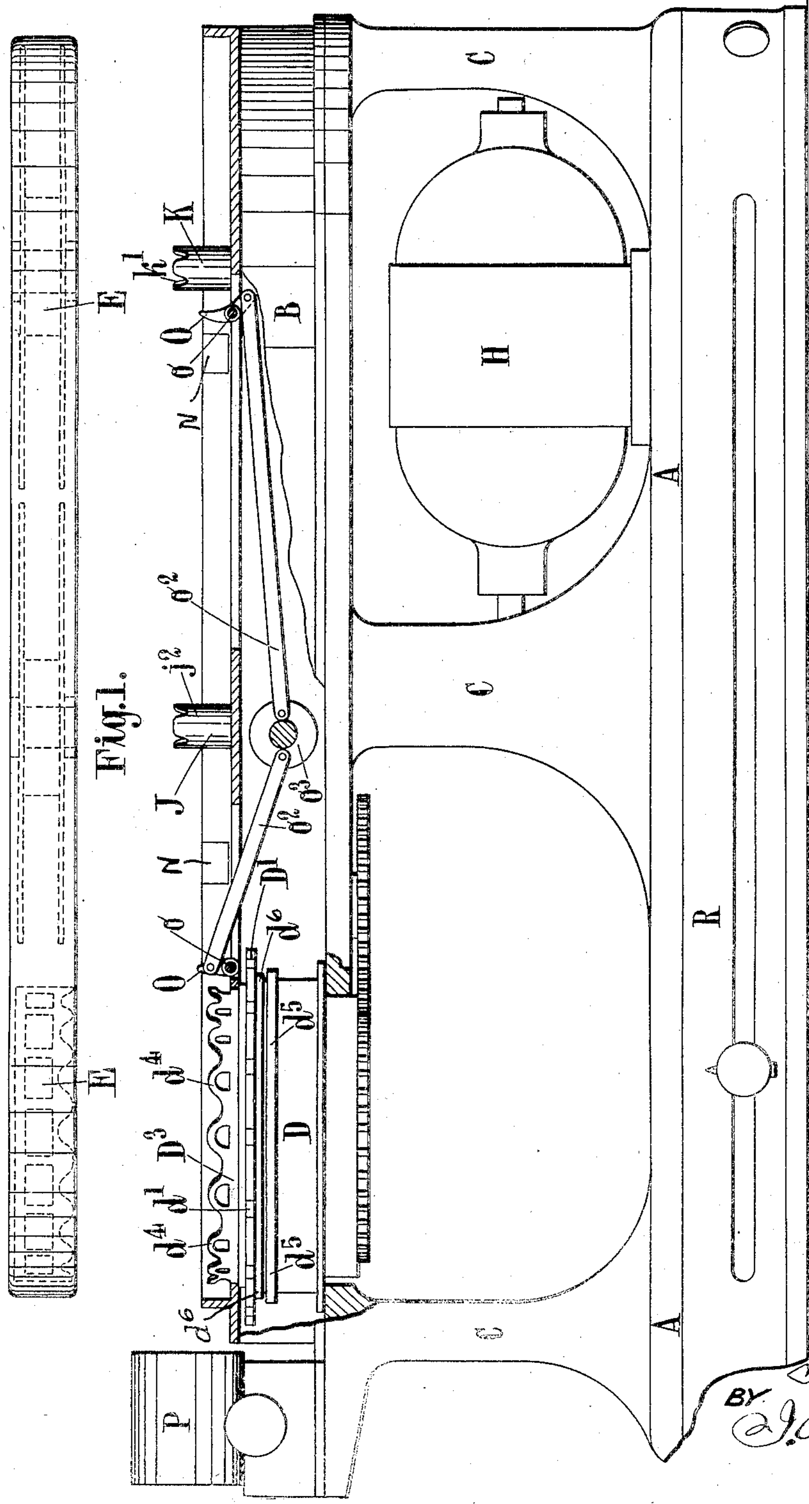
May 27, 1930. J. E. THORNTON 1,760,219

CINEMATOGRAPH PROJECTION APPARATUS

Filed Jan. 13, 1927 6 Sheets-Sheet 1



INVENTOR

J. E. Thornton

BY

