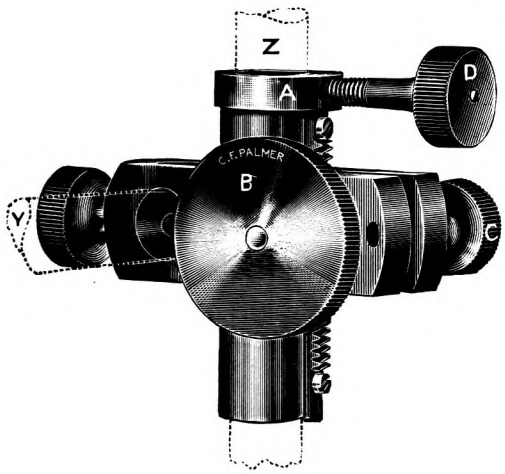


D35.

paratus. It has a standard $\frac{3}{8}$" n the upright of an ordinary h, etc. There are two holes— *B*, into one of which the stem ument fits, as W_1, W_2. The D_1, which moves the block *B*, nall arc to adjust the writing e recording drum. When it is point from the cylinder, for e arm D_1 is pulled out to D_2, and the recording instrument the arm is pushed back, the ns to its former position W_1.

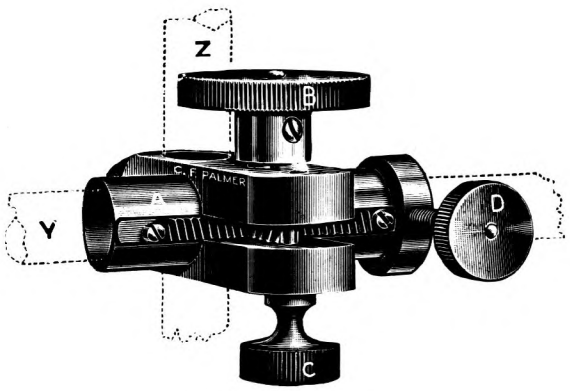
.. **D35** 15/-

THE RACK-WORK "X" BLOCK.



Position 1.

D36.



Position 2.

IN adjusting two or more levers to the same length or height some form of sliding movement is required, to meet which we offer the above. The illustrations are approximately actual size.

Referring to D36 (position 1). The rod *Z* is the usual upright of the Stand, Kymograph, etc., on which the sleeve *A* is clamped by the screw *D*. The block holding the rod *Y* (representing the stem of the instrument being used) can then be moved by means of the milled nut *B*, in conjunction with the skew rack-work, up or down one inch, thus providing **Vertical Movement.**

When it is desired to bring the writing point, of say a time-marker, exactly under any other writing point, the " X " Block must be reversed as shown in position 2, when upon turning the milled knob *B* a **Horizontal Movement** will be imparted to the sleeve *A*, which now carries the instrument. When in position the sleeve *A* can be locked by means of the screw *C*.

It will be noted from position 1 that the main block has another hole at right angles to the rod *Y* and parallel to the rod *Z*, thus further enhancing the capabilities of this useful fitment.

PRICE	**D36**	17/6 each.	£9 12 0 per doz.
,, With longer Rack, giving 2" movement.	**D37**	20/– each.	

If a greater Vertical Movement is required than that given by the above, or if comparatively large and heavy loads have to be carried, we would refer our clients to the " Large Adjustable Screw Stand " D12.

RADIAL ADJUSTMENT "X" BLOCK.

During an experiment which necessitates a large movement of the writing lever of a Volume Recorder or Tambour, it is sometimes found that the writing point does not touch the smoked paper throughout the whole of its movement. This is usually caused by the holding rod *Y* of the Recorder or Tambour not being held truly in the " X " Block, thus the pivots of the lever are not at right-angles with the writing surface. To avoid the necessity of having to disturb the instrument we have designed the Block illustrated at side.

By turning the milled screw *B* the holding rod of the Recorder is rotated so that the writing point will then touch the smoked paper as required.

PRICE, to take standard $\frac{3}{8}$" rods. .. **D38** 15/–

SUPPORTING RODS.

Brass Rods.—English standard size, $\frac{3}{8}$" diameter. Cut to any length, with the ends rounded and lacquered, at 1d. per inch.

The stock sizes are :

	D50	D51	D52	D53
Length.. ..	3"	4½"	6"	9"
PRICE ..	3d.	4½d.	6d.	9d.

Special lengths cut.

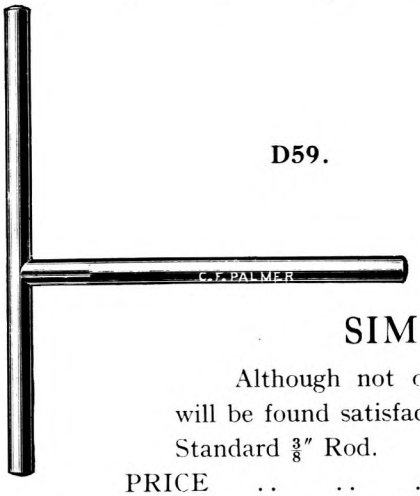
D60.

$\frac{3}{8}$" **Brass Rod,** 2½" long, with boss at end fitting the standard uprights.

PRICE .. .. **D60** 2/6 each.

Special sizes to order.

Brass Rods as above, but $\frac{1}{4}$" diameter, at $\frac{3}{4}$d. per inch. **D54.** State length or lengths required.
,, ,, ,, $\frac{1}{2}$" ,, 2d. ,, **D55.** ,, ,, ,, ,, ,,



D59.

BRASS T-RODS,

as illustrated.

Stem 6" : Arms, one each 4" and 3" x $\frac{3}{8}$"

PRICE **D59** 2/7

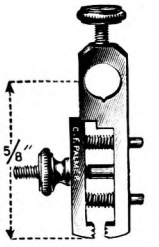
Any size or length of Rod made at proportionate price.

SIMPLE MUSCLE GRIP.

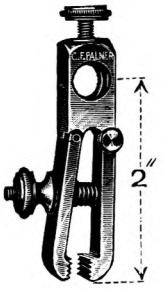
Although not quite so stoutly made as the grip D64, this will be found satisfactory for Students' use, and is made to fit on the Standard $\frac{3}{8}$" Rod.

PRICE .. .. .. **D63** 6/3 each. £3 6 0 per doz.

,, Fitted with $\frac{1}{4}$" diameter Stem. .. .. .. **D61** 6/9 each.



D63.



D64.

MUSCLE GRIP.

A neat, strong form, machined from solid brass ; holes both ways to fit a $\frac{3}{8}$" rod.

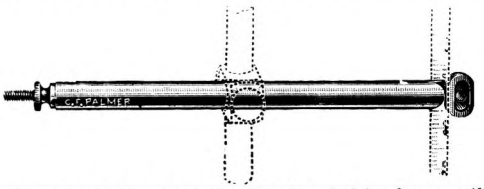
PRICE .. .. .. **D64** 10/6 each. £6 0 0 per doz.

,, Fitted with $\frac{3}{8}$" diameter Stem .. .. **D62** 11/- each.

D62.

THERMOMETER CLAMP.

D68.



Occupying but little space the *V* grip of this clamp will hold glass tubes, etc., of from $\frac{1}{8}$" to $\frac{1}{2}$" diameter securely and safely, the rubber covered jaw preventing fracture of the tube. The hollow rod with adjusting nut on one end will pass through the $\frac{3}{8}$" diameter hole in the Standard "X" block.

PRICE. Clamp 5" long. **D68** 6/- each.

Special length Clamps made to order.

HOOK GRIP.

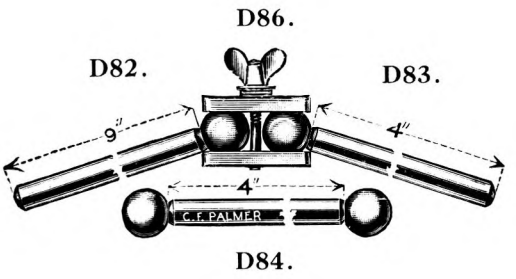
D65.

The Hook Grip will be found useful for holding rods and tubes up to $\frac{3}{8}$" diameter, such as thermometers, etc.

PRICE.

D65 5/6 each. £3 0 0 per doz.

BALL-JOINTED ARM and CLAMPS.



THIS is not put forward as anything new, but hitherto there has been difficulty in turning a perfect sphere. To overcome this difficulty, such expedients as packing the cups, or ballholders, with cork or other yielding material, has been resorted to ; still, such ball joints are unsatisfactory, being usually tight in one position and loose in another.

We have now made a special device for turning the balls for the joints as illustrated, and can guarantee the balls to be of such a degree of accuracy that no appreciable difference in the stiffness or sustaining power of the joint can be found in any position. Moreover, all the balls, as well as those on the various clamps, etc., are made to the same gauge, viz., 0·72" ; thus they are interchangeable, and various combinations can be built up either on a single two-ball joint, or by using one or more of the double ball rods, D84/5. For this purpose we give prices of the various parts. The length can be increased indefinitely ; this, however, is not advisable, as the leverage would become more than the first ball-joint would stand, even if tightened up to an excessive degree. We may mention here that the large clamp D87 on a single joint will, when horizontal, sustain a weight of approximately $2\frac{1}{2}$-lbs.

The large clamp D87 will hold rods or tubes from $\frac{1}{4}$" to $1\frac{1}{2}$" in diameter. The jaws are cork-lined and are actuated by a double (*R* and *L*) screw.

The small clamp D89 will hold rods from $\frac{1}{8}$" to $\frac{1}{2}$". It is not cork-lined, but will be found useful to hold small cannulæ, etc., as will also the swivel clamp D88, which holds rods up to $\frac{3}{8}$" ; and, in addition, such rods or tubes can be swivelled round to any angle.

Standard Outfit consists of—

One 9" x $\frac{3}{8}$" single ball rod, D82.
One 2" x $\frac{3}{8}$" double ,, ,, D85.
Two pairs of clamp plates, complete with spring washer and fly-nut, D86.
One large clamp, D87.

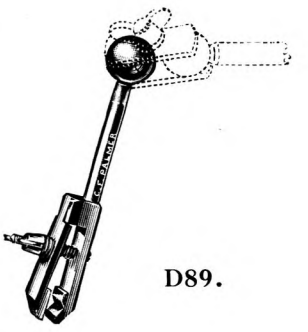
PRICE OF THE SET **D80** £1 3 6

D88.

PARTS.

		s.	d.
Single Ball Rods, 12" x $\frac{3}{8}$" ..	**D81**	2	3
,, ,, ,, 9" x $\frac{3}{8}$" ..	**D82**	2	0
,, ,, ,, 4" x $\frac{3}{8}$" ..	**D83**	1	8
Double Ball Rods, 4" x $\frac{3}{8}$" ..	**D84**	3	0
,, ,, ,, 2" x $\frac{3}{8}$" ..	**D85**	2	10
Clamp Plates, complete ..	**D86**	3	6
Large Clamp	**D87**	12	6
Small Swivel Clamp	**D88**	7	0
,, Clamp	**D89**	9	0

Other accessories for these adjustable arms will be made from time to time. They will have the standard 0·72" ball.



D89.

SECTION

E

RESPIRATION

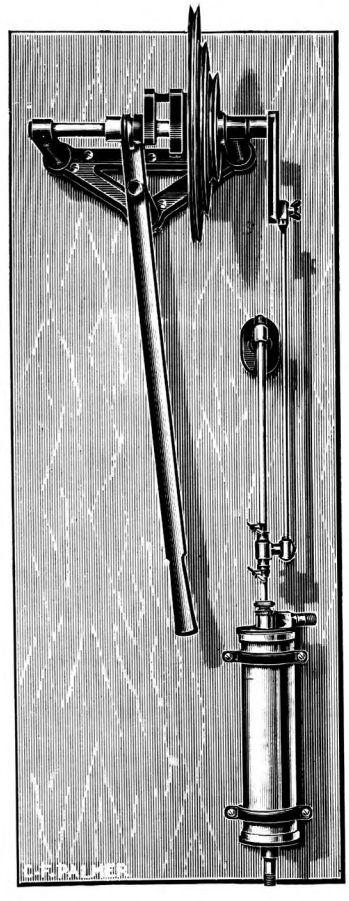
Pumps Operating Tables

Animal Holders

Cannulae

Metabolism Apparatus

THE LATE PROF. BRODIE'S RESPIRATION PUMP.



E1.

This Pump has now been largely superseded by such as the "Ideal," but is still retained in our catalogue as some prefer a simple pump of large capacity.

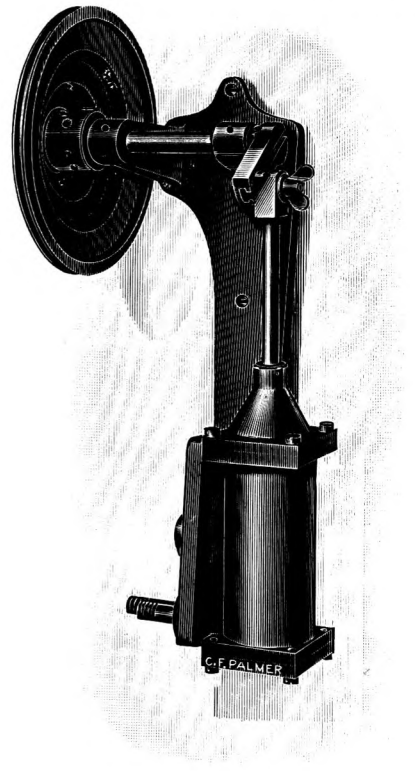
THE Pump consists of a piston working in a barrel 76 mm. in diameter and 280 mm. in length. By a simple adjustment of the crank, the throw of the piston may be quickly altered to deliver any quantity up to one litre of air per thrust. The Pump is driven through a friction clutch by a 12″ three-speed cone pulley. The valves are placed at the bottom of the cylinder and of the piston respectively. They are of simple construction, and are easily reached. The upper end of the cylinder is closed and fitted with an intake tube, so that any mixture of gases may be used. The pump is mounted on a polished board, and is intended to be fixed in a vertical position on the wall of the experimental room.

PRICE **E1** £20 0 0

For means of driving, see Section G.

Replacement parts for the above Brodie Pump.		s. d.
Leather Cup Washer for Piston	**E1a**	3 0 each.
Flat Rubber Valve Disc	**E1b**	0 6 ,,
Flat Valve Springs	**E1c**	0 6 per pair.

SMALL OSCILLATING RESPIRATION PUMP.



E2.

IT has been pointed out that the " Brodie " Respiration Pump, although eminently suitable for large animals, is somewhat cumbersome for small ones, such as rats, guinea pigs, etc., up to a small cat.

The above **OSCILLATING PUMP** has therefore been designed, having an adjustable stroke giving displacements of from 7 cc. to 110 cc.

This Pump is intended to be fixed to the wall in a similar manner to the " Brodie " Pump, but, being small, it can be clamped directly on the operating table, or in other convenient position. It may be noted here that it works equally well either horizontally or vertically, there being no valves, etc., to be deranged, the movement of the cylinder automatically opening and closing the ports.

The leading dimensions are :

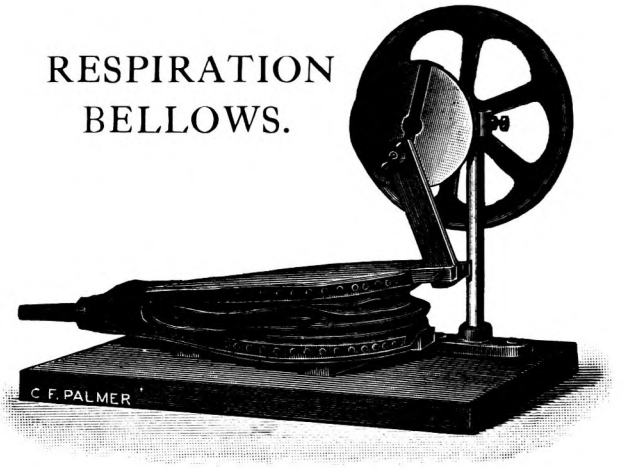
Bore of cylinder	$1\frac{1}{16}$"	43 mm.
Length of stroke adjustable up to	$2\frac{7}{8}$"	73 mm.
Largest diameter of four-speed cone pulley	6"	152 mm.
Overall dimensions of Pump	$14\frac{1}{2}$" x $7\frac{1}{2}$"	370 x 190 mm.
Weight	$11\frac{1}{4}$-lbs.	5 kilos.

PRICE **E2** £6 10 0

We have no hesitation in recommending this Pump for simple experiments ; it is not, however, quite suitable for closed circuit work.

For closed circuit work, see particulars of the " Ideal " Pump E 10/12 and the Schüster Respirometer E15.

RESPIRATION BELLOWS.



E3.

ALTHOUGH the Brodie Pump and other means of artificial respiration have superseded the bellows here illustrated, they are still preferred by some, and are quite useful.

It will be noticed that the throw of the crank, and therefore the amount of air delivered per thrust, is adjustable. The 10" bellows are of good quality, and are mounted on a hard wood base, with grooved wheel 10" diameter.

PRICE .. **E3** £4 0 0

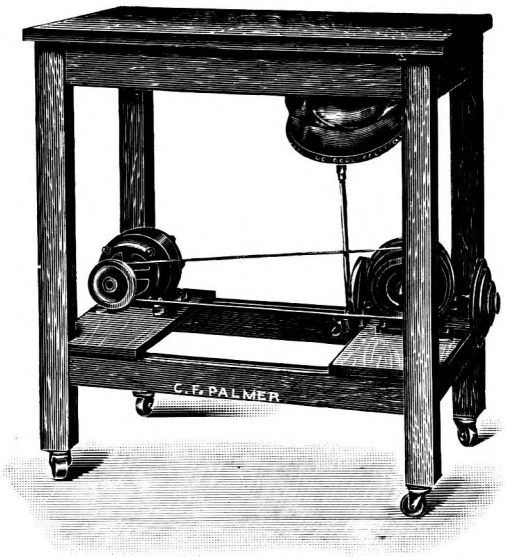
RESPIRATION BELLOWS TABLE.

A VERY convenient independent unit is here illustrated. It is fitted with bellows, made in our own works from leather superior to that generally used for this purpose.

The motor is of $\frac{1}{8}$ H.P., and it will be noted that a 6″ four-speed cone pulley is provided on the worm gear shaft, converting the table into a small power table. This pulley has four speeds, $1\frac{1}{4}$″ to 6″ diameter, and revolves at the same rate as the bellows, as set out below.

The table is 31″ high, with a top 28″ x 18″, and is mounted on strong roller-bearing castors, so that it is easily moved.

The bellows work at approximately the following speeds per minute: 14, 22, 30, 38 and 48. Should it, however, be desired to obtain intermediate speeds, a regulating rheostat, as G154, can be fitted.



E5.

PRICE **E5** £18 10 0

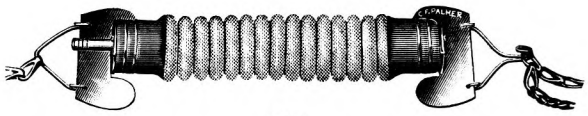
Or if fitted with regulating rheostat, **E6**, £2 5 0 extra.

For prices and particulars of this Table fitted with the "Ideal" Respiration Pumps, see section G170–171.

Please give full particulars of Electric Supply when ordering.

BELLOWS made of RUBBER for ventilating small animals can be supplied, please refer to the complete unit, No. E106.

STETHOGRAPH or PNEUMOGRAPH.



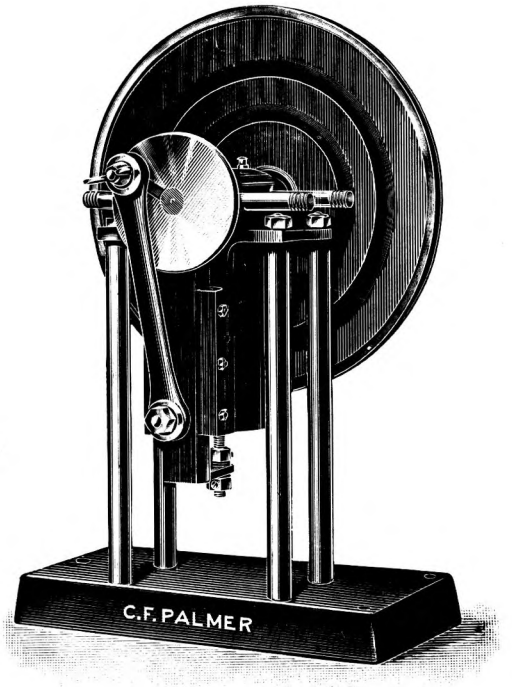
E7.

In place of the usual Rubber Tube with a strong spring inside, the Stethograph shown above consists of a length of canvas-covered corrugated Rubber Tube, which by reason of its structure, requires no internal spring; this has been found to give better tracings than the original type and also to be more comfortable in use. The open link chain can be quickly adjusted to suit individuals, and also has no tendency to stretch or slip. Any of the standard Tambours shown in Section C, Nos. 1 to 12, are suitable for use with the Stethograph.

PRICE .. .. **E7** 18/6 each. £10 10 0 per doz.

THE "IDEAL" RESPIRATION PUMP.

(Patent No. 268416/27).



E10/12.

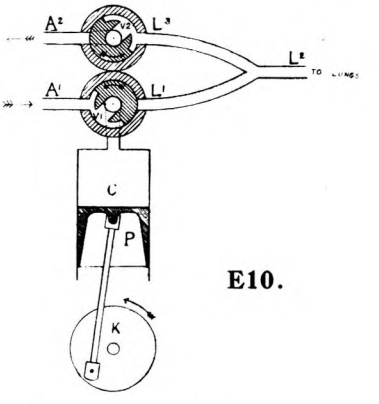
(See proceedings, Physiol. Soc., Jan. 23rd, 1926—Journal Physiol., Vol. LXI.)

THE suggestion for the above Pump is entirely due to the late Professor Starling. Instead of using a double cylinder pump, which has the disadvantage that it is extremely difficult to balance exactly the two cylinders, a mechanically operated valve was added to a single cylinder pump, so that the lungs are first inflated in the usual way, then this extra valve opens, and are then allowed to deflate by their own elasticity.

The Pump is of sound mechanical construction, all parts being of metal, no leather or similar substance being used, which is an advantage if the Pump is used in a high temperature. The driving cone has three speeds of 6″, 9″ and 12″ diameter respectively, and is balanced. The power required to drive this pump is small (about 1/12 H.P.). The stroke is adjustable and graduated in cc. up to 250 cc. The connecting tubes are ½″ inside diameter.

Referring to the diagram, *V*1 and *V*2 are two rotary valves on the same axis, and therefore synchronising with each other.

The cycle of operation is as follows: On the downward stroke of the piston *P* air is admitted to the cylinder *C via A*1 and *V*1. When the piston *P* reaches the bottom of its stroke, the valve *V*1 has turned sufficiently to cut off *C* from *A*1, and immediately connects it to the tube *L*1. Upon the upward stroke of the piston, air is forced from *C* back through *V*1 to the lungs *via L*1 and *L*2, thus inflating the lungs. During the downward stroke of the piston, the additional valve *V*2 opens, and the lungs become deflated by their own elasticity *via L*2, *L*3, *V*2 and *A*2.



E10.

PRICE **E10** £17 10 0

Weight of Pump: about 38-lbs.

In addition to the above we are now making a pump of larger capacity to deliver up to 500 cc.

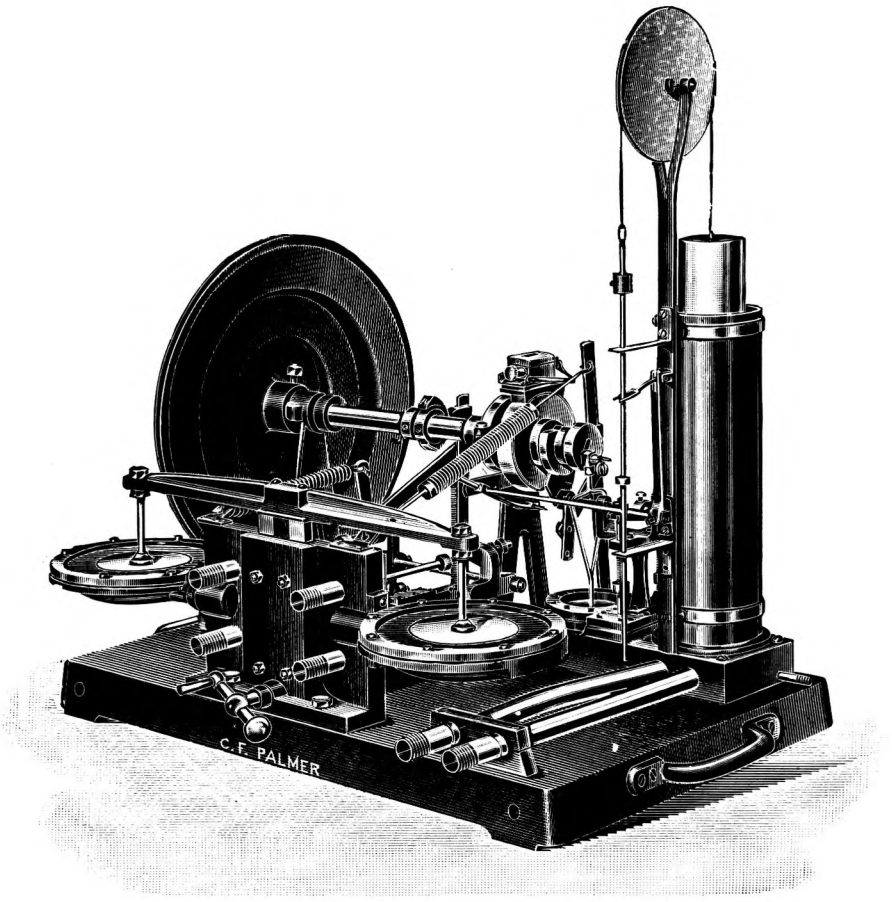
PRICE **E12** £22 0 0

Weight about 45-lbs.

See also G170/1.

THE
SCHUSTER CIRCULATING RESPIROMETER.

(*See the proceedings of the* ROYAL SOCIETY—*B., Vol. 100, 1926.*)



E15.

THE important experiments on oxidation and storage of glucose under the action of insulin, conducted by Drs. C. H. Best, H. H. Dale (Sec. R.S.), J. P. Hoet and H. P. Marks, were made possible by the use of an accurately made Respirometer, designed and constructed by Dr. Schuster himself. The above represents the standard model as made by ourselves under instructions from Dr. Schuster. Acting on his advice, this pump was made larger than the original, so as to be available for larger animals.

Dr. Dale very kindly had one of these pumps at the Medical Research Council's Laboratories at Hampstead, where he thoroughly tested it. The following is taken from a letter he wrote to us under date 28th July, 1927 :—

" The apparatus has worked thoroughly well in several complete experiments in which we have used it. We have also tested its accuracy by fitting it up as for an experiment, using a football bladder to represent the lungs of the animal, and then withdrawing gradually a measured volume of air by means of an aspirator discharging water into a standard flask. To this test it also responds very well, the number of strokes of the accessory pump, corresponding to successive volumes of 500 cc. each, being as uniform as the experimental conditions allow one reasonably to expect."

The instrument consists of two diaphragm pumps working together off a common eccentric, and having mechanically operated and synchronised valves. The movement of the diaphragms, and consequently the amount of displacement of the pumps, is adjustable and under control while working, up to a maximum capacity of 190 cc.

The outlet tube of one of these twin diaphragm pumps is connected to one limb of the Y cannula, tied air-tight into the trachea of the spinal preparation. The other limb of the Y is connected to the inlet of the other pump, the outlet of which is connected through a soda-lime tower to the gasometer. The other tube from the gasometer is connected to the inlet tube of the first pump, so that the working of the pump produces a regular circulation of air through the system, the gasometer rising and falling rhythmically with the artificial respiration, but losing volume corresponding to the absorption of oxygen.

The accessory oxygen pump is brought into operation by the gasometer falling below a certain fixed level, and thereby releasing a trigger, bringing into play a clutch and producing one or more strokes of the accessory pump. The stroke of this pump is also adjustable up to a maximum of 10 cc., and each stroke is registered on a mechanical counter capable of being set to zero at the beginning of an experiment. The inlet tube is connected to a supply of pure oxygen at atmospheric pressure, so that the composition and volume of air in the system are maintained constant, while the counter records the oxygen used to the accuracy of one stroke of the small pump.

The whole apparatus, although somewhat complicated, works well when properly set up. We guarantee every pump sent out to have been tested against the one actually used by Dr. Dale, and to be equal to it in every way.

To give an idea of the size, it may here be mentioned that the base (see illustration) is 20″ x 13″ (exclusive of handles), while the overall height is 22″ ; the rubber diaphragms are each 4⅜″ diameter.

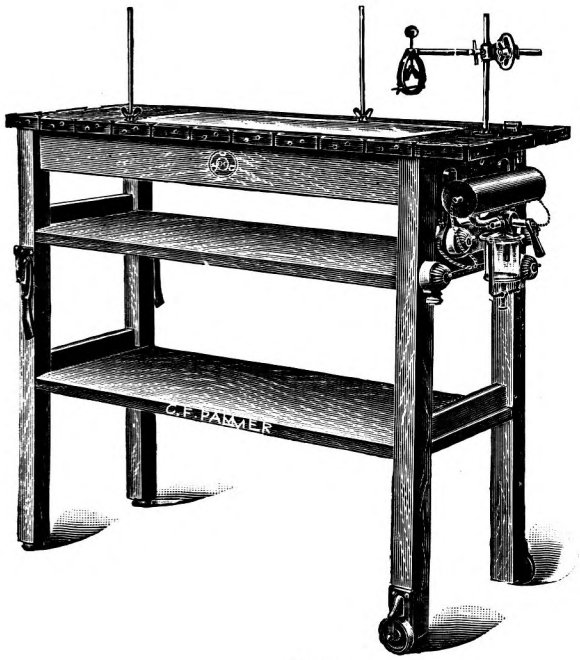
Weight : 80-lbs.

PRICE **E15** £80 0 0

See also G 165.

An extra set of rubber diaphragms is sent out with each pump. They can be fitted by the mechanic, and others cut from rubber sheet (if of good quality), or obtained from us at 7/6 the set. **E16.**

THE BRODIE OPERATING TABLE.



E20.

THIS Table, designed by the late Prof. Brodie, has a top 51″ (129·5 cm.) x 18″ (46 cm.) x 40″ (101·5 cm.) high. It is fitted all round with cleats, into which the holding down cords can be easily and quickly fixed. Near the centre, and flush with the top, is a copper hot-plate, 24″ (61 cm.) x 12″ (30·5 cm.), heated by means of two electric lamps, each having its own independent switch. There is also a removable piece at the head end of the Table, giving an opening 11″ (28 cm.) x 9″ (23 cm.). Two upright rods, sliding in slots, are provided, and will be found useful for many purposes. Sockets for plugs are located in the centre on both sides of the Table so that lamps and other light electrical appliances can be connected. Prof. Brodie's well-known anæsthetic bottle and air warmer is fitted to these tables, a bent tube projecting through the top to supply the air to the animal. The Table is fitted complete with animal holder, four controlling switches, lamps, 12-ft. flexible wire, and wall plug; also wheels and handles for convenience in moving.

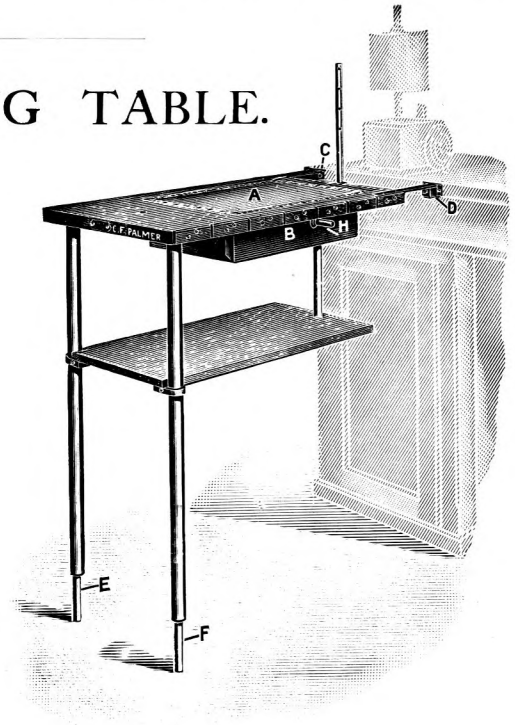
PRICE **E20** £22 0 0

SMALL OPERATING TABLE.

THE Table has a teak top 30″ x 17″, with a copper hot-plate 18″ x 12″, heated by electric bulbs in the tank *B*, a copper tube *H* passes through the tank so that the air from the pump may be slightly heated before reaching the animal.

Cleats are fitted round the top and an upright rod and socket are supplied. The Table with adjustable legs *E* and *F*, and clips *D*, fitting to the side of bench, as shown, or the top only with short legs to stand on bench, can be supplied. The complete Table, as illustrated, is easily dismantled and packed away when not required for use.

			£	s.	d.
PRICE.	As illustrated ..	**E19**	7	0	0
,,	Top only, mounted on short legs, with Hot-plate and Upright ..	**E18**	4	5	0



E19.

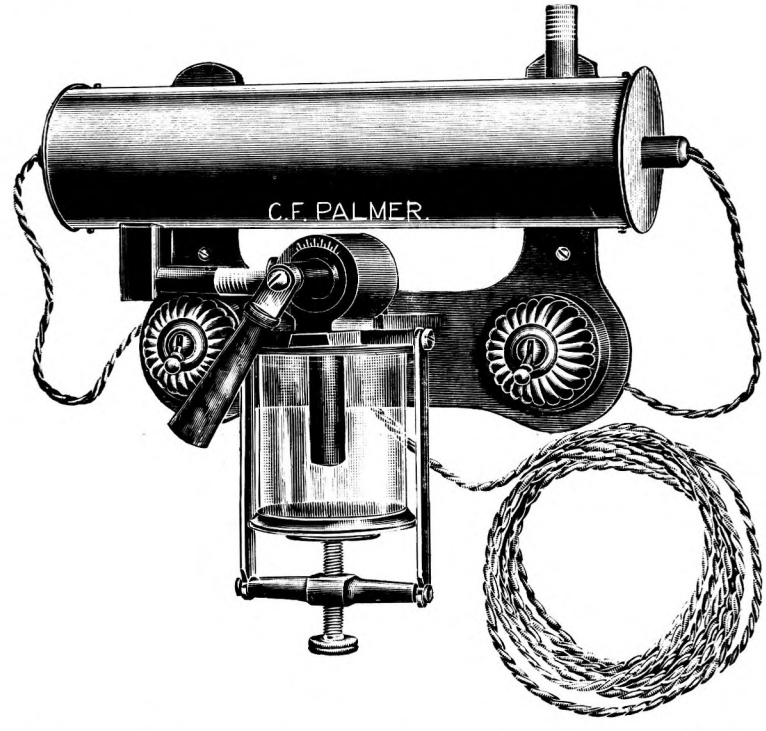
Please state voltage of supply when ordering, and if Bayonet Catch or Edison Screw Lamp Holders are required.

