

*The*  
**ROSS**  
**KINEMATOGRAPH**  
**PROJECTOR**

*S*  
Model "F.C."

**Hints to**  
**Operators**  
**and**  
**Spare Part**  
**Catalogue**



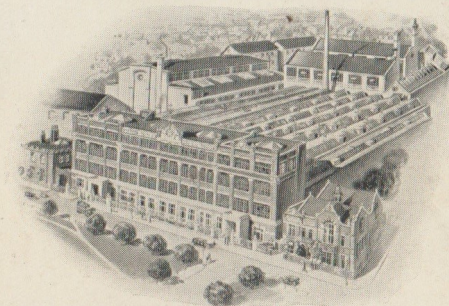
# *The* ROSS KINEMATOGRAPH PROJECTOR

*Model "F.C."*

---

SPARE PART CATALOGUE  
*and*  
HINTS TO OPERATORS

---



## ROSS LTD.

Manufacturing Opticians to His Majesty The King. Contractors  
to His Majesty's Governments, British and Colonial, also to  
Principal Foreign Governments.

CLAPHAM COMMON, LONDON, S.W.4.



*West End Showrooms :*

13 & 14, GT. CASTLE STREET, OXFORD CIRCUS,  
LONDON, W.1.

Telegraphic Address

“ROSSICASTE, CLAPCOM, LONDON.”

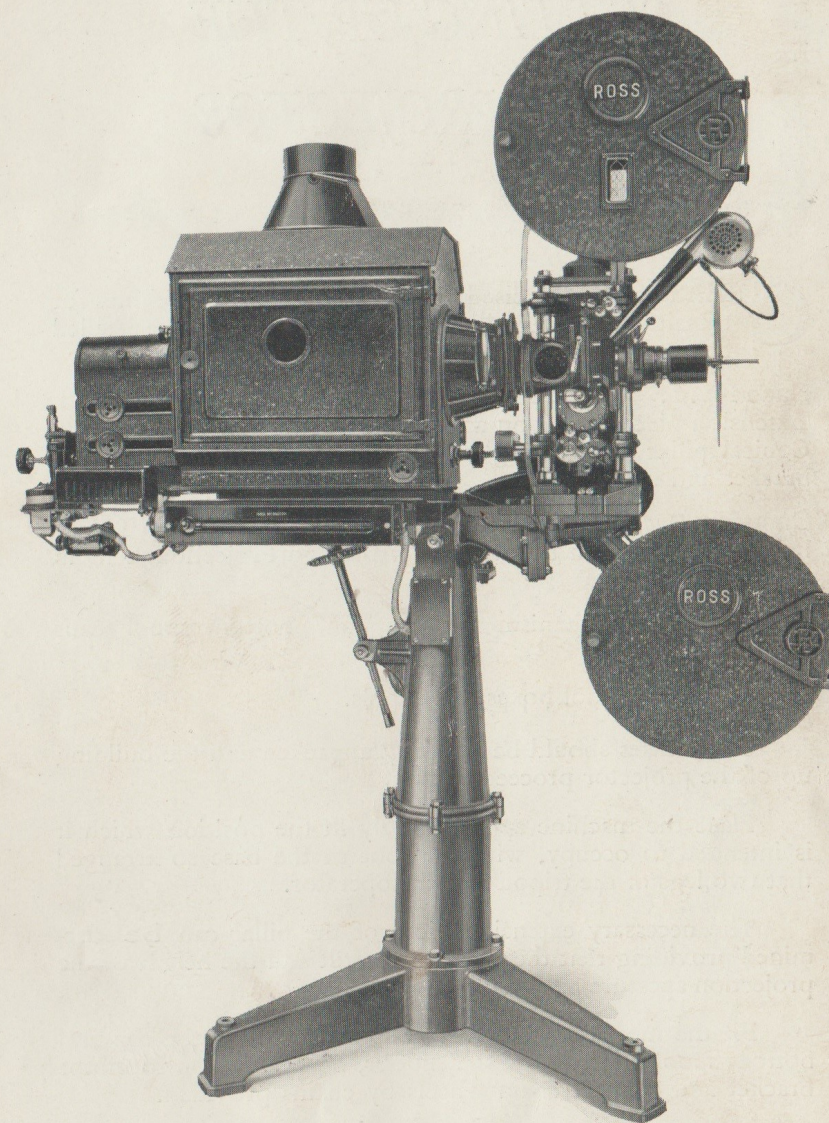
Telephone No.

BATTERSEA 3876, 3877.



## CONTENTS

Setting Up Projector	-	-	-	-	4
Care of Mechanism	-	-	-	-	5
Threading the Machine	-	-	-	-	11
Searchlight Arc Lamp	-	-	-	-	12
Useful Hints to Operators	-	-	-	-	16
Cinematograph Lens Table	-	-	-	-	37
Table of Fuses	-	-	-	-	38
Conversion Table—Centigrade to Farenheit	-	-	-	-	38
Melting Point of Metals	-	-	-	-	38
Abbreviations and Definitions of Terms	-	-	-	-	39



The ROSS Kinematograph Projector. Model "F.C."



## SETTING UP THE ROSS PROJECTOR

**G**REAT care is exercised in the packing of the machines for transit and they will arrive in four cases, as detailed below :—

**Case No. 1.** Tripod base is generally sent out unpacked. Extension piece bolted on and one spare extension piece loose. Conical pillar with tilting mechanism and table top. Motor bracket and motor.

**Case No. 2.** High Intensity Searchlight Arc Lamp in Lamp-house with junction boxes, 10" Mirror and Projection Lens in separate cases.

**Case No. 3.** Mechanism with top and bottom spool arms disconnected.

**Case No. 4.** Spool boxes and spools.

These cases should be carefully unpacked and the building up of the projector proceeded with.

Place the machine approximately in the position which it is intended to occupy, with the foot of the base so arranged that two legs of the tripod face the operator.

The necessary extension piece of the pillar can be determined providing that the angle of the tilt and the height of the projection aperture be already known.

Fit the mechanism to the table, and bolt on the top and bottom spool boxes. Fix the shutter, bolt motor on to motor bracket and connect chain wheels by chains provided.

Assuming that everything is properly adjusted, nothing further remains but to tighten up all the nuts on the stand and the table top, and the machine is now ready for use.

## CARE OF THE MECHANISM

**E**VERY projectionist will realise that the projector demands the utmost care if it is to render a good picture, and long and satisfactory service.

Cleanliness, and a sufficiency of lubrication are the two first considerations, and not until these things are attended to can the machine be expected to give the service demanded of it.

Any adjustment which it becomes necessary to make should receive most careful consideration and if there is any doubt about the matter, the services of the makers should be called upon.

ROSS LTD., are always glad to render assistance to anyone with a Ross installation under their care, and it is by such co-operation that they have gained the reputation which they enjoy. Become familiar with your machine, and tend it carefully. Overnight or at times when it is not in use, it is advisable that the whole machine be covered up so as to prevent as far as possible the settling of dust upon the working parts.

Before the daily run, the machine should be thoroughly gone over with a clean cloth to remove all surplus oil and dust, which is bound to collect during the course of the day, particular attention being paid to the traps of the spool boxes where the accumulation of dust is apt to scratch the emulsion surface of the film.

11 clean

All rollers upon which the film bears should be kept clean, and it should be also seen that these revolve freely.

It is obvious that if a roller be allowed to clog and remain stationary for any length of time, a flat will develop upon it due to the constant friction of the film over the portion on which it bears.



The whole track of the film should be watched and one should assure oneself that the emulsion surface of the film does not come into actual contact with any portion of the metal surfaces of the Gate or film traps during its passage into the lower spool box after passing through the mechanism.

Oil holes are provided in the most conspicuous places, to supply all bearings and gears.

After the machine has become thoroughly run in, oiling should take place at least once per day, and it should be done systematically from the highest lubricated point on the projector which is the spindle bearing of the upper spool box, to the lowest, which is the oil hole to the lower or take-up spindle, in order to ensure that no oil hole is missed.

Regular and constant oiling greatly adds to the life of a projector.

The supply of oil to the maltese cross box is of vital importance, as this houses the heart of the projector, which simply must receive an efficient and regular supply.

The special provision of an air valve has been made on the maltese cross box, and when this is released, no difficulty will be found in pouring a sufficient quantity of oil into the box which should be always kept filled.

The Cross Box should be drained of oil occasionally by releasing the drain plug and filling cap. This practice makes certain that the supply of oil to the box is always clean. In addition to these precautions regarding the lubrication of the working parts of the projector, care ought to be exercised in keeping the surplus oil wiped off, as dust amalgamating with surplus oil is apt to find its way into the various bearings to which damage will result by abrasion, and possible seizure.

The use of a proper grade of oil with the correct degree of viscosity cannot be over emphasised, and on no account should any other grade than that supplied by the makers be used, because its properties have been carefully tested, and the right degree of refinement obtained for its use on the Ross Projector.

A considerable amount of dust from the films will be found to accumulate in the upper spoolbox, and on those parts of the mechanism in close proximity to the gate. This should be removed as soon as possible to prevent it finding its way into the working parts. Paraffin will be found to be a useful

agent in cleaning the oil ducts and bearings periodically, but great care must be exercised in its use.

Paraffin may be squirted into all the oil holes, and the machine should then be given a very slow run in order to ensure that the oil will run through the bearings.

After allowing the paraffin to drain off, and be dried up clear of the mechanism, a very copious oiling should be given, while the machine is being run again slowly. This is to make sure that lubrication is again complete, and no trace of paraffin should be allowed to remain, as it possesses corrosive qualities which are liable to injure the mechanism.

Care can best be taken of the sprockets by the frequent application while running of a stiff tooth brush to the teeth. This will keep them free from dust, wax, or small particles of emulsion which are known to interfere with the steadiness of the picture if allowed to accumulate on the intermittent sprocket.

It is possible to obtain small brushes with fine wire hair. This will be found to suit the purpose admirably providing that the hair be not too coarse.

The take-up mechanism is a part which requires careful attention if it is to be expected to function perfectly.

Oil should not be allowed to get into the friction plates and leather washer, as this results in a jerky movement to the action of the take-up at the commencement of a reel, and possible failure to carry the full load of film towards the end of a reel.

The spring tension to the take-up mechanism has also a bearing upon this matter, and should be adjusted so that it allows a complete reel to be re-wound on to the spool without lag towards the end when the spool is becoming fully loaded.

It will be seen that jerkiness of movement in the first place, and lag in the second place will be harmful to the film, by dragging it over the lower sprocket. This however, can be thoroughly avoided in Ross take-up by careful attention to the above details.

Considerable trouble is sometimes experienced with the accumulation of emulsion on the pressure springs and gate plate.

This invariably happens when new copies are being run, and even in cases where these are previously waxed, the deposit appears when most of the wax has been worn off.



Emulsion deposit is best removed by use of a copper coin, or special tool made of brass, the edges of which are kept reasonably sharp. The application of water to an exceptionally tenacious deposit of emulsion has the effect of softening same, so that a damp cloth will be found to be most effective in keeping the gate free from deposit, but the pressure springs and gate plate should be rubbed over with a little tallow or wax after such operation so as to keep down the formation of deposit as much as possible.