ATTORNEY

May 27, 1930. J. E. THORNTON 1,760,219

CINEMATOGRAPH PROJECTION APPARATUS

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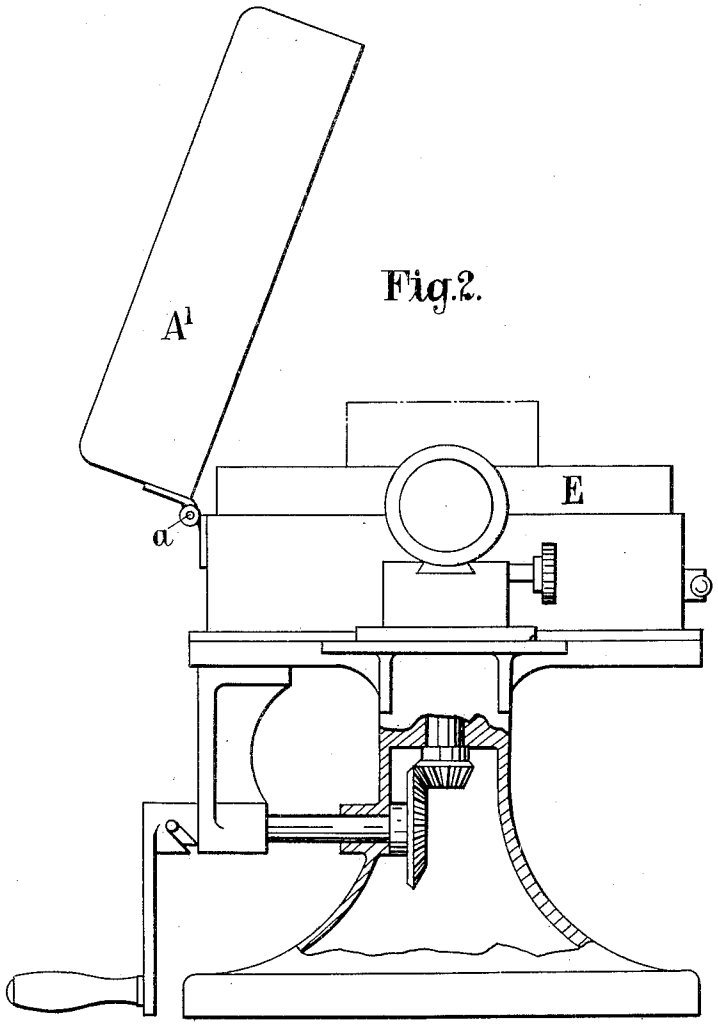
Fig.2.