THE BRODIE
ANÆSTHETIC BOTTLE AND AIR WARMER.

AS FITTED ON THE BRODIE OPERATING TABLE.

For use in connection with a Respiration Pump.

E21.

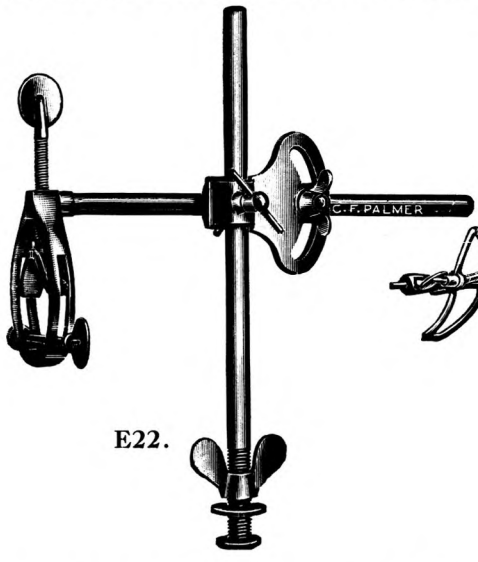


REFERRING to the above illustration, it will be seen that the bottle is similar to an ordinary specimen bottle with ground top, which is held up against a flat plate by a movable bridge piece and screw, it being only necessary to loosen the screw a few turns, when the bottle can be removed for filling or cleaning. On the top of the plate is the regulating cock, which regulates the amount of air (and consequently the strength of the anæsthetic) which passes through the bottle. Should the anæsthetic become used up during an experiment, it is only necessary to push the handle over till the pointer is at *O* of the graduated scale, when the bottle is entirely shut off, and can be removed for re-filling, all the air passing direct to the heater, which consists of a brass tube, with movable ends screwed on, large enough to hold two ordinary electric lamps, there being two holders of the standard bayonet type provided (or Edison Screw Lamp Holders, if so ordered) ; also two switches. It is advisable to have the lamps of different candle powers, say, an 8 and a 16, then either or both can be used, according to the amount of air and degree of heat required. Depending from the plate into the bottle is a tube which causes air to " blow " on to the surface of the anæsthetic, and as the latter becomes used up, means are provided for lengthening this tube from outside the bottle. Mounted complete with 12-ft. flexible wire, two carbon lamps, and plug adapter ready to be connected to the lighting mains.

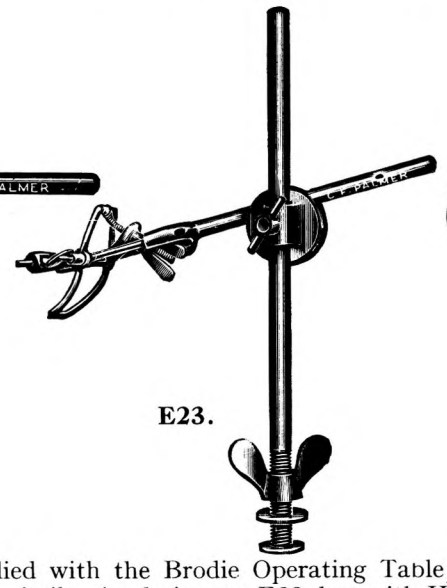
Please state voltage of supply when ordering, and if Bayonet Catch or Edison Screw Lamp Holders are required.

PRICE **E21** £8 8 0

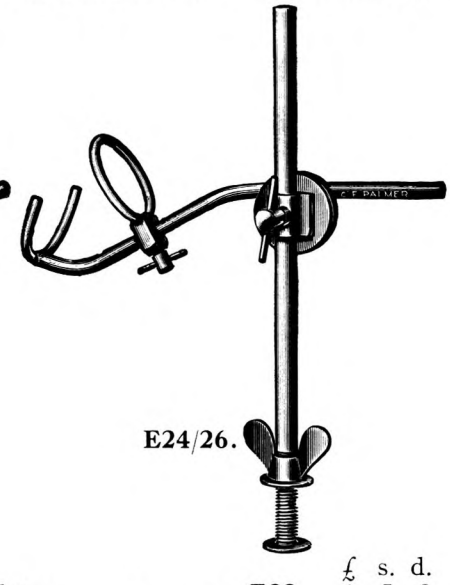
ANIMAL HOLDERS and ADJUSTABLE JOINTS.



E22.



E23.



E24/26.

			£	s.	d.
PRICE.	For DOGS (as supplied with the Brodie Operating Table)	**E22**	4	5	0
,,	For LARGE DOGS, similar in design to E22, but with Head-piece 98 mm. wide	**E27**	4	12	6
,,	For CATS (after the CZERMAK model)	**E23**	3	15	0
,,	Simple " U " and Ring pattern for small Animals.				

Made in three sizes :

$1\frac{1}{2}$" .. **E24** £1 15 0 2" .. **E25** £1 17 6 $2\frac{1}{2}$" .. **E26** 2 0 0

The size denotes the internal diameter of the ring in inches.

All the above are heavily Nickel-plated and polished, and supplied complete with upright, as illustrated.

QUADRANT JOINT.

As fitted to E22.

These are made for Animal Holders, and such-like that require to be held securely. They are made to take $\frac{1}{2}$" rods on both sides, and are adjustable through an angle of about 65°.

PRICE. Nickel-plated .. .. **E35** £1 7 6 each.

Other sizes to order.

SEMI-UNIVERSAL JOINT.

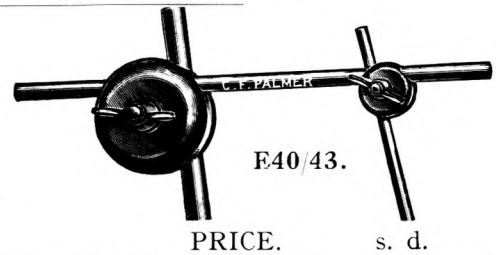
As fitted to E23/26.

These are made for Cat and other small Animal Holders. On the one side is a hole to fit a $\frac{1}{2}$" upright, with an independent tightening screw. On the other side is a cup-like piece, as on the universal joints, taking either $\frac{3}{8}$" or $\frac{1}{4}$" rod, which can be rotated through an angle of 360°.

PRICE. Nickel-plated **E36** 6/–

THE UNIVERSAL JOINTS.

These are two cup-like pieces, with two grooves in each, and having a flat washer between them. There is a screw and fly nut for holding them together, with a spring washer under the fly nut. Any two rods, within their capacity, can be held and rotated through an angle of 360°. Lacquered finish.



E40/43.

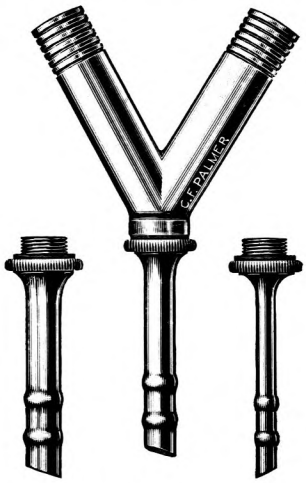
Made in four sizes :—

	PRICE.		s.	d.	
To hold rods, on the one side, either $\frac{5}{8}$" or $\frac{1}{2}$" ; on the other side, either $\frac{1}{2}$" or $\frac{3}{8}$" ..	**E40**	6	0	each.	
,, ,, ,, ,, $\frac{1}{2}$" or $\frac{3}{8}$" ,, ,, ,, $\frac{3}{8}$" or $\frac{1}{4}$" ..	**E41**	5	0	,,	
,, ,, ,, ,, $\frac{1}{4}$" or $\frac{3}{16}$" ,, ,, ,, $\frac{1}{4}$" or $\frac{3}{16}$" ..	**E42**	4	0	,,	
Small size, holding $\frac{3}{16}$" rods on both sides	**E43**	3	6	,,	

Nickel-plated extra. Other sizes to order.

CANNULÆ.

THE following are given as representative forms, but many more have and can be made. We are always willing to make special patterns of tracheal, perfusion, gastric and other cannulæ in silver, nickel silver, or vulcanite.



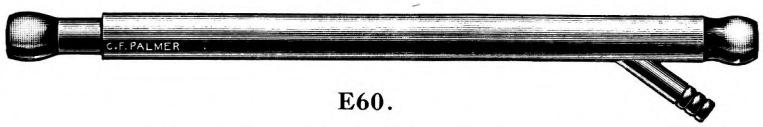
E50.

"Y" Tracheal Cannula for use in connection with the Schuster Respirometer, "The Ideal" and such like closed circuit pumps.

These are made of metal with interchangeable nozzles all fitting the same "Y" piece.

		s.	d.
PRICE of "Y" piece with one nozzle, 6 mm. diameter, for cats	**E50**	10	6
,, ,, ,, ,, ,, 8 mm. diameter	**E51**	10	6
,, ,, ,, ,, ,, 11 mm. diameter, for dogs	**E52**	11	0
,, ,, ,, ,, ,, 14 mm. diameter	**E53**	11	0
,, Extra nozzles, 6 mm.	**E54**	4	0
,, ,, ,, 8 mm.	**E55**	4	0
,, ,, ,, 11 mm.	**E56**	4	6
,, ,, ,, 14 mm.	**E57**	4	6

Special sizes made to order.



E60.

Perfusion Cannula, after Morawitz and Zahn (see Zentralb of Phys., 1912-26, 465), made in nickel silver **E60** 12 6

E76.

Nickel Silver Tracheal Cannula, straight form, with adjustable vent slit.

			s.	d.
PRICE.	2 mm. diameter ..	**E70**	7	0
,,	3 ,, ,, ..	**E71**	6	6
,,	4 ,, ,, ..	**E72**	6	6
,,	6 ,, ,, ..	**E73**	6	6
,,	8 ,, ,, ..	**E74**	6	9
,,	11 ,, ,, ..	**E75**	7	0
,,	14 ,, ,, ..	**E76**	7	6

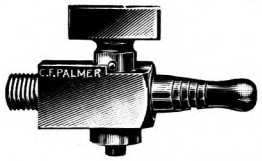
The above are also made in bent form, swivelling at the elbow, at the following prices:

		s.	d.
4 mm. diameter ..	**E82**	16	3
6 ,, ,, ..	**E83**	16	3
8 ,, ,, ..	**E84**	17	0
11 ,, ,, ..	**E85**	17	6
14 ,, ,, ..	**E86**	18	9

E65.

Nickel Silver Perfusion Cannula, as designed by Dr. Rossler (see proceedings Physiological Society, May, 1928).

PRICE **E65** 4/–



E100.

SMALL METAL COCKS.

These are accurately and substantially made and not to be confused with the cheap commercial article. The cock illustrated measures 52 mm. overall, the bore being 3 mm. and the screw part $\frac{3}{8}$" dia. x 26 threads per inch.

PRICE **E100** 7/6

Other sizes can be supplied.

LIGATURE FORCEPS.

E116.

THE forceps illustrated were designed by L. W. Collison, and consist of a pair of dissecting forceps modified to facilitate the passing and tying of ligatures, especially for deep-lying structures. An arm attached to the upper end carries a spindle for a reel of any suitable thread. The free end of the thread passes through the upper end of the forceps and then through a flat metal spring attached to one of the jaws. When the forceps are open the thread is lightly held between the spring and the jaw, but is firmly gripped by closing the forceps as soon as the required length has been pulled from the reel. By holding it thus and taking another pair of ordinary forceps for the free end, a deep ligature is easily and quickly tied without stretching the neighbouring tissue.

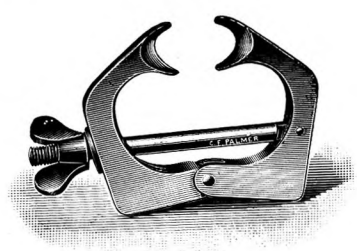
Two types are made, *C*, to take coarse cotton thread, and *F*, to take fine ligature silk.

			s.	d.	
PRICE.	Type *C*, with reel of cotton thread	**E115**	10	6	each.
,,	Type *F*, ,, ,, ligature silk	**E116**	10	6	,,

VERTEBRAL CLAMP.

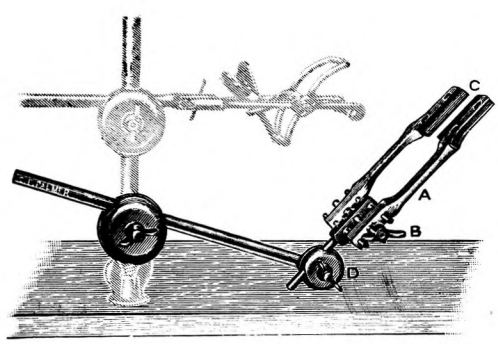
Substantially made in gunmetal, heavily nickel-plated, the above clamp is made to the design of Prof. McDowall (*see* "Journal of Physiology," Vol. 69, No. 1, March, 1930).

PRICE. As illustrated **E120** 15/-



E120.

DECEREBRATION CLAMP.



E125.

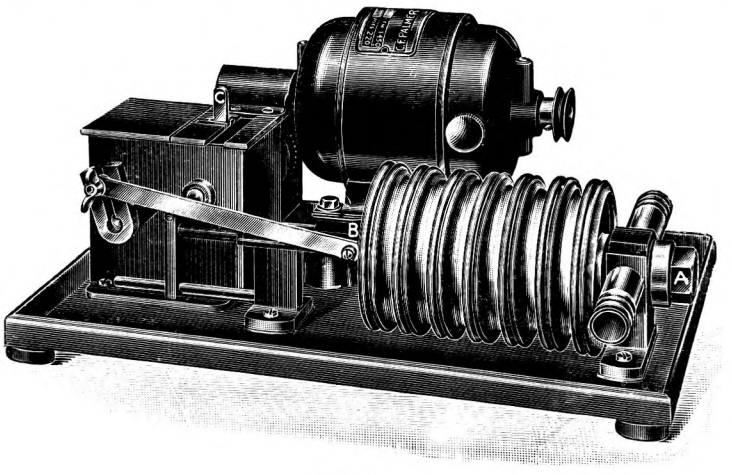
Designed by Prof. F. R. Miller to replace the use of the thumb and forefinger in making pressure over the vertebral arteries during and following decerebration, the clamp illustrated is described in the "Journal of Physiology," Vol. 69, p. xx.

PRICE. Complete with semi-universal joint.

E125 £2 5 0

The Cat Holder, E23 (shown in outline) is suitable for use with the clamp. Leaflet giving hints on the use of the above will be sent on request.

RUBBER BELLOWS RESPIRATION UNIT.



E106.

FOR the ventilation of small animals up to a maximum displacement of 180 cc. the above unit will be found quite efficient, and very convenient.

A three-speed gear box is fitted, giving approximately 18, 27 and 36 strokes per minute of the Bellows. To change the speed, which can be done when running, it is only necessary to press and slide the lever *C* with the thumb.

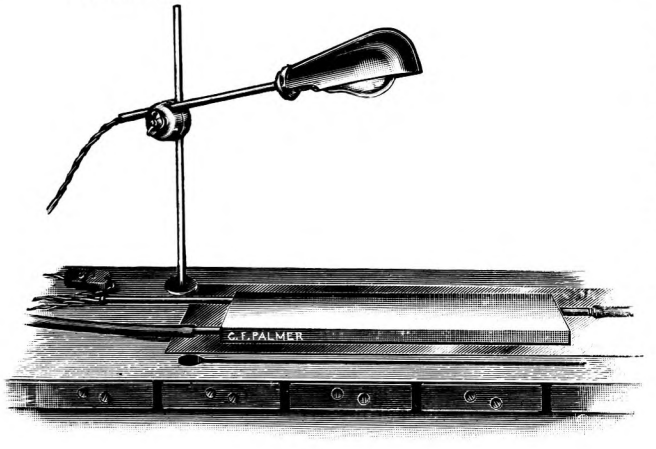
The useful life of the Rubber Bellows is considerable, and when replacement is necessary the screw *B* and the nut *A* only have be loosened and the new Bellows, which can be supplied at moderate cost, placed in position.

Small metal mushroom type valves are fitted, and require practically no attention.

		£	s.	d.
PRICE of complete unit	**E106**, as illustrated.	14	15	0
,, Spare Rubber Bellows	**E107**	1	5	0

ANIMAL WARMING PLATE.

THIS warming plate, which was introduced to us by Prof. McDowall, will be found very convenient for keeping an animal warm during experiments when a table with a copper hot-plate is not available.



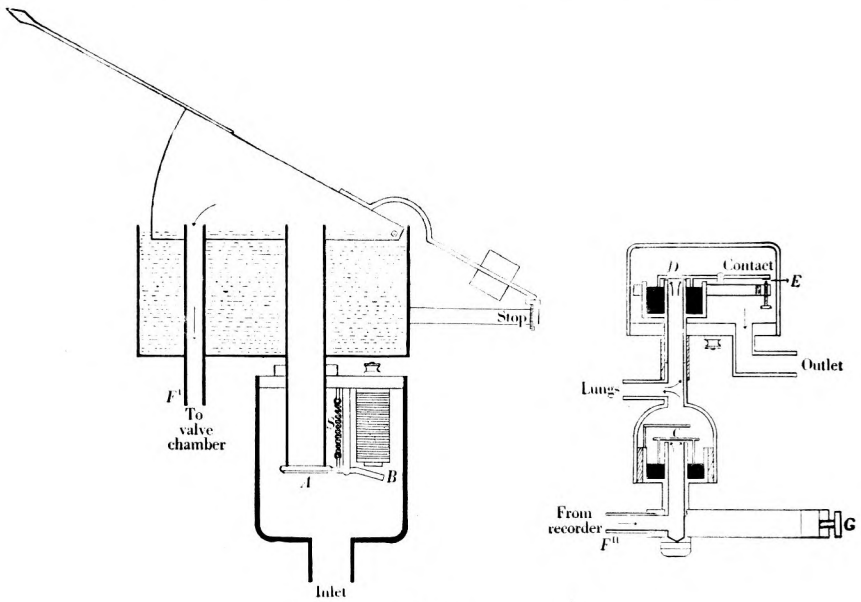
E131.

The plate consists of a number of coils of resistance wire sealed in a shallow zinc box measuring 14″ long x 7″ wide. Passing through the box is a metal tube, so that air or mixture from the respiration pump may be slightly warmed before reaching the animal. For most satisfactory results a 60 watt lamp should be connected in series with the resistance coils. We can, therefore, supply the warming plate with suitable leads for connection to the table lamp as illustration, which shows the warming plate and lamp fitted to an operating table top.

PRICE.		£	s.	d.
Warming Plate only ..	**E130**	1	12	6
,, ,, with Table Lamp, complete with leads and connectors..	**E131**	2	12	6

Please give particulars of Electric Supply when ordering.

RESPIRATION RECORDER.



E134.

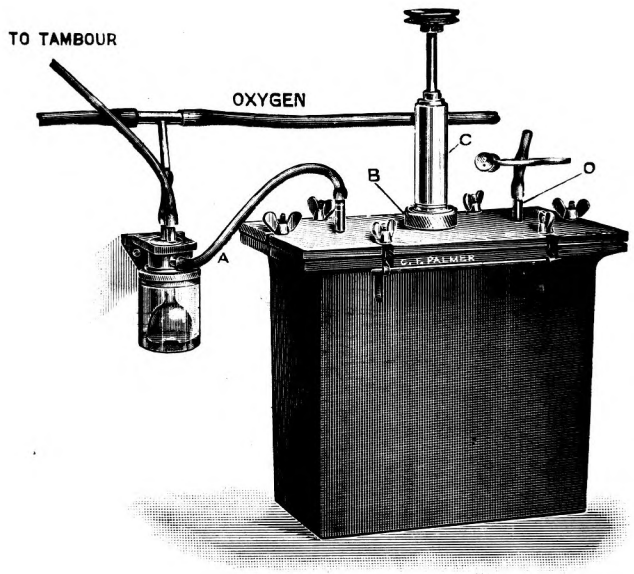
IN cases where it is desirable to obtain quantitative records of the respiration of small animals, the above apparatus, described by Prof. S. Wright in the " Journal of Physiology " (Vol. 80, No. 4, February, 1934), will be found very suitable.

" The apparatus consists essentially of a Krogh type Spirometer of 250 cc. capacity, with an outlet *F'* which is connected at *F''* with respiratory valves. The inspiratory and expiratory valves, *C* and *D*, are both of the hat type, being made of ebonite, and float on a pool of mercury. The inspiratory valve is prevented from being lifted excessively by a little shelf. During inspiration air is withdrawn from the Spirometer and the writing point sinks. During expiration, when the valve *D* is raised, a contact is made at *E*. This closes a circuit which is connected with the electro-magnet *B*, and as a result the tambour valve *A* is opened. This enables air from the inlet chamber to refill the Spirometer to its original position, over-swing being prevented by the stop. When expiration ends, contact at *E* is broken, and the valve *A* (assisted by the action of the spring *S*) returns to the position shown in the diagram, and shuts the Spirometer off from the inlet. The apparatus can be readily calibrated so that it is accurately quantitative. If the effects of various gas mixtures are to be studied, the inlet can be connected by means of corrugated rubber tubing with a Douglas Bag. The spirometer should first be washed through several times with the experimental mixture. The resistance of the valves is exceedingly small (less than 2 cm. water) and the dead space is about 10 cc. The expired air can be collected from the outlet. The record is unaffected by the movements of the animal other than respiratory. The Spirometer has some inertia and the first five or six breaths recorded by it are less deep than the succeeding ones. When the breathing is exceedingly shallow, as just prior to respiratory arrest, expiration may be too short to make the contact *E* or too brief to open the valve *A* for a sufficient time to refill the Spirometer. This difficulty occurs rarely."

The Spirometer is fitted with a substantial " X " Block for attaching to Kymograph upright, and a $\frac{3}{8}$" dia. upright rod is supplied with the valve chamber so that it can be fixed to the operating table near the animal.

PRICE **E134** £13 10 0

OXYGEN CONSUMPTION CHAMBERS.



E137.

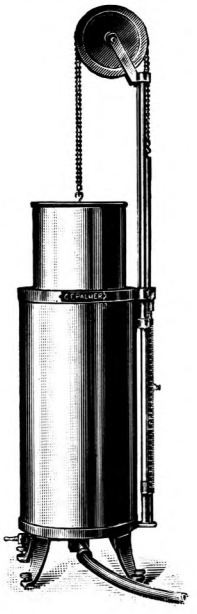
THE illustration shows an assembly which has been slightly modified from that described by Prof. A. N. Richards and L. W. Collison, in " The Journal of Physiology " (Vol. 66, No. 3, 1928).

Instead of the Chamber being of Glass, a metal tank, tinned or enamelled on the inside, is used.

The absorption apparatus is the same as that described in the paper and a mercury seal is used for the fan shaft. The cover plate is slotted so that the six holding-down bolts can be quickly released, a rubber gasket being used to ensure that an air-tight joint is made. Outlet *O* is for calibration purposes only. The internal size of the Chamber shown is 7″ x 3½″ x 4¼″ deep under the soda lime container, so that rats, guinea pigs and very small rabbits can be used ; larger Chambers can be made if required. The oil valve is now mounted as a separate unit ; this is more convenient as it enables the Chamber to be opened without disturbing the valve. When two or more Chambers are ordered, a pair of multiple-way tubes are supplied for the oxygen.

A Chamber similar to that shown was submitted to Dr. Gaddum, who, after testing it, expressed himself satisfied that the results obtained were up to the standard of the original model.

			£	s.	d.
PRICE.	Single Chamber, valve and bracket (as shown) ..	**E137**	8	0	0
,,	Three Chambers, valves, bracket and oxygen distribution tubes	**E138**	21	10	0
,,	Four Chambers, valves, bracket and oxygen distribution tubes	**E139**	28	10	0



E142.

SPIROMETER (Six Litre Capacity).

SUITABLE for measuring vital capacity, or can be used as a gasometer for making up mixtures.

The counterbalance of the Float is chain compensated. The float being balanced throughout its entire movement.

For convenience in storing, etc., the upright carrying the pulley can be lowered by simply loosening two thumb screws.

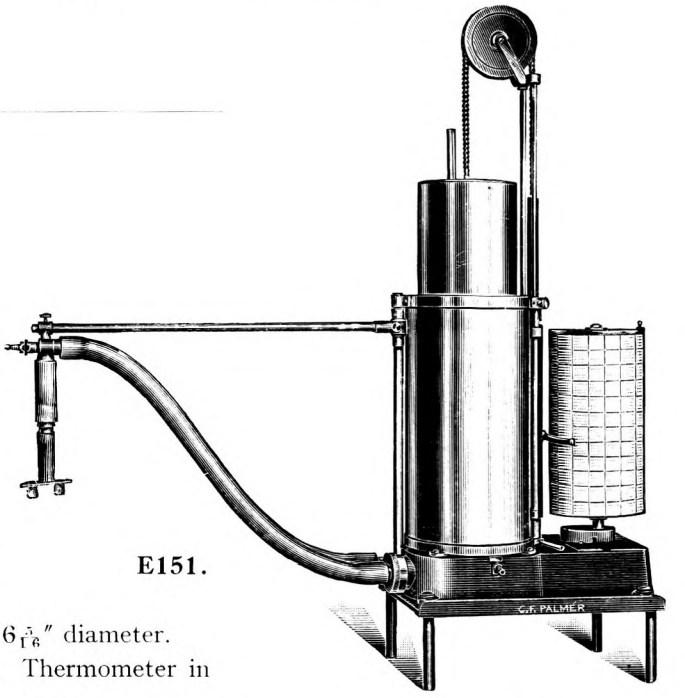
The model illustrated is fitted with single inlet tube, side cock for use with gases and drain cock for water.

Inlet and outlet tubes can be fitted without extra charge if specified at time of ordering. Standard Finish Dull Nickel.

PRICE. As illustrated **E142** £12 10 0

RECORDING SPIROMETER

(Flutter Valve Type).



E151.

THIS Spirometer operates on the principle used by Prof. F. G. Benedict for the determination of Basal Metabolism by measurement of the oxygen consumption. Features of the model include the following :

Capacity of float 6 litres. Size $15\frac{3}{4}$" x $6\frac{5}{16}$" diameter.

Counterbalance compensated by chain. Thermometer in float.

Recording Drum 12" high x 6" diameter, lift-off cylinder, one revolution in 20 minutes, 30-hour clockwork movement.

Writing Pen, adjustable by lever at bottom. Spirit Level fitted to base for convenience when levelling up.

Valves enclosed, easily accessible for examination or replacement.

Soda Lime Container, screw connection in centre chamber.

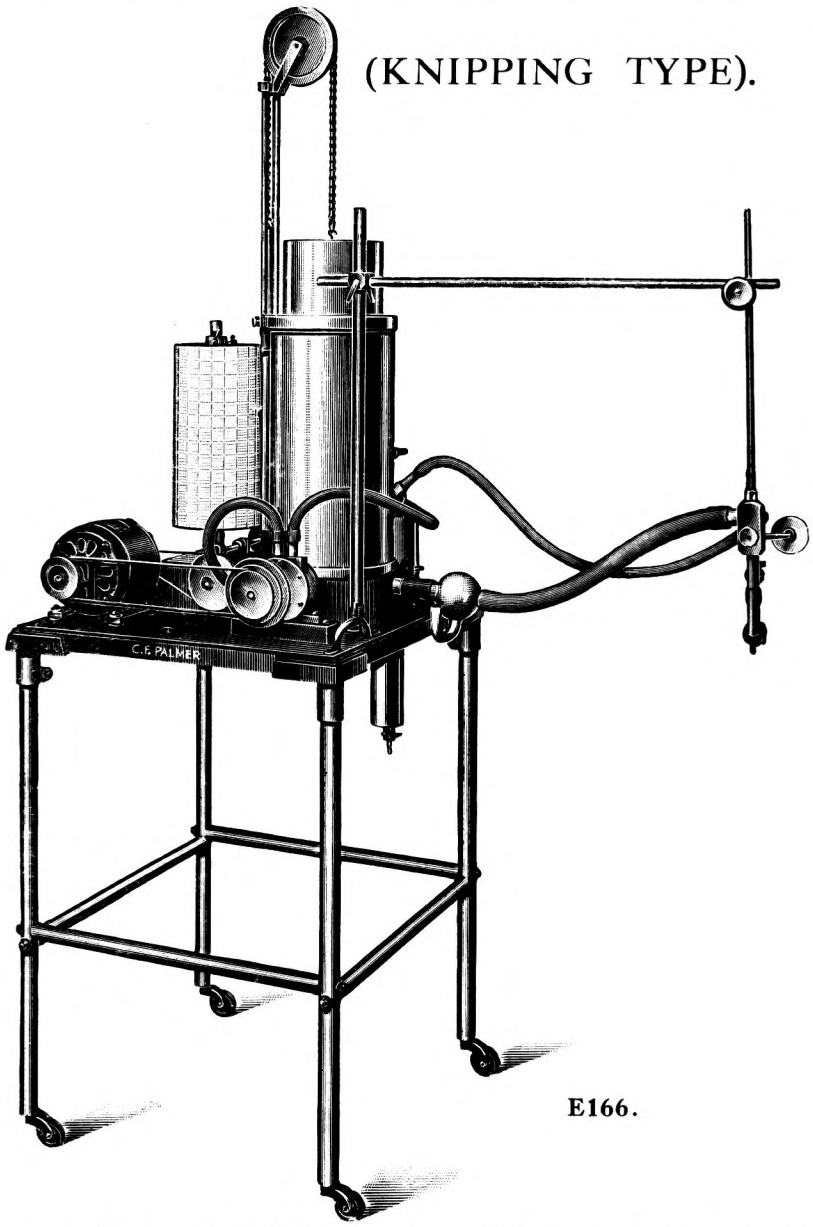
Drain cocks to all tubes and containers. Sampling cock at mouthpiece.

Overhead support and mouthpiece support quickly unassembled for transit.

			£	s.	d.
PRICE.	Apparatus complete as specified above, with necessary tubes, valves, and mouthpieces, nose clip, pens, etc.	**E150**	36	0	0
,,	Recording Spirometer on Steel Stand, as illustrated	**E151**	37	0	0
,,	Recording Spirometer on portable steel frame table, teak top, with castor wheels	**E152**	41	0	0
,,	Printed Charts for above Spirometers .. .. per 100	**E153**		12	6

CLOSED CIRCUIT RESPIRATION APPARATUS

(KNIPPING TYPE).



E166.

WITH this instrument working on the principle used by Prof. Knipping, it is possible to show on the same record, in addition to the volume of oxygen consumed, the volume of $C.O._2$ produced.

Also by using a rotary air pump to ventilate the apparatus, no valves are necessary.

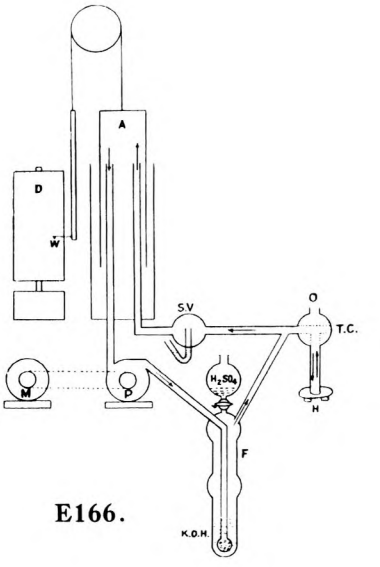
Dimensions and features of the Spirometer itself and the recording cylinder are identical with those given for No. E150.

The air circulating pump is substantially made and fitted with a water jacket for cooling; this should be connected to the nearest water supply. Lubricating points in the pump are conveniently placed, and should receive occasional attention.

The electric motor is quiet running, and has ample power. Two models of this Spirometer are made. In one, No. E 165, the recording cylinder is driven by a clockwork movement making one revolution in 20 minutes. In the other, No. E166, the recording cylinder is driven from the motor, this enables a two-speed gear to be used, so that the cylinder can be run at a fast rate (1 revolution in 2 minutes) in addition to the normal speed of one revolution in 20 minutes.

THE several parts of the assembly as shown in outline drawing herewith, consist of the following :—

1. The Spirometer *A*, the float of which is carefully balanced by a chain compensated counterpoise.
2. The rotary air pump *P*, works on the centrifugal principle, and is driven by the electric motor *M*.
3. The glass flask *F* contains the *K.O.H.* solution in the bottom, depending into this is a tube with a perforated bulb at one end, so that air from the pump is forced through the solution, and to the outlet in the side. At the top of the flask is a container for the H_2SO_4, which is released through the cock *C*, when it is desired to ascertain the $C.O_2$ produced.
4. The three-way cock *T.C.* is used to connect the subject at the mouthpiece *H*, to the apparatus, or to the outside air *O*.
5. A "U" tube *S.V.*, containing water, acts as a safety valve in the circuit.
6. The recording cylinder *D* carries the calibrated record charts, *W* being the ink writing pen.



E166.

Very briefly the circulation system is as follows : Gas is drawn from the Spirometer *A*, which has previously been charged with oxygen, into Pump *P*, and forced from there down the centre tube of the flask F, and through the *K.O.H.* where the $C.O_2$ produced is absorbed, and so to the three-way cock *T.C.* and the mouthpiece *H*, from thence it returns through the safety valve *S.V.*, to the Spirometer *A*. The reduction in volume due to the amount of oxygen consumed, is registered by the ink pen W, on the calibrated chart fixed to the recording cylinder *D*.

In order to ascertain the amount of $C.O_2$ produced, the subject at the mouthpiece *H* should be disconnected from the apparatus by means of the three-way cock *TC*, the air should continue to be circulated in the apparatus until the pen *W* records a horizontal line. The H_2SO_4 is then run slowly into the *K.O.H.* in the flask *F*, through the cock *C*. Cooling is effected by the water in a cylindrical tank around the outside of the flask.