The cleaning of the optical system is an operation which should be executed with the greatest of care.

Take the Mirror of the Searchlight Lamp to start with.

This is best cleaned by complete removal from the gimbal in which it is housed, and the fine carbon dust blown from surface and rim of the backing where it will be found to have collected. The dust may also be removed by use of a very soft brush.

When this is done, the mirror can be rubbed gently over with a clean piece of cambric soaked in a solution of Wood Alcohol to which an equal quantity of water has been added. This will remove all surface deposit, and will not evaporate too quickly, thus allowing a final polish to be given by a further piece of well washed cambric.

The same method can be applied to the cleaning of the Negative lens which is easily removable for the purpose.

With regard to the Projection lens, no dust should be allowed to remain on the lens surfaces and finger marking should be avoided as much as possible.

It is surprising how dust, if allowed to collect on a lens, has the effect of dispersing and absorbing the light on its passage to the screen. The lens barrels are absolutely dustproof and it will be seldom, if ever, necessary to remove the lens components for the purpose of cleaning the inner surfaces.

Never, if it can be avoided, endeavour to unscrew the lens components, as these are carefully adjusted before being sent out from the works. If, however, it should become necessary, great care should be taken to note the manner in which the components are fitted in order that they can be replaced in the correct manner.

Do not use tissue on any account for cleaning, or even silk; the best material has been found to be old pieces of cambric which have been well washed. These should be kept in a place free from dust.

In cleaning the lens a slight application of diluted Wood Alcohol carefully rubbed in a circular motion will remove all scum from the surface, after which the final polishing should be done with a further piece of cambric, using the same circular motion.

Cover your lenses when not in use; they are valuable pieces of work, and this little tip will save your lenses a great deal in the long run.

An occasional minute inspection of the wearing surfaces of the sprockets should be made, especially those of the intermittent, as these are heavily taxed by doing the work of pulling the film through the gate against the action of the pressure springs.

When sprocket teeth do show signs of hooking or undercutting, this is a clear case for replacement.

The judicious adjustment of the spring tension on the gate is a point which in many cases does not obtain the attention it deserves. When the functioning of these parts is considered, the importance of careful adjustment will readily be seen.

The first duty of the skates is to bring the film to a dead stop in front of the gate aperture when the intermittent stops, and their second duty is to hold the film perfectly flat over the gate aperture during this period of rest.

If the tension on the skates is too weak it will be seen that the rapidity with which the film is drawn through the gate will cause it to "overshoot" the aperture, or in other words, the film will not come to rest at the exact moment when the intermittent stops, but will continue slightly after the sprocket stops. The effect is a very unsteady or dancing motion on the screen.

Too much tension has the effect of causing unnecessary wear on the intermittent mechanism, and heavy wear upon the sprocket holes in the film. It is possible even for the sprocket holes to be split, thus making it impossible for a steady picture to be obtained from that particular copy.

Efficient means of adjustment are provided on the Ross Machine and it is considered advisable always to run with the least possible amount of tension consistent with a steady result



on the screen. Under no circumstances apply the full amount of tension if the film continues to show unsteadiness, as it is found in most cases that unsteadiness is due to printing or camera work.

Sprocket Rollers on the Ross Projector are adjusted so as not to bear down upon the film, and this adjustment should always be maintained while frequent examination is made to determine that the rollers revolve freely.

The Arc Lamp mechanism should be kept free from dust and carbon grit by the frequent use of a soft brush or pair of bellows, and the lubrication of the working parts should receive attention from time to time.

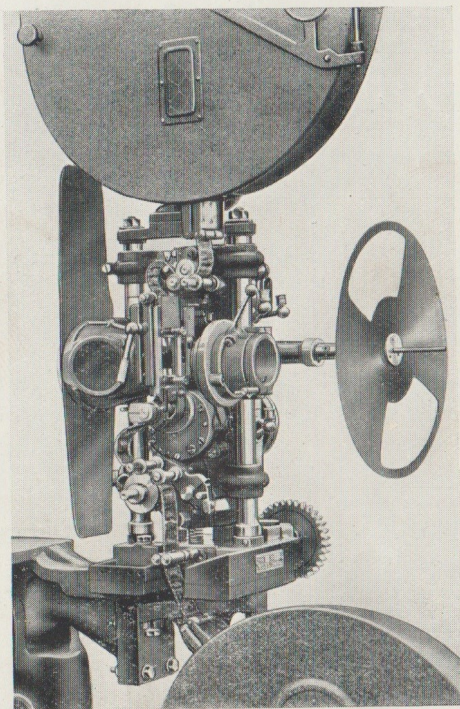


Photo of Threaded Mechanism.

## THREADING THE M A C H I N E

THE operation of threading the film on a Ross Projector is an extremely simple one, as can be seen from the photograph on the opposite page.

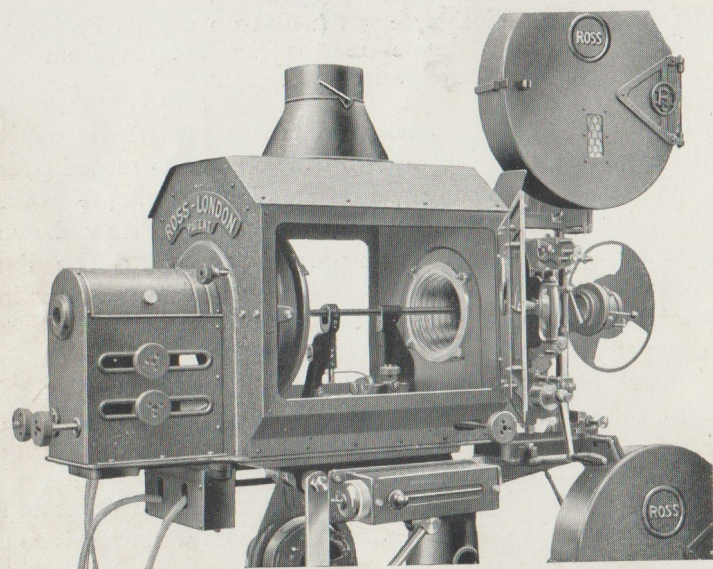
The loaded spool is placed on the spindle of the upper spool box, and the spring catch on the spindle is turned over after the spool has been engaged on the pin projecting from the flange against which the spool rests. The film is now drawn through the trap and the upper spool box closed. The film having been engaged upon the feed sprocket which revolves in a clockwise direction, is now placed on the film track in the gate and engaged upon the intermittent sprocket, care being taken to allow the requisite loop above the gate which can be closed by lowering the actuating lever with the right hand while the film is being held in position with the left.

A further loop is left below the intermittent sprocket and the film is attached to the lower sprocket, from whence it is run over the idler roller and through the film trap into the lower spool box.

Sufficient lead should be allowed so as to make sure that a taut hold is secured upon the take-up spool, and it is always a wise precaution to attach to each reel a lead of blank film at least three feet in length, thus to avoid as far as possible the handling of the front ends of the actual copy, which are often found to be mutilated through rough usage in threading up.

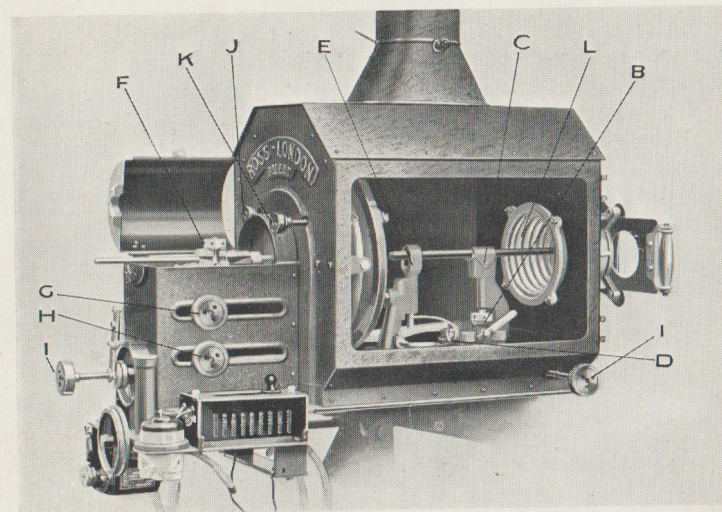


# THE SEARCHLIGHT ARC LAMP



## OPERATION.

When it is intended to run this lamp on low amperage, it is advisable to use 14 mm.  $\times$  12" S. A. Positive Carbons in conjunction with 9 mm.  $\times$  9" S. A. Negative Carbons: 20 to 30 amps. will be found to produce excellent results providing that the voltage across the arc be adjusted to about 50 or 55. This point of using the correct carbon combination and arc voltage is of the utmost importance in obtaining correct results, and being the outcome of practical experience in the use of the lamp, it should be adhered to as nearly as possible.



In order to insert the Positive carbon, slacken off the clamping screw *B* and rack the feed back to its fullest extent; insert the carbon through the rear compartment and mirror and through the Locating Pillar *E* after depressing the spring *D*. Now push the carbon through the clamp *C*, and after leaving about  $1\frac{1}{4}$ " of carbon projecting through the locating pillar *E*, tighten up the clamping screw *B*.

The negative carbon is first inserted into the holder supplied, care being taken to push it completely through the small brass collet inside the holder, and to tighten up firmly the screw collar which secures the carbon to the holder.

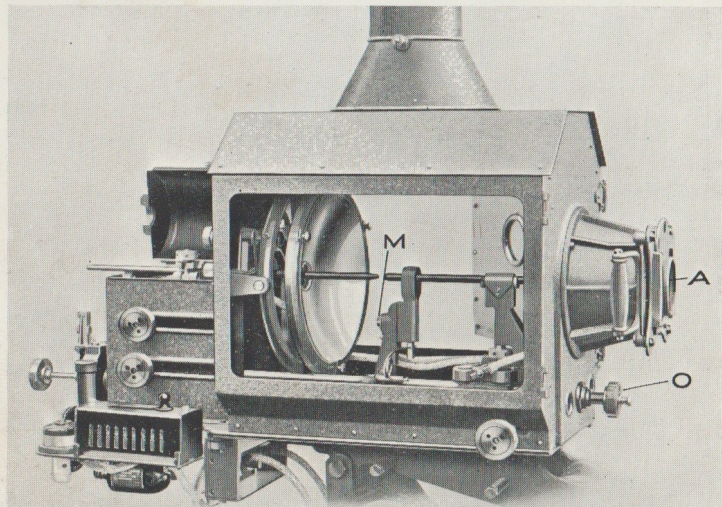
Now insert the holder into the lamp, pushing the negative carbon through the hole in the centre of the mirror until the tip of it comes to rest within  $\frac{1}{2}$ " of the positive carbon.

Tighten up the clamp *F* located under the cover of the rear compartment of the lamp house, upon the steel bar of the holder and by means of the movements from the handles *G* and *H* centre up the negative carbon to its correct position in front of the positive.