INVENTOR
J. E. Thornton
BY
J. Owen O'Brien
ATTORNEY

May 27, 1930. J. E. THORNTON 1,760,219

CINEMATOGRAPH PROJECTION APPARATUS

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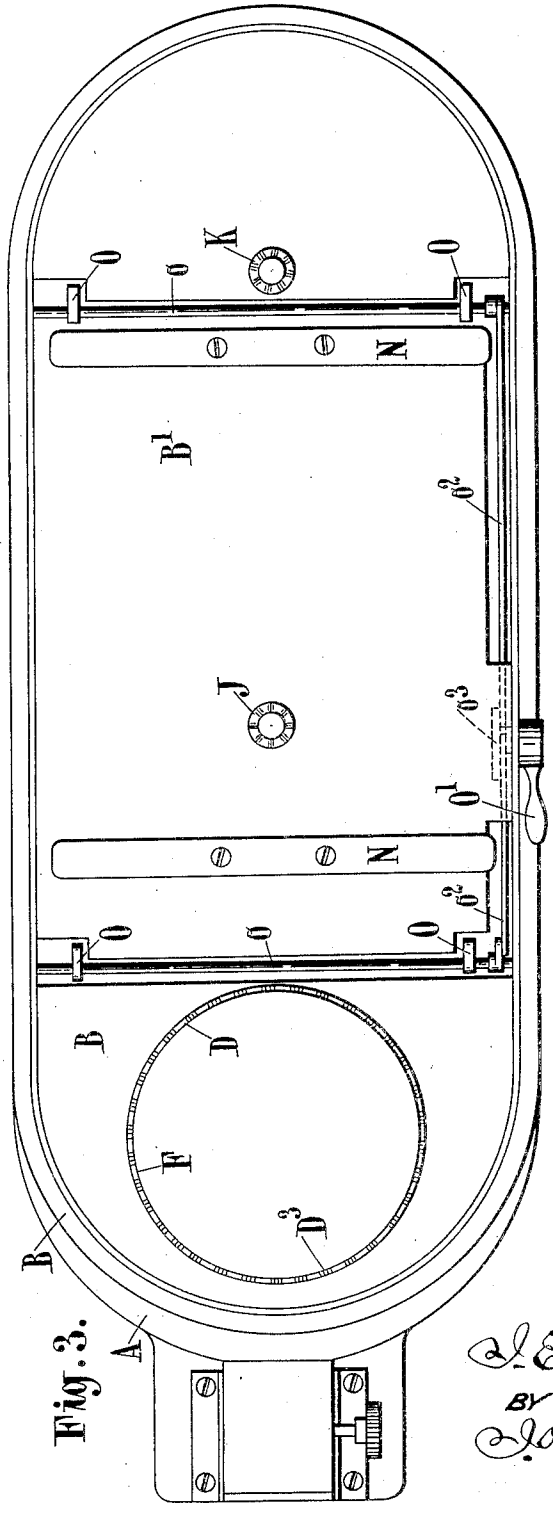

Fig. 3.

INVENTOR
J. E. Thornton
BY
Lowden & O'Brien
ATTORNEY

May 27, 1930. J. E. THORNTON 1,760,219

CINEMATOGRAPH PROJECTION APPARATUS

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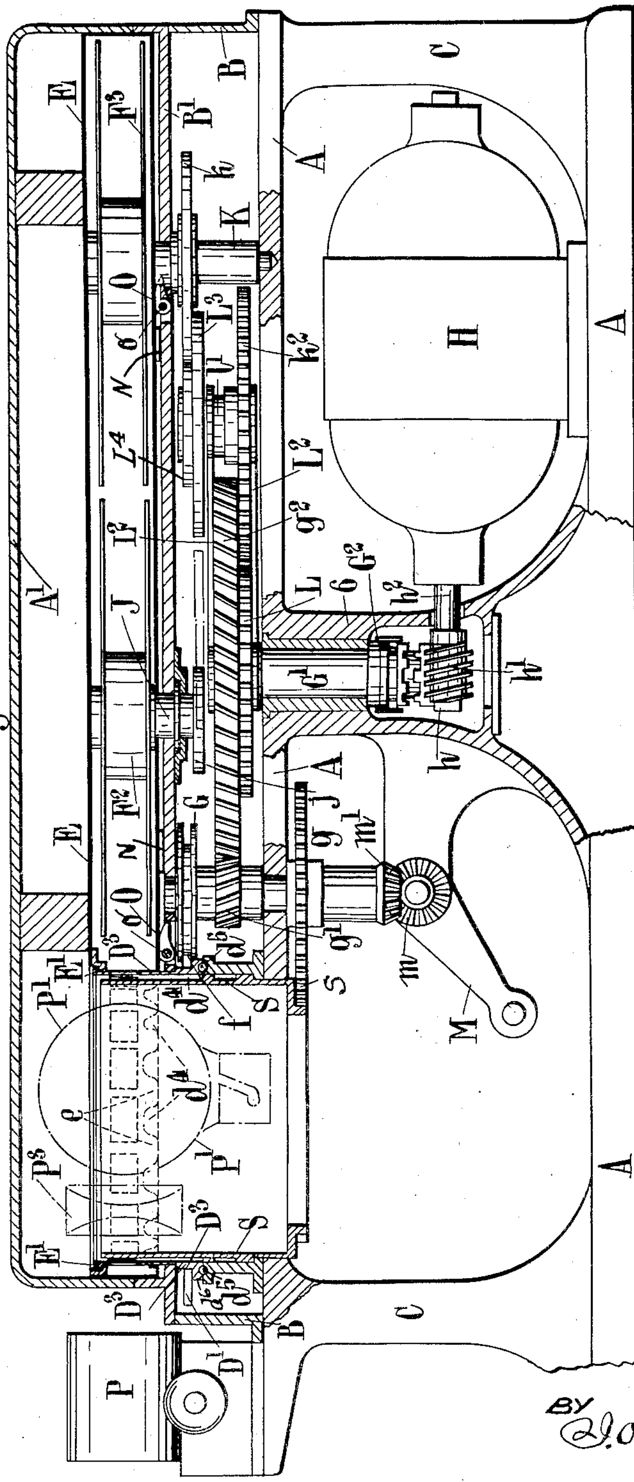
Fig. 4.