The action of the H_2SO_4 on the *K.O.H.* causes the $C.O_2$ absorbed to be given off, and so the float of the Spirometer rises, the amount being recorded by the ink pen *W*.

The foregoing is only a very simple description of the method of using the apparatus ; before actual records are taken with subjects, *further information should be obtained from a competent authority.*

The apparatus is supplied complete with all necessary tubes, charts, spare *K.O.H.* flask and carrying case for same, nose clip, mouthpieces, pens, etc.

			£	s.	d.
PRICE.	Mounted on portable table with single speed clockwork driven recording drum	**E165**	70	0	0
,,	Mounted on portable table, but with two-speed motor driven recording drum (as illustrated)	**E166**	75	0	0
,,	Stout carrying case to take Spirometer Unit on Table Top	**E167**	5	0	0
,,	Printed Charts, per 100	**E153**		12	6

Please give full particulars of Electric Supply.

SECTION

F

Circulation and

PERFUSION

Pumps

Baths for Isolated Organs

Oxygenators

Stromuhr

Coagulometer

PROF. DIXON'S PERFUSION APPARATUS.

The following is from the Proceedings of the Physiological Society, May 20th, 1922.
"Journal Physiology" (Vol. LVI.)

"THIS Perfusion Apparatus consists of two pieces. One is an oven, shown in Fig. 1, sufficiently large to hold all the working parts of the apparatus, the perfusing fluid and the organ perfused. It has the following internal dimensions: 25″ high, 17″ wide and 12″ deep. It is provided with a 3″ water jacket, with an opening for filling and a tap for emptying. There is a hole at the top for a thermostat, when this is required for very long experiments; though, in practice, I have found that with the very large water jacket and the complete felt covering provided, the temperature varies only very slightly within an hour or two, and by placing a small Bunsen beneath the oven, it is easy to keep a constant temperature. Two narrow movable shelves, with suitable holes through them, trisect the oven (Fig. 2); on the upper

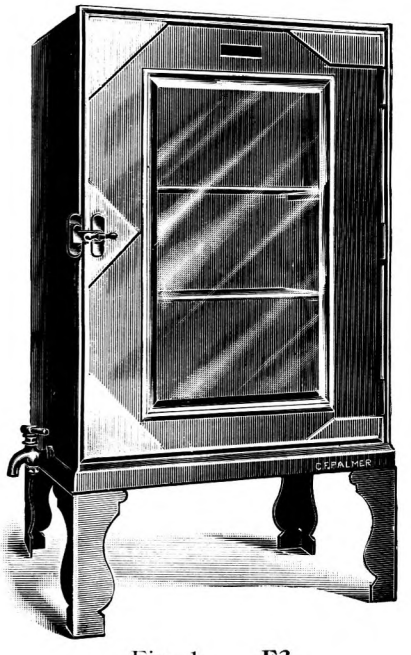


Fig. 1. **F3.**

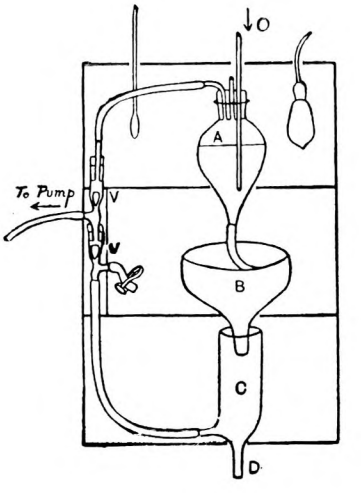


Fig. 2.

part is the flask *A* containing the perfusing fluid—this is provided with a rubber cork through which three holes pass, the first receiving the tube transmitting the venous return flow from the perfused organ; the second tube passes from without to the bottom of the flask, and is connected to the oxygen cylinder. The third opening is to allow excess of oxygen to escape, the pressure of oxygen being regulated by a mercury valve. The flask tapers off below to a tube which is connected to the artery of the organ. The perfused organ is placed in a suitable retainer, such as Buchner funnel *B*, and the fluid allowed to escape from the cut veins directly into the flask *C*; or, if preferred—that is when exact rate of perfusion from minute to minute is required rather than metabolic changes—a cannula may be inserted into the vein, and connected through a rubber cork to the receiving flask *C*. The circuit is completed by means of Brodie's valves, worked by a pump. Samples of fluid may be drawn off from the tap *D* as required. By connecting the retainer *C* to a volume recorder, the volume of the air space of *C* may be determined, *i.e.* the difference between the rate of filling and emptying. The object of the pump is to provide a very simple and rapid method of equalising these two.

The perfusion pump consists of any ordinary hypodermic syringe, specially mounted, to be worked mechanically from the laboratory shafting. The main feature of the pump is a variable stroke, which can be very easily adjusted while it is working, and the fact that the piston on all strokes comes to the bottom (outlet) end of the barrel, and therefore the internal capacity remains constant.

In Fig. 3, *A* is the driving pulley, having four V grooves for round band. *B* is a disc crank which moves the arm *CD* through a fixed arc on a pivot at *C*. On *CD* is a radial graduated slot having its centre at the joint *E*, when the arm is at its lowest position. Along this slot, and moved by a screw having a

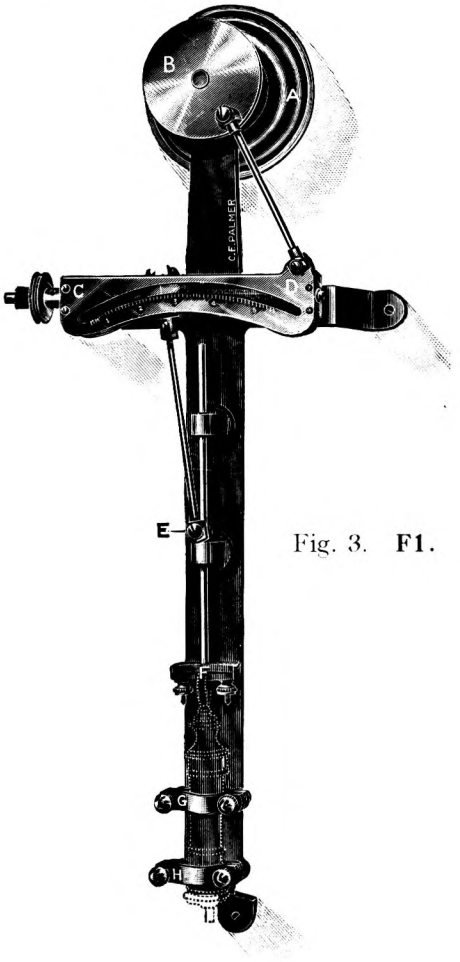


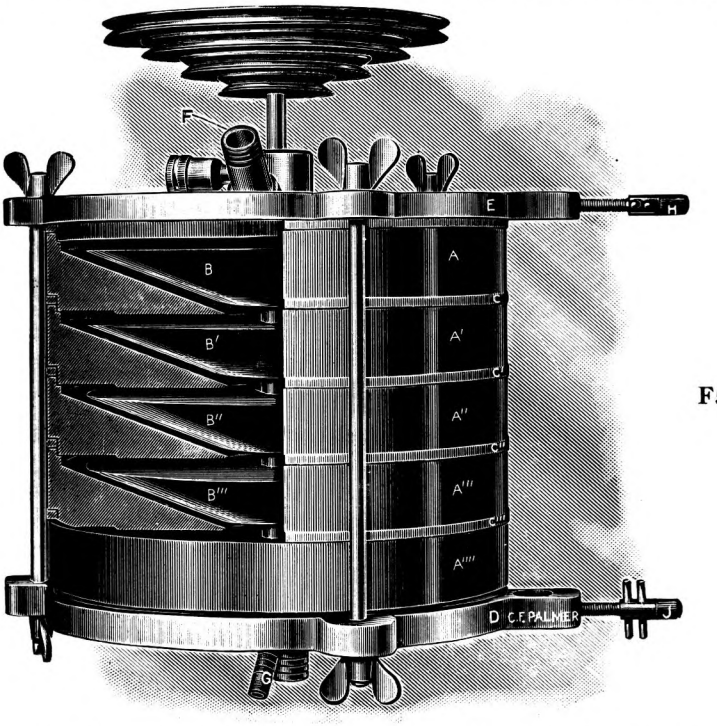
Fig. 3. **F1.**

milled head, shown near *C*, is a block which gives motion to the piston rod. Now, it is obvious that when the arm *CD* is at its lowest position, the block can be moved along the slot without moving the piston of the pump ; it follows that the further from the end *C* the block is moved, the greater is the movement imparted to the piston on the upward stroke of *CD*.

The thrust of the pump can be read on the arc, and if the internal diameter of the syringe is known, the amount of fluid withdrawn from the receiving chamber C can be computed. In practice, it is convenient to place a U-tube containing mercury between the pump and valves to prevent escape of fluid to the pump. The ingenuity of the pump is due to the maker."

			£	s.	d.
PRICE of Pump as described	**F1**		10	10	0
,, Suitable Metal Syringe, for use with the above	**F2**			17	6
,, Copper Hot Chamber or Oven, complete with heavy felt cover	**F3**		21	0	0
,, Glass Valves	**F4**	per pair		6	0

OXYGENATOR (Bayliss, Fee and Ogden).



F5.

THE above represents the latest form of artificial lung adopted by Messrs. Bayliss, Fee & Ogden. For details of former model *see* " Journal of Physiology " (Vol. LXVI.)

Further work, however, with this instrument revealed the fact that aluminium was not altogether satisfactory for the plates, therefore we now use bakelite mouldings. Furthermore, the metal end plates are lined with vulcanite to prevent the blood coming into contact with them.

Referring once again to the above illustration, which shows the instrument partly in section. It consists of a series of inverted truncated cones, *B* to *B''''*, mounted upon an axle and capable of being rotated by the aluminium four-speed cone pulley shown. These movable cones are intercalated between a series of stationary plates, *A* to *A''''*, fitting one another accurately at their periphery, the joint being made air-tight by means of the rubber washers *C* to *C'''*. As will be seen, the whole is held together by side rods and fly nuts, so is easily dismantled for cleaning. It fits the large stands D6 by the lugs and clamping screws *H* and *J* provided.

When re-assembling it is advisable to put the plate *E* on the stand first in reversed direction and build up to the plate *D*, clamp together and reverse the whole to its normal position. It is, of course, of the utmost importance that the plates are thoroughly clean, especially from grease.

Venous blood enters at the inlet tube *F*, and falling on to the plate *B*, is thrown in a film to the periphery, where it collects on the upright wall of the stationary plate *A*, flows down the inclined surface and passing through the central orifice to the plate *B'*, when the process is repeated until the blood finally reaches and leaves by the large tube situated behind tube *G*. There is a second tube at the top (hidden in the illustration) by which the air enters, and after flowing through the space between the plates, leaves by the tube shown at *G*.

A speed of from 150 to 200 revolutions per minute has been found to be satisfactory.

The leading dimensions of the instrument are :—

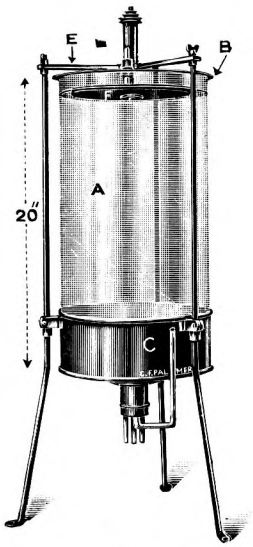
Diameter of the plates *A* to *A''''*. 6″.
Thickness of each plate *A* to *A''''*. Approximately 1″.
Diameter of plates *B* to *B''''*. 5″.
Weight of the complete assembly, as illustrated. 12-lbs.

PRICE .. **F5** £6 5 0

We are advised by users of the above Oxygenator that special attention must be paid to cleaning and setting up the apparatus ; also it is necessary that the blood flow must be continuous. Satisfactory results are somewhat difficult to obtain.

OXYGENATOR

(Hooker).



F6.

THIS apparatus employs the principle of Oxygenating Blood, described by Hooker in 1915; more recently it has been used in experiments for investigating the Circulation through the Liver, and is mentioned in the paper by W. Bauer, H. H. Dale, L. T. Poulsson, and D. W. Richards. *See* " Journal of Physiology " (Vol. 74, No. 4, April 26th, 1932).

The Oxygenator is capable of handling large volumes of blood and can be easily set up in any convenient position.

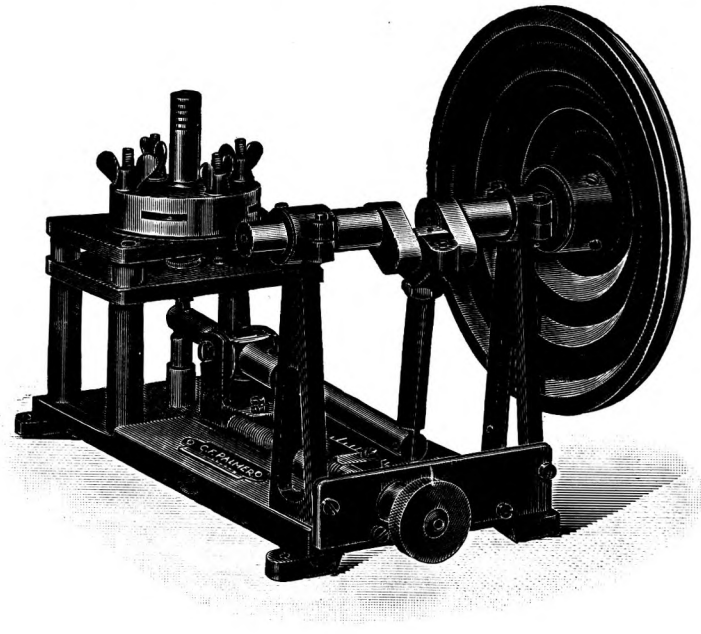
For mechanical reasons some modification of the apparatus has been found necessary. The present design consists of a large transparent celluloid cylinder *A*, measuring 20" long x 10" in diameter, fitting into a silver-plated funnel *C*; near the top of the cylinder is an ebonite disc *F*, which is connected by a spindle running in ball bearings to the grooved driving pulley, when this is caused to rotate, the blood passing through a glass tube immediately over the disc is spun off and covers the inside of the Celluloid Cylinder in the form of a film which collects in the funnel *C*. Oxygen is fed into the Cylinder through one of the glass tubes in the bottom of the funnel; the other glass tubes are two outlets and a " U " tube. The latter enables the level of the blood in the funnel to be easily ascertained.

For cleaning purposes, the Oxygenator can be quickly dismantled, it being only necessary to screw off the fly nuts and remove the three-arm piece *E*.

PRICE. Complete as illustrated. **F6** £7 10 0

THE SCHUSTER PERFUSION PUMP.

(See article by H. H. DALE *and* E. H. J. SCHUSTER *on "A Double Perfusion Pump." Journal of Physiology, Vol. LXIV., No. 4, Feb. 10th, 1928.)*



F10.

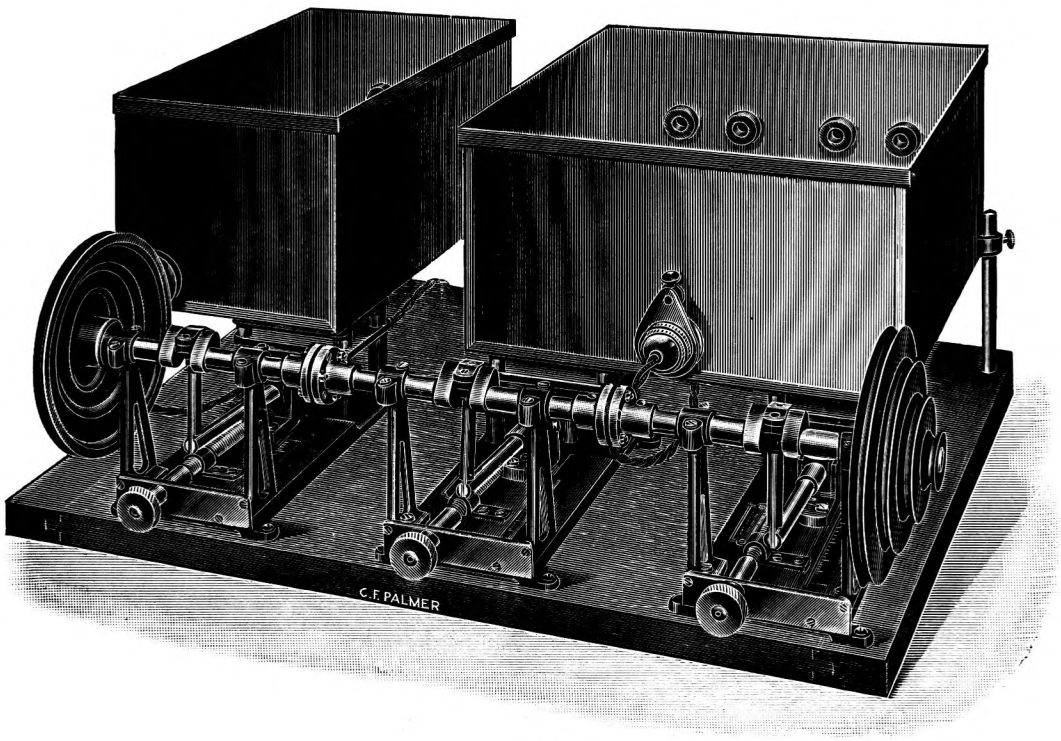
Overall dimensions: 12″ x 8″ x 8″. Weight: 13-lbs.

THIS Pump having been described in the above article by Drs. Dale and Schuster, it will only be necessary for us to give a few particulars, referring our clients to the article in the Journal for full details.

The most interesting point in this pump is that the blood only comes in contact with glass and rubber, and never with metal, as in some pumps that have been tried for blood perfusion. This is accomplished as follows: Fixed to the nozzle of the pump, which is of the "diaphragm" type, is a special rubber bag similar to a finger stall, but with a tubular extension. Surrounding this is a closed glass vessel with inlet and outlet valves, through which the blood is pumped in the following manner. The rubber bag and the space above the diaphragm of the pump are filled with water by means of the tubular extension on the bag, which is then closed. The action of the pump is to cause the rubber bag to be alternately extended or contracted, thus altering the internal capacity of the glass vessel, which in turn causes the blood to be drawn in through one valve and expelled through the other. The quantity thus pumped can be accurately regulated by adjusting the fulcrum of the pump while working, a scale being fitted for reference, indicating the traverse of the centre of diaphragm.

Two or more of these Pumps can be mounted on a teak baseboard, and connected with a special semi-flexible coupling (easily disconnected) at the price of the Pumps, without extra charge, if ordered at the same time.

			£ s. d.
PRICE of Single Pump	**F10**	10 0 0
,, Double ,, ...	**F11**	20 0 0
,, Triple ,, ...	**F12**	30 0 0



F17.

Overall dimensions : 24″ x 24″ x 11½″ Weight : 75-lbs.

THIS Pump can be supplied with copper tank fitted with electric heater and packing glands, either as a single, double or triple unit.

		£	s.	d.
PRICE of Single Pump, fitted with copper tank, electric heater and packing glands ..	**F15**	14	0	0
,, Double ,, ,, ,, ...	**F16**	27	0	0
,, Triple ,, ,, ,, (as illustrated, or with one large tank)	**F17**	41	0	0

Please give particulars of Electric Supply when ordering.

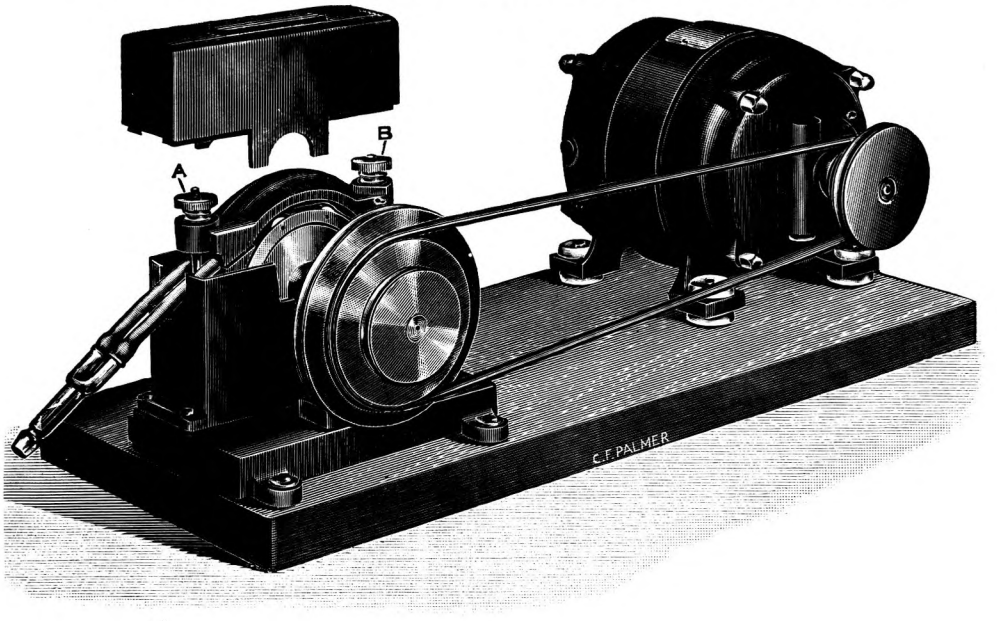
Glass parts, rubber valves and special rubber finger stalls are supplied.

		£	s.	d.
PRICE per set	**F20**	0	15	0
,, Special Rubber Finger Stalls only, each	**F21**	0	3	0
,, ,, ,, Valves ,, ,, ...	**F22**	0	0	4
,, ,, ,, Diaphragms ,, ...	**F23**	0	0	6

THE HEMINGWAY VALVE CHAMBER.

This is similar in design to that described by Dr. A. Hemingway in the " Journal of Physiology " (Vol. 77, No. 2, Jan., 1933), but is made of Chromium plated brass instead of erinoid—the latter was found to be unsuitable after being in use for some time. The Hemingway Valve Chamber can be fitted to all models of the Schuster Perfusion Pump, both with and without copper tanks, in place of the usual type Chamber with its rubber finger stall, glass dome and valves, for an extra cost of 20/- per Pump, if specified when ordering.

HIGH SPEED ROTARY PUMP.



F32.

THE above, taken from a photograph, represents a pump working upon the same principle as the original used by Messrs. Bayliss and Muller, viz., a rubber tube or tubes, compressed by a series of rollers which pass along from one end to the other driving the contents before them (*see* "Journal of Scientific Instruments," Vol. V., No. 9, Sept., 1928). The above pump differs in mechanical detail and instead of working direct off the motor spindle, it will be seen that it has a pulley, and can therefore be driven from any available source of power or mounted, as the photograph shows, as a complete unit with motor to which it is connected by a band and a pair of three-speed pulleys.

In practice it has been found that two small tubes last much longer, and are generally much more satisfactory than a single tube of double the size. The tubes are very easily renewed as follows : Two pieces about 6" long are joined at their ends by Y glass tubes. The top pressure plate is then slightly raised and the tubes slipped in, one on either side of the adjusting screws, *A* and *B*, care being taken to see that they are in the slots provided.

This pump can be run at high speeds when liquids are being pumped. A slower speed is advisable when pumping gases owing to the generation of heat. It can also be used as a vacuum pump, the vacuum being maintained when the pump is stopped.

As it is impracticable to give the quantity of gas pumped, the following table shows the approximate quantity of water delivered at varying speeds and against zero pressure, which within reasonable limits however does not greatly affect the output.

Revolutions per minute ..	750	960	1280
Litres per minute	1·0	1·5	2·0

This pump has been run to deliver three litres per minute, but at this speed it becomes somewhat noisy, and as would be expected, the wear on the rubber is excessive. For this reason it is better to keep the speed low, consistent with the required output, using two or more pumps if necessary.

The above output table is a fair average, but it should be pointed out here that the pressure plate requires careful adjustment by means of the nuts, *A* and *B*. It is worthy of note that if the nut on the output side be screwed down a little tighter than the one on the intake side, the output is greater than if the reverse be the case. Obviously the pressure should be such as just to close the tube ; more than this will only cause useless friction and wear on the tube.

The whole pump is mounted in an oil bath, which has been found to be better than glycerine, the oil during an experiment having a negligible effect upon the rubber.

During tests, the same pair of rubber tubes have been in use for a week running intermittently, and several tubes run continuously at approximately 1,000 R.P.M., have stood for 15 hours, or more.

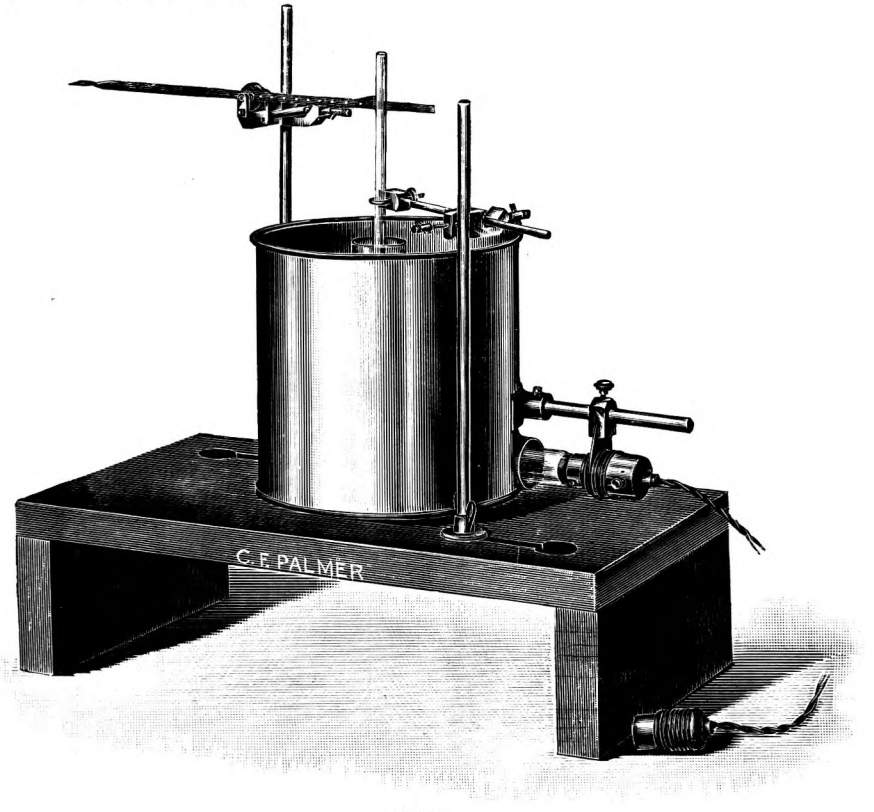
In the photograph the cover has been raised above the pump to show the rotor, which is not a roller-bearing as in the original, but a rotor specially designed for the purpose.

			£	s.	d.
PRICE.	Pump fitted with Three-Speed Pulley	**F31**	5	10	0
,,	,, complete with $\frac{1}{8}$ H.P. Motor, as illustrated ..	**F32**	10	15	0
,,	If fitted with regulating resistance .. .. .. extra	**F33**	2	5	0
,,	Three-Speed Cone Pulley to match the driving Cone of Pump, bored as required up to $\frac{5}{8}$" to fit own motor extra	**F34**	0	10	6
,,	Special Quality Rubber Tube .. .. per foot	**F35**	0	0	3
,,	,, Glass " Y " Pieces .. .. each	**F36**	0	1	3

Please give particulars of Electric Supply.

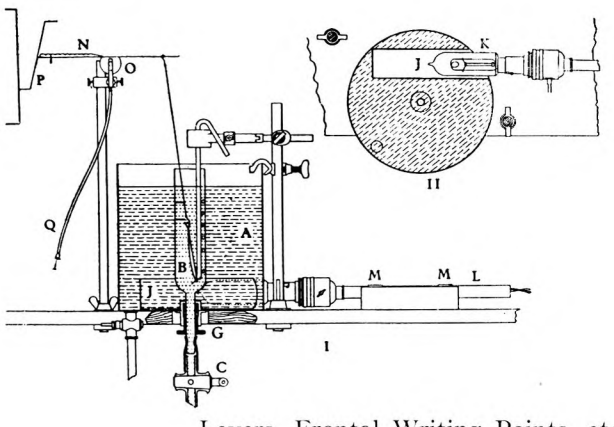
APPARATUS FOR ISOLATED UTERUS, INTESTINE, Etc.

(See Medical Research Council's Report on "Standardization of Pituitary Extracts," by J. H. BURN, M.A., M.B., *and* H. H. DALE, C.B.E., M.D., F.R.S. *Published by H.M. Stationery Office. Special Report Series, No. 69, 1922. Price 1/6 nett).*



F45.

BY permission of Dr. Dale we reproduce below a reduced copy of the original sectional drawing of his apparatus. The above is from a photograph of the apparatus as now made by us, and which, although similar in the main shows some alterations in detail. For instance, for the lever *N* we use one of our "Fixit" levers, whilst the oxygen tube dipping into *B* is held in one of our "Hook Grips." The lamp-holder slides on a rod fixed to the tank, and the whole is mounted on a platform to obviate the necessity of cutting holes in the table.



PRICE.

		£	s	d
Complete with inner glass vessel *B*, heating lamp for any standard voltage, but without oxygen tube or draw-off cock.	**F45**	5	5	0
Oxygen tube with platinum wire hook fused in, each	**F46**		5	0
Spare inner glass vessels ..	**F47**		2	6
Large bore glass cock *C* ..	**F49**		6	0
,, 2-way glass cock	**F50**		12	6

For technical details see the published report mentioned above.

A somewhat larger round bath, but fitted to take two inner vessels can also be supplied.

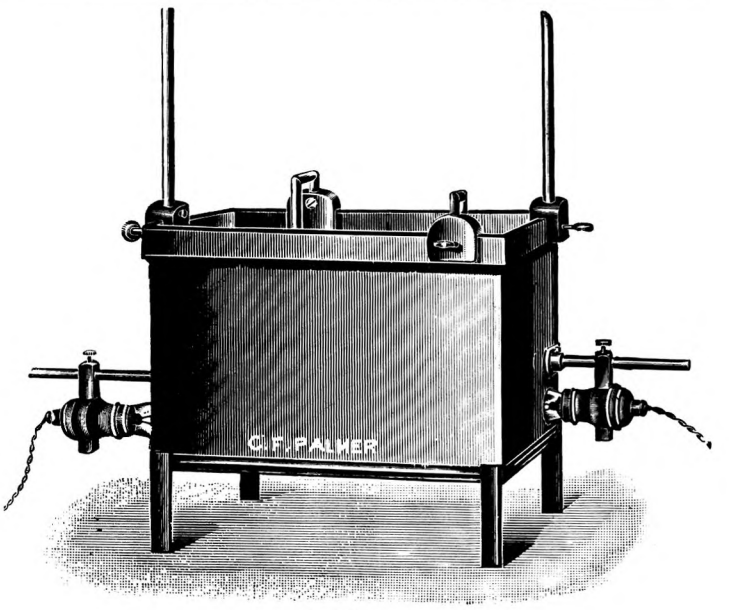
Levers, Frontal Writing Points, etc., will be found in Section C.

Please give particulars of Electric Supply.

LARGE BATH.

For Isolated Organs, &c.

THE above apparatus is similar to that described on the preceding page, but consists of a larger and rectangular copper bath 12″ x 9″ x 8″ deep. Around the top is a broad stiff band, on which the upright and depending rods are clamped. At diagonally opposite corners are the heating lamps, each having its own independent switch, and, as in the foregoing, the lamps can be slid in or out to regulate the heat. There is a drain-cock, and detachable iron stand 3″ high.



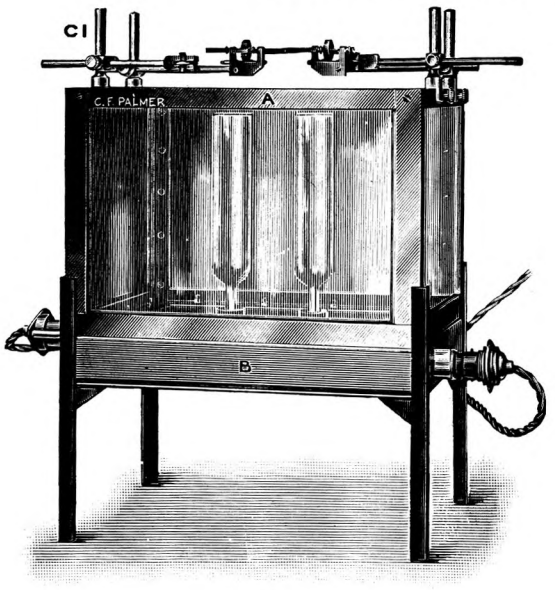
F55.

			£	s.	d.
PRICE.	Bath, complete, on iron stand, with two upright and two depending rods, ⅜″ diameter, double glass vessel holder, two sliding key switch lamp holders, and two special tubular lamps	**F55**	7	0	0
,,	Extra ⅜″ uprights to clamp on tank	**F56** each	6	0	
,,	Extra ⅜″ depending rods to clamp on tank	**F57** ,,	7	6	

For suitable Recording Levers, etc., see Section C.

ISOLATED ORGAN BATH,

WITH GLASS SIDES.



F60.

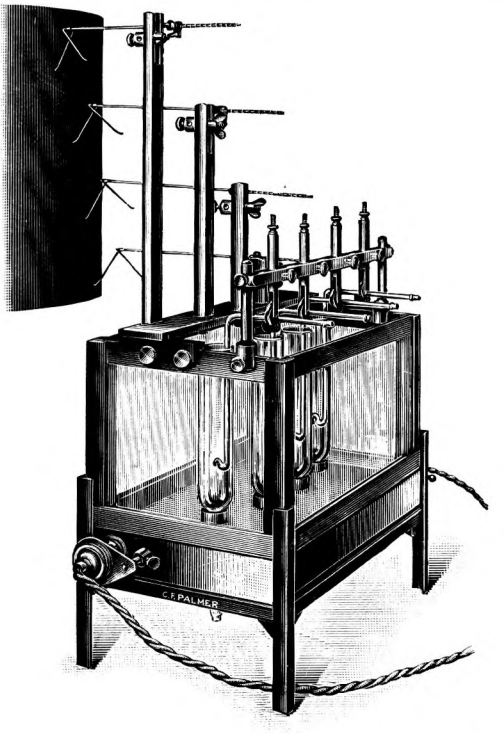
THIS consists of a glass-sided tank *A*, measuring 12″ x 9″ x 8″ deep standing on a separate copper heating chamber *B*, which has the electric heating bulbs placed in opposite corners, the temperature of the bath being roughly controlled by means of the sliding lamp-holders. A stout brass rail is fitted around the top edge of tank *A* for clamping supporting rods, and the whole rests on an angle iron stand having legs 5½″ high. The bottom of the tank is fitted with two packing glands to take the Glass vessels, the limbs of which pass through the heating chamber.