The arc may now be struck, and the light focussed upon the gate in the following manner: Move the arc mechanism by means of Handle *O* till it is observed that the Feed Handle *I* is centrally situated in the slot provided for its movement with the carriage of the lamp. Now direct the beam upon the gate by



adjusting the mirror with handles *J* and *K* and the focus will be found to be correct when by opening the lamp house door the beam will be observed to fill the negative lens without striking any part of the internal cone *L*. In order to bring more carbon into use when the feed is nearing its limit it is only necessary to release the clamp screw *B*, rack the feed back, and after slacking off the clamp screw *F* move the negative carbon holder forward, re-tighten the clamps and the lamp will be found to be left in focus.



## HIGH INTENSITY.

11 mm.  $\times$  12" High Intensity Positive carbons in conjunction with 8 mm.  $\times$  9" High Intensity Negative carbons will be found to be a good combination for use on a current density of 50 to 70 amps. Indeed this is a good all-round combination for general High Intensity purposes. But for amperages ranging from 70 to 100 amps., 13 mm. or even 14 mm. Positive and 9 mm. Negative carbons become essential.

In such cases it is necessary to readjust the locating pillar in the following manner :—

Slacken the Nut *M*, insert the carbon firmly in the clamp. Now depress spring *D* and while holding it thus tap down the locating pillar head until the carbon makes good contact with

the top of the aperture of the locating pillar. Tighten up the Nut *M* again and the adjustment is correct if there is no movement of the carbon when the spring is released and the plunger comes up against it.

The latter adjustment should be carefully made, as unless the perfect alignment of the carbons is obtained the positive carbon will break when the feed is nearing its limit.

The voltage across the arc when High Intensity is being used should be about 32, and it is very important that this matter should receive the operators' careful attention.

ROSS LTD. supply a special type of resistance which makes the conditions of rapid change over from low to high intensity simple and ideal. The advantage of such a resistance will be appreciated after close observation of the photograph and particulars given in separate Catalogue.

## CLEANING AND CARBONING.

The utmost cleanliness is essential to the perfect functioning of the searchlight lamp and its mechanism and the cleaning of the Mirror and Negative Lens should receive the daily attention of the operator.

This is best done with the aid of some old pieces of cambric which have received repeated washings, or an old pocket handkerchief will be found to suit the purpose admirably.

The application of Wood Alcohol which has been diluted with water will be found to remove Carbon deposit and greasy finger marks easily, after which the surfaces may be polished with clean cambric. Carbon dust and deposit should never be allowed to accumulate in the cowl or upon the mechanism of the arc, but should be frequently removed by means of a soft brush specially kept for this purpose.

Provision is made for the lubrication of the working parts, and the application of a dry lubricating medium such as graphite is recommended for the steel runners and worm gearing of the Feed Mechanism.



## USEFUL HINTS TO OPERATORS

THE Diameter of Carbons is a matter of great importance, and unless the correct carbon combination be used in accordance with the conditions of electrical supply, economy and efficiency cannot be expected.

It will pay you to adhere strictly to the sizes recommended by Ross Ltd., for use in their Arc Lamp.

Carefully examine Carbons before setting up for use in the Lamp, and discard those which show signs of flaw, or imperfect core.

It is essential that carbons be stored in a very dry place, and it is also beneficial to subject them to a gentle heat for some time before use.

An occasional check of the Arc Voltage is advisable, and this is best done by connecting a voltmeter across the Positive and Negative Carbons, or Arc Terminals, while in use.

Keep clean and examine all resistance connections regularly. It is a good plan occasionally to remove terminal connections and clean with sand paper. Metal oxidises under the action of heat, and if the connections are left too long without attention, trouble is bound to ensue.

Care of the film is a matter which is now often the subject of lively discussion. The emulsion surface is a very delicate one and is easily damaged by abrasion, while the film stock itself is easily damaged if it be handled carelessly. Get into the habit of handling a film by supporting the edges between the fingers. This will go far towards avoiding finger marking and scratching. Insist upon the films being stored in dust proof cases, and endeavour to keep out dust absolutely from the rooms in which films are handled. Insist upon slow rewinding, and on no

account allow tightening of the reel by holding the spool and drawing the film by hand, since this last action is considered one of the direct causes of scratching due to the fact that the film surfaces are damaged by the friction of small particles of grit or dust when the various layers of film slip one over the other.

In jointing see that the overlap is cleaned free of all emulsion and apply film cement, not excessively but by one clean sweep of a camel hair brush. A good formula for film cement is—

Amyl Acetate .. ..	6 ozs.
Acetone .. ..	4 ozs.
Glacial acetic acid ..	1 oz.

This should be mixed for use in the above proportions, and a small quantity kept for immediate use in a tightly stoppered bottle. The remaining stock should be kept in a sealed bottle, which is best done by floating the cork and bottle neck with molten paraffin wax. Punching holes in the film or sticking paper on the surface as a means of signalling part ends for the purpose of changing over is a practice which is to be condemned. An alternative and not injurious method is to paint over the perforations a narrow white line, with the aid of a small camel hair brush, and Messrs. Reeves' "Poster White," which is a form of water colour which dries quickly and is easily removed if necessary without injuring the film.

Beware of spools which through rough usage have become buckled, as these in use, are liable to cause the film to rub against them or nip the film at each revolution.

It is better never to overload a spool for the sake of saving time in threading by having to use single reels. By this is meant that if two parts of a film can be got on to one spool, that spool should never be allowed to be loaded so that the film is protruding above the sides of the spool.

### MEASURING FILM.

The Ross Projector passes one foot of film to every two revolutions of the lower sprocket, so that the exact number of feet contained in a reel can be determined by counting the revolutions of the sprocket while the film is being run through and dividing the product by two.



The actual running speed can also be determined by counting the revolutions for a period timed by watch. Speed indicators or revolution counters can be obtained for a moderate sum and one of these instruments will be found very useful in the projection room.

*Take Up.* When the take-up washer and friction discs have worn smooth, and if oil has found its way into the leather washer, it is advisable to take the take-up mechanism down and remove the washer, steep it in paraffin for a while and then grip it tightly in a vice to press all the oil and paraffin out of it. The surfaces of the friction discs can now be cleaned with paraffin and after being thoroughly dried, they can be slightly scored by the use of a little coarse emery rubbed in a criss-cross manner. The take-up mechanism if now refitted will be found to grip tightly and allowance will have to be made for the application of much less tension.

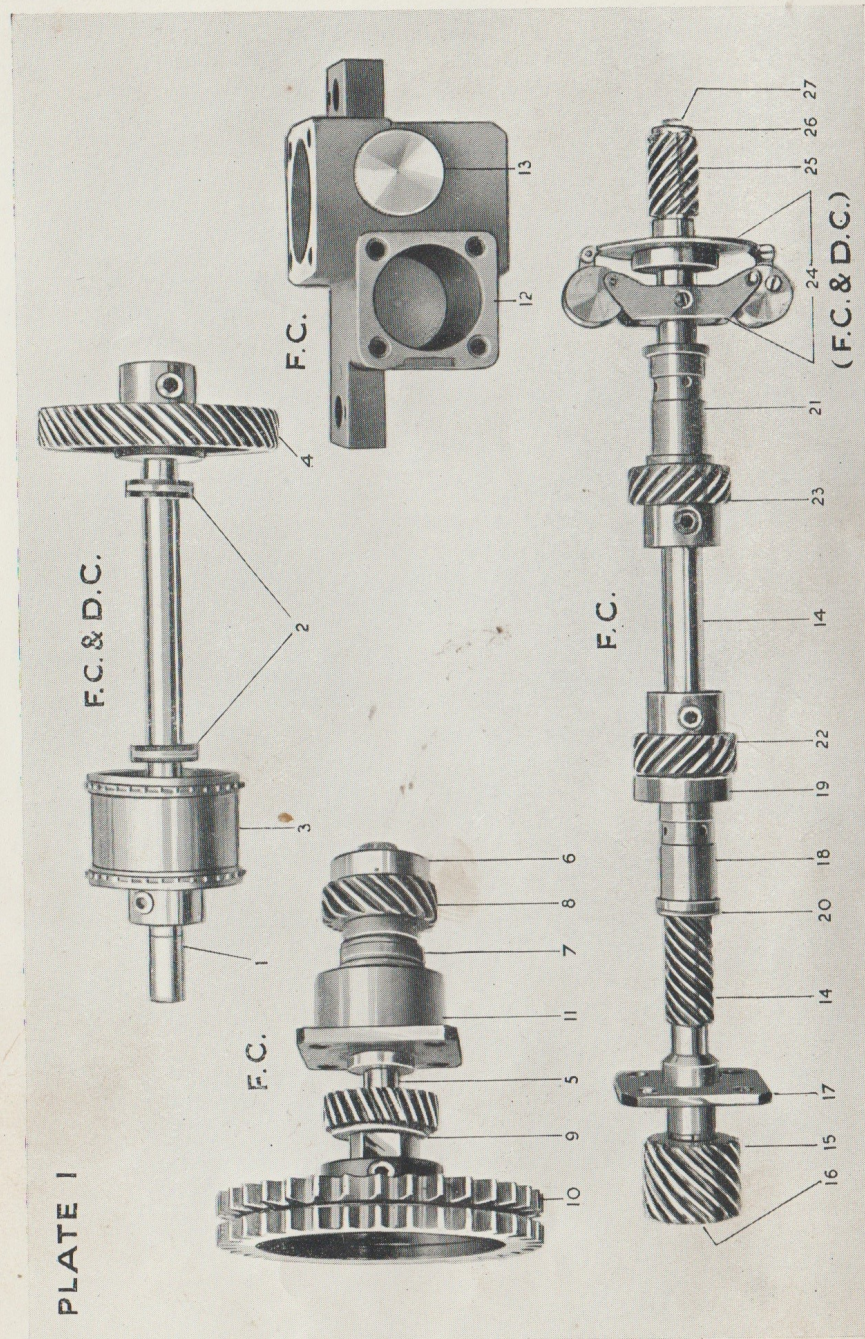




PLATE 2

F.C. & D.C.