INVENTOR
J. E. Thornton

BY
J. Owden O'Brien
ATTORNEY

May 27, 1930. J. E. THORNTON 1,760,219

CINEMATOGRAPH PROJECTION APPARATUS

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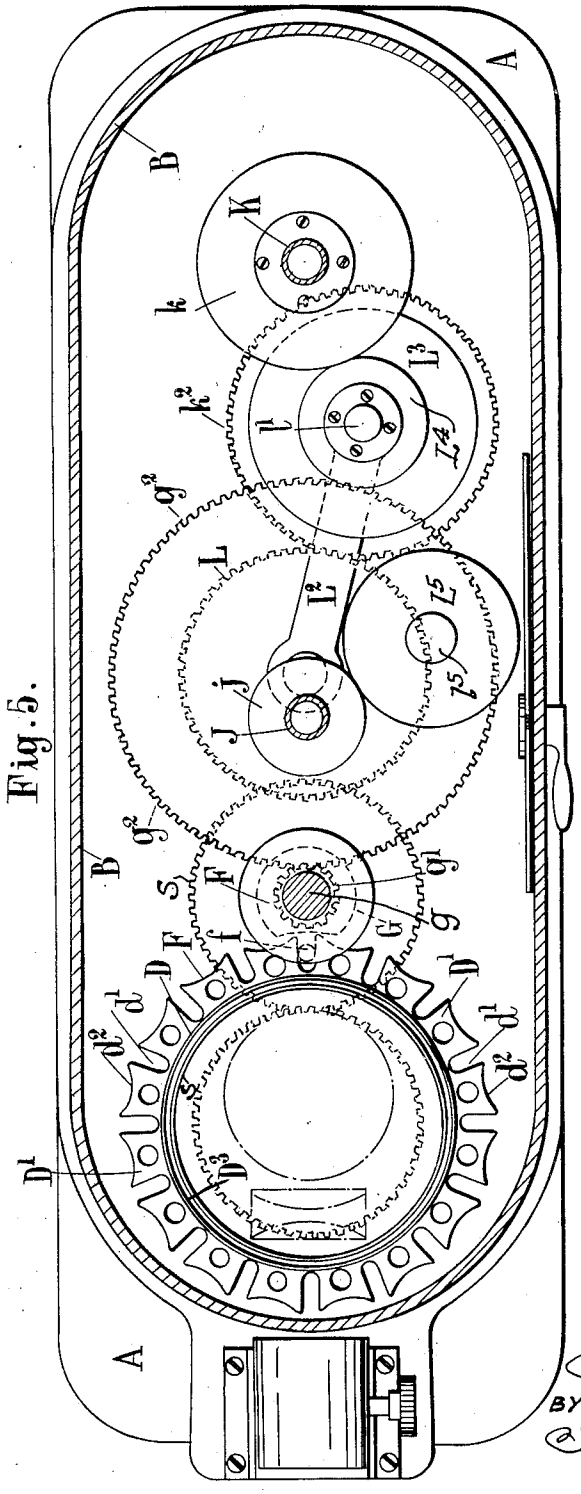

Fig. 5.