When required the Bath can be supplied complete with 4 supporting rods, 2 " Fixit " Levers and 2 Grips to hold the oxygen tubes.

			£	s.	d.
PRICE	of complete assembly, as illustrated	**F60**	12	5	0
,,	As above, but without supporting rods, " Fixit " Levers and Grips	**F61**	10	7	6
,,	Complete assembly but with copper bath	**F62**	9	5	0

Please give particulars of Electric Supply.

FOUR UNIT ISOLATED ORGAN BATH.



F67.

THE above Bath, designed from suggestions given by Dr. W. H. Newton, enables simultaneous records to be taken from any number of units up to four without fear of the tracings overlapping, provided a recording cylinder of not less than 12″ high x 12″ dia. is used.

The glass inner vessels and the uprights carrying the levers are arranged in an arc of a circle so that the degree of magnification of the movement of the organ is similar for each unit.

A detachable bar is fitted to hold the adjustable clamps which secure the pointed glass oxygen tubes so that the complete assembly can be removed for attaching the organs.

Final adjustment of the levers can be made by sliding the lever pivot frames up or down in the slotted uprights.

All metal frontal writing points with aluminium levers are fitted as standard.

The Bath illustrated has glass sides, but a copper bath similar with regard to fittings can be supplied if required.

Heating is by means of electric lamps fitted with adjustable holders, and the bath is mounted on an angle iron stand 4″ high. Stands of any height can be supplied without extra charge.

			£	s.	d.
PRICE.	Four Unit Bath, all copper with fittings, uprights, levers, etc., as shown ..	**F66**	12	10	0
,,	Four Unit Bath, glass sides, with fittings, etc. (as illustrated)	**F67**	14	10	0

For special cylinder 12″ high x 12″ diameter, to fit recording Drum, *see* Section A, page 17.

Please give particulars of Electric Supply.

SPECIAL BATHS.

THE previous pages describe our Standard Baths, we can however supply Baths to suit individual requirements, such as :—

Small Glass Bath, electrically heated for Students' use.
Large lead-lined Wooden Bath to take several Oxygen Consumption Chambers. (E137).

Particulars and prices of these will be sent upon request.

TEMPERATURE CONTROL OF WATER BATHS.

For accurate control of temperature a Glass Regulator of the Toluene and Mercury type is generally used with a suitable relay (*see* H80).

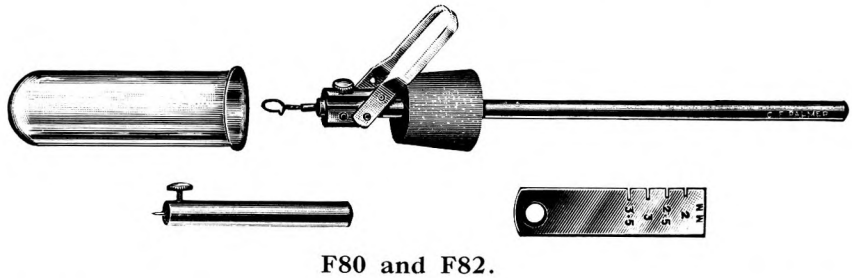
We are able to supply the glass parts only of the regulator, it being necessary of course to fill it in the Laboratory.

In cases where very accurate control of temperature is not necessary, a Capsule type regulator can be supplied.

Stirrers for circulating the water can be supplied for use with all types of Water Baths.

Levers, Frontal Writing Points, etc., suitable for use with Isolated Organ Baths, are described in Section C.

BLOOD COAGULOMETER.



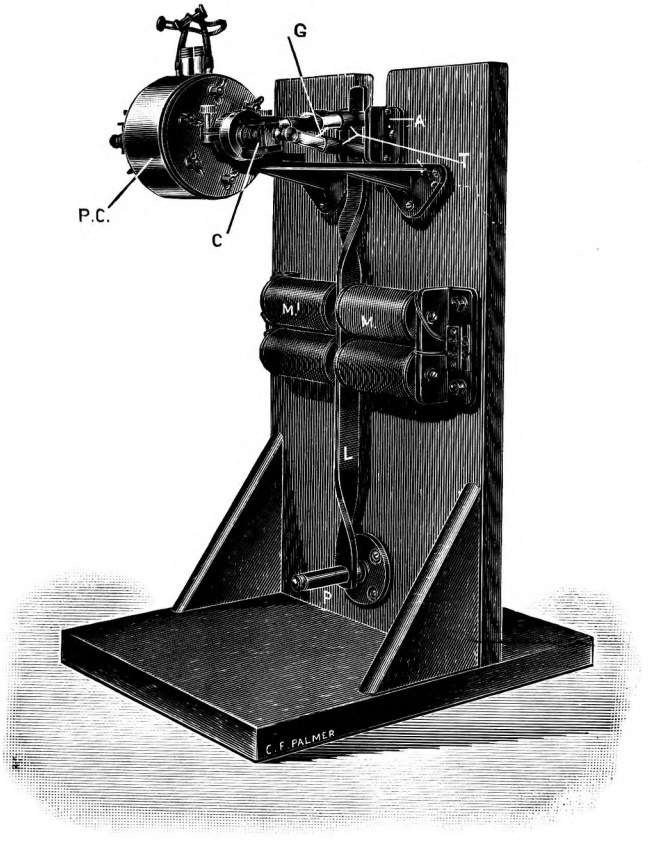
F80 and F82.

THE above instrument was designed by Prof. O. S. Gibbs, and is described in the quarterly " Journal of Medicine " (Vol. 17, No. 67, April, 1924).

A modified platinum wire loop is now fitted, and a jig for bending the loops can be supplied, and also the pricker and depth gauge shown in the illustration, if required.

			s.	d.
PRICE.	Coagulometer, with one extra Platinum Loop	**F80**	15	0
,,	Bending Jig	**F81**	2	6
,,	Pricker and Gauge	**F82**	2	0
,,	Extra Platinum Loops	**F83**	1	6

MECHANICAL STROMUHR.

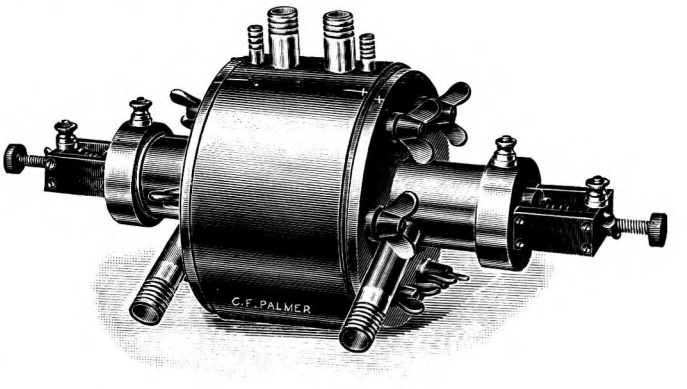


F70.

DESIGNED by H. Barcroft, the Stromuhr is suitable for the measurement of the blood flow through the larger arteries of operated animals, and is described in "The Journal of Physiology" (Vol. 57, No. 4, July, 1929). In brief, the arrangement consists of a Piston chamber *PC*; with the Electric Contacts *C*, at the ends; these, through a relay operate the electro magnetic clamp which compresses or releases the Rubber Tubes *T*. The complete assembly is mounted on a stout teak frame, and the coils *MM'* of the electro magnetic clamp can be wound for use with Direct Current electric supplies of any voltage. A set of special glass **Y**-tubes is supplied with the complete assembly.

		£	s.	d.
PRICE, as illustrated ..	**F70**	23	10	0
,, Piston Chamber only	**F71**	12	16	0

Relay H82 is suitable for use with the Stromuhr.

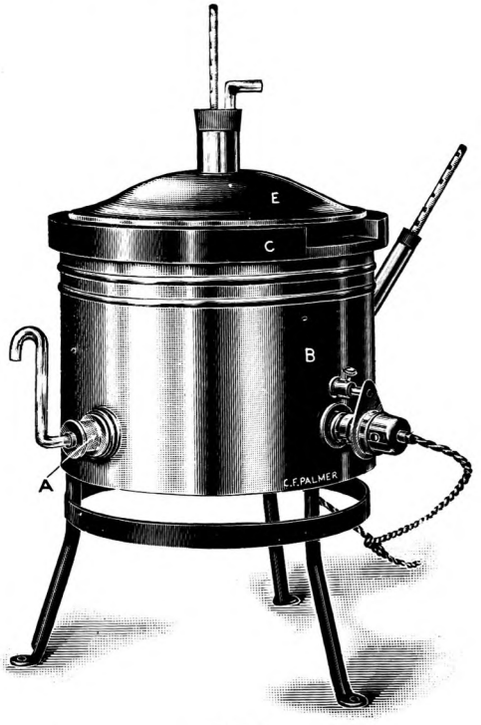


F71.

Please give voltage of D.C. Electric Supply.

LIVER PLETHYSMOGRAPH.

THE general construction of the Plethysmograph closely follows the original as designed at the National Institute of Medical Research, Hampstead, and used for the experiments in the Control of the Circulation through the Liver carried out by W. Bauer, H. H. Dale, L. T. Poulsson and D. W. Richards. *See* " Journal of Physiology " (Vol. 74, No. 4, April 26th, 1932).



F100.

A Copper Tank *B*, 11″ diameter x 8″ high, is used as a thermostat, being heated by two tubular carbon lamps mounted on adjustable supports, a tube for filling and to hold a Thermometer is located at the side.

Fitting on the top of the tank, and held in position by means of a groove is a thick ebonite ring *C* carrying on the inside a silver-plated circular tray, the joint being made air-tight with putty, in the tray rests a support holding a muslin sling to take the Liver.

In the bottom of the tray, and fixed by a rubber bung, a length of silver tube with a rubber diaphragm at the upper end, passes through the tank *B* into a packing gland at the base ; a glass cannula from the vena cava is pushed through the rubber diaphragm, and passed down the silver tube.

In the rubber bung at the bottom of the circular tray is also an accessory outlet tube, which passes through the tank, and the packing gland *A*, this is made detachable for convenience in fitting up.

Two wide slots are cut in opposite sides of the ebonite ring *C* to take the Cannulæ, these are embedded in fresh putty to make the whole air-tight.

The cover *E* is of glass, the joint with the ebonite ring *C* again being made with putty. A Thermometer and an outlet tube to the Volume Recorder pass through a rubber bung fitted in the top of the cover.

A circular metal stand supports the apparatus, this is 9″ high, but stands of any height can be fitted if required.

The foregoing is a very brief description of the Plethysmograph, and users are referred to the paper published in the " Journal of Physiology " for full details.

			£	s.	d.
PRICE.	Plethysmograph, as described	**F100**	15	0	0
,,	Set of four Cannulæ, fitted with two small Thermometers	**F101**	1	10	0

Please give particulars of Electric Supply.

SECTION

G

MECHANICAL

Electric Motors

Shafting, Pulleys, Brackets, Standards

Speed Varying Gears

Power Tables

High Speed Shaker

Rotary Mixer

SHAFTING AND FITTINGS.

THE majority of apparatus in a Physiological Laboratory requires to be driven at a slow speed ; and the most convenient, and now almost universal source of small power, is the electric motor, which, to be efficient, must run at a high speed. It is therefore necessary to reduce this speed. The following particulars of shafting and fittings show how this may be accomplished in a convenient and flexible manner.

We are always pleased to offer suggestions with regard to the installation of driving gear, and to submit a complete layout for the Laboratory, on receipt of plan, giving size, height and position of fixtures, etc.

For driving Students' Drums, the usual way is to have a line of shafting down the back or centre of bench, according to whether the students work at one or both sides. In the latter case, the same length of shafting, with double the number of pulleys, will, of course, drive twice the number of drums. Such shafting is conveniently carried on standards, as that illustrated in G1, placed 48″ to 54″ apart ; 24″ is recommended as the best height. Sometimes, however, it is desirable that the shafting should reach over a number of separate tables, with space for walking between. In this case, the standards must be sufficiently high to allow head room.

These high standards, however, are not recommended, since they not only need stay bars, but are also very inconvenient, as the average student is unable to reach the pulley to put on the drum driving band.

In the Research Laboratory, a convenient form of drive is a shaft extending right across the room, hung from the ceiling on " J " hangers, as G12. If the ceiling is too high, a beam may be put across the room, the under side of the beam being from 8′ to 9′ above the floor. The "J " hanger, illustrated in G15, is suitable for this, and like the standards, should be placed 4′ to 4′ 6″ apart. The hanger shown in G20 is useful to fix on the side of a beam, when, as often happens, pipes, etc., have already been placed on the under side.

To drive the Brodie-Starling Kymograph, the most convenient arrangement is a swing arm, having a weight at one end and a pair of guide pulleys at the other, over which the driving band from the main shaft runs ; this automatically takes up the slack in the band when the Kymograph is raised. See illustration G102. The supporting rod can be fixed to the ceiling, or above or below a beam. In places where the ceiling is very low, a swing arm can be supplied with a spring in place of the weight, which would be dangerous should the band break.

When apparatus such as the Brodie Respiration Pump, Kymograph Smoker, etc., is mounted on the wall, a pair of Guide Pulleys, G80, should be fixed above to direct the belt from the main shaft. These, of course, are not necessary if the shafting is carried in brackets fitted to the wall itself.

In the foregoing, nothing has been said about the driving power. In the majority of cases, a $\frac{1}{4}$ H.P. Geared Motor (*see* G153) will be found the most convenient. It is easily installed, and can be connected directly to the main shaft by a pair of three-speed cones. Besides the regulation on the D.C. Motor, this gives three speeds on the main shaft, which are usually sufficient. Such an arrangement is illustrated in Fig. 1. On the other hand, the motor can be fitted with a three-speed cone, driving a large wheel running on a countershaft, which can, in turn, be connected to the main shaft by a pair of cones. In this arrangement a greater variety of speeds can be obtained, and it is therefore preferred by some to the worm and wheel drive fitted on the motor itself. In place of a countershaft, and where a wall running at right angles to the main shaft is available, the large wheel and cone can be run on a spigot instead of a countershaft. Fig. 2 will make this clear. It will be seen that there is a " Jockey " pulley running on the slack side of the belt, which takes up the slack when the belt is put on to a smaller speed on the motor pulley.

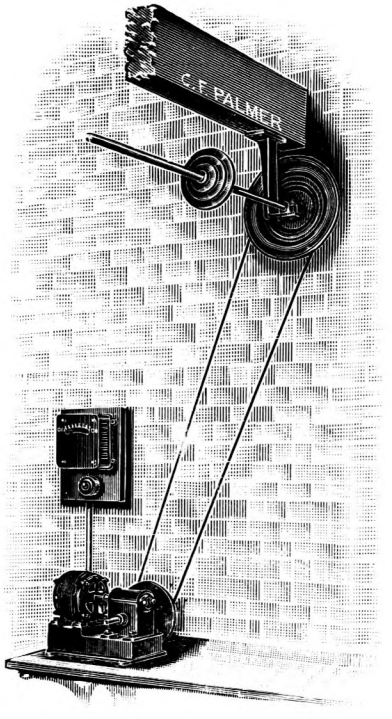


Fig. 1.

SPLIT PULLEYS.

IT often happens that an extra Cone Pulley is required in a certain position. To obviate taking a section of shafting down to slip on a solid Pulley, and thereby stopping experiments for the time being, we now supply $4\frac{1}{2}$" and 6" Cone Pulleys in halves, which are easily screwed together on the shaft, *see* G95, 96.

A few of these should be in every laboratory, as they can, in a few minutes, be easily taken off the shaft and refixed in a new position.

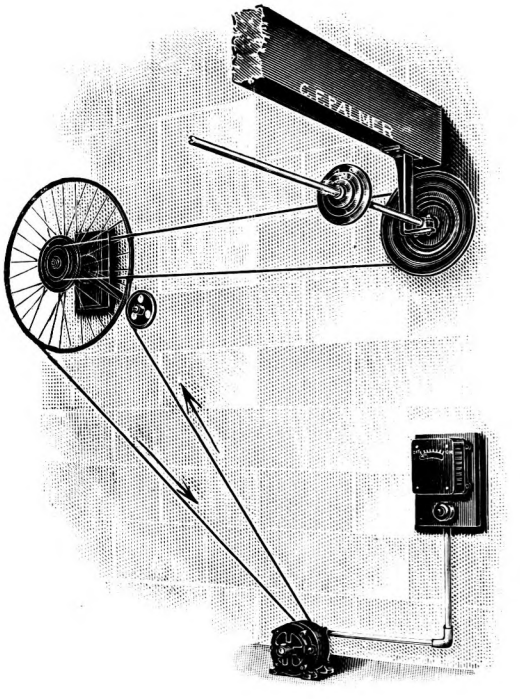


Fig. 2.

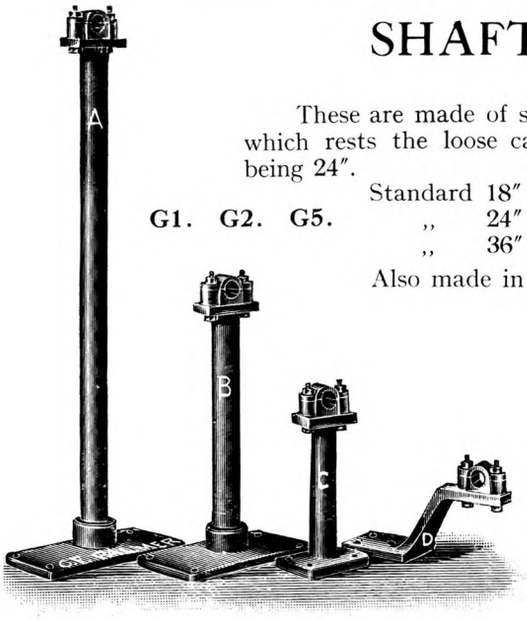
SPECIAL NOTICE.

Leaflet, giving a few hints on erecting Laboratory Shafting, will be sent on request.

SHAFTING AND FITTINGS.

STANDARDS.

These are made of steel tubing, fitted into a cast iron foot and "T" head, on which rests the loose cap gunmetal bearing for ¾" shafting, the standard height being 24".



G1. G2. G5.

PRICE.				£	s.	d.
Standard 18" high	.. ..	*A*	**G1**	0	14	9
,, 24" ,,	.. ..	,,	,,	0	15	0
,, 36" ,,	.. ..	,,	,,	0	16	6

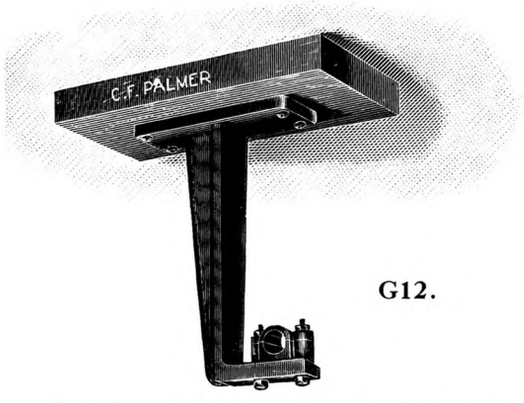
Also made in solid cast iron, with adjustable bearings, as above :—

8" high	.. ..	*C*	**G2**	0	13	6
9" ,,	.. ..	,,	,,	0	13	6
12" ,,	.. ..	,,	,,	0	14	0
15" ,,	.. ..	,,	,,	0	14	6

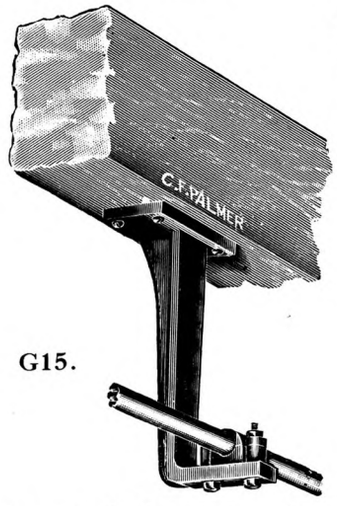
Please give required length as well as number when ordering thus, G1—24" meaning a Standard G1 pattern 24" high.

Bent ditto 4¼" high	.. ..	*D*	**G5**	0	13	0

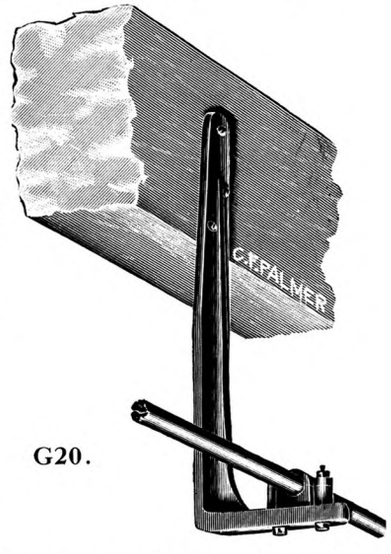
HANGERS.



G12.



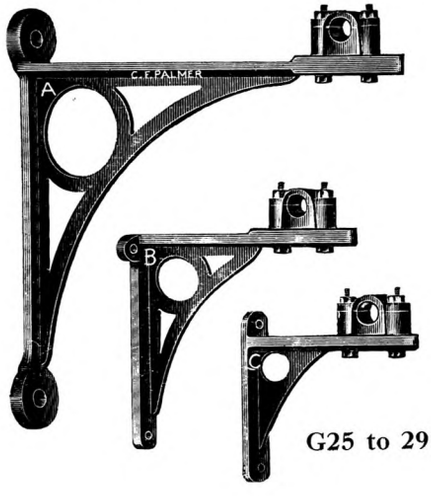
G15.



G20.

Length 9" to centre of shaft, complete with bearing similar to those fitted to the standards.

PRICE.			£	s.	d.
For ceiling. Size of sole plate, 6¾" x 2¼"	.. ..	**G12**	0	15	0
,, For beam. As above, but with sole plate 5¼" x 2½" turned, through an angle of 90°	.. ..	**G15**	0	15	0
,, For side of beam, overall length 15"	.. ..	**G20**	0	15	0



G25 to 29.

BRACKETS.

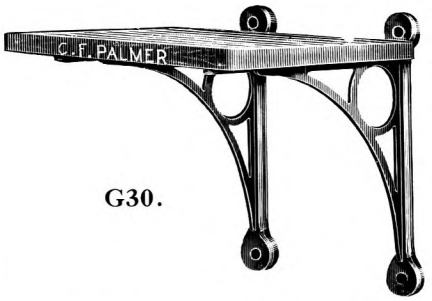
These have bearings similar to the above, and are made in two standard sizes, viz., 13" for countershafts, and 6" for ordinary shafting and in two patterns.

Pattern *A* for fixing to a wall by means of cemented-in bolts.
,, *B* ,, ,, to woodwork by means of ordinary screws.

PRICE.				£	s.	d.
13" Bracket, Pattern	*A*	**G25**		0	17	6
,, 13" ,, ,,	*B*	**G26**		0	17	6
,, 6" ,, ,,	*A*	**G27**		0	13	6
,, 6" ,, ,,	*B*	**G28**		0	13	6
,, 4" ,, for short lengths of shafting (wood screw fixing). Pattern *C*		**G29**		0	12	6

BRACKET SHELF.

PRICE. Suitable for carrying the $\frac{1}{4}$ H.P. Geared Motor, with hardwood top .. .. **G30** £ s. d. 1 11 6



G30.

PULLEYS.

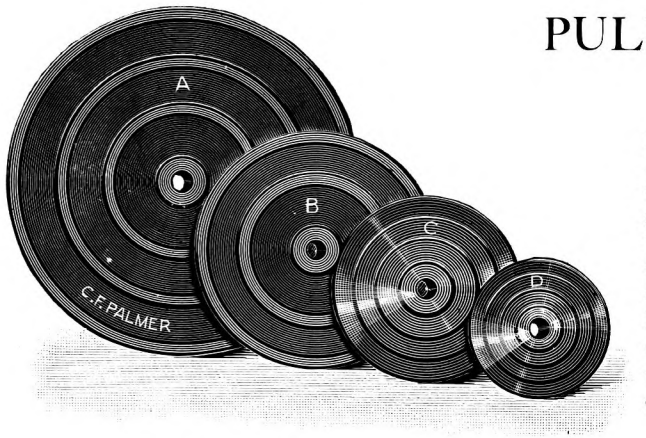


Fig. 3. **G50 to 57.**

Fig. 3 represents a group of standard cone pulleys. *A* and *B* are main driving cones. *C* is a four-speed cone for the Experimental Laboratory, and is similar to that of the Brodie-Starling Kymograph. *D* is intended for the Class Room shafting to drive the Sherrington-Starling Drum, the pulley of which it matches. Either of the above can, of course, be used for other purposes. In the Experimental Laboratory, it is well to have some of both pulleys, while one or two 8″ cones are useful to drive such things as a Brodie Pump or other comparatively heavy pieces of apparatus. The grooves in *A* and *B* are for $\frac{1}{4}$″ round band, while those in *C* and *D* are for $\frac{3}{16}$″ and $\frac{1}{8}$″ respectively.

Fig. 4.—Other cone and single speed pulleys are made, as will be seen by the group illustrated. The wheel *B* is 10″ diameter, and has a single groove, and is useful where it is desired to connect two shafts to run at the same speed. *D* is a small pair of guide pulleys that can be clamped to the edge of a table, etc., while *K* is a larger pair, 5′ diameter, for main bands.

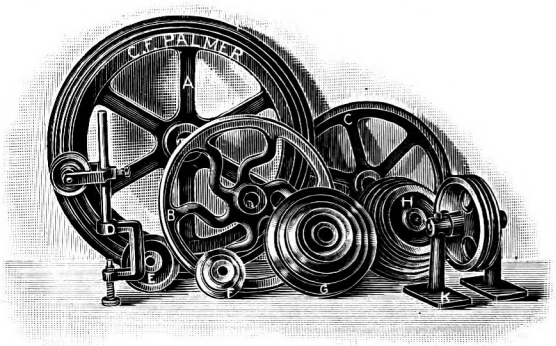
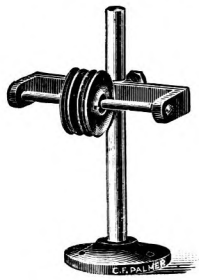


Fig. 4. **G55 to 82.**

PRICES.

			£ s. d.
Three-speed grooved cast-iron cone pulleys, 6″, 9″, and 12″ diameter ..	Fig. 3 *A*	**G50**	1 1 6
,, ,, ,, ,, ,, ,, $1\frac{1}{2}$″, 5″, and 8″ ,, ..	Fig. 3 *B*	**G51**	0 15 0
,, ,, ,, ,, ,, ,, for motor with $\frac{1}{2}$″ spindle ..	Fig. 4 *F*	**G55**	0 10 6
Four ,, ,, gunmetal ,, ,, $1\frac{1}{4}$″ to 6″	Fig. 3 *C*	**G56**	0 14 6
,, ,, ,, ,, ,, ,, $1\frac{1}{2}$″ to $4\frac{1}{2}$″	Fig. 3 *D*	**G57**	0 10 6
,, ,, ,, ,, ,, ,, $1\frac{1}{2}$″ to 3″, bored $\frac{3}{8}$″		**G58**	0 6 6
Single ,, ,, cast-iron pulleys, 10″ diameter	Fig. 4 *B*	**G60**	0 11 6
,, ,, ,, ,, guide pulleys, 5″ diameter		**G70**	0 7 0
,, ,, ,, ,, ,, ,, 3″ diameter		**G71**	0 4 0
,, ,, ,, gunmetal ,, ,, 2″ diameter		**G72**	0 2 6
Pair of 5″ guide pulleys, mounted	Fig. 4 *K*	**G80**	1 1 6
,, 2″ ,, ,, ,, ...	Fig. 4 *D*	**G82**	0 16 6
,, $1\frac{1}{2}$″ ,, ,, ,, on adjustable upright		**G83**	0 11 6



G83.

All standard pulleys are bored for $\frac{3}{4}$″ shafting unless otherwise ordered. Guide pulleys are bored $\frac{1}{2}$″, $\frac{3}{8}$″ or other sizes as required.

Pulleys made to suit special requirements, such as those shown at *A*, *C*, *G* and *H*, in Fig. 4.

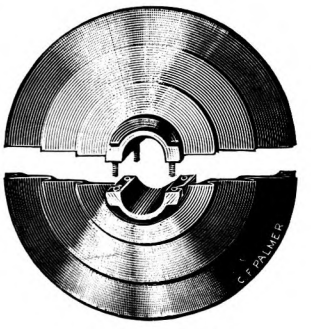
SHAFTING AND FITTINGS.

			£	s.	d.
PRICE.	24″ single speed wheel, with polished and lacquered gunmetal hub and set screw	**G90**	1	7	6
,,	Swing arm, with 5″ " Jockey " pulley and set collar for use with above (*see* Fig. 2)	**G91**	0	16	0

SPLIT PULLEYS.

Made in two sizes, each with four speeds, to match the gunmetal cone Pulleys G56, G57.

			£	s.	d.
PRICE.	4½″ split gunmetal cone, for ¾″ shaft	**G95**	0	15	6
,,	6″ ,, ,, ,, ,, ...	**G96**	0	19	6



G95 & 96.

Fig. 5. **G102.**

			£	s.	d.
PRICE.	24″ wheel and swing arm, complete with 8″ cone and spigot, as illustrated. Fig. 2	**G101**	3	5	0
,,	Swing arm for directing the band from main shafting to the Brodie-Starling Kymograph, as described .. .. Fig. 5	**G102**	1	15	0

BEARINGS.

			£	s.	d.	
PRICE.	Standard ¾″ as on the foregoing	**G110**	0	6	0	each.
,,	,, ,, ,, ,, with sole plate for mounting on wood	**G111**	0	7	0	,,

SHAFTING.

			£	s.	d.	
PRICE.	¾″ steel shafting, specially selected for truth and gauge ..	**G116**	0	1	0	per ft.
,,	For cutting and facing ends of lengths under 10′		0	1	0	per piece extra.
,,	**Muff couplings** for joining two lengths of shafting	**G117**	0	3	0	each.
,,	**Set collars** for taking thrust of shafting	**G118**	0	1	9	,,

BELTING.

Round Solid Leather Belting.

				£	s.	d.	
PRICE.	¼″	**G120**	.. .. per ft. 4d.	1	7	0	per 100 ft.
,,	3/16″	**G121**	.. .. ,, 3d.	1	1	6	,,
,,	⅛″	**G122**	.. .. ,, 3d.	1	1	6	,,

Wire hooks for above, 3d. per doz. either size. **G125.**

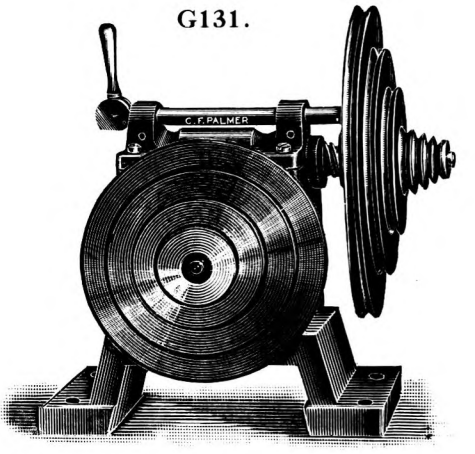
Complete countershafts are not quoted for in this list, but for a small table countershaft it is easy to take the component parts, say, two Standards *C* or *D* (G2 or 5), 3′ of shafting, two set collars, G118, and two cones, as *C* and *D*, Fig. 3 (G56 and 57). This would be a useful outfit for most light work. *See* also G135.

SPEED REDUCING GEAR.

THE following, although not made for any special purpose, will be found useful where a slow, or very slow speed is required.

G130.

G131.



G130 represents a simple Speed Reducing Pulley. There are three large speeds of approximately 3″, 4½″ and 6″ (76, 114 and 152 mm.), and four small, ⅝″ to 1¼″ diameter (16 to 32 mm.), which allow a possible maximum reduction of about 10 to 1. It is mounted on an iron base, of convenient shape for screwing or clamping to table.

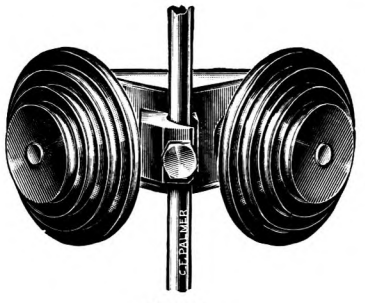
PRICE **G130** £1 7 6

G131 is a compound Speed Reducing Gear, having a totally enclosed, correctly cut worm and wheel, giving a reduction of 50 to 1. There is a small lever, shown at the top, which actuates a friction clutch at the back of the larger pulley, so that the driven instrument can be started or stopped at will without stopping the motor or other source of power. The largest speed of the driven cone being 6″ and the smallest of the driving cone 1½″, it follows that the maximum reduction is approximately 200 to 1.

PRICE **G131** £5 5 0

It may here be pointed out that when the clutch is out of gear the large pulley runs free and can then be used as a simple Speed Reducer as G130, the four smaller speeds being added for this purpose.

BEVEL GEAR BOX.



G137.

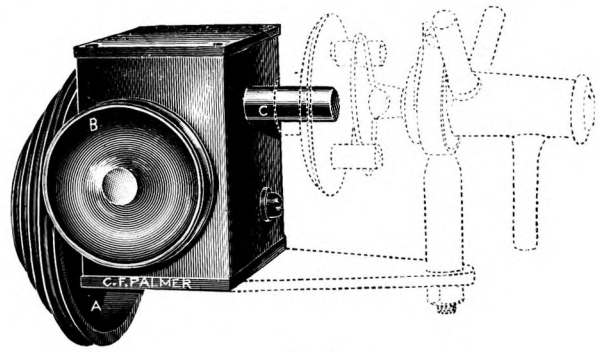
The box will be found very useful when it is desired to run driving belts at an angle of 90°, with the additional convenience that it is possible by using the various steps of the cone pulleys to obtain variations of speed.

Substantial gunmetal bevel wheels are completely enclosed in the box which has an open type clamp for fixing to uprights up to ½″ in dia.

Two 3″ four-speed cone pulleys are fitted as standard.