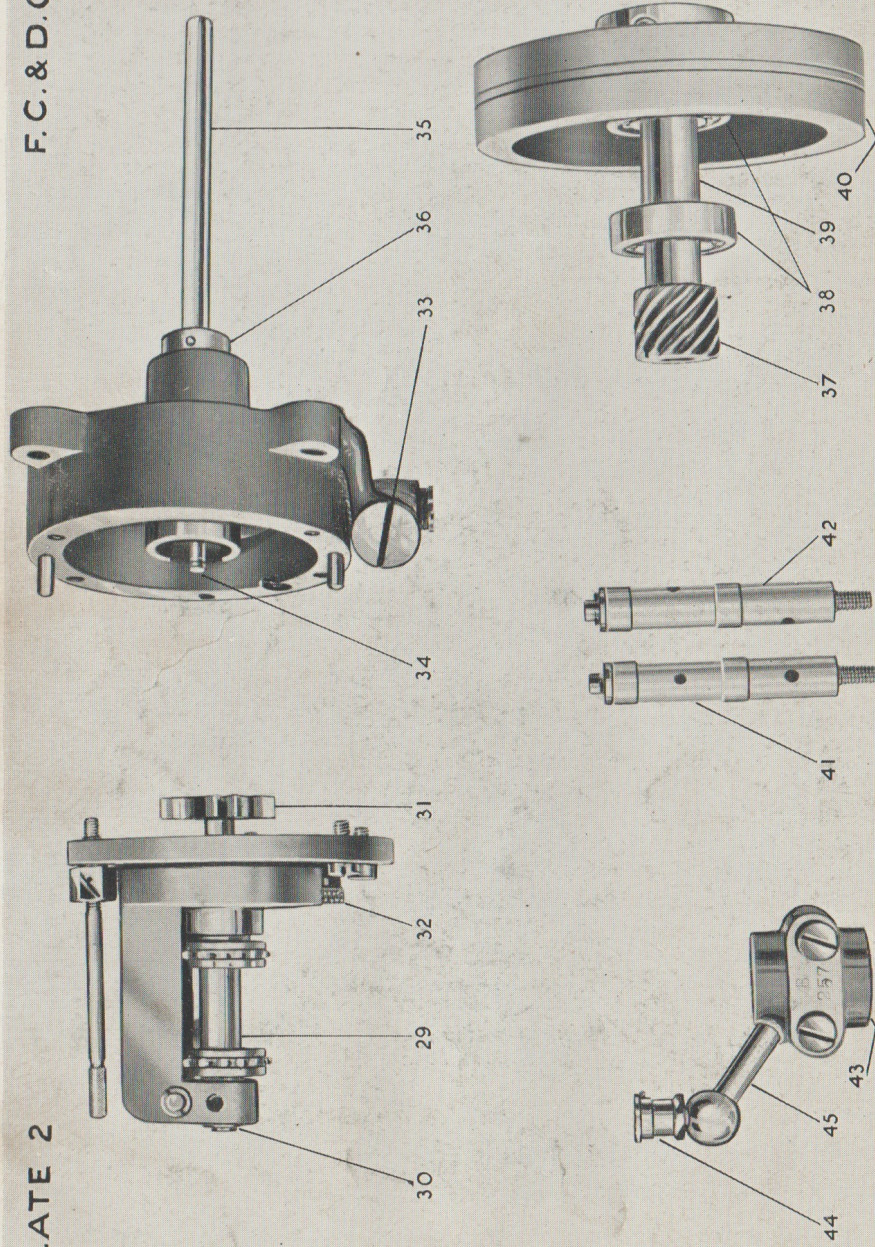


PLATE 3.

F.C. & D.C.

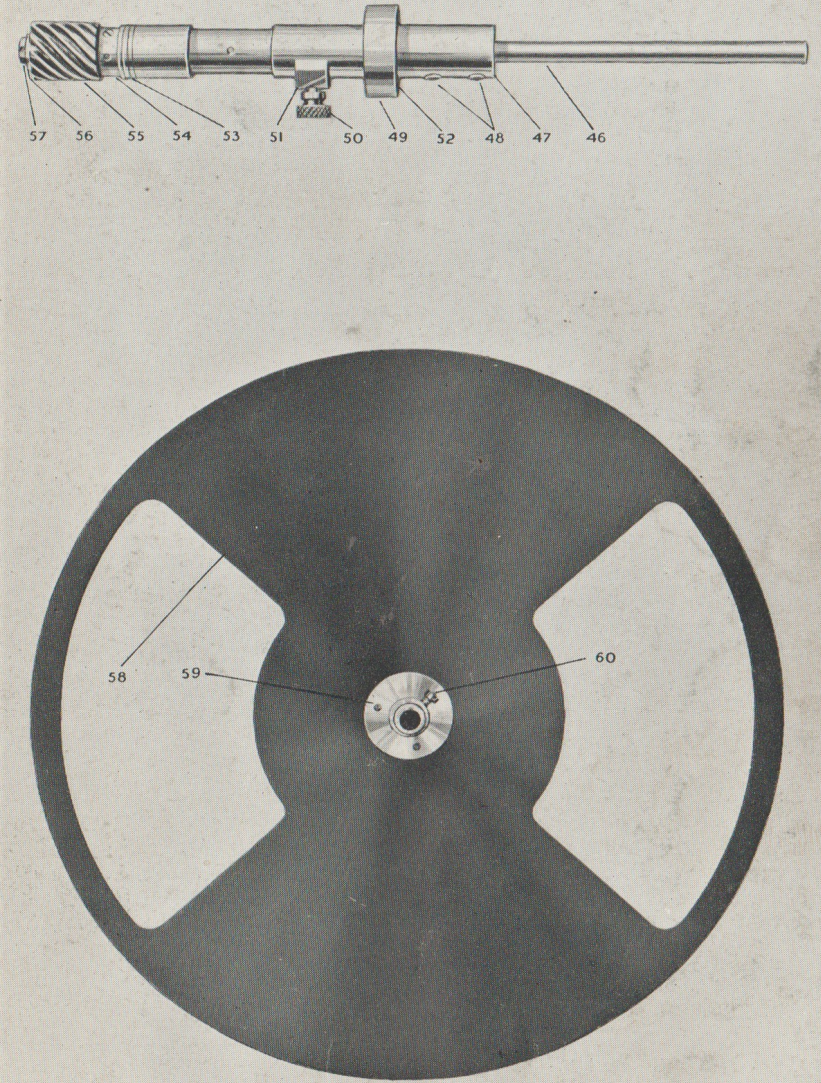




PLATE 4

F.C. & D.C.

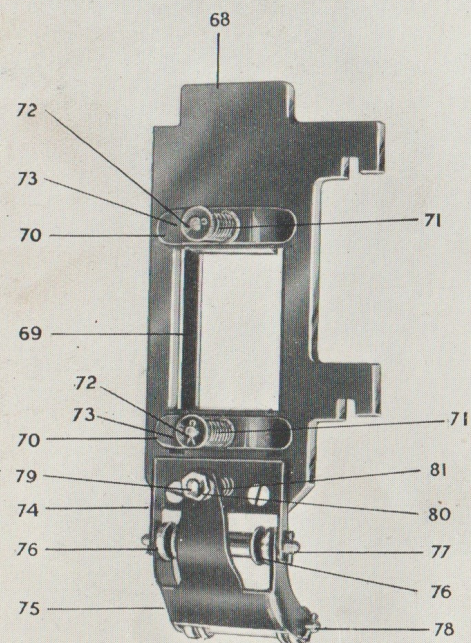
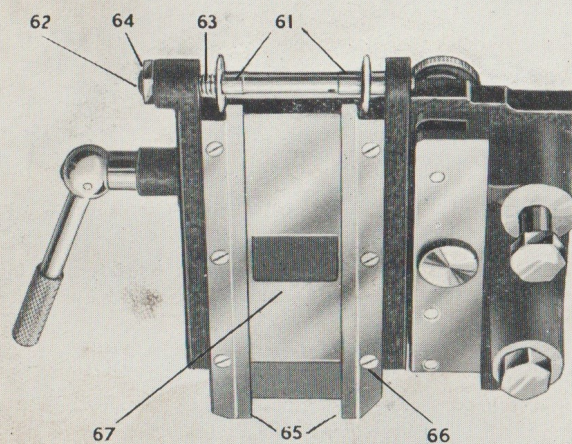
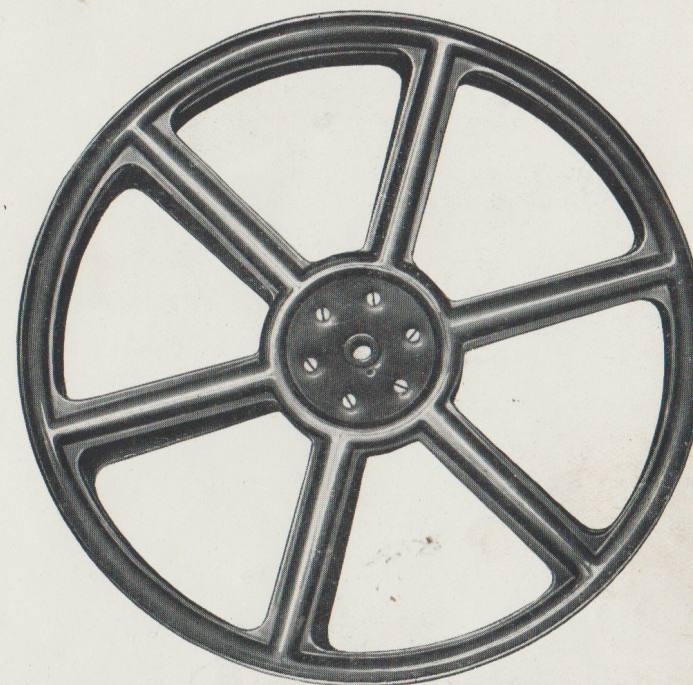


PLATE 5

F.C. & D.C.



90

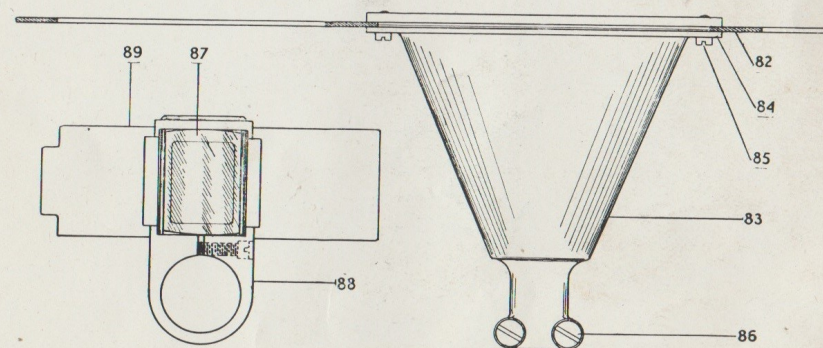
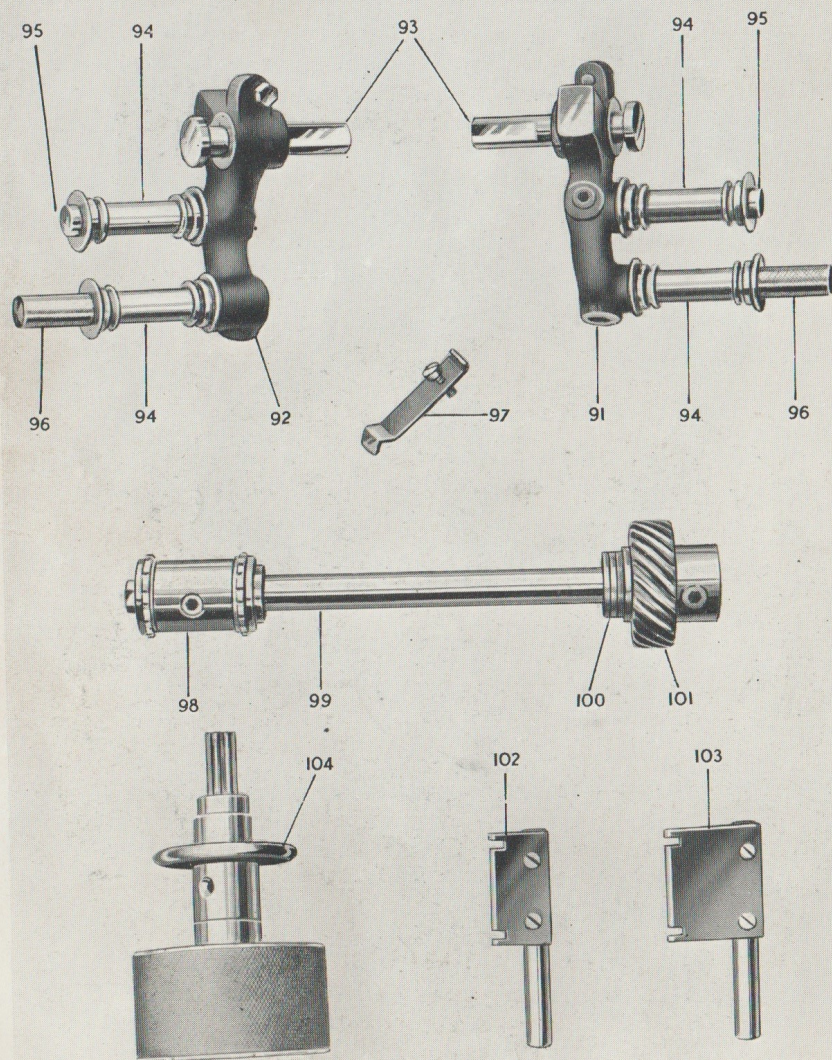