INVENTOR
J. E. Thornton
BY
Dowell & O'Brien
ATTORNEY

May 27, 1930. J. E. THORNTON 1,760,219

CINEMATOGRAPH PROJECTION APPARATUS

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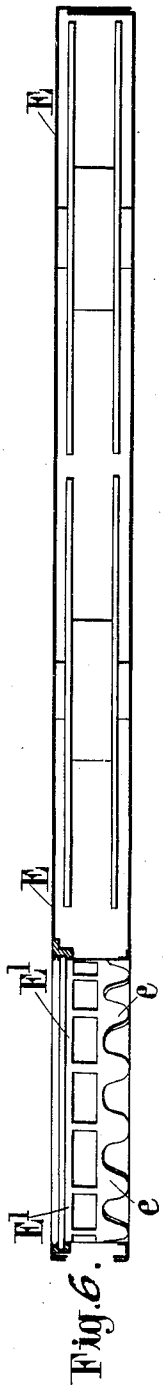

Fig. 6.

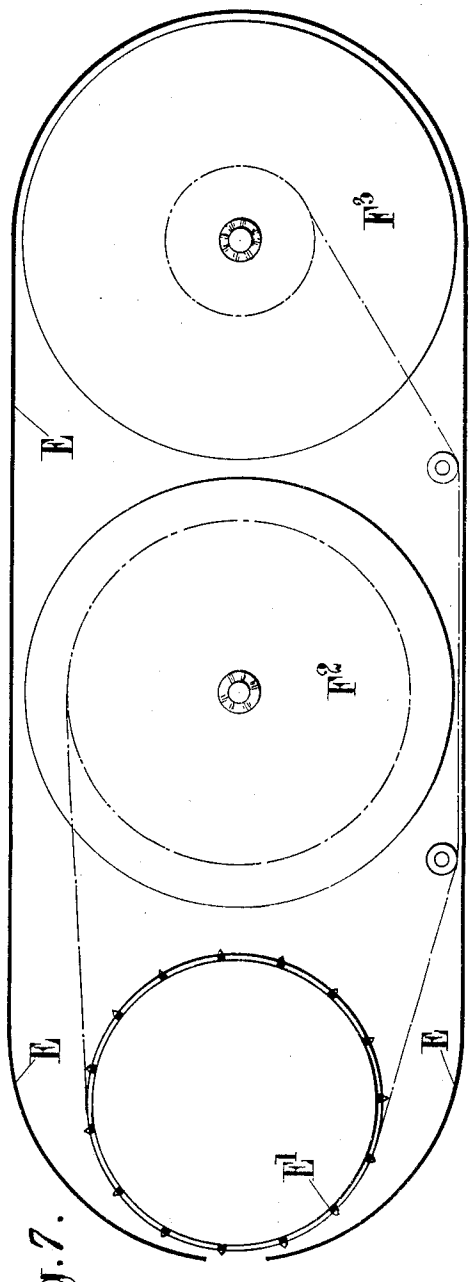

Fig. 7.

INVENTOR
J. E. Thornton
BY
Dorsam & Brien
ATTORNEY

Patented May 27, 1930 1,760,219

UNITED STATES PATENT OFFICE

JOHN EDWARD THORNTON, OF WEST HAMPSTEAD, LONDON, ENGLAND, ASSIGNOR TO JOHN OWDEN O'BRIEN, OF MANCHESTER, ENGLAND

CINEMATOGRAPH PROJECTION APPARATUS

Application filed January 13, 1927, Serial No. 160,963, and in Great Britain January 28, 1926.

This invention relates to improvements in projectors for cinematograph films of the type in which the film is carried in a detachable case not forming a part of the projector.

According to the invention the projector comprises a framing, an electric motor mounted within the framing, gearing driven by the motor, a casing carried by the framing within which the gearing is housed, two spindles and a crown wheel projecting through the casing, a clutch between the motor and the gearing to allow for the stopping of the rotation of the spindles and crown wheel independently of the motor, a Geneva wheel driven intermittently from the gearing to exhibit the film, a lamp and lens by which the film is illuminated and projected, a friction drive for the spindles to allow for a change in size of the reels during projection, an arm for reversing the friction drive for rewinding the film, a lid to close over the film during projection and a spring and levers to prevent driving contact with the spindles and crown wheel when the lid is raised.

The invention will be described with reference to the accompanying drawings:—

Fig. 1 is a side elevation partly in section of one form of the invention, showing frame and base plate containing an adjustable resistance, supporting pillars, motor, flat table containing the gears, and surmounted by the removable spoolcase, the closing lid being removed.