PRICE. As illustrated .. **G137** £2 10 6

SMALL HIGH RATIO SPEED REDUCING GEAR.



G132.

THE above illustrates a miniature speed reducing gear having an overall reduction of 1600 to 1 with an intermediate spindle giving a reduction of 40 to 1.

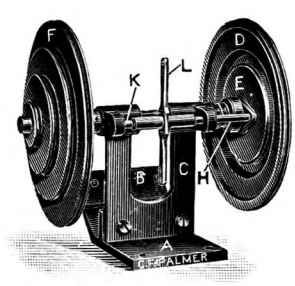
It consists of a box-like structure measuring only $2\frac{1}{2}''$ x $2''$ x $1\frac{1}{2}''$ with a lug for fitting on an ordinary $\frac{3}{8}''$ upright. There is a four-speed cone, *A*, the largest and smallest speeds of which are approximately $3''$ and $1\frac{1}{2}''$ diameter respectively. The spindle of this is geared to the spindle carrying the single speed grooved pulley, *B*, so that the latter is driven at a speed of $\frac{1}{40}$ of the pulley, *A*. There is also a third spindle, *C*, to which the pulley *B* can be removed. In this case the reduction is $\frac{1}{40}$ still lower, giving an overall reduction of 1600 to 1.

This gear can be specially adapted to any purpose requiring but small power. In the illustration it is shown turning a three-way cock so as to perfuse liquids very slowly by opening alternatively to two separate supplies.

The price would vary somewhat according to the nature of the adaptation. The apparatus as shown in full line with Pulley *A* and *B*, and with the spindle *C* (which is $\frac{3}{8}''$ diameter) left bare to receive the pulley, *B*, or other fitting but without any addition as shown by dotted lines.

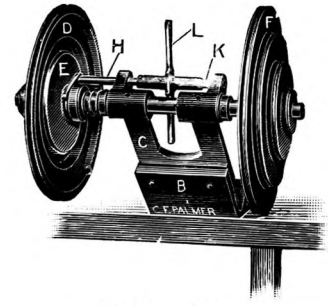
PRICE **G132** £2 10 0

SMALL UNIVERSAL BENCH COUNTERSHAFT.



G135. Fig. 1.

WE have been asked if we can supply a clutch pulley similar to that on our compound reducing gear (G131). The above is the answer, which takes the form as shown here, of a small bench countershaft, having a $6''$ three-speed clutch pulley *D*, which MUST BE THE DRIVEN PULLEY when working, the clutch of which is actuated by the lever *L*. This lever is double ended and has holes for attaching strings so that it may be worked from a distance. The fixed pulley, the one FROM WHICH the APPARATUS MUST BE DRIVEN is also $6''$ diameter, and similar to the clutch pulley, except that it has one extra small speed. Fig. 1 shows the countershaft arranged for general use. When however it is desired that it shall overhang the side of bench so that it may be driven from below, the upright part marked *C* is detached from the base *A*, and refixed on the sloping part *B* (as in Fig. 2) thus making it capable of meeting all requirements.



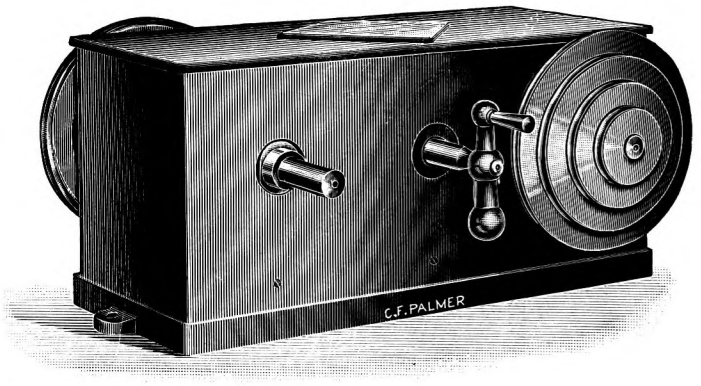
G135. Fig. 2.

PRICE **G135** £3 3 0

THE PALMER VARIABLE SPEED GEAR.

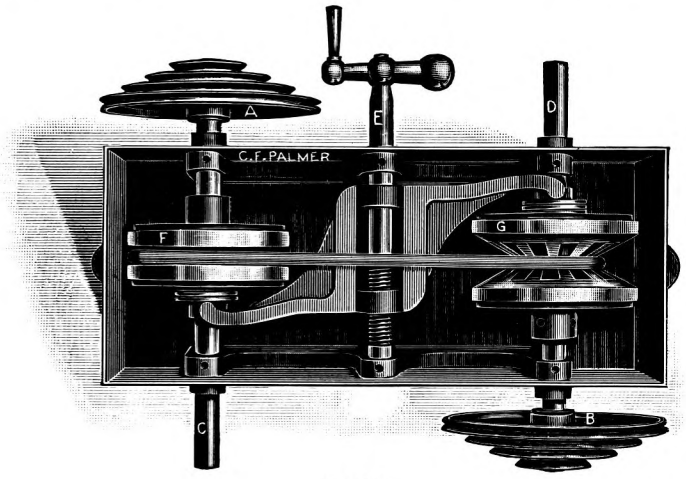
THIS is an adaptation of an old principle used to vary the speed of a machine within fine limits. Amongst other things it has been used as a variable speed gear upon motor cars and cycles.

It is not here put forward as a speed-reducing gear, but to give a continuously variable reduction, or increase of speed, varying within the limit of about 2 to 1, either up or down, and is useful in connection with other driving gear to make a machine synchronise with a given regular movement, or in the case of recording with smoked paper, a certain distance in a given time.



G136.

The first illustration shows the apparatus complete, and here it may be noted that the spindles are extended on both sides, and that the external pulleys are equal and interchangeable. There is a lug at either end for fixing when necessary, but this will only be required when driving heavy loads.



G136.

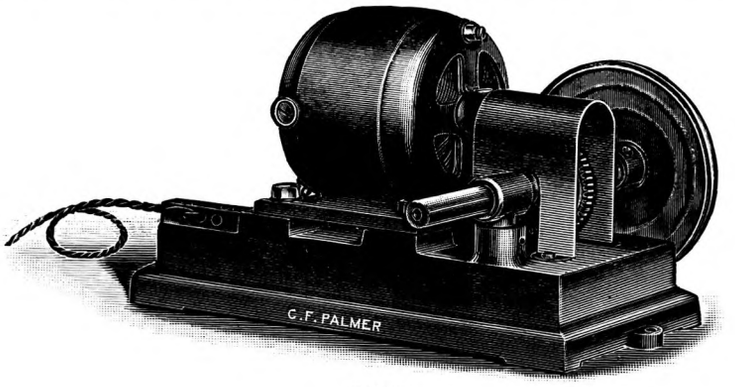
The second illustration shows it viewed from above, with the cover removed. It will be seen that there are two "V" pulleys. Each is made in halves and each half has segments which fit into their complementary halves in such a manner that, when the handle is turned, one pulley is caused to open while the other closes a like amount. Thus the band connecting them remains taut, although the one pulley in effect gradually expands while the other equally contracts.

This gear can be driven at practically any speed and it will transmit considerable power. The external pulleys are $4\frac{1}{2}$" diameter, and have four speeds for $\frac{3}{16}$" or $\frac{1}{8}$" round leather band.

PRICE **G136** £6 0 0

Extreme overall size, 12" x $9\frac{1}{2}$" x $5\frac{1}{2}$" high. Weight $18\frac{1}{2}$-lbs.

SMALL GEARED ELECTRIC MOTORS.

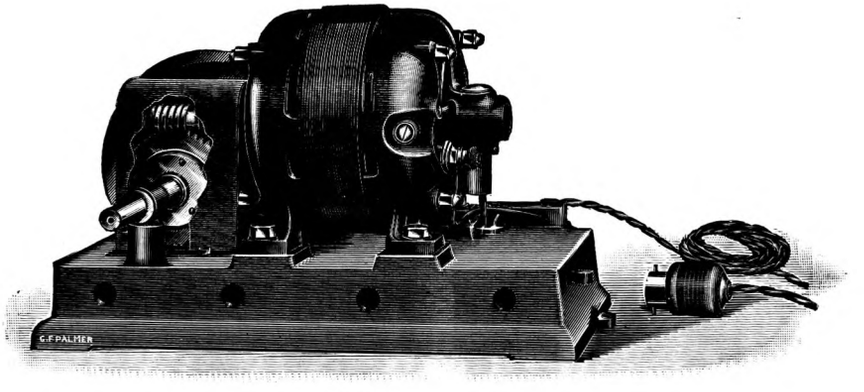


G151.

THE above represents a 1/40 H.P. Electric Motor of a well-known make, chosen on account of silence in running combined with excellence in manufacture generally, mounted on a cast-iron base containing a regulating rheostat giving four speeds, and a 50 to 1 worm reducing gear. The driving pulley runs at approximately 40 revolutions per minute, and has four grooves, the largest being 4½″ and the smallest 1½″ diameter. The spindle is prolonged to take a pulley on either side.

This motor is suitable to drive the Brodie-Starling Kymograph, the Palmer " Demonstration " Kymograph, or one or two Sherrington-Starling Drums, etc.

PRICE **G151** £8 10 0



G152.

Similar Motor to above, but more powerful, being ⅛ H.P. It is compound wound, and the rheostat in base gives a range of five speeds. Fitted with a 6″ cone pulley having four speeds, running at approximately 40 revolutions per minute.

PRICE **G152** £12 10 0

The above Motors are made for a voltage of either 100/120 or 200/240 continuous current, and fitted with 6 ft. flexible wire and plug adapter.

Can also be supplied for single phase alternating currents, but with switch only in place of rheostat.

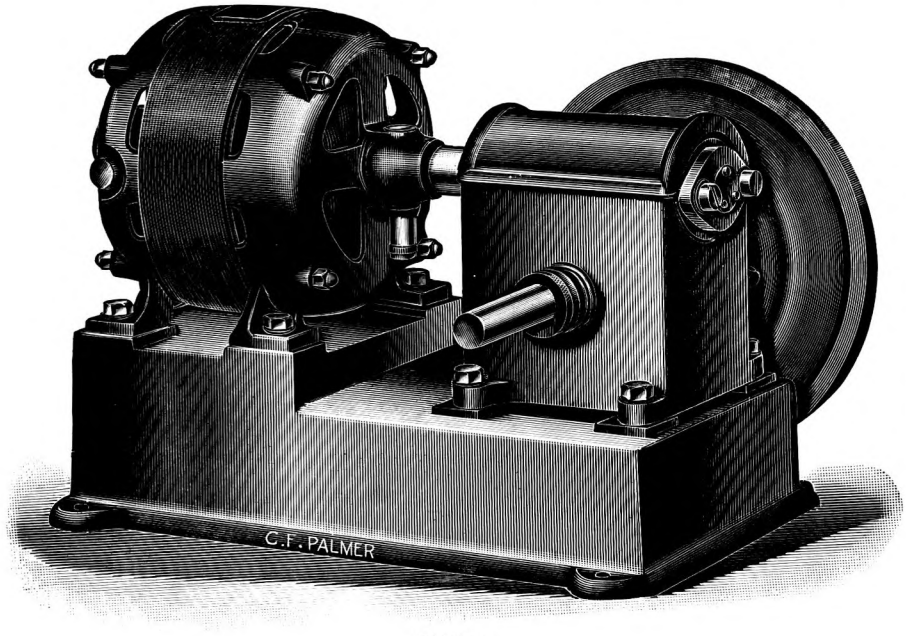
Any size of motor for all standard voltages, geared to suit requirements, supplied to order.

Resistances for regulating the speed of Motors, or for any other purpose, made and wound as required.

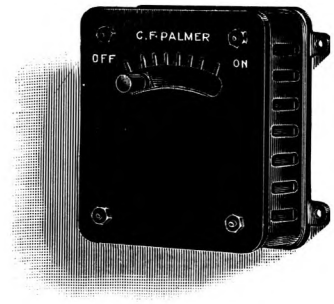
If for D.C., please state voltage of supply when ordering.

If for A.C., please give phase and periods in addition to above.

¼-H.P. GEARED ELECTRIC MOTOR.



G153.



G154.

¼-H.P. compound wound Electric Motor, fitted with a 30 to 1 worm reducing gear, running in an oil bath, and having a three-speed driving cone of 2″, 5″ and 8″ diameter, which runs at approximately 60 R.P.M.

This Motor is intended to drive the laboratory shafting, and is capable of dealing with thirty or forty Sherrington-Starling Drums, or any other light apparatus. It may be placed on the floor, or high up out of reach of the students. For this reason the regulating starting resistance is supplied in the separate case, so that it may be fixed in a convenient position.

			£	s.	d.
PRICE of	Motor for D.C. supplies, including separate starter	**G153**	16	15	0
,,	starter only, wound for any voltage 100 to 240	**G154**	2	5	0

Can also be supplied for single phase alternating currents, but without speed regulator.

PRICE of Motor for A.C. supplies **G155** £14 10 0

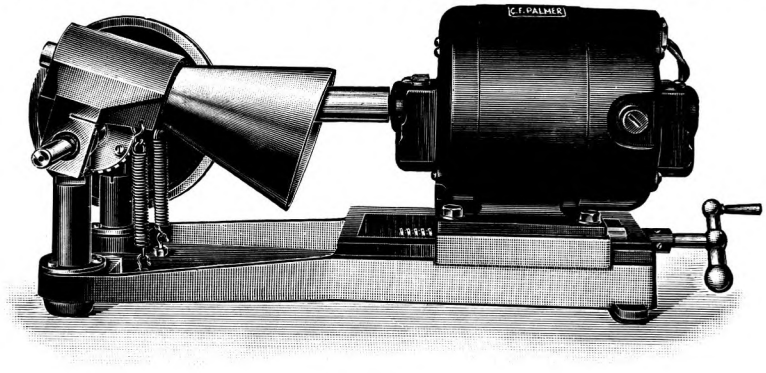
Any size of Motor for standard voltages, geared to suit requirements, supplied to order.

If for D.C., please state voltage of supply when ordering.

If for A.C., please give phase and periods in addition to above.

Laboratories fitted complete with shafting and all driving gear. Estimates and description of shafting recommended, sent upon receipt of plan and particulars of room available.

THE PALMER VARIABLE GEARED MOTOR.



G156.

WHERE a direct current electrical supply is available it is comparatively easy, by inserting suitable resistance in the motor circuit, to obtain a fine regulation of speed. It is not, however, so simple a matter where the supply is alternating. We have therefore designed a mechanical speed regulating device which can be adjusted to fine limits, after the approximate speed has been obtained by pulleys and bands or other gearing in the usual manner.

It will be seen from the illustration that the motor is mounted on a sliding base, the spindle being extended and having on its outer end a small friction wheel running inside a metal cone. By means of the screw which slides the motor along the base this friction wheel can be caused to run at any position inside the cone, thus giving a fine regulation of reduced speeds whilst in motion, it will be obvious that as the friction wheel approaches the small end of the internal cone the surface in contact increases. It is so arranged that the greater the power taken from the driving cone pulley the greater is the pressure on, and consequently the driving power of, the small friction wheel. The cone is geared 15 to 1 to the spindle carrying the driving pulley which has four speeds of $1\frac{1}{2}$ to 6″ in diameter.

Approximate Revolutions of driving pulley from 50 to 100 per minute.

PRICE, with $\frac{1}{8}$ H.P. Motor for standard A.C. single phase 50 period supply.

Standard Type, G156 .. .. £16 10 0

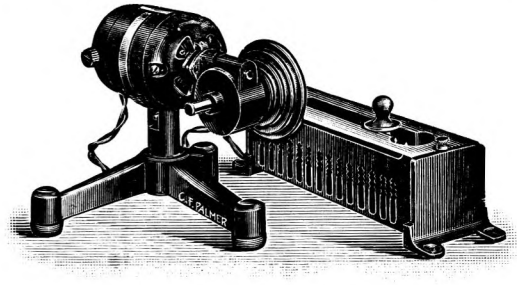
This Motor can also be fitted with a 50 to 1 Worm and Wheel at the same price, in which case the driving pulley will run at three-tenths of the above speed. **Slow Type, G157.**

Motors for other periods of supply can be supplied.

Please give voltage and full particulars of Electric Supply

SMALL UNIVERSAL MOTORS.

Whilst we do not recommend Universal Motors for general Laboratory use, on account of the high speed at which these Motors run, together with the variation of speed with a fluctuating load, the small machine, 1/40 H.P. at 4,000 R.P.M. shown here, will be found very useful for driving light apparatus when used with a variable resistance, on A.C. and D.C. supplies.



G142.

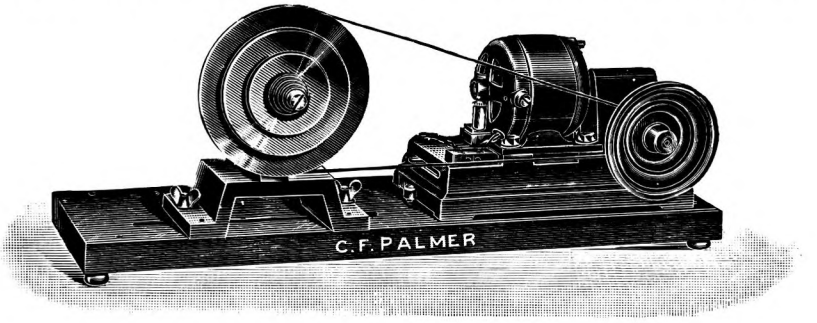
The Motor can be supplied with a pulley or an enclosed worm gear-box having a ratio of 50 : 1.

PRICE.

		£ s. d.
Universal Motor fitted with Pulley $1\frac{1}{8}$″ diameter, Variable Resistance and 6-ft. Flex	**G140**	4 17 6
As above, but with Worm Gear-Box (as illustrated)	**G142**	6 17 6

Please state if required to run on 100/110 volt or 200/240 volt supply.

SLOW SPEED COMBINATION.



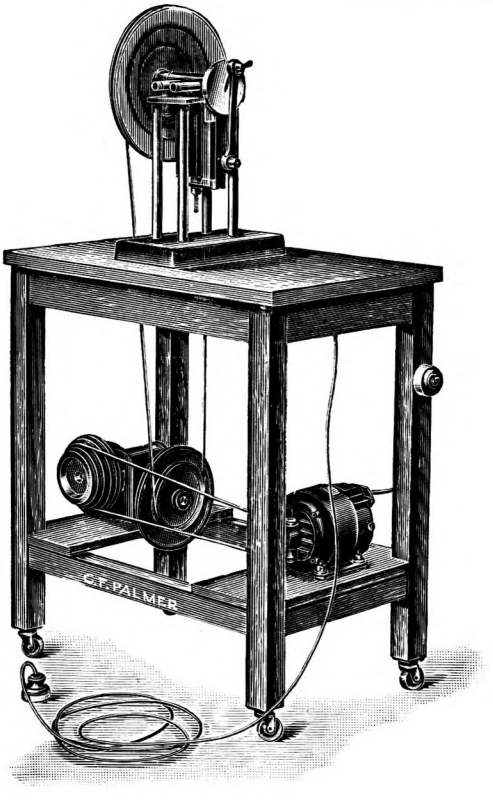
G160.

WHEN it is desired to obtain slower speeds than are given by the Geared Motors on the preceding pages, the unit illustrated above can be used. It consists of a 1/50 H.P. motor, with a 50 to 1 worm reducing gear (G151), in combination with a simple speed reducing pulley, as that illustrated (G130). It will be noted that the base board is slotted, so that the band from motor gear to the pulley can be adjusted. Rubber feet are fitted, which tend to deaden noise and vibration, and prevent slipping along the table.

When using the above combination to drive a Standard Sherrington-Starling Drum, speeds down to as low as one complete revolution of the cylinder in 90 minutes can be obtained.

PRICE. Complete unit (as illustrated) **G160** £10 15 0

If still slower speeds are required the Compound Speed-Reducing Gear G131 can be substituted for the simple speed-reducing pulley as above.



G170.

SMALL POWER TABLE

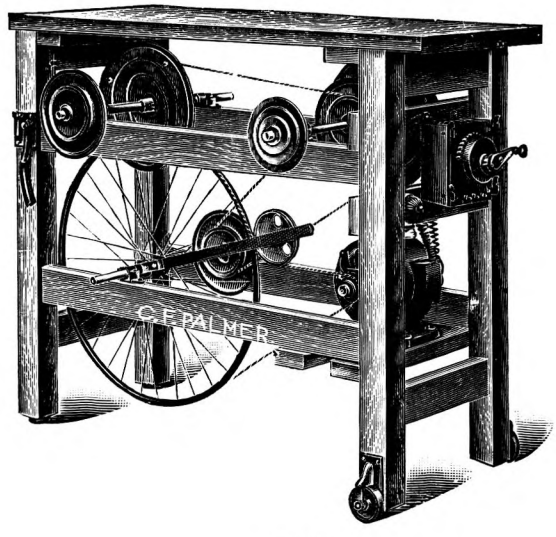
THIS was originally designed as a portable respiration unit, and for that purpose was fitted with bellows (*see* E5). It is, however, very suitable for such pieces of apparatus as the " Ideal " pump (E10/12), the Schuster Respirometer (E15), or any such apparatus requiring to be driven at a comparatively slow speed. As set out in description of E5, the speeds of the pulley here seen connected to the " Ideal " Pump are from 14 to 48 R.P.M. and in addition there is a 6" four-speed cone on the outer end of this same spindle whereby a useful range of speeds are provided.

PRICE.

		£	s.	d.
Table with Motor, Gearing and one each 8" and 6" interchangeable Pulleys	**G165**	17	0	0
Regulating Resistance if required (D.C. only) extra	**G154**	2	5	0
Complete Table fitted with 250 cc. " Ideal " Respiration Pump (E10) as illustrated	**G170**	34	10	0
Or with 500 cc. " Ideal " Pump (E12)	**G171**	39	0	0

Kindly give full particulars of Electric Supply when ordering.

STANDARD POWER TABLE.



G180.

IT often happens in an experimental laboratory that some apparatus requires to be driven, if only a motor could be brought to it. The Power Table illustrated above exactly fulfils that want. There are three shafts or spindles, which, by means of the cone pulleys, can be made to revolve at a variety of speeds, the last or third spindle having a range from about 3 to 300 R.P.M. The top of the Table is 48″ (122 cm.) x 18″ (46 cm.) x 36″ (91.5 cm.) high, and is removable for easy access to the working parts. Any apparatus can be permanently or temporarily fixed to this top. The spindles project beyond the frame on both sides, and are of the standard $\frac{3}{4}$″ diameter. Sent out with the Tables are two cone pulleys (besides those driving the spindles) to drive apparatus, *viz.*, an 8″ cone having three speeds from $1\frac{1}{2}$″ to 8″, also a 6″ cone having four speeds from $1\frac{1}{4}$″ to 6″. Extra cones can be had. As will be seen from illustration, there are wheels at one end and fall-down handles at the other for convenience in moving about. The extreme width of spindles is 23″ (58.5 cm.). It will, therefore, go through a very narrow doorway.

PRICE. Table, fitted with $\frac{1}{4}$ H.P. motor, suitable for either 100/110 or 200/240 volts., D.C. or A.C., single phase, 50 periods **G180** £25 10 0

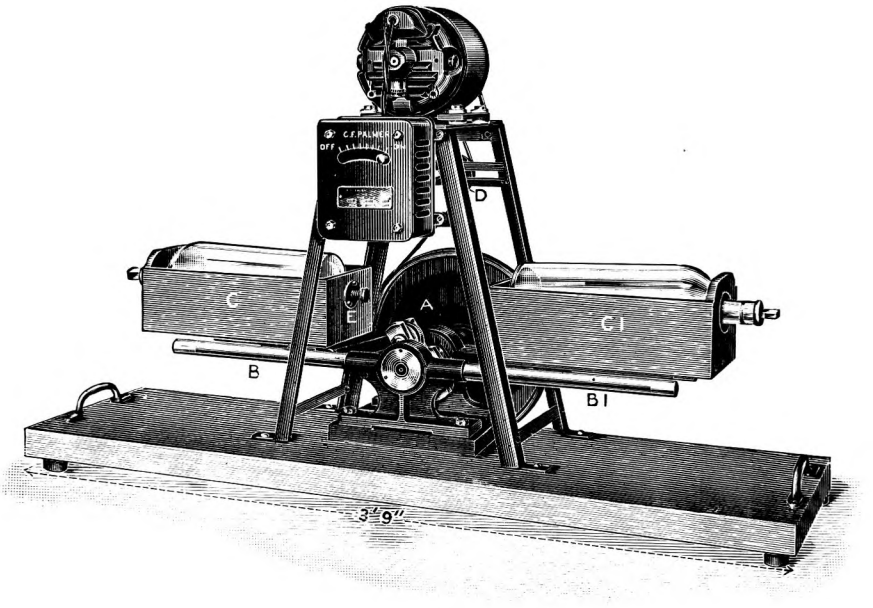
Motors for other periods quoted for.

If for D.C. please state voltage of supply when ordering.

If for A.C. please give phase and periods in addition to above.

For extra Cone Pulleys, *see* G50 to G96.

HIGH SPEED SHAKER.



G201.

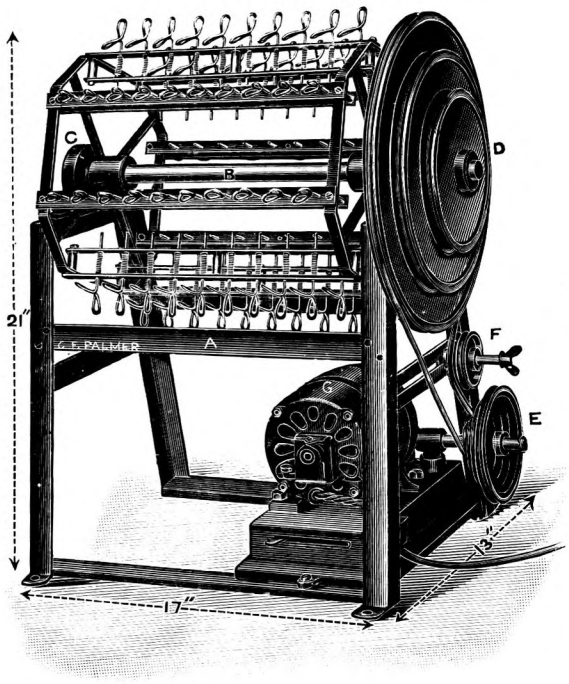
THE above machine has been produced in an endeavour to reduce the amount of noise and vibration common to most single-throw shakers. The illustration shows the horizontally opposed containers *C*, *C'*, which are caused to move by a double-throw crank *A*, and run on enclosed guide rods *B*, *B'*, the drive from the Motor (or shafting) being by means of a belt and the 12″ three-speed Cone Pulley. The maximum capacity of the containers is two 90-oz. Winchesters, but packing pieces can be supplied to take smaller vessels if required. When run from a standard ¼ H.P. 220 volt D.C. Electric Motor fitted with motor-cone, G55, the speeds are:

Fast Speeds	400	R.P.M.	Approximately.
Medium ,,	300	,,	,,
Slow ,,	180	,,	,,

A Shaking Machine, similar in principle, was described in "The Journal of Physiology" (Vol. 52, July, 1917), by H. Hartridge and G. Winfield.

			£	s.	d.
PRICE.	Shaker only with 12″ driving Pulley ..	**G200**	17	10	0
,,	Complete with ¼ H.P. Motor and resistance, the whole mounted on stout base-board as illustrated	**G201**	25	10	0

Please give particulars of Electric Supply when ordering.



ROTARY MIXING MACHINE.

THE slow-speed Rotary Mixing Machine shown herewith represents one of the many special pieces of apparatus which we are always pleased to design to meet the requirements of workers in Physiology and kindred branches of Medical Science.

The rotating frame *B* of the machine runs on Ball Bearings *C*, and holds 40 glass tubes $\frac{5}{8}$" diameter by means of the pull-up spring clips; a 1/20 H.P. worm-geared Electric Motor provides the drive with a jockey pulley belt adjuster *F*. Standard speed from 4-24 R.P.M.

The whole assembly is compact and rigid, and can be used in a large sized incubator if required.

G210.

PRICE complete, as illustrated **G210** £18 10 0

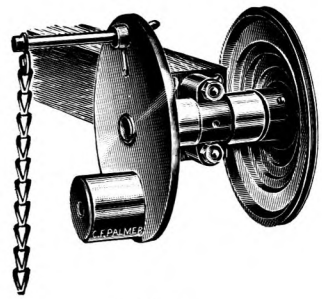
Prices of other sizes can be quoted on request.

Please give particulars of Electric Supply when ordering.

ROTARY LIFTING GEAR.

FOR use with the Haldane ~~Blood~~ Gas Analysis Apparatus. The gear can be supplied in several designs for fixing to the wall, the shafting beam or on the end of a protruding beam as shown illustrated.

Provision is made for adjusting the amount of lift and a 6" four-speed cone pulley is fitted to take the drive from the shafting or small worm geared electric motor; 4' of open link chain is supplied as standard.



G222.

		£	s.	d.
PRICE with 13" bracket for fixing to wall	**G220**	2	0	0
,, with 6" bracket for fixing to shafting beam	**G221**	1	16	6
,, with sole plate (as illustrated)	**G222**	1	10	6

It is possible to arrange this rotary lifter to work in various positions, and we are always able to offer suggestions to suit different conditions.

SECTION

H

ELECTRICAL

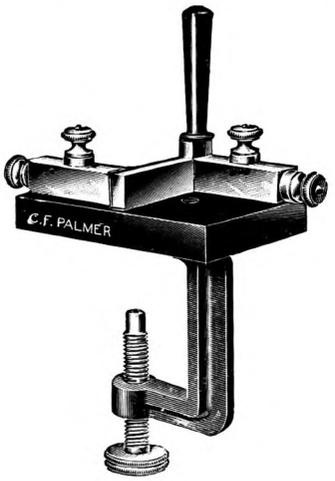
Induction Coils Relays

Rotary and other Keys

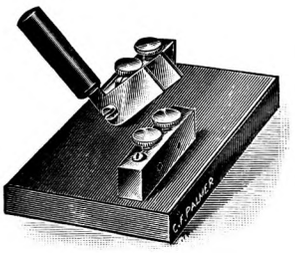
Batteries Electrodes

KEYS.

THE Keys illustrated below represent some of our standard manufactures suitable for students' use, and also for research work. We are, however, always prepared to make other types of Keys for class use, or for special experimental purposes.

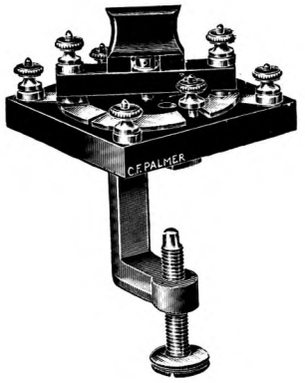


H1.

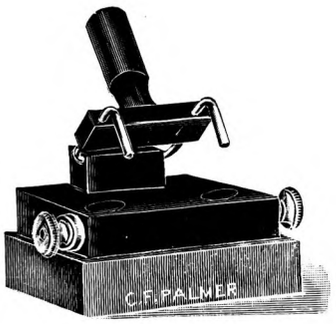


H3.

			Each.		Per doz.		
			s.	d.	£	s.	d.
PRICE.	**Du Bois Reymond Key.** Massive, well-made key, on vulcanite base, with clamp for table	**H1**	13	0	7	0	6
,,	**Prof. Sherrington's Key.** A variation of the above	**H2**	12	0	6	10	0
,,	**Simple Key,** mounted on Teak base	**H3**	6	6	3	12	0



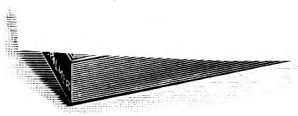
H5.



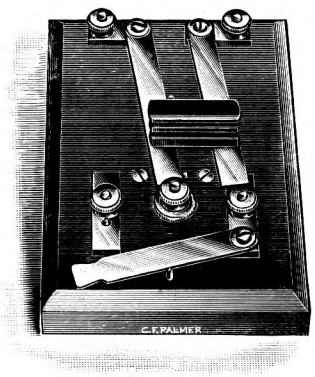
H6.

H7.

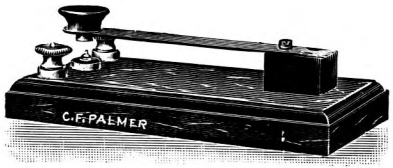
			Each.		Per doz.		
			s.	d.	£	s.	d.
PRICE.	**Reversing Key,** with arrangement for two circuits. With table clamp	**H5**	25	0	13	10	0
,,	**Mercury Key,** with vulcanite base, mounted on iron block	**H6**	10	6	5	13	6
,,	**Pohl's Commutator.** Improved form, with vulcanite base, mounted on iron block	**H7**	16	0	8	13	0



H9.

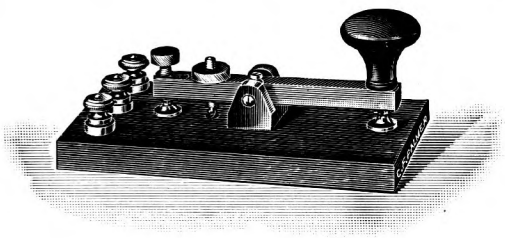


H8.

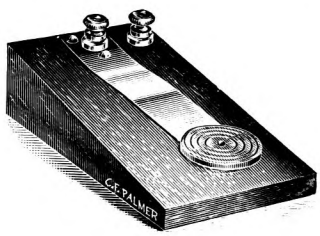


H10.

			Each.	Per doz.
			s. d.	£ s. d.
PRICE,	**Combined Reversing Key and Commutator,** mounted on stout wooden base. The Key was designed by Prof. H. E. Roaf to avoid the use of Mercury in the Pohl's Commutator	**H8**	14 0	7 12 0
,,	**Spring Key** on Teak base, with clip for making permanent contact when required	**H9**	7 6	4 4 0
,,	**Spring Key,** on polished hard wood base. Silver contacts	**H10**	7 6	4 1 0



H11.



H14.

The Morse Key.—This is a high-class instrument mounted on vulcanite base and having platinum contacts. Moreover the terminals and contacts are clearly marked so that the student can trace all connections.