PLATE 6

F.C.&D.C.



F.C.&D.C.

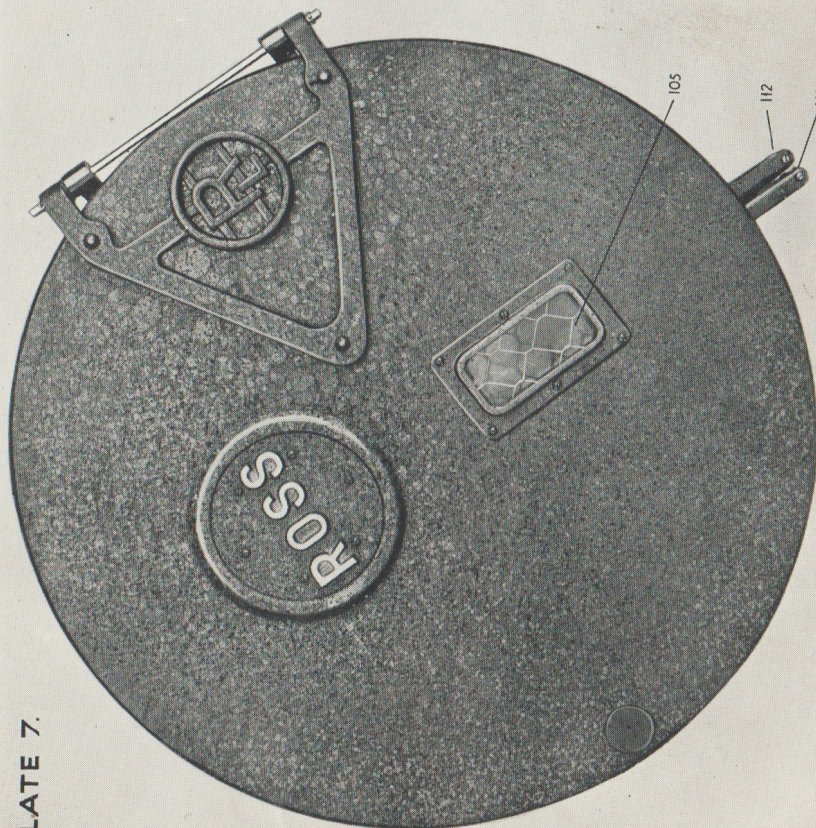
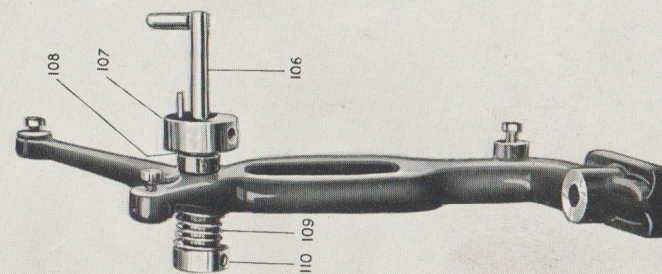
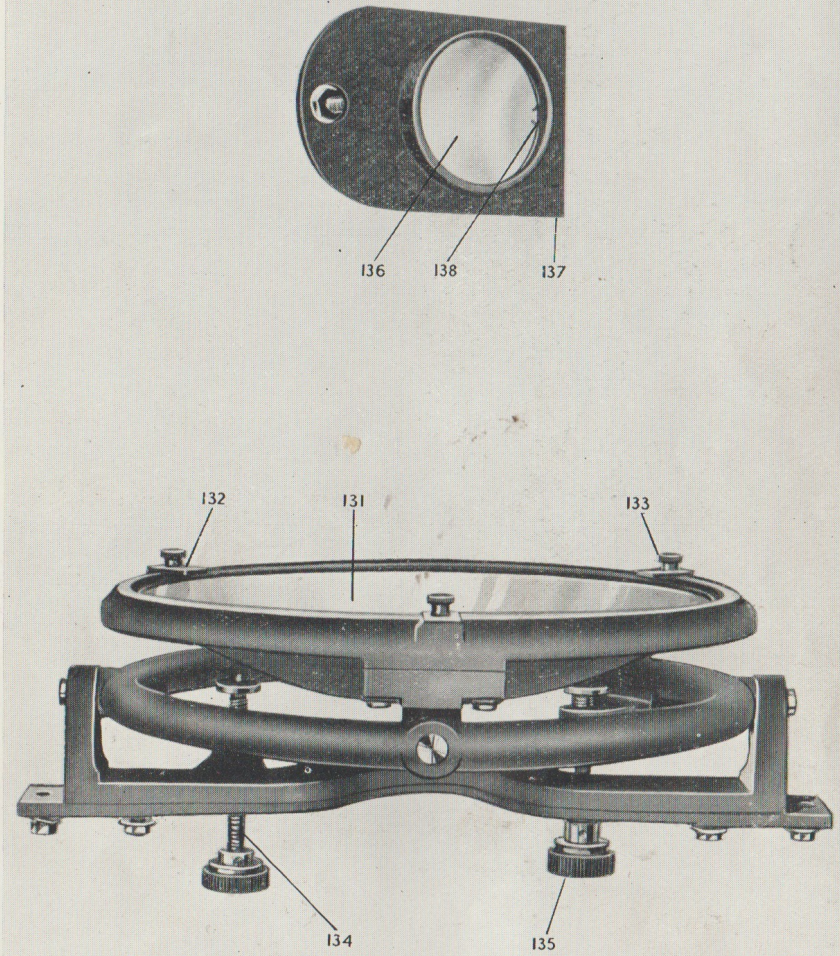
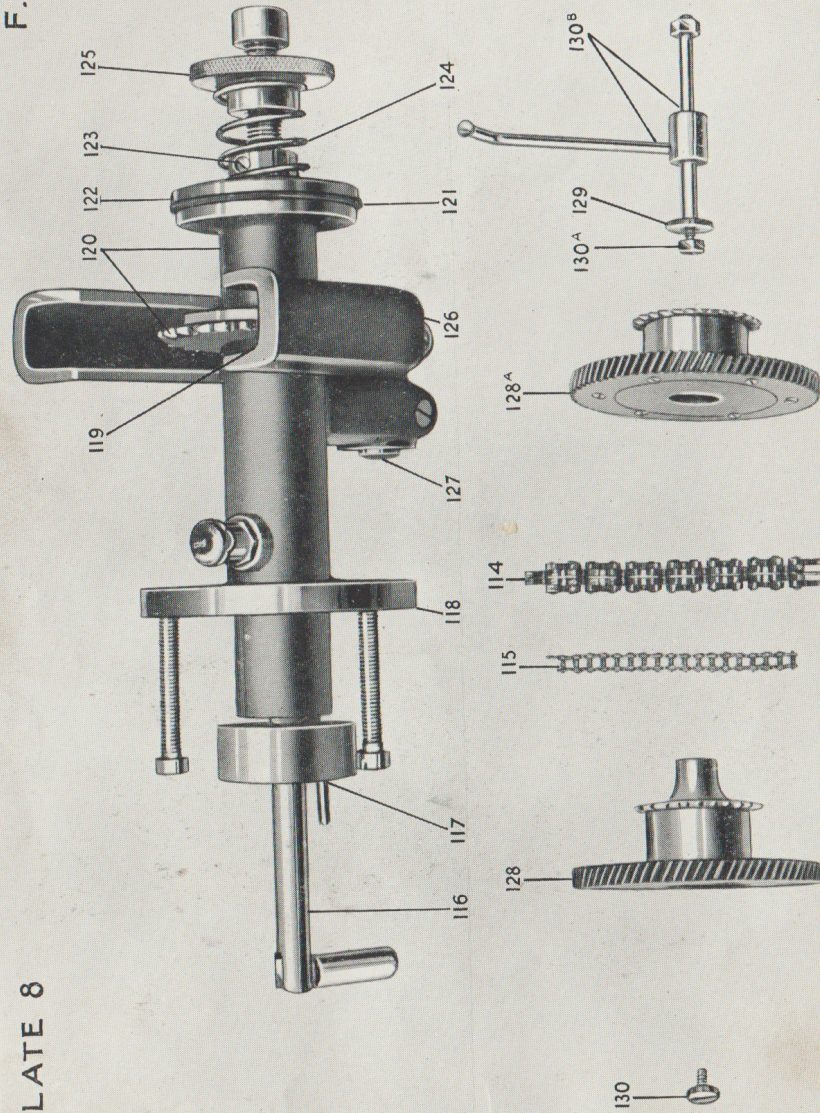
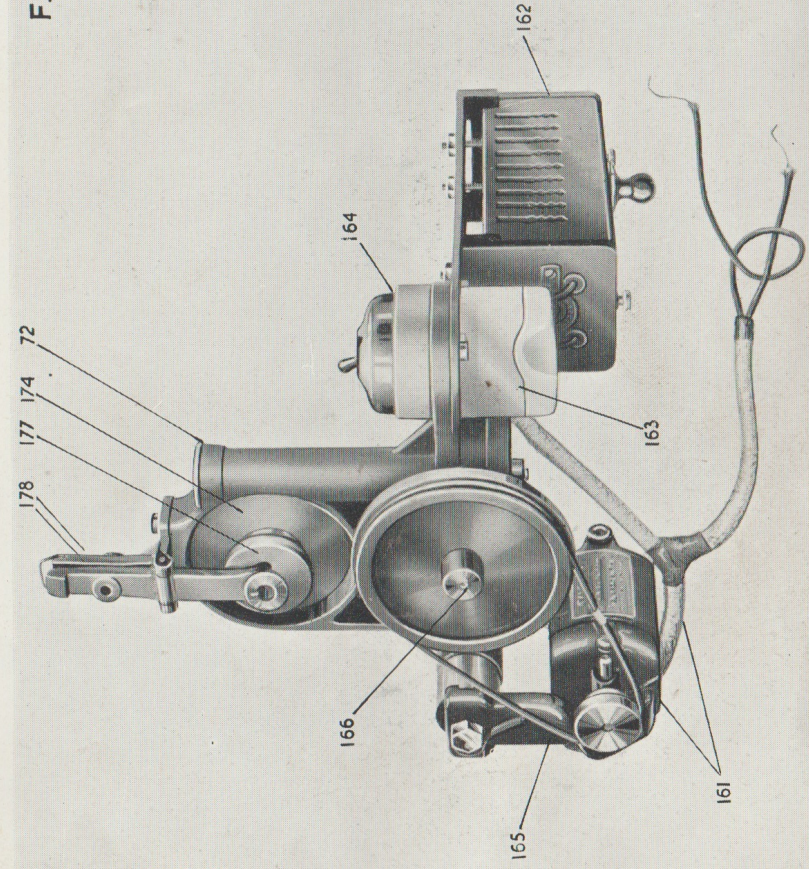
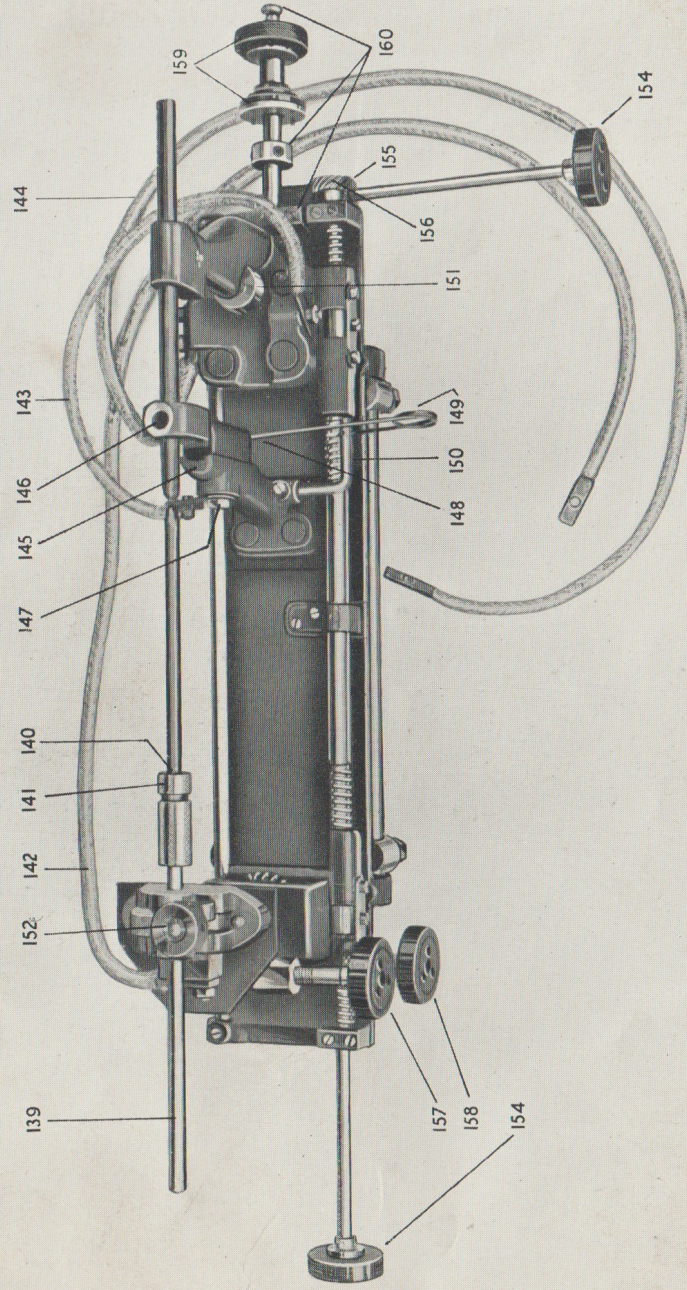