Fig. 2 is an end view of same also partly in section showing the hinged lid in the open position and having a hand drive with a detachable handle instead of a motor drive.

Fig. 3 is a plan of same with the lid and spoolcase removed.

Fig. 4 is a vertical section showing the gearing.

Fig. 5 is a horizontal section.

Figs. 6 and 7 are side elevation and plan respectively, the casing being in section, of the spoolcase for use with the machine.

The machine comprises a framing having a flat base A which supports pillar C carrying a gear case B in the form of a flat horizontal table and an electric motor H.

The motor H on a shaft h^2 is provided with a worm h^1 gearing with a worm wheel h mounted inside the central pillar C. The worm wheel h drives a vertical shaft G^1 mounted within the pillar C through a clutch G^2. The shaft G^1 projects upwards into the gear case B and carries a skew gear wheel g^2 which is the main driving pinion and a wheel L.

The wheel g^2 drives a wheel g^1 mounted on a stud g carrying a pin wheel G formed with a pin f by which an intermittent motion is given to a Geneva wheel D^1 which gives the necessary picture change to the film during exhibition. The wheel D^1 is formed with a number of slots d^1 in the edge with hollows d^2 between each pair of slots to receive the rotating pin f and forming a one-toothed pinion drive. A disc F having a cut away portion beds easily against the slotted ring D^1 to keep it firmly clamped or locked against rotation until the rotating pin f enters one of the slots, whereupon the slotted disc is rotated for a distance equal to one picture space, after which the pin emerges from its slot, and the slotted disc is locked as aforesaid until the pin comes round again and enters the next slot to repeat the movement.

The slotted or toothed ring D^1 is made in the form of a horizontal flange projecting centrally from a vertical tubular sleeve D^3 upon the upper edge of which are formed a series of teeth d^4 with rounded edges. The number of teeth d^4 on the top edge of the sleeve and the number of slots in the edge of the horizontal intermittent type of ring or wheel D correspond exactly to the number of picture spaces in the perforated feeding and measuring drum.

The object of the teeth d^4 on the ring D^1 is to engage with and drive corresponding teeth e carried by the film measuring and feeding drum E^1 contained in the film spool case E, so that when the spoolcase is placed in position on the projector the separate ring D^1 on the projector and the drum E^1 in the spoolcase become locked together, and the two rotate in unison as one and so shift and drive the film. Furthermore the arrangement

will allow the spoolcase E to be placed in the projector with the film at any point of its travel, without necessity for rewinding it to the starting point and a picture will always be automatically centred without adjustment; and also for the further purpose of providing apparatus in which no handling of the film by the operator is needed and no adjustments whatever are required. In fact such a spoolcase can be almost thrown into position and the connections will automatically find their proper place without any adjustment, a point of incalculable value when the apparatus is to be used by unskilled non-technical persons.

Through the table or gearbox of the frame a hole is formed, into which the bottom end of the sleeve D^3 fits and in which it rotates an easy fit. A flange d^6 on the lower edge of the sleeve rests upon a ball race d^5 into which a series of steel balls are placed so that the sleeve will rotate with a minimum of friction.

A friction wheel j on a spindle J is mounted on the top of the flat table or gear box, the spindle J carrying a toothed crown wheel j^2 formed on its upper end to engage with a similar crown wheel in the interior of a hole bored through the centre of a supply-spool F^2. The supply-spool F^2 is placed over this sleeve, so that the spool may engage with and be driven by the toothed crown wheel j^2; thus forming a clutch driven when they are in gear and free running when they are not in gear.

A similar wheel k but of larger diameter, spindle K, and crown wheel clutch k^1, is provided for driving the film-receiving-reel F^3.

The receiving reel F^3 is driven from the wheel L through a gear wheel k^2 permanently in mesh therewith and mounted on a stud l^1 attached to a swinging arm L^2 which also carries a compound disc wheel L^3, L^4 preferably milled on its edges.

The spindle J also has mounted upon it a disc wheel j and a similar wheel k is mounted on the spindle K.

The receiving reel F^3 receives its motion from the wheel L which rotates at constant speed and transmits this motion to the compound wheels L^3 and L^4.

The part L^4 of the compound wheel engages with and drives the wheel k on the spindle K which is in engagement with the reel F^3.