PRICE **H11** £1 2 6

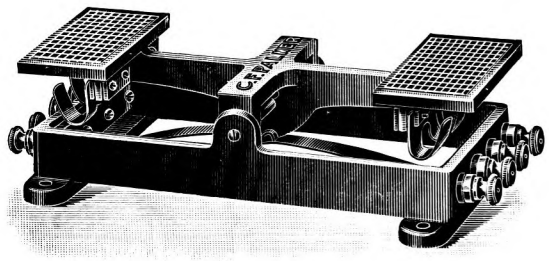
The insulated knob can be fitted with a wide flange if required.

Foot Tapping Key. The heavy wedge-shape wooden base of this Key allows the operator's foot to assume a comfortable position when the spring pedal is depressed.

PRICE **H14** 8/6

FOOT SWITCH.

In experimental work it is very inconvenient at times to have to operate a switch by hand. The switch shown here has been introduced to obviate this. It consists essentially of four single double-break switches, each insulated and with a separate pair of terminals, mounted in such a way that they can be switched "on" or "off" in pairs by depressing either the red or black end of the foot lever.



H15.

PRICE **H15** £1 17 6

Overall dimensions: $9\frac{1}{4}$" x 5" x $2\frac{3}{4}$" Weight: 4-lbs.

BREAK KEY.

This Key is for use in assemblies where it is desired to give a single break shock. It can be conveniently worked by a striking lever fitted to the main spindle of a Recording Drum. Such an arrangement is described by Prof. Sir Charles Sherrington, in his book " Mammalian Physiology." Exercise XVIII.

PRICE, with platinum contacts **H17** 15/-

H18.

RHEONOME.

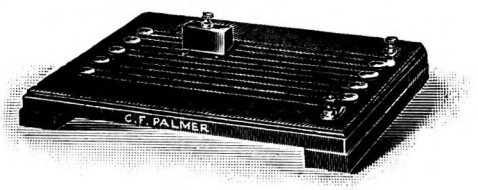
With vulcanite base 8" square.

PRICE .. .. **H18** 52/- each.

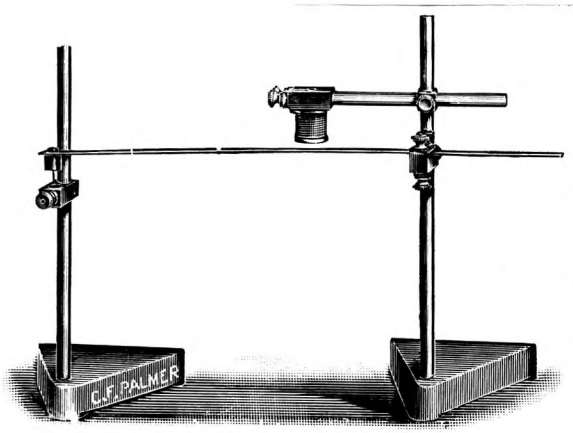
OXFORD PATTERN RHEOCORD.

On polished mahogany base, with a total of three metres of resistance wire, and contact block.

PRICE **H19** 25/-



H19.



H20.

TETANUS SET.

Comprising vibrating spring 15" long, spring holder, mercury cup, maintaining magnet, X-block, and two plain stands.

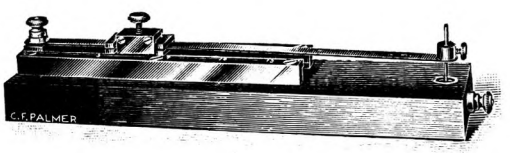
PRICE, the set. **H20** 40/- each. £22 16 0 per doz.

Separate Parts: Spring, 2/-; Spring Holder, 5/-; Mercury Cup, 4/6; Magnet with X-Block, 21/-; Stands, 5/- each.

ADJUSTABLE VIBRATING REED.

The above Reed is calibrated to vibrate at approximately 5, 7, 10, 15 and 20 vibrations per second. The adjustment is accomplished by sliding the clamping plate along metal guides fixed to the baseboard. One thumb screw only is necessary to securely lock the Reed to the guides.

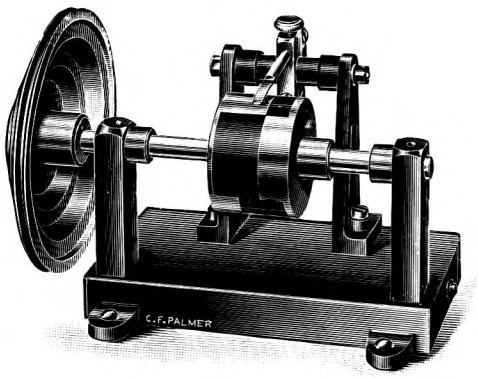
An adjustable platinum tipped wire is used to make contact with the mercury cup.



H21.

This Vibrating Reed is very convenient for Students' use, and by an occasional pressure of the finger can be maintained for long periods. PRICE. **H21** £1 5 0 each. £12 12 0 per doz.

ROTARY KEY.



H24.

IT is sometimes necessary to vary the time during which an electrical circuit is made and broken. The Rotary Key illustrated is very suitable for this purpose.

The standard rotor has three segments which will give the following make and break periods per revolution.

Contact made,	3/4.	Contact broken,	1/4.
,, ,,	1/2.	,, ,,	1/2.
,, ,,	1/4.	,, ,,	3/4.

Rotors giving other periods of make and break per revolution, can be supplied.

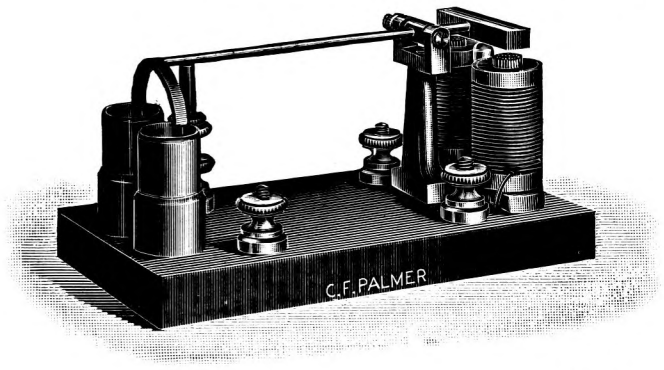
A fully adjustable contact brush is carried on an insulated bar, and the Key may safely be used on D.C. mains of 100/110 volt., provided a lamp and condenser are connected in the circuit (see page 45).

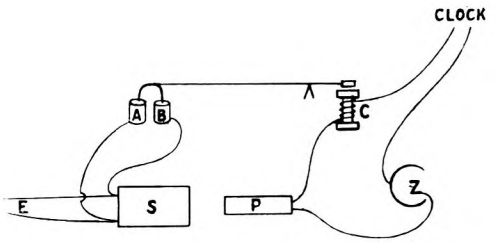
The Rotary Key is supplied with a $4\frac{1}{2}$" four-speed cone which may be driven from the laboratory shafting or small motor.

PRICE **H24** £3 5 0

AUTOMATIC CUT-OUT KEY.

A SIMPLE APPARATUS FOR EXCLUDING MAKE SHOCKS.





H25.

IN cases where stimulation at regular intervals is required, the device illustrated above is a convenient one when used in connection with the Brodie Clock, or other form of electrical interrupter.

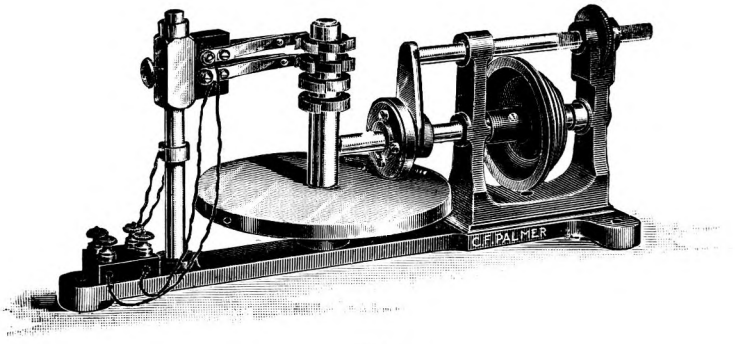
Referring to the above diagram, it will be seen that the Clock is in circuit with *C* (the coils of the electro-magnet), *P* (the primary of the induction coil) and *Z* (the battery). *A* and *B* (the mercury cups) are connected across *S* and *E* (the secondary and electrodes). Normally, *A* and *B* are joined by a bent platinum wire dipping into them. When contact is made at the Clock, current flows through *P*, but, as the secondary is " shorted " by the bent wire across *A* and *B*, no effect is felt at the electrodes. The same current energises *C*, which in turn causes the platinum connecting wire to be drawn out of *A* and *B*. Now when the Clock breaks contact, the secondary being no longer " shorted," a shock is given at *E*, before the lever falls back to rest and re-connects *A* and *B*.

PRICE (mounted on vulcanite base) **H25** £2 17 6

For further particulars *see* Dr. Laidlaw's description in the " Journal of Pharmacology and Experimental Therapeutics," 1913 (Vol. 5, pages 468-9).

SIR THOMAS LEWIS'S ROTARY CONTACT.

(Break Shocks only), for Regulating the Rate of Heart Beats in Experiments in which (*a*) Constant Heart Rate, or (*b*) Varying Heart Rate, is required.



H26.

THIS instrument has two pairs of contact springs, to be connected as follows: one pair in the primary circuit of the induction coil, and one pair across the secondary leads. These contacts are actuated by a pair of wheels having two projections, and thus making contact twice in each revolution of the friction plate in the following sequence: (1) secondary is short circuited; (2) primary circuit closed; (3) secondary short opened; (4) primary circuit opened and break shocks transmitted. There is a second pair of wheels having six teeth or projections, which can be quickly brought into use when a more rapid rate is required.

The friction plate gives a variation in speed of fully 3 to 1, and has a screw for adjusting. Rhythmic shocks can be thrown in at rates ranging from 60 to 1,000 per minute.

PRICE **H26** £7 12 6

THE BRODIE CUT-OUT KEY.

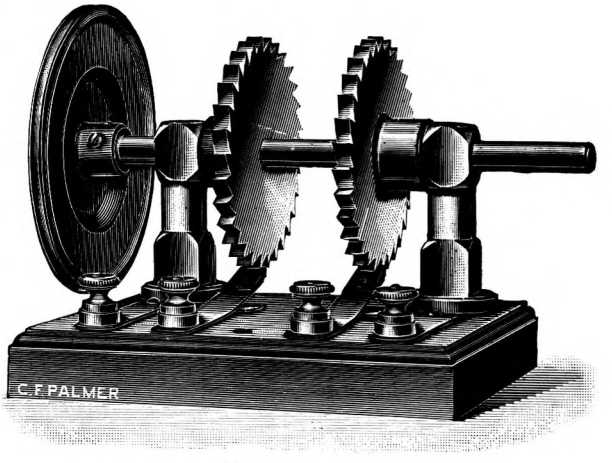
FOR GIVING BREAK-SHOCKS ONLY.

THIS Key is made to give a number of shocks per revolution. The original Key (*see* Brodie's "Essentials of Experimental Physiology," 1898 edition, p. 13) gave one, or six; we have, however, often been asked for keys to give a quick succession of shocks. The one illustrated gives thirty per revolution, so that, when driven at various speeds, almost any number of shocks per unit of time can be obtained.

PRICE.

With a pair of wheels for any *one* number of contacts **H27** £2 7 6

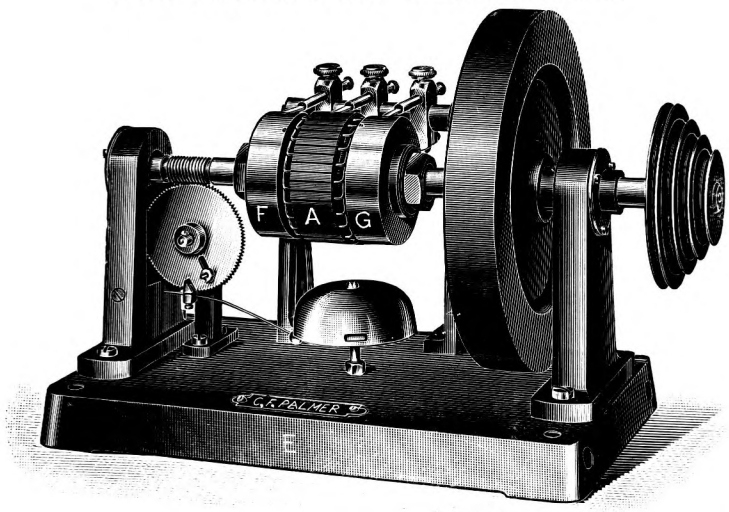
This Key can be had with wheels for either 1, 6, 12, 20, or 30 contacts, at the same price.



H27.

A ROTARY COMMUTATOR.

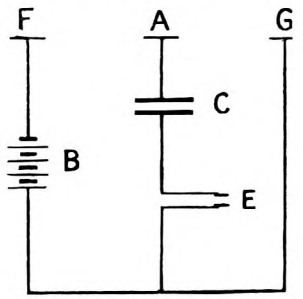
FOR CONDENSER STIMULATION.



H28.

THE Commutator shown above closely follows the design of the instrument used for condenser stimulation in Prof. A. V. Hill's Laboratory and mentioned in the paper " A Closer Analysis of the Heat Production of Nerve " (*see* Proceedings of the Royal Society B., Vol. III, 1932).

A copper and mica commutator *A*, of the type used for small electric motors, is mounted on a shaft running in ball bearings, which are housed in uprights fixed to a substantial iron base plate *E*, measuring 9″ x 6″.



Fixed to the shaft but insulated from it are two collector Rings *F* and *G*. These are attached to alternate segments of the commutator. A brush bearing on *A* whilst it is rotating is therefore first connected to ring *F* and then to ring *G*. An insulated bar carries the three brushes ; these are easily adjusted for position and also for pressure on the rings and commutator. The method of connecting up the commutator for stimulating is shown in the outline drawing herewith, *B* is the battery, *C* the condenser, and *E* the stimulating electrodes.

To enable the speed of the shaft to be readily counted, a worm and worm wheel counter is fitted ; this operates a striker which rings a bell every 100 revolutions of the commutator.

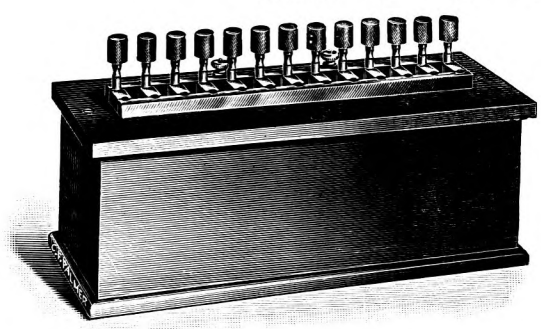
The standard driving pulley has four-speed grooves, the largest being 3″ dia. ; a heavy flywheel is fitted to help maintain a steady rotation of the commutator.

PRICE, with 46 or 32 Segment Commutator **H28** £8 15 0

A Rotary Commutator having a special commutator *A*, with two segments only, can be supplied at the same price.

The complete shaft with two segment commutator *A*, collector rings *F* and *G*, and worm for driving counter can be supplied to interchange with the standard commutator shaft.

PRICE **H29** £3 3 0



H36.

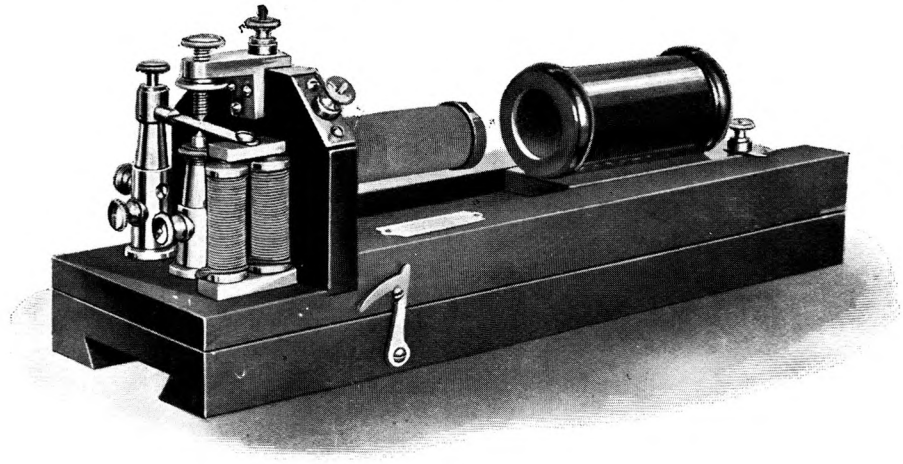
CONDENSER UNIT.

This unit consists of thirteen fixed condensers of 1 mfd.—·001 mfd. in a hardwood case with brass plug switches mounted on an ebonite panel.

The condensers are of good quality and with the exception of the two largest capacities are of mica dielectric type. Capacities are normally short-circuited and are brought into use by moving the appropriate plugs from one hole to another.

PRICE .. **H36** £6 5 0

THE DU BOIS-REYMOND INDUCTION COIL.



H30.

THE above represents a well-designed, high-class coil, suitable for experimental or class work. It is of the well-known sledge type, after the model of Prof. du Bois-Reymond, with Helmholtz' modification of the Neef Hammer. The base is graduated in mm. to 500, and folds under to economise space. The primary consists of approximately 300 turns of silk-covered wire, wound on a core of specially annealed iron wire. For the secondary of 7,500 turns, a high-grade enamelled wire is used, which, in combination with the " bank " system of winding, has been found to give good results for a general purpose coil. There are a full set of terminals, so that all the experiments mentioned in the text-books can be demonstrated.

PRICE **H30** £5 17 6

The Du Bois-Reymond Coil can be fitted with the Variable Interrupter, H40, in place of the Standard Neef's Hammer.

PRICE **H31** £6 5 0

Special price quoted for one dozen or more.

SPECIAL INDUCTION COIL.—We can always supply Induction Coils to meet special requirements. A Coil having 20,000 secondary turns, Meyer type variable Interrupter and movable iron core, similar to that used by Prof. F. R. Miller, *see* " Journal of Physiology " (Vol. 73, No. 1, September, 1931), can be made at short notice.

PRICE **H32** £12 0 0

The Ni + Fe cells described on page 130, being practically indestructible, are very suitable for students' use. It is equivalent to giving them a bucket full of water—they can spill the water (short circuit the cell) without harm to the bucket (cell).

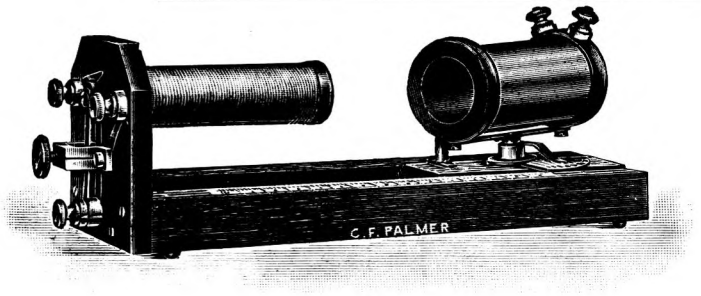
VARIABLE INTERRUPTER.

THE Interrupter consists of an electrically maintained pendulum having its swing controlled by a stop screw, and is capable of adjustment from approximately 4 to 100 contacts per second.

Referring to the illustration, *P* is a pendulum carrying a contact point *C'* which normally rests against the spring *C*. Upon completing the circuit through the coils *ZZ* and primary of induction coil, the pendulum is set in motion by the electro-magnet (which is set a little in advance) attracting the armature *A*, and thereby breaking the circuit at *C'C*. The pendulum, however, continues on its course by the momentum gained, till stopped by the adjusting screw *S*, when it returns and again makes contact at *C'C*. It will be seen that the time greatly depends upon the distance the pendulum is allowed to swing before being checked by the screw *S*.

This interrupter is supplied as a separate unit when it becomes available for any experiments requiring an interrupted current, such as those in tetanus, or of course it can be connected up in circuit with any existing coil.

PRICE. Interrupter only as a separate unit. **H40** £1 17 6



H50.

THE PALMER INDUCTION COIL.

IN designing the Palmer Coil, consideration has been given to the following points :—

(*a*) A thoroughly efficient coil.

(*b*) A coil that will take up but little bench room.

(*c*) A coil that can be produced at a low cost.

To take the size (*b*) first. The overall dimensions are as follows : length, 292 mm. ; width, 90 mm. ; height 100 mm. ; weight, ·910 kilogramme.

As to the efficiency (*a*), we know of no standard, but the following are the particulars :—

The **iron core** is built up of approximately 400 pieces of annealed wire specially drawn for the purpose.

The **bobbins** for both the primary and secondary are of vulcanite.

The **primary** consists of about 300 turns of thick silk-covered copper wire, and has a resistance of ·9 ohms.

The **secondary** consists of approximately 6,500 turns, with the terminals mounted on the top at one end of the bobbin.

The interrupter works direct off the iron core, and is of the usual type, with adjusting screw fitted with **platinum** point, extra terminal being provided for **primary shocks.**

The secondary is mounted so that it can be slid off the primary, there being a scale graduated in mm., to denote the position, up to 15 cm. ; when this point is reached, further reduction in the strength of the secondary current is obtained by revolving the coil horizontally through an angle of 90°. Here, again, the position is indicated by a scale and pointer.

PRICE	**H50**	£3 5 0
,, Fitted with Variable Interrupter H40	**H51**	£5 2 6

MP.

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£ s. d.
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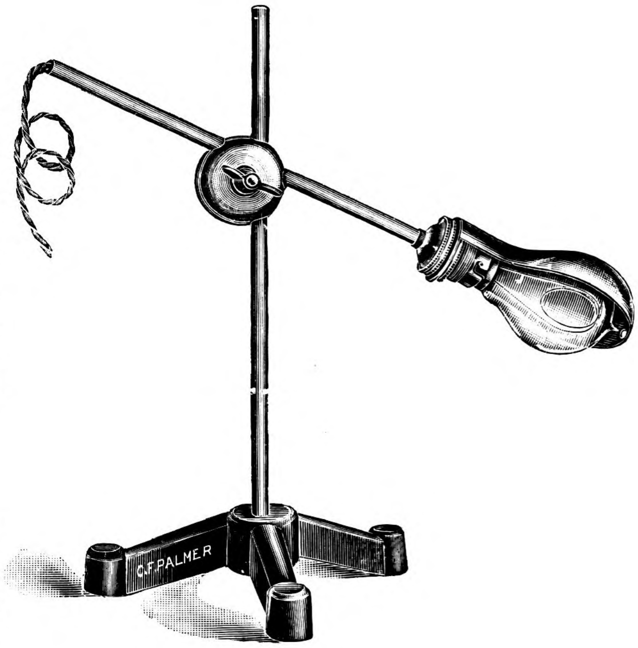
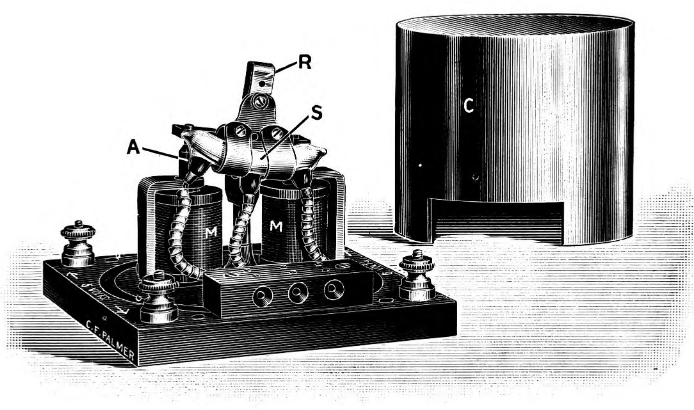


H55.

SMALL RELAYS.



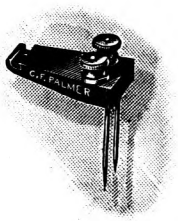
H82.

THESE consist of a Mercury-in-Glass Switch *S*, rocked by an electro-magnet *MM*. They can be supplied in many forms, that illustrated being a single pole double-throw type, capable of breaking a current of 4 amps. at 220 volts. A 6 amp. type is also made. The electro-magnets can be wound to suit individual needs, 8 ohms being standard. A stout brass cover *C* fits over the relay, leaving the terminals clear.

				£	s.	d.
PRICE.	Single pole, single throw (4 amp. type)	..	**H80**	1	7	6
,,	Single pole, double-throw (4 amp. type)	..	**H82**	2	10	0

Prices of other types on application.

ELECTRODES.



H60.

Platinum Electrodes.

Sheathed in vulcanite with terminals.

Model with fixing pins as shown, **H60**, without fixing pins, **H61**, PRICE (either pattern), 4/6 each. 50/– per doz.

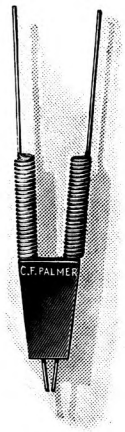
Simple Electrodes,

having copper wire poles sheathed in Vulcanite.

PRICE.

Each .. **H62** 1/6

Per doz. 16/–



H62.

Non-Polarizable Electrodes, as made for University College, London, but having sliding spring grips for the U tubes ; Zinc Electrodes and double binding screws ; on vulcanite insulating arm (as shown).

PRICE, with arm .. **H66** 17/6 per pair.

H68.

Sir Charles Sherrington's Unipolar Electrode, with platinum ball point and spring sheathed in vulcanite holder with terminal ; for stimulation at surfaces in the central nervous system.

(*See* Sherrington's " Mammalian Physiology," 1919, page 80).

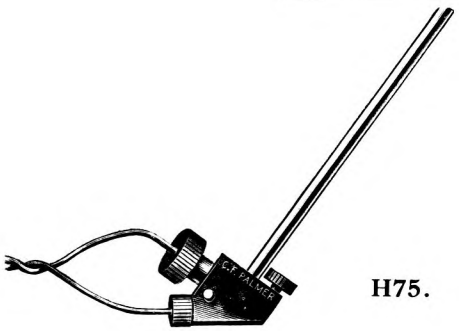
PRICE **H68** £1 5 0

BIPOLAR ELECTRODE.

Consisting of two stout sheathed copper wires with terminals, bound together and terminating in stout **platinum** Electrodes.

PRICE .. **H70** 15/6 each.

H70.



H75.

FLUID ELECTRODE.

Similar to that described by L. W. Collison in the " Journal of Physiology " (Vol. 80, No. 3, December, 1933).

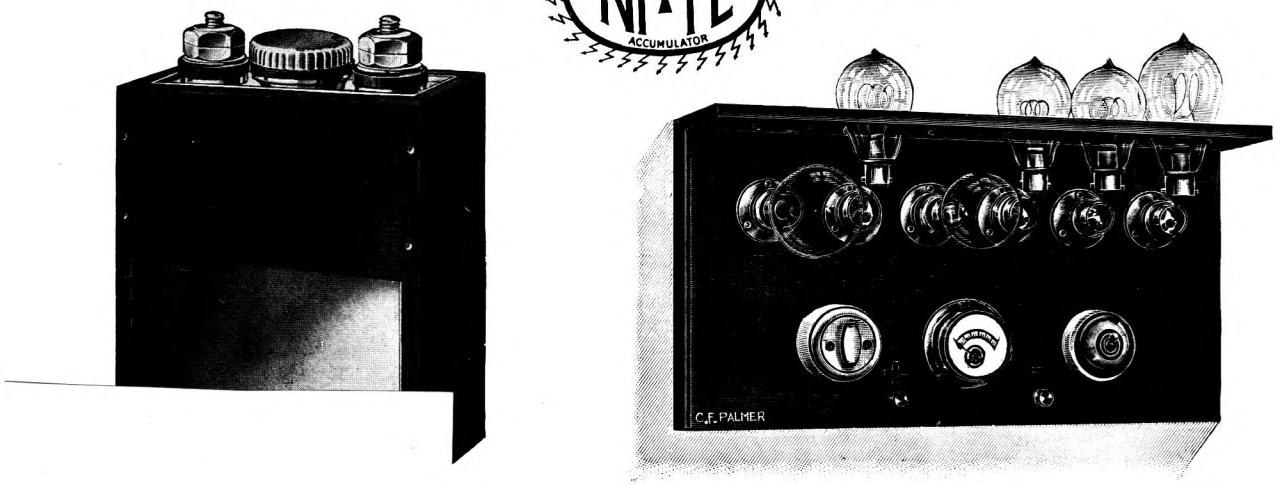
This is a most convenient form of electrode when it is desired to stimulate a nerve in blood or other fluid. Provision is made for screwing the holding stem in the side of the ebonite block if necessary.

Supplied with rubber covered flexible leads.

PRICE .. .. **H75** £1 3 0 each.

The above are representative forms of Electrodes. We are pleased at all times to receive enquiries for, and to make special forms.

THE NI+FE CELL.



H100.

kel Iron) ACCUMULATORS to your notice ? Although the first cost is somewhat e extra outlay will be found to be justified in a short time, especially in laboratories ailable for re-charging.

ay be short-circuited," " left discharged for any period," " over-charged," " charged in the wrong direction," and generally ill-used without harm ; in fact, they state that " they are indestructible," and further, that " they do not lose their charge while standing."

We have made the following rough but practical tests of a J.O.4 cell, which was taken at random and short-circuited for 24 hours through an ammeter and readings taken. After a period of three weeks it was re-charged and again short-circuited in a similar manner, when the readings were found to be slightly higher. After a further period of three weeks' rest, it was charged in the reverse direction ; under this treatment the polarity was not reversed. The voltage on open circuit was 1·2, but quickly fell to almost zero upon the cell being put to work through a low resistance, but recovered itself after a short lapse of time. It remained thus for two weeks, when it was again charged in the wrong direction. The polarity was still the same, but the voltage was reduced to 1·1. Upon re-charging in the right way the cell appeared as good as ever. Such treatment would have utterly ruined a lead accumulator.

The above test was made many years ago. This identical cell has since been in constant use, and is still in working order.

PRICE LIST and PARTICULARS OF " NI + FE " CELLS.—Type H—J.O.4 to H—J.4.

Type of Cell.	H—J.0.4	H—J.1	H—J.1.5	H—J.2	H—J.3	H—J.4
Normal ampere-hour capacity ..	4	10	15	22	34	45
Normal watt-hour capacity	4·8	12	18	26·4	40·8	54
Average discharge voltage	1·2	1·2	1·2	1·2	1·2	1·2
Normal rate of discharge .. Amps.	0·5	1·25	1·87	2·75	4·25	5·62
Normal time of discharge .. Hours	8	8	8	8	8	8
Charging voltage	1·4 to 1·8	1·4 to 1·8	1·4 to 1·8	1·4 to 1·8	1·4 to 1·8	1·4 to 1·8
Normal rate of charge .. Amps.	1·0	2·5	3·75	5·5	8·75	11·25
Normal time of charge .. Hour	6	6	6	6	6	6
Weight per cell, including electrolyte lbs.	0·8	1·41	2·19	2·75	4·03	5·25
Weight of solid electrolyte per cell lbs.	0·05	0·075	0·15	0·13	0·22	0·315
Volume of liquid electrolyte per cell pints	0·115	0·18	0·35	0·31	0·53	0·75
Dimensions—						
Width .. .. inches	3·15	3·15	3·15	4·14	4·14	4·14
Length .. .. inches	1·15	1·15	1·61	1·15	1·61	2·05
Height, including terminals .. inches	4·14	5·9	5·9	8·55	8·55	8·55
PRICE per cell, including crates and electrolyte	8/6	11/–	14/–	17/–	22/–	26/–

CHARGING BOARD.

Where D.C. Mains are available a convenient method of charging accumulators is to place lamps in circuit with the cells to be charged.

The Board illustrated is fitted with holders to take any number of Lamps up to six, fuse, switch and direction reading ammeter.

PRICE. Without Lamps **H100** £2 10 0

SECTION

W

MISCELLANEOUS APPARATUS

FOR

BACTERIOLOGY, BOTANY, Etc.

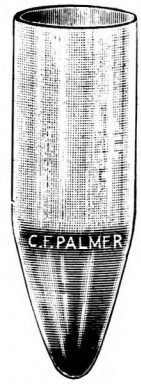
A REPRESENTATIVE SELECTION OF

INSTRUMENTS FOR

EXPERIMENTAL PSYCHOLOGY AND PHONETICS.

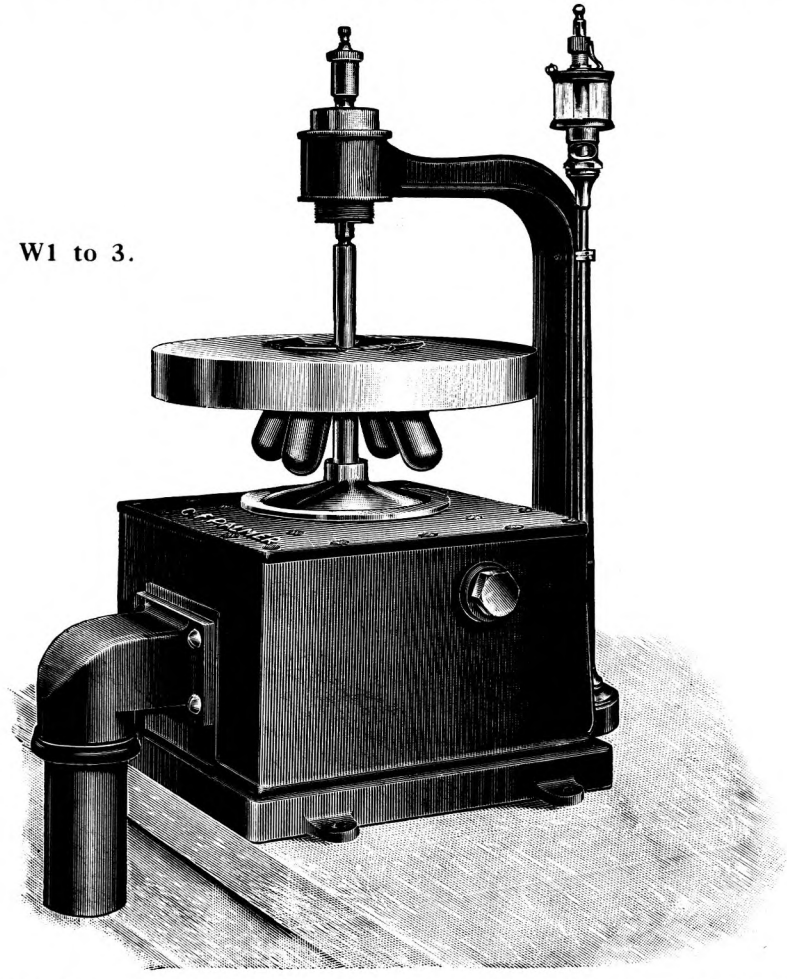
THE MARTIN WATER-DRIVEN CENTRIFUGE.