PLATE 7.

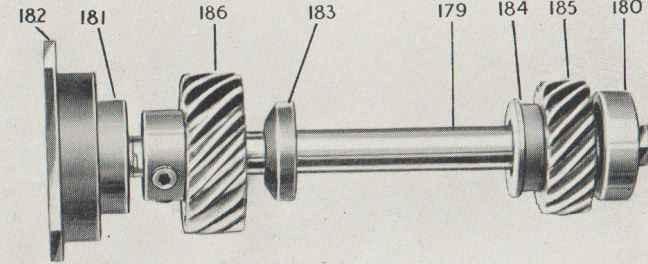
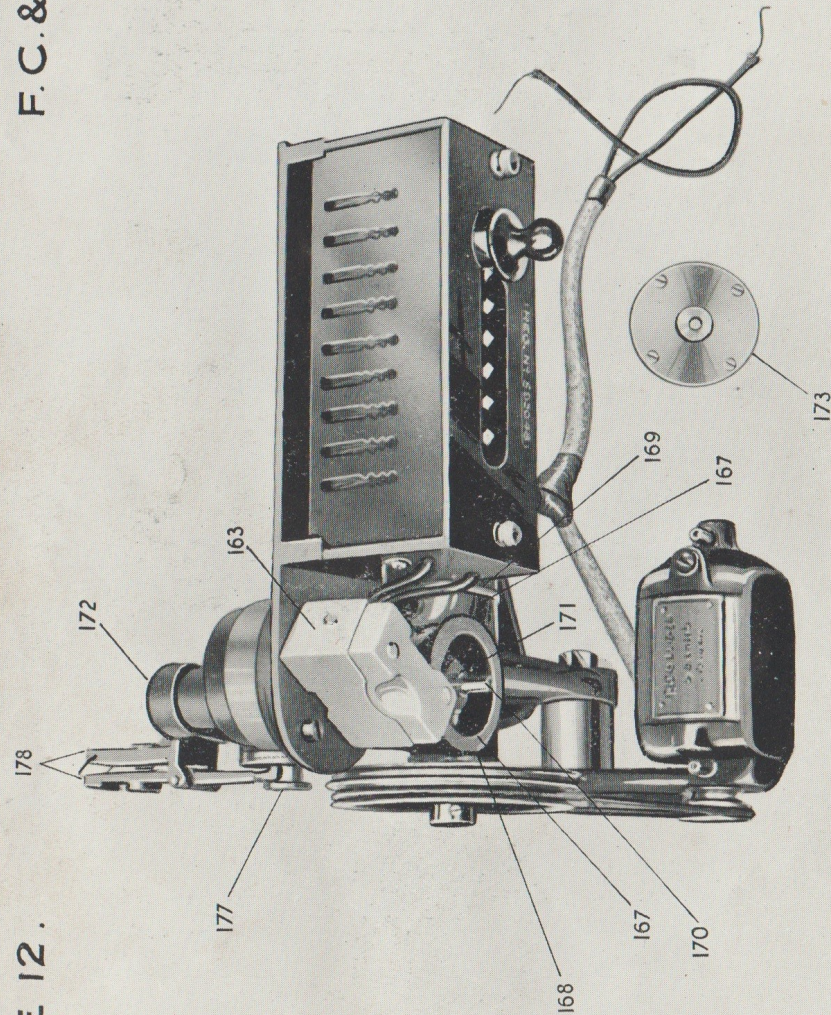




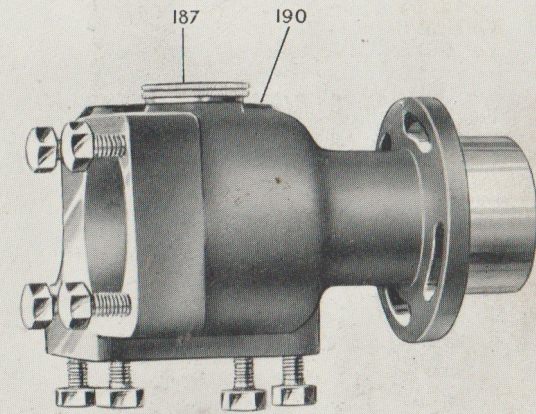




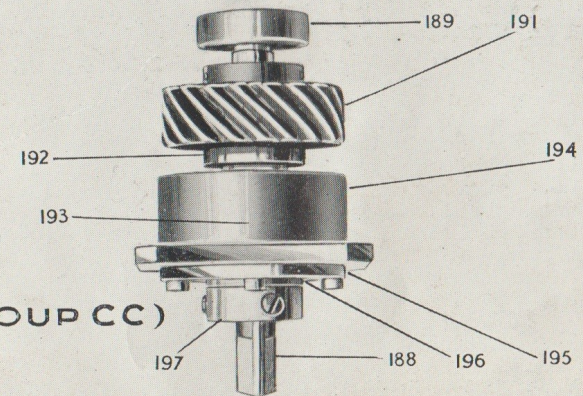




(GROUP AA)



(GROUP BB)



(GROUP CC)



## PLATE No. 1.

No.	DESCRIPTION	£	s.	d.
1	Bottom Sprocket Spindle ... ..	7	6	
2	Bottom Sprocket Spindle Ball Thrust ... ..	3	6	
3	Bottom Sprocket with Screw ... ..	1	5	0
4	Bottom Sprocket Spiral Gear with Screw ... ..	16	6	
5	Drive Spindle with Screw and Washer ... ..	19	6	
6	Drive Spindle Radial Ball Bearing ... ..	7	0	
7	Drive Spindle Ball Thrust ... ..	6	0	
8	Drive Spindle Spiral Pinion (Inner) ... ..	19	0	
9	Drive Spindle Spiral Pinion (Outer with 2 Screws) ... ..	1	1	6
10	Drive Spindle Chain Wheel with 2 Screws ... ..	2	0	0
11	Drive Spindle Bearing Bush with 4 Screws ... ..	1	1	3
12	Drive Spindle Gear Box ... ..	1	12	0
13	Drive Spindle Gear Box Oil Cap ... ..	2	0	
14	Vertical Spindle ... ..	2	10	0
15	Vertical Spindle Bottom Gear ... ..	12	6	
16	Vertical Spindle Bottom Gear Screw ... ..			6
17	Vertical Spindle Gear Box Bearing ... ..	16	0	
18	Vertical Spindle Bearing Bush (Bottom) ... ..	16	6	
19	Vertical Spindle Bearing Bush (Bottom) Ball Thrust ... ..	6	0	
20	Vertical Spindle Bearing Bush (Bottom) Thrust Washer ... ..	1	6	
21	Vertical Spindle Bearing Bush (Top) ... ..	6	6	
22	Vertical Spindle Cam Spiral Gear with Screw ... ..	19	0	
23	Vertical Spindle Shutter Spiral Gear with Screw ... ..	19	0	
24	Vertical Spindle Safety Shutter Control ... ..	3	0	0
25	Vertical Spindle Top Spiral Pinion ... ..	19	0	
26	Vertical Spindle Top Spiral Pinion Washer ... ..	2	0	
27	Vertical Spindle Top Spiral Pinion Screw ... ..			3