W12.

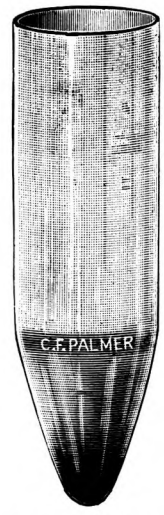


5 cc. Tube
Full Size.

W1 to 3.



W13.



10 cc. Tube
Full Size.

THIS is not put forward as a new idea, but as an improved form of an old instrument originally made for Sir Charles Martin (then Dr. Martin) many years ago by Mr. Crouch. Since his death, however, although several machines have appeared, none have been up to the standard desired, and Sir Charles Martin has approached us with a view of having a better machine made, with attention to the essentials of design. This we have done to the entire satisfaction of Sir Charles Martin, to whom we are indebted for every possible assistance.

The machine, as illustrated above, is made with interchangeable plates, each for four buckets, taking (unlike the original tubes with round bottoms) taper bottomed glass tubes, with an actual working capacity of 5 and 10 c.c. respectively. (A 15 c.c. plate is now made).

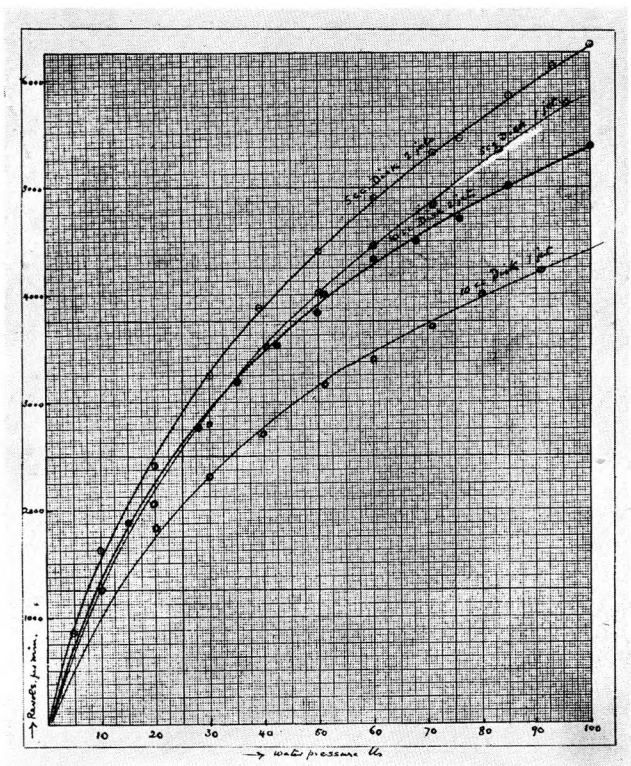
May we here point out that taper bottomed tubes are of necessity longer, and therefore require a larger diameter of plate which in turn lowers the ultimate speed. We are however told, by those competent to judge, that this is more than counterbalanced by the small space at the bottom.

PRICE :

		£	s.	d.
Standard two-jet machine with 5 c.c. plate, set of 4 buckets and 1 dozen glass tubes	**W 1**	14	5	0
The same machine, but with 10 c.c. plate and accessories as above	**W 2**	14	10	0
do. do. 15 c.c.	**W 3**	14	17	6
Extra 5 c.c. plate and set of buckets	**W 4**	3	15	0
do. 10 c.c. do. do.	**W 5**	4	0	0
do. 15 c.c. do. do.	**W 6**	4	7	6
Special taper-bottomed glass tubes, 5 c.c. .. .. per dozen	**W12**	0	3	0
do. do. do. 10 c.c. .. .. do.	**W13**	0	4	0
do. do. do. 15 c.c. .. .. do.	**W14**	0	4	8
A suitable water pressure gauge, with 3″ dial, reading 0—100 lbs. per sq. inch ..	**W21**	0	17	6
A Gunmetal guard can be had that entirely surrounds the plate and is easily removed when required. It is large enough to accommodate the 15 c.c. plate	**W22**	1	7	0
Aluminium Cover Plate for above	**W23**	0	7	6

THE MARTIN WATER-DRIVEN CENTRIFUGE—*continued.*

The speed of the Centrifuge, according to water pressure, is represented in the graph and table below.



Approximate Revolutions of Martin Centrifuge (Palmer) with Water Pressure.

lbs. Pressure.	5 c.c. Plate.		10 c.c. Plate.		15 c.c. Plate.		lbs. Pressure.
	1 Jet	2 Jets	1 Jet	2 Jets	1 Jet	2 Jets	
10	1250	1500	1000	1400	—	—	10
20	2200	2500	1750	2250	—	—	20
30	2900	3250	2300	2900	—	2800	30
40	3500	3900	2750	3500	—	3400	40
50	4000	4400	3150	3900	—	—	50
60	4450	4900	3450	4300	—	4300	60
70	4800	5250	3750	4600	—	—	70
80	5250	5600	4000	4900	—	4900	80
90	5600	6000	4200	5100	—	—	90
100	5850	6350	4400	5350	—	—	100

The 5 c.c. plate revolves about 11% faster with 2 jets.
,, 10 c.c. ,, ,, ,, 24% ,, ,, ,,

All machines are fitted with 2 removable jets, one of which can be blocked up if desired.

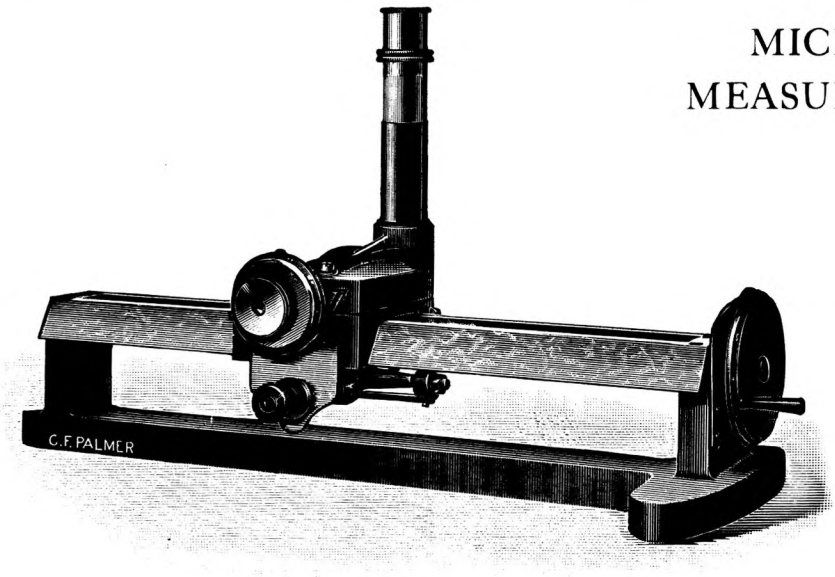
All removable parts, such as the revolving plates, spindles, etc., are carefully made to standard, and are therefore interchangeable.

When erecting, place thick rubber pads under the screw holes. It is important to see that the spindle is truly vertical: if the bench is fairly level, this can be done by placing a spirit level upon the plate, and varying the tension on the screws until it is horizontal.

The spindle should be just loose in its bearings to secure the best speeds.

PLATE FOR ALBUMINOMETERS.—A special Plate to fit in the Martin Water-Driven Centrifuge (Palmer Type), can now be supplied to take four Aufrecht Albuminometers. Owing to the larger size of the plate, the speed, for a given water pressure, will not be quite so high as with the Standard Plates.

			£	s.	d.
PRICE.	Plate and set of buckets	**W24**	5	0	0
,,	Aufrecht Albuminometers to suit above plate, each	**W25**	0	5	6



W30.

MICROSCOPE FOR MEASURING TRACINGS.

THIS instrument has a longitudinal traverse of 300 mm., and a cross-slide reading up to 50 mm. Both of these slides are actuated by screws which are of 1 mm. pitch, and have heads divided into 100, thus giving readings of ·01 mm.

The inverted " V " slide is mounted on a heavy base, so that it may stand firm without being clamped down. The nuts on both screws can be disengaged when it is desired to move the slides by hand.

The instrument takes the English standard objectives, and is sent out complete with an eye-piece with cross-lines and a 50-mm. objective. It is guaranteed to be of sufficient accuracy for all practical purposes, the error, if any, being negligible.

A lower price instrument is made, fitted with a nut release movement to the longitudinal slide only, the cross slide nut being solid.

PRICE :

		£	s.	d.
Fitted with nut release to longitudinal slide only	**W30**	12	15	0
Fitted with nut release for quick movement of both slides	**W31**	15	5	0

Weight : 21 lbs.

For Electric Microscope Lamp see H 55.

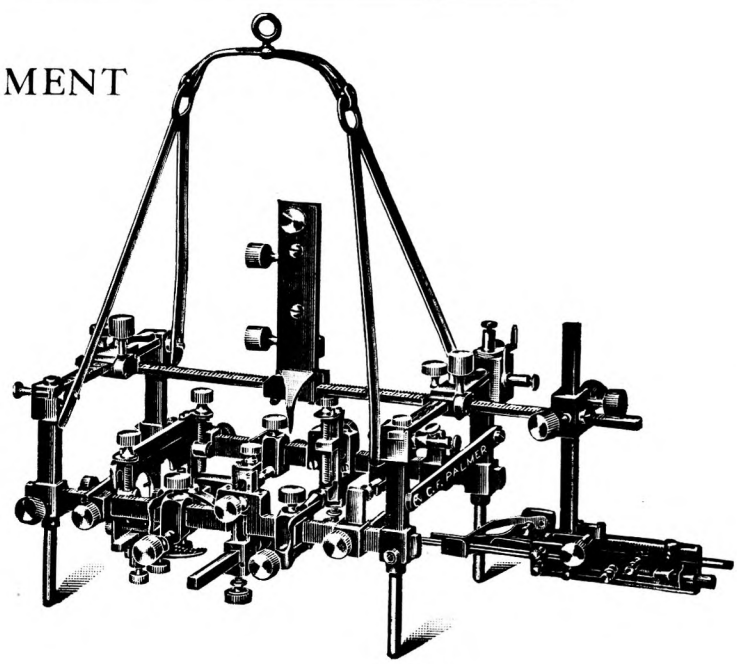
STEREOTAXIC INSTRUMENT

The illustration shows the instrument described by Sir Victor Horsley and Dr. R. H. Clarke in " The Structure and Functions of the Cerebellum,"—(" Brain," Vol. 31. 1908. Part 1.) Macmillan & Co. Ltd.

We are prepared to make alterations or additions to the above to suit individual requirements.

PRICE.

Stereotaxic Instrument, as illustrated. **W150** £60 0 0



W150.

THE PHONETIC KYMOGRAPH.

FOR GRAPHICALLY RECORDING SPEECH.

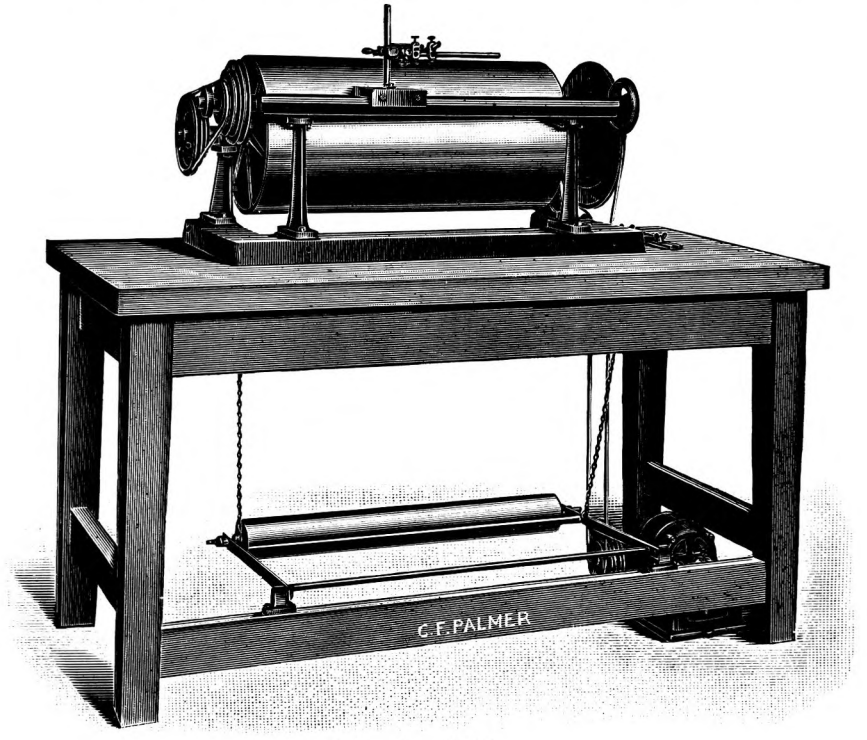


Fig. 1. **A24.**

THE Phonetic Kymograph illustrated above has been designed to record the vibrations produced in the air, and other variations of pressure involved in speech by the human voice. The name Kymograph is derived from two Greek words, meaning "wave" and "writing." It consists essentially of two parts:—

(1) A surface to be recorded on, and
(2) Sensitive recording points.

The surface consists of a moving endless band of highly glazed paper, on which is deposited, by means of a special gas (Fig. 2) or Kerosene (Fig. 3) burner, a thin layer of soot.

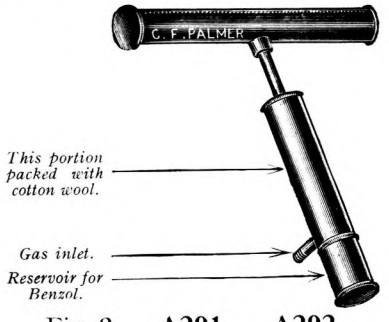


Fig. 2. **A291. A292.**

The number of writing points, and the means of moving them, vary according to the nature of the problem. In all tracings it is necessary to know the time in which

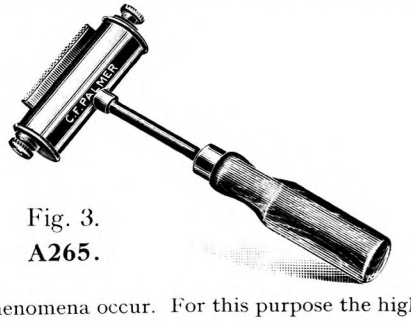


Fig. 3. **A265.**

certain phenomena occur. For this purpose the high speed time-marker (Fig. 4) is used. It is electromagnetic in action, having a very light armature, and is worked in

Fig. 4. **B25.**

circuit with a battery and an interrupter which takes the form of a vibrating fork (Fig. 5), giving 100 cycles per second. Time, therefore, to 1/200 of a second can be

N.B.—The references Fig. 1, etc., refer to the illustrations, while the numbers **A24,** etc., are the catalogue numbers and should be quoted when ordering.

easily read off the tracing. In this, as in the following, the record, or tracing, is formed by the point attached to the armature or lever, as the case may be, rubbing the soot off the highly glazed surface, and thus leaving white wave-like lines on a black surface.

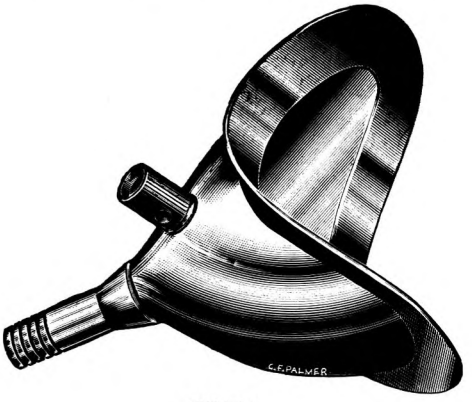
When it is desired to make these tracings permanent, they can be so made by drawing them through a weak solution of shellac in methylated spirit. The exact strength is immaterial, but it should be sufficiently strong to fix the black (i.e., so that it will not rub off) without making it excessively glossy.

The problem in recording speech is to show graphically the very minute changes in pressure caused by the vibrations in the air. For this purpose a very sensitive tambour is used (Fig. 6), which is practically a tube with a bell-like extremity, on which is stretched a thin rubber diaphragm, with its centre connected to a light lever, terminating in the writing point. To one of these tambours is

Fig. 6. **W100.**

attached, by means of a rubber tube, one of the following :—

(1) A funnel-shaped mouthpiece (Fig. 7, two shapes) for a mouth record.



W111.

(2) A nasal olive (Fig. 8, three sizes) is connected up and lightly inserted into the nostril, when it is desired to map out a nasal.

(3) A larynx capsule (Fig. 9), for determining the boundaries of a voice plosive.

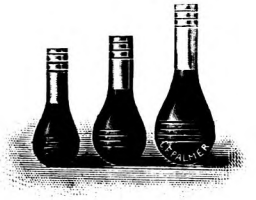


Fig. 8. **W115/7.**

This latter record has to be taken from the outside of the larynx by placing the capsule on the neck, in the space (left or right) between the thyroid cartilege and the hyoid bone. The capsule is now made slightly bent so that this can be done more readily. It is obvious that the three records can be taken simultaneously.

Referring back to the illustration of the Kymograph, it will be seen that there are two cylinders. The glazed paper can be put round either the upper and larger one, and the ends cemented together ; or a long endless band reaching round both cylinders, can be used. When the cylinder/s is/are in motion the paper can be easily smoked by one of the burners illustrated.

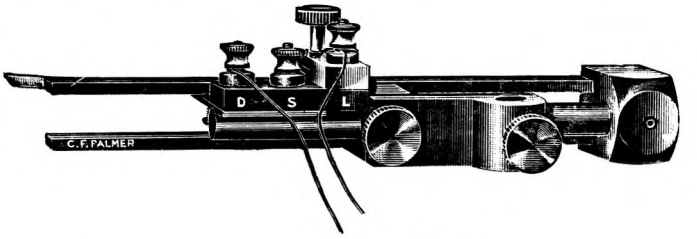


Fig. 5. **B12.**

Near the top of the large cylinder is the bar upon which the time-marker and tambours are fixed. This bar has a fine adjustment for regulating the pressure of the writing-points upon the paper. The carriage supporting the bar can either remain still (in which case it should be moved to a new position on the blackened surface, when the paper has made a complete turn), or the carriage can be caused to move automatically along the slide by means of the leading screw, such leading screw being geared to the axis of the cylinder by a belt running on the cone

Fig. 7. **W112.**

pulleys seen on the left of the illustration. By this means a long spiral tracing is obtained.

The usual method of driving the Kymograph is by a small electric motor, fitted with worm gear to reduce the speed to that required.

Fig. 9. **W120.**

We are indebted to Mr. Stephen Jones, of the Phonetics Department, University College, London, for his assistance, and would refer all readers interested in Experimental Phonetics to him for further details.

* * * *

Since the foregoing was written new forms of smaller kymographs have been constructed. That shown at Fig. 10 is a useful instrument for general work, it having a cylinder 10″ long by 9″ diameter. In other respects it follows closely after the larger model.

Where simple experiments only are desired and for demonstrating, the clockwork kymograph, shown at Fig. 11, is quite useful. Being light, it is easily carried, in fact Mr. Jones lately took one of these with him to America, where he was invited to give a series of lectures. The cylinder *A* of this instrument is 6″ diameter and 3″ long. The winding handle is inserted at *B* and immediately underneath is a small lever conveniently placed for starting or stopping. The upright rod *C* has sufficient adjustment to accommodate most instruments when held upon the adjustable horizontal bar (not shown in illustration). This kymograph runs long enough at one winding for most experiments.

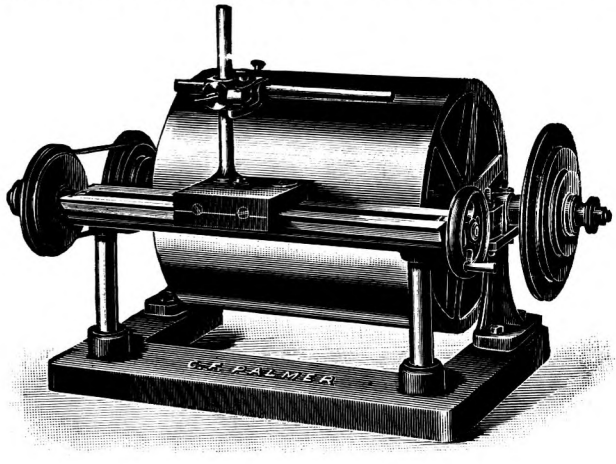


Fig. 10. **A30.**

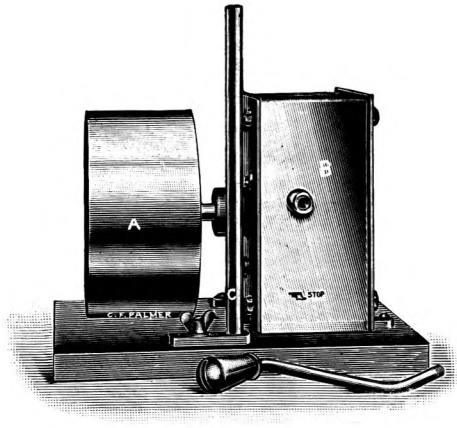


Fig. 11. **W125.**

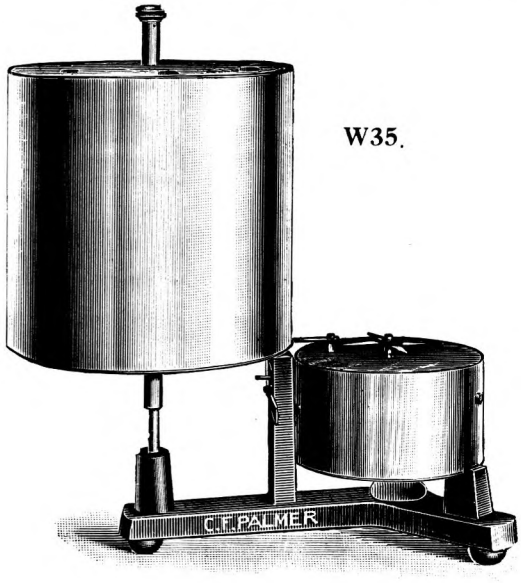
		£	s.	d.
Fig. 1.—**Horizontal Kymograph,** 24″ long and 12″ diameter, with table and extension for long paper	**A24**	78	10	0
Do. do. but without table or extension	**A25**	63	0	0
Fig. 10.—**Horizontal Kymograph,** 10″ long and 9″ diameter, similar in design to the above and with ball bearing adjustable rod to carry tambours, etc. (as supplied with A 24)	**A30**	35	10	0
Extension for long paper (to fix on floor)	**A31**	2	7	6
Suitable pitch pine and teak topped table	**A32**	9	5	0
Fig. 11.—**Clockwork Kymograph,** with cylinder 3″ long x 6″ diameter with adjustable upright *C*.	**W125**	6	10	0
The above fitted with wooden cover and carrying handle	**W126**	7	5	0
Ball bearing horizontal bar for instruments as fitted to A24 and A30, Extra	**W130**	1	10	0
Fig. 2.—**Gas Smoking Burner,** 5½″	**A291**	1	17	6
,, ,, ,, 9″	**A292**	2	2	0
Fig. 3.—**Kerosene Smoking Burner**	**A265**	2	5	0
Fig. 4.—**High Speed Time Marker**	**B25**	2	5	0
Fig. 5.—Electrically maintained **Tuning Fork** for 100 ~	**B12**	4	10	0
Fig. 6.—**Oval Tambour,** 23 x 18 mm.	**W100**	1	5	6
Round Tambour with 22 mm. diaphragm	**W101**	1	1	0
,, ,, ,, 28 mm. ,, ...	**W102**	1	1	0
,, ,, ,, 35 mm. ,, ...	**W103**	1	1	0
Fig. 7.—**Mouth Piece** formed of sheet copper, nickel plated. Outlet tube ⅜″ ..	**W110**	0	12	6
,, ,, fitted with relief valve and flange edge	**W111**	0	15	6
,, ,, cast aluminium	**W112**	0	12	6
Fig. 8.—**Nasal Olives,** made in three sizes. Small, price per pair	**W115**	0	5	0
,, ,, Medium, ,, ,, ...	**W116**	0	5	0
,, ,, Large, ,, ,, ...	**W117**	0	5	0
Fig. 9.—**Larynx Capsule,** 44 mm. diam. with grooved edge for rubber diaphragm ..	**W120**	0	7	6
,, ,, bent form	**W121**	0	8	6

For further details of Kymographs (vertical and horizontal), Tambours and other recording apparatus; also Shafting and Motors, see our Physiological Catalogue, Sections A to H.

When ordering please quote the numbers in dark type, and not the figure numbers, which refer to the text only.

BOTANICAL APPARATUS

as used in the LABORATORIES, SOUTH KENSINGTON.



W35.

PROF. J. B. FARMER'S AUXANOMETER.

THE cylinder is very light and is of the standard size (6″ x 6″). It does not revolve, but moves through a small arc, and then back to its normal position. The clock, which has a 30-hour lever movement, is so arranged that it can be set to give an impulse to the drum every 15, 20, 30 or 60 minutes, and can be removed for re-winding without disturbing the record. The tracing being vertical, several levers can be arranged to write on the drum at the same time.

PRICE (as illustrated) .. **W35** £4 10 0

SEVEN DAY RECORDING DRUM.

W34.

THIS ultra Slow Speed Recording Drum, making one revolution in seven days, is fitted with a superior clockwork movement with jewelled escapement and is thoroughly reliable in every way.

The Recording Cylinder is our standard size 6″ diameter x 6″ high, and is fitted with a locking clip which can be readily released when it is desired to remove the cylinder or to turn it by hand.

To enable papers to be smoked when a smoking stand is not available, a special smoking handle is provided.

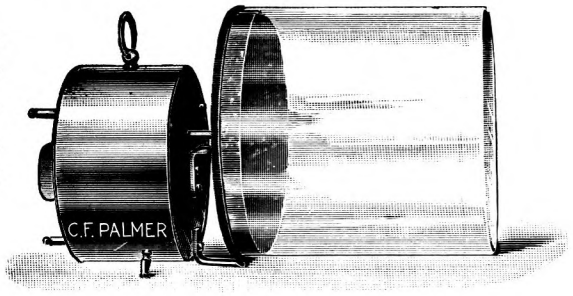
			£	s.	d.
PRICE. Complete with **Smoking Handle** (as illustration)	**W34**	10	0	0
,, **Glazed Papers,** cut to size and gummed .. per 100	**A300**	0	3	6

Weight of Recording Drum, 10 lbs.

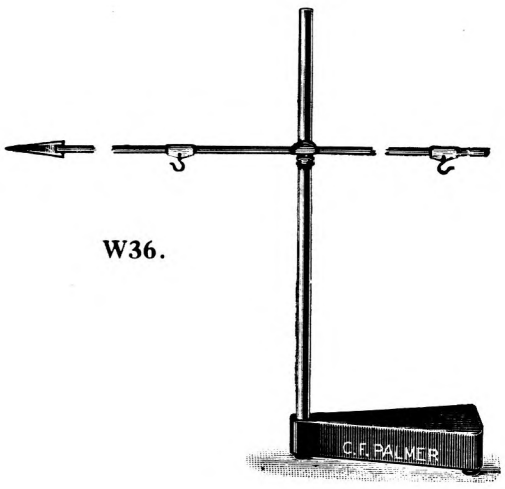
PROF. J. B. FARMER'S KLINOSTAT.

THE Klinostat has a lever movement the same as the Auxanometer, and is made to stand either in a vertical or horizontal position. It is provided with a cork table 5″ diameter, which revolves once in every 15 minutes. The transparent celluloid cover is 5″ high.

PRICE, complete .. **W37** £2 3 6



W37.



W36.

BOTANICAL RECORDING LEVER.

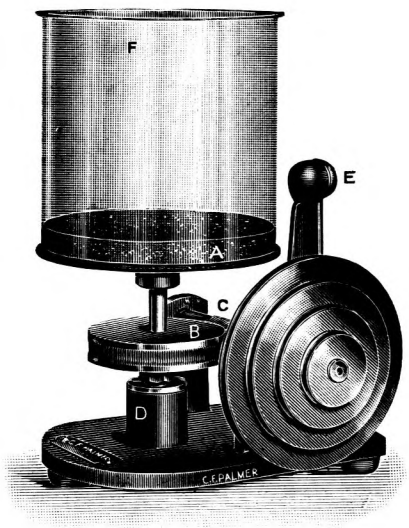
This is a long light wooden beam, having a writing point at one end, also adjustable bearings and two hooks that can be slid anywhere along the beam. The one is for attaching to the plant, and the other for the counter balance weight provided. There is a support for the lever, which can be fixed at any height on the stand.

PRICE (complete on stand) .. **W36** £1 5 0

PULLEY DRIVEN KLINOSTAT.

A Klinostat is sometimes required to carry plants which are too heavy for the Clockwork instrument, W37. The arrangement illustrated, which can be driven from the Laboratory shafting or small motor, has therefore been designed. The cork table *A* is 5″ diameter, and the transparent cover *F* is 5″ high, the worm *C* and the worm-wheel *B*, have a ratio of 1 : 250. The instrument can be used in the vertical or horizontal position, and rubber feet are fitted to prevent slipping on the bench.

Price (as illustrated) **W38** £4 18 6



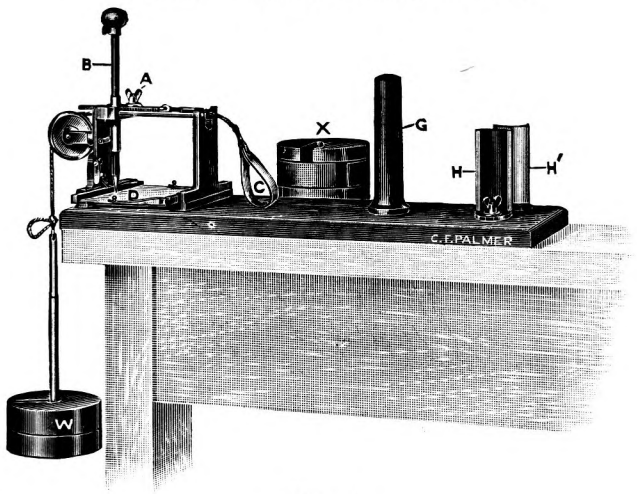
W38.

PSYCHOLOGICAL APPARATUS.

The following pages illustrate and describe some of the apparatus which we have produced for use in experimental Psychological Laboratories.

New pieces are being designed from time to time, and customers are requested to write to us if they are in need of Instruments which are not yet shown in this Catalogue.

THE ERGOGRAPH.



W200.

FOR determining individual differences in muscular fatigue. This is of the self-recording type and produces its curve directly upon a strip of paper fitted in a carrier tray moving one ratchet tooth at each return of the weight. Carrier tray fitted normally with 180 teeth.

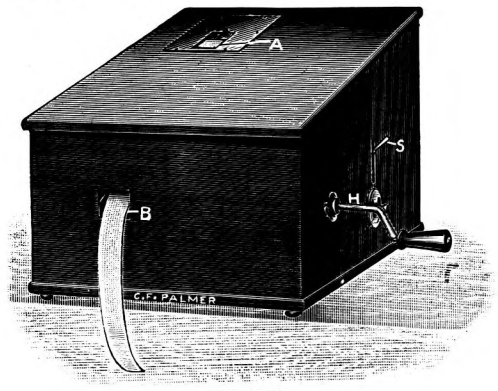
Sent out with each instrument are three one-kilo. and two half-kilo. weights, as shown at *X*, which, together with the permanent hook weight, gives a total load of five kilos.

		£	s.	d.
PRICE	**W200**	9	10	0
,, Suitable papers for the above .. .. .. per 100	**W201**	0	2	0
,, ,, ,, ,, ,, ... per 1,000	**W202**	0	17	6

"DOTTING" APPARATUS.

McDougall's Pattern for determining individual differences in "Motor Fatigue."

This is housed in a polished mahogany desk-like box with top 17″ x 11½″. The specially printed paper passes under an adjustable opening at *A*, there being a sliding shutter which reduces the opening from 2½″ to 1½″. The spring motor is of the gramophone type with the winding handle at *H*. The starting lever is seen at *S*, with the regulator immediately underneath; this enables the speed at which the paper passes the opening to be varied.



W205.

		£	s.	d.
PRICE	**W205**	13	0	0
,, Specially Printed Paper in Rolls .. .. .. Per Roll	**W206**	0	7	6

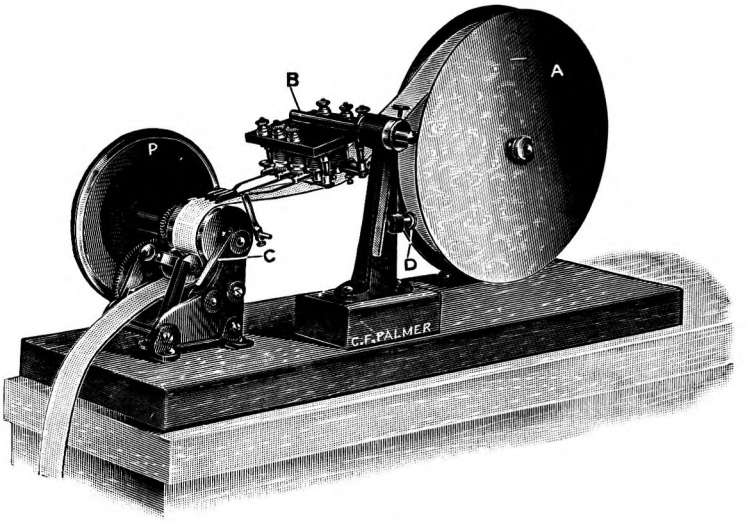
THE CONTINUOUS INK-RECORDING CHRONOGRAPH.

IS useful for many purposes, *i.e.*, simple reaction times or for recording a number of stimuli and responses. The time marking is readily and clearly given by a Mercury dip Metronome at speeds up to 0·25 sec. The Recorder pens will work continuously up to 30 minutes with one filling of ordinary ink.

This instrument takes paper rolls 8″ diameter 1″ wide and is intended to be driven from the laboratory shafting or motor by the pulley *P*. The pens are adjusted by the screw *D*, and by loosening one screw only can be withdrawn as a whole from their supporting standard for cleaning.

(It is a good plan to insert the supporting rod into the other side of the standard, allowing the points to hang down into a beaker of water till any dried ink has softened and can be wiped off with a piece of blotting paper.)

(PLEASE NOTE.—When this instrument was set up for photographing, the roll of paper was inadvertently put on the wrong way round. Obviously it should lead off from the bottom of the roll, so as not to foul the framework of the marker).



W210.

			£	s.	d.
PRICE.	**3-Pen Chronograph**	**W210**	10	5	0
,,	**6-Pen** ,, ...	**W211**	12	12	6
,,	**3-Pen Marker**, only	**W212**	3	10	0
,,	**6-Pen** ,, ,, ...	**W213**	5	17	6
,,	Suitable paper in rolls of approximately 1,300-ft. .. .. each	**W214**		2	3

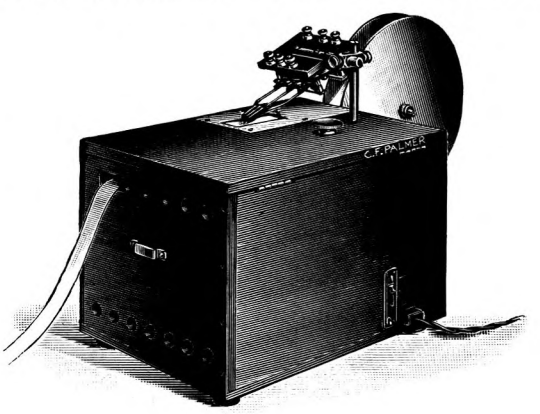
Pen Markers having any number of pens up to twelve, and with the pens arranged to write in a small width, can also be supplied. Particulars will be sent on request.

PORTABLE RECORDING CHRONOGRAPH OR DOTTER.

This machine is completely self-contained, the electric motor is of the universal type, and can be readily adjusted to run on a supply of 100-250-volt. A.C. or D.C. The holder for the paper reel, and the upright carrying the marker are detachable, and can be fixed inside the case when the machine is not in use. Speed regulation is carried out by means of the small milled knob shown on top of the case.

The 3-Pen Marker supplied with the machine is similar to that shown in W210.

When using the apparatus as a Dotting Machine the aperture can be adjusted for length.



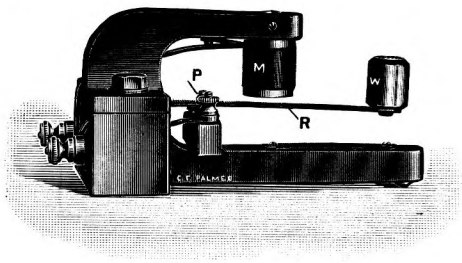
W215.

			£	s.	d.
PRICE (as illustrated), complete with roll of Chronograph Paper, roll of Printed Dotting Paper, and carrying strap		**W215**	20	0	0

TIME.

Apparatus suitable to operate the Timemarking Pen of Recording Chronographs or to give electrical impulses at regular intervals.

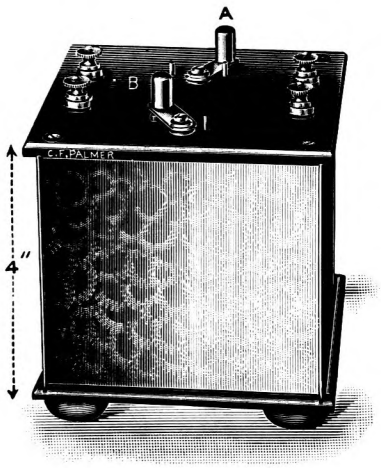
ELECTRICALLY MAINTAINED VIBRATOR.



W216.

THE steel reed *R*, having a weight *W* at one end and being firmly clamped at the other, is set to vibrate at 10 per second. The electro magnet *M*, when connected in a battery circuit causes these vibrations to be maintained, thus making and breaking the circuit at the platinum points *P*. Any standard type of signal can be used with the Vibrator.

			£	s.	d.
PRICE.	1/10 sec.	**W216**	3	5	0
,,	1/20 sec.	**W217**	3	10	0



W218.

CLOCK TIME-MARKER.

A clock movement with lever escapement and 4-volt. battery provide the necessary impulse to actuate an electro magnet, which in turn imparts a rotary movement to a notched wheel ; this, by means of spring contacts, closes the circuit to the signal. The standard intervals of time provided are 1 sec., 10 secs. and 1 min., but the clock can be supplied to give other times if required. Switch *A* stops the clock movement and disconnects the battery, whilst switch *B* is set to the time interval indicated.

			£	s.	d.
PRICE.	Giving 1 sec., 10 secs. and 1 min.	**W218**	6	15	0
,,	,, 15 secs., 30 secs. and 1 min.	**W219**	6	15	0

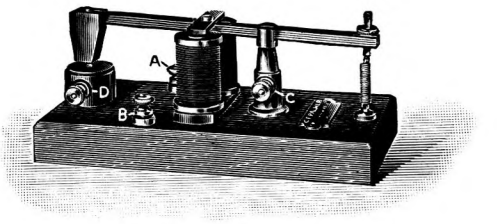
Any three of the following time intervals, 2, 3, 4, 5, 6, 12 or 20 secs., can be substituted for those given in B.6.

See Section *B* for prices and particulars of other types of **TIMEMARKING APPARATUS.**

THE SOUND HAMMER.

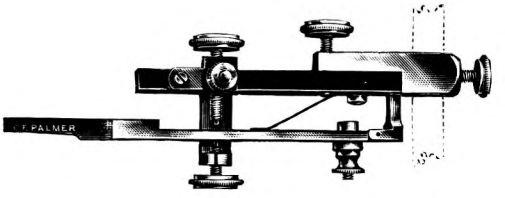
This is of the type as almost universally used in Auditory and Time-reaction experiments, giving both make and break circuits, being operated from a distance by an independent key.

PRICE **W220** £2 2 6



W220.

THE LIP KEY.



W225.

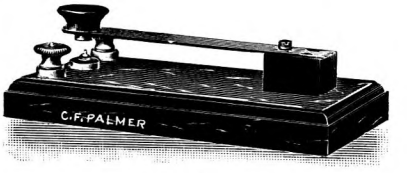
Giving both make and break circuits, by labial response to reaction times. This instrument fits the ordinary upright stand (*see* Section D of our catalogue). It has an adjustable spring and contacts. The detachable lip-pieces are of vulcanite.

PRICE (with two lip-pieces) **W225** £2 2 0

SPRING TAPPING KEY.

This simple form of make key will be found very useful for many purposes. It occupies little space, and when the knob is depressed a good contact is made, the contact points being of silver.

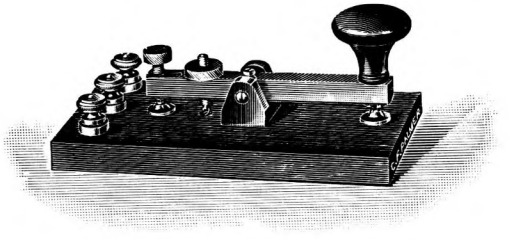
The key is mounted on a polished hardwood base.



W227.

PRICE. As illustrated or with the terminals at the opposite end **W227** 7/6

MORSE KEY.



W230.

This is a substantial well made instrument, mounted on a vulcanite base; the make and break contacts are of platinum.

The amount of "free movement" between the break and the make can be accurately adjusted by the knurled contact screw. Moreover, the terminals and contacts are clearly marked so that the student can quickly trace all connections.

Insulated knobs of various size and shape can be fitted to suit individual requirements.

PRICE **W230** £1 2 6

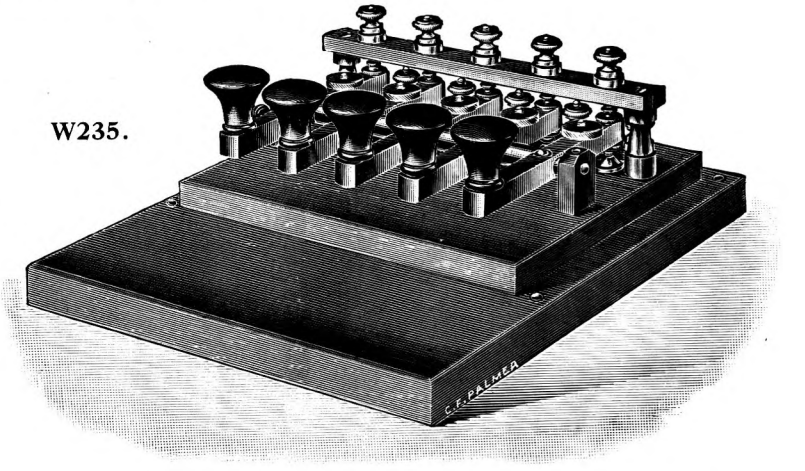
DOUBLE MAKE KEY. Similar to the standard Morse Key, but fitted with a bridge piece carrying another contact so that when the knob is depressed, one circuit is broken and two are made.

PRICE .. **W231** £1 7 6

MULTIPLE REACTION KEY.

THE Multiple Point choice Reaction Key consists of five keys similar to the Morse Key, but with modified contacts.

In the standard form each key bar is insulated from its fellow, and provided with terminals, the platinum contacts are also independent. When required, we can, however, arrange the key bars so that they are connected to a common terminal, the contacts only having independent terminals.

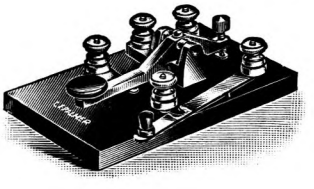


W235.

The Keys are mounted on a vulcanite base, and the whole fitted to a stout hardwood board. Insulated knobs of various designs recessed to take indicating discs can be supplied without extra charge.

PRICE. Five-Point Reaction Key **W235** £4 4 0

MAKE OR BREAK KEY (FLAT TYPE).



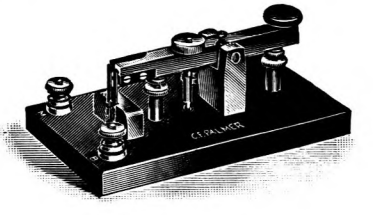
W238.

Many experimental workers prefer a flat type of key, which enables circuits to be made or broken with the hand resting on the bench, and consequently with an almost imperceptible movement of the finger. Connections are made to terminals which form part of the actual strips carrying the platinum make and break contacts. A short circuiting key is incorporated, and can be used independently if required.

PRICE. As illustrated .. **W238** £1 6 0

INSTANTANEOUS MAKE AND BREAK KEY.

One of the chief difficulties with the normal type of make and break key is that it is practically impossible to arrange for the instantaneous breaking of one circuit, and the making of another. The key illustrated has, therefore, been produced. It consists of a contact bar machined at the end in such a manner that contact and insulating surfaces are at opposite corners. It is therefore apparent that two spring fingers of equal length pressing on these surfaces, will make contact on one surface and be insulated on the other when the key is depressed.



W240.

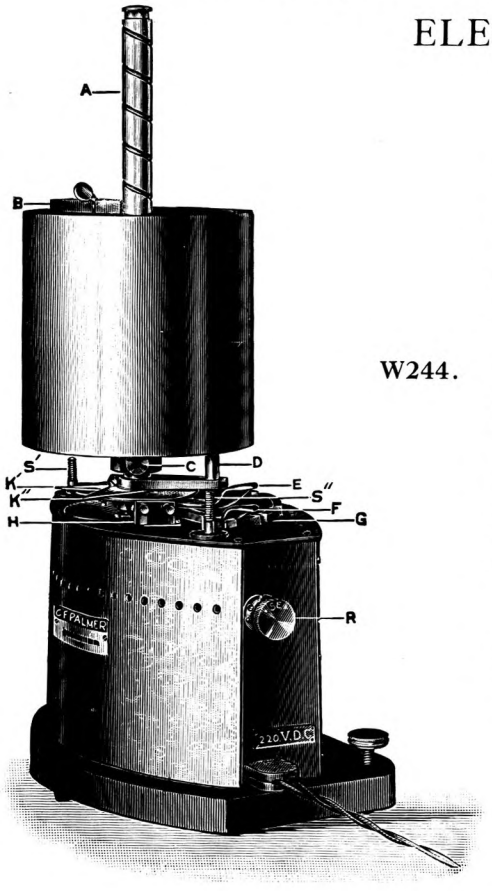
PRICE. Mounted on Vulcanite base **W240** £1 12 6

For Keys and Commutators of various types *see* Section H.

RECORDING DRUMS.

For taking records on smoked paper or with ink pens.

ELECTRICALLY DRIVEN DRUM.



W244.

THIS drum is complete with self contained, built-in motor to run off the lighting mains, and can be supplied for any one voltage 50 to 250, either D.C. or A.C. single phase.

There are nominally five speeds which, measured on the surface of a standard 6″ drum, are approximately ·18, 1·6, 15, 135 and 1,215 c.m. per min. Further, by adjusting the speed regulating knob *R*, these speeds can be raised gradually to about double or cut down to half, which is useful when exact rates are required.

An alternative range of five speeds can be supplied. These give an approximate surface speed with a 6″ diameter cylinder of 1·94, 9·72, 48·6, 243 and 1,215 cm. per min. Please indicate this speed range by ordering W245.

To change the speed it is only necessary to raise the lower lever *F* out of the notch in the quadrant *G* and swing it round until it is over the notch required, each notch being marked with the respective speed, as above. There is an extra notch marked *N* (neutral). When the control lever *F* is in this, the drum is free to be turned by hand.

Incorporated in this drum is the upward spiral movement, giving a continuous tracing up to 1″ wide, and five times round the cylinder in length.

			£	s.	d.
PRICE.	With speed range ·18–1215 cm. per min.	**W244**	20	0	0
,,	With speed range 1·94–1215 cm. per min.	**W245**	20	0	0
,,	Pair Jointed Uprights to fit above	**W246**	1	5	0

CLOCKWORK DRUM.

These are made in many models and speed ranges giving from one revolution of the cylinder in five seconds to one revolution in five hours.

They are fitted with adjustable fan escapement and cylinders 6″ diam. x 6″ high are standard.

A model which has been found very useful for general work has a two-speed gear which, with the adjustable fan, gives one revolution in 30–60 seconds and one revolution in 15–60 minutes.

PRICE **W248** £10 10 0

See Section A for a complete range of

KYMOGRAPHS and RECORDING DRUMS.

HIPP'S CHRONOSCOPE.

GENERALLY recognised as the standard laboratory instrument for recording Reaction Times.

The Clockwork is weight-driven and has a working duration of one minute ; the escapement is of the vibrating reed type devised by Hipp.

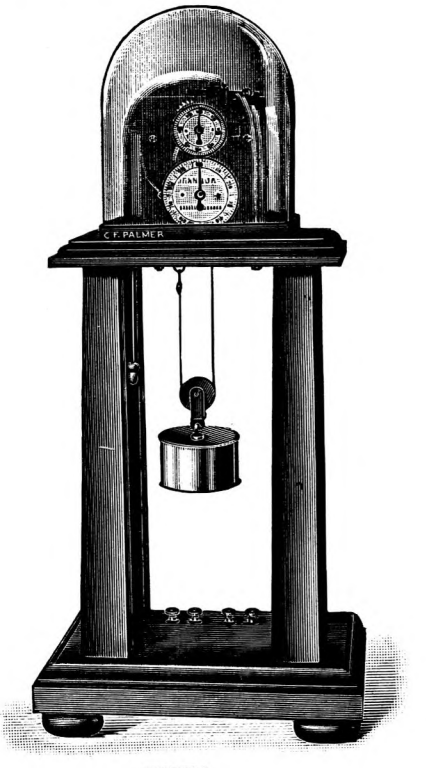
The two dials give readings of tenths and thousands of a second respectively. The frame is stoutly constructed of hard wood, and a glass cover protects the clockwork mechanism.

A very clear description of the movement and method of setting the Chronoscope for use, is given in " Experimental Psychology," Part 2, by Charles S. Myers and F. C. Bartlett.

PRICE. Chronoscope, as illustrated. **W250** £45 0 0

(The price is subject to exchange fluctuations).

A model can also be supplied with the device for re-setting the hands to zero.



W250.

ATCH CONTROLLER.

DESIGNED to operate an ordinary Stop-Watch by means of a powerful electro-magnet. The Watch is enclosed in a stout metal case, which incidentally gives it considerable protection. A circular aperture in the front sloping panel allows the dial to be easily viewed. In order that watches of various sizes may be accommodated, the holding clamp is fully adjustable, and the front panel can be slid out to facilitate fitting.

With the Stop-Watch fixed in the Controller it is only possible to operate the watch mechanism electrically by connecting a battery and key to the terminals fitted at the back of the case.

PRICE. Mounted on rubber feet .. **W255** £3 17 6

in above Controller, are shown in Section B.

nown in the illustration, can be supplied. Prices will be sent on

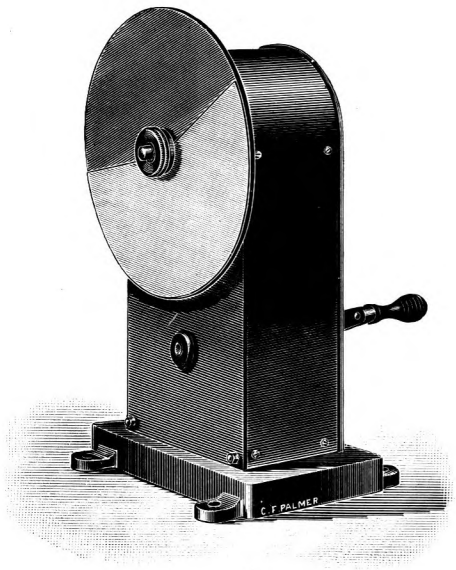
COLOUR MIXERS.

HAND COLOUR MIXER.

SUITABLE gearing enables this machine to be easily operated by hand, the discs revolving at such a speed that there is no flicker. Stoutly constructed of metal, and of sufficient weight so that screwing down is not necessary.

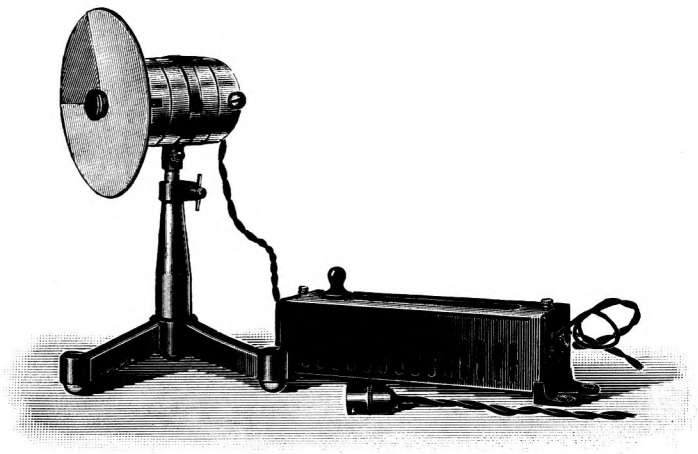
A machine fitted with two disc spindles running at the same speed, is also made.

			£	s.	d.
PRICE.	Single disc type, complete with two colour discs (as illustrated)	**W260**	3	15	0
,,	Double disc type, complete with four colour discs	**W261**	6	0	0



W260.

ELECTRIC COLOUR MIXER.



W265.

THE Motor is of the High-Speed Universal Type, and can be run from A.C. or D.C. supplies, speed being controlled by the variable resistance up to a maximum of 4,000 R.P.M.

The Stand is adjustable for height, and is fitted with rubber feet. Connecting flex, plugs and two colour discs are supplied.

PRICE.

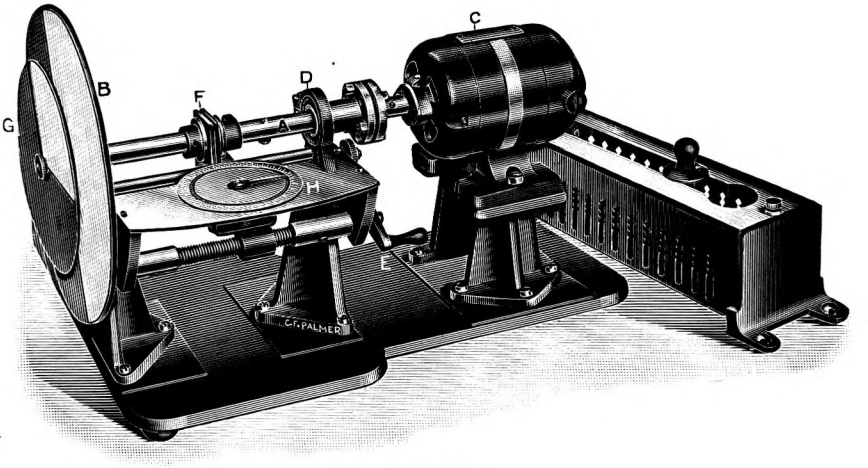
Complete, as illustrated.

W265 £5 12 6

Please state if required to run on 100/110 volt or 200/240 volt Electric supply.

The Electric Colour Mixer can be fitted with a worm and worm wheel type of counter, showing each 100 revolutions, for an extra cost of 12s. 6d., if specified when ordering.

COLOUR COMPARATOR.



W270.

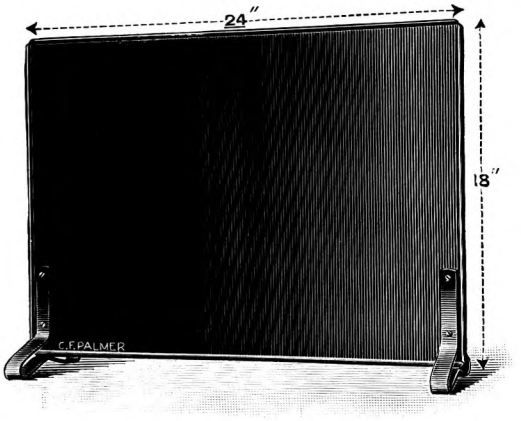
DESIGNED in co-operation with the Psychological Laboratory at University College, London, the machine shown above enables the operator, by turning the handle *E*, to vary the colour proportions of the smaller disc *G* from 10° to 350° whilst it is revolving, and to compare the colour with the large disc *B*, which is also revolving at the same speed. The colour proportions of the smaller disc are indicated in degrees by a pointer and circular scale *H*.

The discs are driven by the Universal Motor *C*, connected to the spindle *A*, which runs in ball-bearings, speed being controlled by the variable resistance. By means of this instrument, the fixed colour proportions of disc *B* are accurately and quickly matched by the variable colour disc *G*, without stopping the discs revolving.

PRICE complete (as illustrated) **W270** £18 10 0

Please state if required to run on 100/110 volt or 200/240 volt Electric supply.

LARGE METAL SCREEN.



W275.

It is often necessary to screen the operator from the subject during certain tests, and for this purpose the substantial screen shown herewith will be found very suitable.

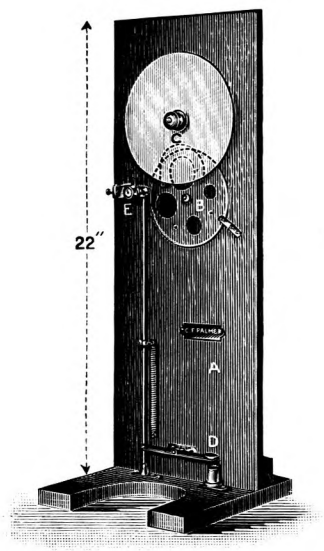
Unlike the flimsy cardboard article which is usually unsatisfactory in use, this screen is made of aluminium with steel feet, and the whole being enamelled dead black.

PRICE. As illustrated, 24" x 18". **W275** 10/–

Screens of various shapes and sizes can be made to order.

SHUTTERS.

JASTROW SHUTTER.



W280.

THE illustration shows the side of the apparatus from which the operator controls the shutter, etc. A circular opening on the other side is all that can be seen by the subject.

When the key *D* is depressed, the shutter *C* (shown in outline) uncovers the opening and exposes a colour or figure to the subject; at the same time an electrical contact is made at *E*. The size of the opening can be varied by rotating the plate *B*. Different colours or figures can be fixed to the large disc and brought into position as required.

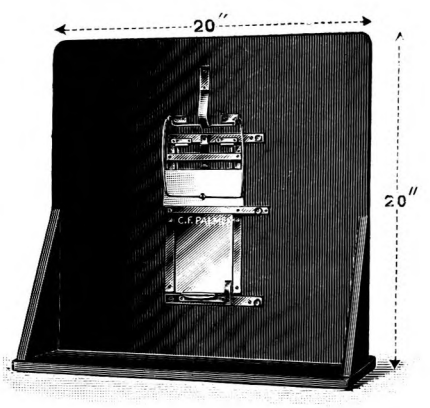
PRICE, complete, as illustrated, with seven colour Spots on Disc .. **W280** £3 15 0

HAND OPERATED SHUTTER.

This consists of a strong metal shutter mounted in the centre of a wooden framework, painted dead black, measuring 20″ x 20″. Contact strips for electrical connections are located at the top and also at the bottom of the shutter guides, so that it is possible to record the moment when the shutter is moved in a downward direction and also when the maximum position is reached.

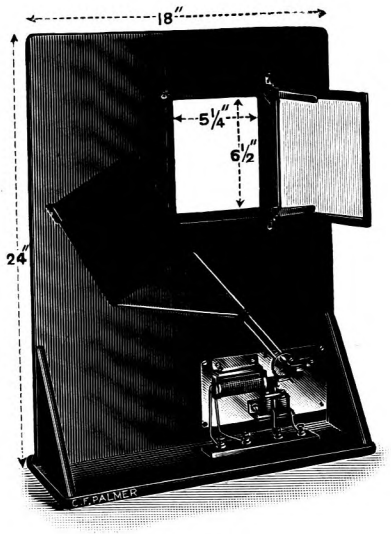
The size of the normal aperture is 3″ x 1½″, but this can be modified to suit individual requirements. A stout spring is used to hold the cards in position at the opening.

PRICE. As illustration .. **W282** £3 10 0



W282.

LARGE APERTURE SHUTTER.



W285.

IT is sometimes necessary to expose for a period cards of comparatively large size. We have, therefore, produced this shutter. It will be seen from the illustration that the aperture measures 6½" x 5¼" and the surrounding dull black framework 24" x 18".

In order to make the exposure, a very light but rigid shutter is released by a trigger operated by an electro-magnet. To close the aperture, the shutter is pulled backwards by a powerful solenoid.

It will, therefore, be apparent that when using two keys and a battery of 4–6 volts, cards can be shown and covered by an operator some distance away, also it is a simple matter to record the duration of the exposure.

A swing back holder is provided to take cards up to the full size of 6½" x 5¼".

PRICE. As illustrated .. **W285** £9 10 0

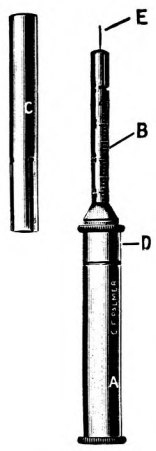
HAIR ÆSTHESIOMETER.

For tests of touch, Von Frey's model, a horse hair *E* is carried in a graduated nickel-silver holder *D*, by sliding *B* into *D*, the protruding part of horse hair *E*, is lengthened. A protecting cap *C* fits over *E* and *B* when not in use.

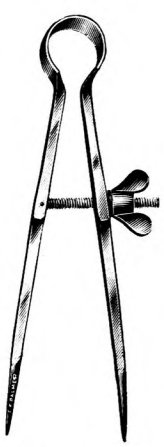
PRICE **W290** £1 0 0

Simple Hair Æsthesiometer for Students' use made of metal but without graduations and protecting cap.

PRICE .. .. **W291** 7s. 6d.



W290.



W295.

COMPASS ÆSTHESIOMETER.

Stoutly made in blackened steel with well formed points and with an adjusting screw giving a movement of approximately 1 mm. per half-turn to the points.

PRICE .. .. **W295** 7s. 6d.

W300.

LIGHT POINTED HAMMERS.

For exploring Heat and Cold Spots, the hammers are heavily nickel-plated so that they can be immersed in hot water if necessary.

PRICE .. .. **W300** per pair 7s. 0d.

Small Pointed Hammer, wit
stoutly made for class use.

PRICE .. ..

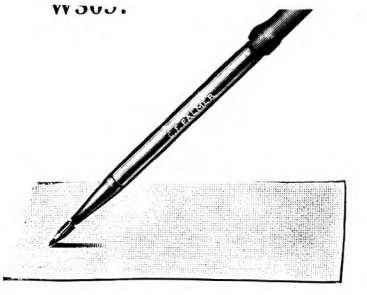
ELECTRIC CONTACT PENCIL.

In appearance the pencil is similar to the ordinary self propelling type, the holder to take lead or metal stylus is adjustable.

A platinum point contact is made when pressure is put on the point of the pencil, one wire being connected to the metal body of the pencil and the other to the contact.

When using the pencil for Dotting experiments, a small metal wire should be used as a stylus.

PRICE. Nickel Silver, as illustrated. **W305** £1 5 0

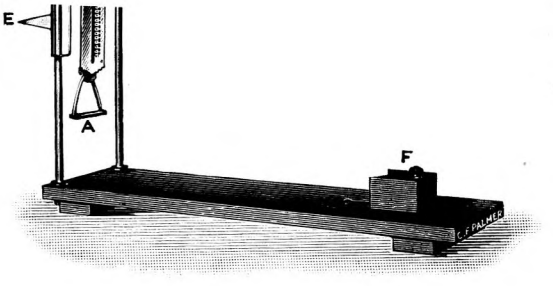


PNEUMATIC RECORDING PENCIL.

To record the varying pressures applied both at the point and also at the finger grip during writing tests, this pencil will be found most suitable.

The pencil is of necessity somewhat larger than an ordinary pencil, but is not in any way awkward to
((light rubber tubes from the pencil to two simple Tambours

.. .. **W306** £3 3 0



FINGER DYNAMOMETER.

A strong baseboard, with adjustable elbow stop *F*, has two uprights fixed at one end carrying the crossbar *C*, to which is suspended the balance *B*, with finger stirrup *A*, at the lower end. A cord runs from the balance over two guide pulleys *D*, to the stylus carrier *E*, so that when pressure is exerted at *A*, the carrier is pulled upwards by the cord.

The balance is graduated in 1/10 kilo divisions up to 50 kilos.

PRICE **W310** £3 10 0

TAMBOUR BOARD.

THE illustration shows the board with the electrodes and receiving Tambour used for the Conditioned Reflex experiments by J. B. Watson and described in a " First Laboratory Guide on Psychology " by Collins and Drever.

The movements of the finger resting under the small stirrup of the receiving Tambour are transmitted to the recording Tambour through a light rubber tube.

To complete the necessary equipment for the experiments the following instruments are also required :—

Recording Kymograph.	(W248 or Section A).
Double electro-magnetic marker.	(Section B, No. 21).
Induction Coil.	(Section H, No. 50).
Recording Tambour.	(Section C, Nos. 5–12).
Reaction Key.	(W227 or Section H).
Three-way Key.	(Section H, No. 8).
Electric Bell.	
Screen.	(W275).

W312.

The references given with the foregoing list of apparatus will perhaps help customers to select suitable instruments for their experiments.

PRICE. Tambour Board (as illustrated) **W312** £3 3 0

GALTON'S WHISTLE.

For testing the upper limits of audibility, made of nickel silver, with white ivorine scale of vibrations.

PRICE .. **W315** £1 10 0

STEADINESS TESTER.

The nickel-silver front plate, with 8 holes of from 12 mm. to 2.5 mm. is fitted to a heavy metal casting, thus ensuring stability while tests are being made.

The pointer has a nickel silver point so that good contact is made with the lightest touch at the sides of the holes in the front plate.

PRICE, complete as illustrated. **W320** £1 12 6

W320.

TAPPING BOARD. Whipple's pattern, consisting of a stout hardwood board 20″ x 4″, with brass plates 4″ square at each end ; these are joined to a central terminal for making the electrical connection. Tapping stylus has a vulcanite handle and is complete with connecting cord.

PRICE .. **W325** £1 5 0

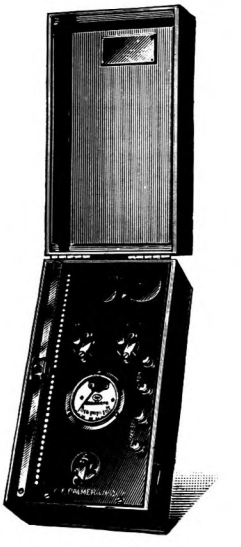
AUDIOMETER.

THE design of this instrument closely follows the Audiometer described by C. E. Seashore in 1899, and still recognised as one of the standard pieces of apparatus used by the Psychologist to produce and measure relative variations in the intensity of sound. The essential feature of this appliance is the use of the principle that for certain given relations between the primary and the secondary coils of an Induction Coil, the induced current varies directly with the number of turns of wire in the secondary coil.

In order that the variations of the intensity of sound shall follow the psycho-physics law the number of turns of wire in each of the forty sections of the secondary coil have been so arranged, and tappings brought out to numbered studs on the panel; contact with these is made by means of a slider.

To ensure that the current flowing in the primary coil is always constant, a variable resistance is in circuit with the cell and should be adjusted so that readings taken at the milliameter (shown in the centre of the panel) are always the same. Current is only taken from the cell when contact is made by the rotary key. With the closing of the contacts at the key, current is induced in the secondary coil and a click is heard in the telephone ear-piece, the intensity depending upon the number of turns of wire in the secondary coil as indicated by the slider. Switches are fitted so that the cell and the milliameter can be disconnected from the circuit.

When it is necessary to use a " tone " instead of the single click made by the rotary key, a Tone Unit, consisting of an electrically maintained tuning fork of 256 ~ fitted with double contacts and blocking condensers can be supplied.



W330.

Terminals are provided on the panel of the Audiometer for connection to the Tone Unit.

PRICE.			£	s.	d.
	Audiometer in hard wood case fitted with carrying strap and with telephone earpiece	**W330**	19	10	0
,,	Tone Unit 256 ~ for use with above Audiometer	**W331**	5	10	0

ACOUMETER. Politzer type, a simple instrument to produce a constant sound by means of metal hammer dropping on a metal rod from a fixed height.

PRICE .. **W335** £1 0 0

VISUAL RANGE OF ACCOMMODATION. The apparatus mentioned in " Practical Physiology of the Sense Organs " by R. J. Lythgoe. A light metal graduated slide 55 cm. with handle and provided with fixing for lens and test card.

PRICE .. **W340** £1 2 0

LOCALISATION OF SOUND. Simple arrangement of apparatus as shown in " Practical Physiology of the Sense Organs," consisting of Tuning Fork with sound box, Adjustable Tubes and Ear Pieces.

PRICE .. **W345** £4 15 0

We are always pleased to receive Enquiries for Experimental Apparatus.

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