## PLATE No. 2.

28	Air Valve ... ..	2	6	
29	Intermittant Sprocket with 2 Screws ... ..	2	0	0
30	Intermittent Sprocket Bracket Bush ... ..	4	6	
31	Maltese Cross ... ..	2	8	6
32	Drain Plug with Leather Washer ... ..			6
33	Filler Screw with Leather Washer ... ..			6
34	Cam Pin and Roller ... ..	5	0	
35	Cam Spindle with Cam Pin and Roller ... ..	3	5	6
36	Cam Spindle Collar with Pin ... ..	2	6	
37	Cam Spiral Pinion ... ..	2	8	0
38	Cam Spiral Pinion Radial Ball Bearing ... ..	6	6	
39	Cam Spiral Pinion Collar ... ..	2	0	
40	Flywheel with 2 Screws ... ..	18	0	
41	Mechanism Base Roller ... ..	4	0	
42	Mechanism Base Roller Stud with Washer and Split Pin ... ..	2	6	
43	Vertical Spindle Bearing Cap with 2 Screws ... ..	5	0	
44	Vertical Spindle Bearing Oil Cup ... ..	1	0	
45	Vertical Spindle Bearing Oil Extension ... ..	2	0	

## PLATE No. 3.

No.	DESCRIPTION	£	s.	d.
46	Flicker Shutter Spindle ... ..	4	6	
47	Flicker Shutter Pinion Spindle ... ..	1	8	6
48	Flicker Shutter Pinion Spindle Screw ... ..	1	0	
49	Flicker Shutter Bearing Bush ... ..	1	5	0
50	Flicker Shutter Adjusting Screw ... ..			6
51	Flicker Shutter Adjusting Screw Washer ... ..	1	6	
52	Flicker Shutter Large Ball Thrust ... ..	6	0	
53	Flicker Shutter Small Ball Thrust ... ..	4	0	
54	Flicker Shutter Adjusting Collar with 3 Screws ... ..	4	6	
55	Flicker Shutter Spiral Pinion ... ..	19	0	
56	Flicker Shutter Spiral Pinion Washer ... ..	2	0	
57	Flicker Shutter Spiral Pinion Screw ... ..			3
58	Flicker Shutter ... ..	2	0	
59	Flicker Shutter Boss with Washer and 3 Screws ... ..	6	6	
60	Flicker Shutter Boss Clamp Screw ... ..			3

## PLATE No. 4.

61	Gate Bracket Roller (2 halves) ... ..	11	0	
62	Gate Bracket Roller Spindle ... ..	7	6	
63	Gate Bracket Roller Spring ... ..			6
64	Gate Bracket Roller Nut ... ..			6
65	Gate Bracket Runners each ... ..	19	0	
66	Gate Bracket Runner Screws with Nuts (per 6) ... ..	2	6	
67	Gate Bracket Mask Plate ... ..	1	5	0
68	Gate ... ..	2	10	0
69	Gate Skates, each ... ..	5	0	
70	Gate Flat Springs (each) ... ..	1	0	
71	Gate Spiral Springs (each) ... ..			6
72	Gate Spring Studs with Split Pin (each) ... ..	1	0	
73	Gate Spring Stud Nuts (each) ... ..	1	0	
74	Gate Roller Bracket Frame with 2 Screws ... ..	4	0	
75	Gate Roller Bracket ... ..	5	0	
76	Gate Roller Bracket Roller (2 halves) ... ..	7	0	
77	Gate Roller Bracket Roller spindle (long) with 2 Split Pins ... ..	1	0	
78	Gate Roller Bracket Roller Spindle (short) with 2 Split Pins ... ..	1	0	
79	Gate Roller Bracket Adjusting Stud ... ..	1	0	
80	Gate Roller Bracket Adjusting Stud Nut ... ..			3
81	Gate Roller Bracket Adjusting Stud Spring ... ..			6

## PLATE No. 5.

82	BP Flicker Shutter ... ..	2	0	
83	BP Flicker Shutter Boss ... ..	15	0	
84	BP Flicker Shutter Boss Washer ... ..	5	0	
85	BP Flicker Shutter Boss Washer Screws (4) ... ..	1	0	
86	BP Flicker Shutter Boss Clamp Screws (2) ... ..			6
87	BP Supplementary Gate Lens ... ..	2	0	0
88	BP Supplementary Gate Lens Holder with Screw ... ..	15	0	
89	BP Gate Bracket Mask Plate ... ..	1	5	0
90	Spool with Aluminium Centre ... ..	12	6	



### PLATE No. 6.

No.	DESCRIPTION	£	s.	d.
91	Top Sprocket Roller Bracket with Stop Screw and 2 Set Screws ... ..	9	6	
92	Bottom Sprocket Roller Bracket with Stop Screw and 2 Set Screws ... ..	9	6	
93	Top and Bottom Roller Bracket Pivots (each) ...	3	9	
94	Top and Bottom Rollers (each) ... ..	5	0	
95	Top and Bottom Roller Spindles (short) (each) ...	3	0	
96	Top and Bottom Roller Spindles (long) (each) ...	4	0	
97	Top and Bottom Roller Bracket Spring with Screw	1	6	
98	Top Sprocket with Screw and Felt Washer ...	1	0	0
99	Top Sprocket Spindle ... ..	7	6	
100	Top Sprocket Spindle Ball Thrust ... ..	3	6	
101	Top Sprocket Spindle Spiral Gear with Screw ...	15	0	
102	Top Sprocket Stripper Complete ... ..	4	0	
103	Bottom Sprocket Stripper Complete ... ..	4	0	
104	Racking Handle Complete ... ..	1	10	0

### PLATE No. 7.

105	Top Spool Box Glass Window ... ..	2	6	
106	Top Spool Spindle ... ..	13	6	
107	Top Spool Driving Collar with Pin and Screw ...	3	6	
108	Top Spool Spindle Washer ... ..	6		
109	Top Spool Spindle Spring ... ..	1	0	
110	Top Spool Spindle Spring Collar with Screw ...	3	0	
111	Top or Bottom Film Trap Roller (large) (each) ...	4	0	
112	Top or Bottom Film Trap Roller Stud (each) ...	1	0	

### PLATE No. 8.

114	Motor Drive Chain ... ..	12	6	
115	Bottom Spool Spindle Drive Chain ... ..	9	6	
116	Bottom Spool Spindle with End Cap ... ..	17	6	
117	Bottom Spool Spindle Driving Collar with Pin and Screw ... ..	3	6	
118	Bottom Spool Spindle Bearing with Screws and Oil Cup ... ..	2	6	0
119	Bottom Spool Spindle Washer ... ..	1	6	
120	Bottom Spool Spindle Chain Wheel ... ..	12	6	
121	Bottom Spool Spindle Leather Friction Disc ...	1	0	
122	Bottom Spool Spindle Friction Collar ... ..	7	6	
123	Bottom Spool Spindle Friction Collar Locating Screw ... ..	3		
124	Bottom Spool Spindle Spring ... ..	1	0	
125	Bottom Spool Spindle Spring Adjusting Nut ...	2	6	
126	Bottom Spool Spindle Chain Wheel Guard ...	5	0	
127	Bottom Spool Spindle Chain Wheel Guard Rod ...	1	0	
128	Bottom Spool Spindle Driving Gear with Chain Wheel complete for R.C.A. or B.T.H. Model F.C.	3	0	0
128A	Bottom Spool Spindle Ditto for Silent Model F.C.	3	0	0
129	Bottom Spool Spindle Driving Gear Washer ...	1	6	
130	Bottom Spool Spindle Driving Gear Screw for R.C.A. or B.T.H. Model F.C. ... ..	6		
130A	Bottom Spool Spindle Driving Gear Screw ...	6		
130B	Bottom Spool Spindle with Oil Pipe and Nut for Silent Model F.C. ... ..	15	0	

### PLATE No. 9.

No.	DESCRIPTION	£	s.	d.
131	Lamphouse Mirror ... ..	3	10	0
132	Lamphouse Mirror Clips (each) ... ..	6		
133	Lamphouse Mirror Clip Screws (each) ... ..	9		
134	Lamphouse Mirror Adjusting Screw ... ..	4	6	
135	Lamphouse Mirror Adjusting Screw Knob ...	2	0	
136	Lamphouse Condenser Lens ... ..	1	0	0
137	Lamphouse Condenser Lens Holder ... ..	5	0	
138	Lamphouse Condenser Lens Spring Wire Ring ...	9		

### PLATE No. 10.

139	Negative Carbon Holder ... ..	7	6	
140	Negative Carbon Holder Adapting Sleeve (state size of Carbon) ... ..	2	6	
141	Negative Carbon Holder Clamp Nut ... ..	2	6	
142	Negative Carbon Asbestos Covered Lead complete	7	6	
143	Positive Carbon Asbestos Covered Short Lead complete ... ..	6	0	
144	Positive Carbon Asbestos Covered Long Lead complete ... ..	10	0	
145	Positive Carbon Locating Arm ... ..	17	6	
146	Positive Arm Locating Arm Slide ... ..	7	6	
147	Positive Carbon Locating Arm Slide Bolt ...	1	0	
148	Positive Carbon Contact Rod ... ..	2	0	
149	Positive Carbon Contact Rod Spring ... ..	1	6	
150	Positive Carbon Contact Rod Spring Elbow ...	2	0	
151	Positive Carbon Clamp Nut ... ..	2	6	
152	Negative Carbon Clamp Nut ... ..	2	6	
153	Negative Carbon Clamp Nut Tommy Bar ...	1	0	
154	Arc Adjusting Knobs each ... ..	2	0	
155	Arc Adjusting Bottom Spiral Gear ... ..	6	3	
156	Arc Adjusting Top Spiral Gear ... ..	6	3	
157	Negative Carbon Top Adjusting Knob ... ..	2	6	
158	Negative Carbon Bottom Adjusting Knob ...	2	6	
159	Arc Focussing Knob complete ... ..	10	0	
160	Arc Focussing Screw complete ... ..	15	0	

### PLATES Nos. 11 and 12.

161	Auto. Carbon Feed Motor with Leads ... ..	5	0	0
162	Auto. Carbon Feed Regulator Resistance ...	1	6	0
163	Auto. Carbon Feed Fuse Box ... ..	3	0	
164	Auto. Carbon Feed Switch ... ..	2	0	
165	Auto. Carbon Feed Belt ... ..	1	0	
166	Auto. Carbon Feed Main Worm Spindle ...	1	5	0
167	Auto. Carbon Feed Main Worm Spindle Ball Bearings ... ..	7	0	
168	Auto. Carbon Feed Main Worm Spindle Front Cover Plate with 3 Screws ... ..	1	6	
169	Auto. Carbon Feed Main Worm Spindle Back Cover Plate with 3 Screws ... ..	1	6	
170	Auto. Carbon Feed Vertical Spindle ... ..	1	1	0



PLATES Nos. 11 and 12—continued.

No.	DESCRIPTION	l	s.	d.
171	Auto. Carbon Feed Vertical Spindle Worm Wheel with Screw ... ..	17	6	
172	Auto. Carbon Feed Vertical Spindle Top Bush with 3 Screws ... ..	7	6	
173	Auto. Carbon Feed Vertical Spindle Bottom Bush with 3 Screws ... ..	7	6	
174	Auto. Carbon Feed Large Worm Wheel with Clutch Washer ... ..	1	15	0
175	Auto. Carbon Feed Large Worm Wheel Stud ... ..	16	0	
176	Auto. Carbon Feed Large Worm Wheel Stud Nut ... ..	2	6	
177	Auto. Carbon Feed Loose Clutch Washer ... ..	17	6	
178	Auto. Carbon Feed Lever Bracket with Lever complete with 2 Screws ... ..	17	6	

PLATE No. 13.

MOVIETONE DRIVE UNIT.

179	Drive Horizontal Spindle with Screw and Washer	12	6
180	Drive Horizontal Spindle Radial Ball Bearing Small	7	6
181	Drive Horizontal Spindle Radial Ball Bearing Large	7	0
182	Drive Horizontal Spindle Radial Ball Bearing Large Housing ... ..	12	6
183	Drive Horizontal Spindle Ball Thrust ... ..	6	0
184	Drive Horizontal Spindle Thrust Washer ... ..	1	6
185	Drive Horizontal Spindle Spiral Pinion (Inner) ... ..	19	0
186	Drive Horizontal Spindle Spiral Pinion (Outer) with 2 Screws ... ..	19	0
187	Drive Horizontal Gear Box Oil Cap ... ..	1	6
188	Drive Vertical Spindle ... ..	12	6
189	Drive Vertical Spindle Radial Ball Bearing Small	7	0
190	Drive Vertical Spindle Radial Ball Bearing Small Housing ... ..	3	10 0
191	Drive Vertical Spindle Spiral Gear ... ..	19	0
192	Drive Vertical Spindle Ball Thrust ... ..	6	0
193	Drive Vertical Spindle Radial Ball Bearing Large	7	0
194	Drive Vertical Spindle Radial Ball Bearing Housing	1	4 0
195	Drive Vertical Spindle Radial Ball Bearing Cap ... ..	12	6
196	Drive Vertical Spindle Thrust Washer ... ..	1	6
197	Drive Vertical Spindle Collar ... ..	4	6

MISCELLANEOUS SPARES.

Ruby Glass Window for Gate Inspection ... ..	2	0
Ruby Glass Window for Lamphouse Doors ... ..	2	0

CINEMATOGRAPH LENS TABLE

Width of Gate Aperture = 0.91"

Distance Lens to Screen in Ft.	FOCAL LENGTH OF LENS.								
	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"
	APPROXIMATE WIDTH OF PICTURE ON SCREEN.								
	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.	Ft. Ins.
30	13 8	10 11	9 1	7 10	6 10	6 1	5 6	5 0	4 6
40	18 2	14 6	12 2	10 5	9 1	8 1	7 3	6 7	6 0
50	22 9	18 2	15 2	13 0	11 4	10 1	9 1	8 3	7 7
60	27 4	21 10	18 2	15 8	13 8	12 2	11 0	10 0	9 0
70	31 10	25 5	21 3	18 3	15 11	14 2	12 9	11 7	10 6
80	36 4	29 0	24 4	20 10	18 2	16 2	14 6	13 2	12 0
90	41 0	32 9	27 3	23 6	20 6	18 3	16 6	15 0	13 6
100	45 6	36 4	30 4	26 0	22 8	20 2	18 2	16 6	15 2
110	50 1	40 0	33 4	28 8	25 0	22 3	20 1	18 3	16 7
120	54 8	43 8	36 4	31 4	27 4	24 4	22 0	20 0	18 0
130	59 2	47 3	39 5	33 11	29 7	26 4	23 9	21 7	19 6
140	63 8	50 10	42 6	36 6	31 10	28 4	25 6	23 2	21 0

To secure a certain size picture at a certain distance, multiply the distance from the lens to the position of the screen by the width of the Gate aperture and divide the product by the size of picture required. The result will be the focal length of the lens needed.

For instance it is required to find the focal length of a lens which will give a 13 ft. picture at a 50 ft. throw. Assuming the gate aperture in this case to be 0.91"

$$\text{then } \frac{50 \times 0.91}{13} = 3\frac{1}{2}" = \text{Focus of lens.}$$

Vice versa, to find the size of picture which will be given by a 3½" lens at a throw of 50 ft.,

$$\text{then } \frac{50 \times 0.91}{3\frac{1}{2}} = 13 \text{ ft. Size of Picture.}$$

Similarly for lantern slides, assuming that the slide carrier

$$\text{opening be 3" wide then } \frac{50 \times 3}{13} = 11\frac{1}{2}" \text{ approx. focus of lens.}$$

$$\text{and } \frac{50 \times 3}{11.5} = 13' \text{ approx. size of picture.}$$



## PROJECTOR ARCS.

TABLE OF FUSES FOR CERTAIN WORKING CURRENT VALUES.

Full Load Current or Working Current of Circuit. Amp.	TINNED COPPER		PURE TIN		LEAD		COMPO. 75% LEAD 25% TIN	
	S.W.G.	Approx. Fusing Current.	S.W.G.	Approx. Fusing Current.	S.W.G.	Approx. Fusing Current.	S.W.G.	Approx. Fusing Current.
1	43	2.2	31	2.1	29	2.1	30	2
2	39	3.8	26	4	25	3.9	25	4.1
3	37	5.7	23	6.1	22	6.5	22	6.8
4	35	7.9	22	7.7	21	7.9	21	8.3
5	33	10.2	21	9.4	20	9.4	20	9.9
6	31	12.8	20	11.2	19	11	19	11.5
7	30	14.2	19	13.1	18	14.5	18	15.2
8	29	15.5	18	17.3	18	14.5	18	15.2
9	28	18.4	18	17.3	17	17.8	17	19.1
10	27	21.5	17	21.3	17	17.8	17	19.1
15	25	29	15	31.8	14	31.2	15	27.9
20	23	38.1	14	37.2	13	38.5	13	40.3
25	22	48						
30	21	58.6						
35	21	58.6						
40	20	70						
45	20	70						
50	19	81.5	Strip Fuses should be used For Thicker Gauges than 12 S.W.G.					
75	18	107.7						
100	16	165.8						
150	14	232						
200	13	286						

Conversion Table Degrees Centigrade to Fahrenheit.

Cent.	Fahr.
5	41
10	50
20	68
30	86
38	100.4
45	113
50	122
60	140
70	158
80	176
90	194
95	203
100	212

Melting Point of Metals

	Fahr.
Tin ...	449
Lead ...	621
Zinc ...	787
Aluminium ...	1218
Bronze ...	1675
Silver ...	1761
Copper ...	1981
Cast Iron ...	2300
Steel ...	2500

## ABBREVIATIONS AND DEFINITION OF TERMS

E.—“Earth.” Gnd.—“Ground” (American term for ‘Earth.’)  
 F. or Fil.—Filament. G.—Grid. H.F.—High Frequency. H.T.—  
 High Tension Current, or High Voltage. I.—Inductance. I.P.—Input.  
 L.F.—Low Frequency. L.T.—Low Tension. O.P.—Output. P.—  
 Primary. S.—Secondary.

**ACCUMULATORS.**—A device for converting electrical energy to chemical energy, so that the energy may be released in the form of electrical current upon connecting the accumulator terminals to the conductor. Lead plates separated from one another are immersed in a solution of Sulphuric Acid and when a charging current is passed through the accumulator a chemical change takes place. When charged, if the terminals be connectd by wire or other conductor a further change takes place, giving rise to a flow of electric current.

**ACTINIC RAYS.**—Often spoken of in Photographic and Cinematograph circles, are rays of light or radiant energy which can induce chemical action, the Violet and Ultra-Violet rays being the most powerfully actinic in the spectrum.

**ACETONE.**—A chemical used in the manufacture of film cement.

**AMPLIFICATION.**—Increase of power.

**ANODE.**—A positive terminal or electrode. Term usually applied when a terminal forms the end of a metallic conductor in an electric circuit. The corresponding negative term is the cathode. The plate of a valve or tube is known as the anode.

**ARC.**—In relation to lighting, is the result of the passage of electrical current between Carbon Tips which are slightly separated. The gap between the carbons is composed of gases generated by the volatilisation of the Carbon.

**AUDIO FREQUENCY.**—A frequency or number of cycles of an oscillating current, or waves per second not less than about 30 or greater than about 20,000, and therefore within the range of audibility.

**BATTERY.**—A number of accumulators or cells coupled together in series or parallel.



**CANDLE POWER.**—The standard unit of illumination, i.e., the light given by a British standard candle at 1 foot distance.

**CAPACITY.**—The capacity of a condenser is its ability to retain a charge of electricity.

**CELLULOID.**—Highly inflammable material generally used for films.

**CONDENSER.**—A device which stores a charge of electricity, giving it up as required.

**CYCLE.**—A complete wave or current oscillation rising from zero to maximum value and then falling to minimum or vice versa.

**DIFFUSION.**—In the practice of Optics means a scattering of light.

**FARAD.**—The unit of capacity of a condenser. Microfarad is 1,000,000th part of a farad.

**FILAMENT.**—Fine drawn wire usually of tungsten, rendered incandescent by the passage of a current through it.

**FOCUS.**—Concentration of point at which the rays of light, after passing through the lens, meet and form an image.

**INDUCTION.**—A production of current in a conductor due to current flowing through another conductor not directly connected to it.

**LENS.**—Optical instrument used for projecting picture on to screen.

**MEGOHM.**—1,000,000 Ohms.

**MICA.**—A substance having properties which are highly insulating and heat resisting. It is a mineral substance and is semi-transparent.

**MICROHM.**—1,000,000 part of an ohm.

**MICRO AMP.**—1,000,000 part of an amp.

**MILLIAMP.**—1,000 part of an amp.

**OHMS LAW.**—The current varies directly as the E.M.F. and inversely as the resistance of the circuit.

$$I = \frac{E}{R} \quad E = I \times R \quad R = \frac{E}{I}$$

**PERIODICITY.**—This word has the same meaning as frequency. Term employed in stating the number of oscillations of an A.C. Current per second.

**POTENTIOMETER.**—Adjustable resistance inserted in an electric circuit for varying the voltage.

**PHOSPHER BRONZE.**—An alloy of considerable strength and durability frequently used in the manufacture of bearings. It is a mixture of copper and tin with a small percentage of Phosphorous.

**RADIO FREQUENCY.**—A frequency greater than Audio Frequency.

**RECTIFIER.**—A device for converting A.C. to D.C.

**RHEOSTAT.**—A resistance covering electric current.

**VOLATILISATION.**—As applied to an arc means the production of vapour from the carbon through heat.