As the diameter of the film on the reel F^3 increases and as the film is prevented from being wound on to the reel F^3 at a greater speed than it is delivered by the feeding drum E^1 there is gradually more and more slip between the discs L^4 and k so that the surface speed of the film will remain the same as the surface speed of the drum E^1.

When it is desired to rewind the film from the reel F^3 back on to the supply-spool F^2 the swinging arm L^2 is moved over so that the disc L^4 is moved out of engagement with the disc k and the disc L^3 into engagement with the disc L^5 mounted on a stud l^5 and in frictional contact with the periphery of the disc j.

As the disc j is of small diameter and the disc L^3 of large diameter the spool F^2 is rotated at a high speed so that the rewinding of the film will take as short a time as possible.

Over the whole of the gearing a case or cap A^1 of stamped or cast metal is placed to enclose the whole in a chamber thus forming the gear case B. This may be provided with a flange and screws by which it is attached to the table top, and between the two faces may be tightly clamped suitable packing to effect an oil-tight joint.

The interior is lubricated either with thick lubricating paste, or with fluid oil led by channels or ducts from one common centre to the respective rotating parts.

In operation the spoolcase E is laid upon the secondary flat table provided by the top B^1 of the gearcase B, through which project the ring D^3 and the two vertical spindles J and K. At the front end the crown wheel d^4 engages with the drum F^1 and drives the latter.

At the rear end is the vertical sleeve K which engages with and drives the receiving reel F^3. Midway between the two is the vertical sleeve J which engages with and drives the delivery spool F^2.

When the spoolcase is laid in position on the projector top the two vertical projecting spindles J and K enter the centre holes of the spool and reel, but the spoolcase is kept out of operative engagement with the projector mechanism by springs N on the projector table which hold the spoolcase slightly away from the table.

Above the projector table and attached thereto by hinges a at one side is a flanged lid A^1 (see Fig. 2) of stamped or cast metal, forming a recessed enclosing case capable of completely covering the spoolcase F. When the lid A^1 is raised the springs lift the spoolcase out of operative engagement, but when the lid A^1 is shut down and fastened by its snap catch the spoolcase is pushed lower, and into operative engagement, by compression of the springs, N, which therefore allow the crown wheel d^4 to engage with the film-drum E^1 at the forward end and the crown-wheel k^1 of the spindle K to engage the receiving reel F^3 at the other end. The delivery spool F^2 runs free because it is not thrown into engagement with the mechanism by lowering of the lid but instead by pushing the swinging arm into gear therewith, which can only be done when the lid is lifted and the spoolcase thrown out of gear with the driving stud and with the receiving-reel drive by the lift of the springs, whereupon there is nothing

in gear with the drive except the supply spool rewind.

In addition to the springs, four fingers or levers O mounted on two rods *o* may be employed to raise the spoolcase out of operative engagement with the projector. These rods *o* are rotated by the handle O^1 through the levers o^2 and cranks o^3 so that when the handle is rotated the levers O will move from the horizontal to the vertical position and so lift the spoolcase.

A projection lens P is mounted at the front end of the machine, forward of the ring E^1 and upon a slide controlled by rack and pinion for focussing purposes.

Lighting is obtained from an electric filament lamp P^1 placed in the central aperture through the sleeve of the drive and the film-drum so that the light passes through the perforations of the drum, the film, and the lens, to the screen. The lamp P^1 is mounted upon a carrier attached to the base-plate in such manner as to be slidably adjusted backwards or forwards, sideways, and vertically, to ensure accurate centering of the filament, picture, and lens P. Behind the light is placed a concave reflector, and between film and light a suitable condensing lens system P^3 to collect and condense the light rays. This also is provided with suitable adjustment.

A shutter S for obscuring the lens during the picture-shift is placed inside, between the ring E^1 and the condenser P^3 and is geared through gearing *s* to the pinion shaft *g* which drives the sleeve.

In order to view any one picture in a stationary position selected from the service on the film, the movement of the film can be stopped by the clutch G^2 which throws the film-moving mechanism out of gear with the driving mechanism. The ring E^1 may then be rotated at any desired speed by a handle M through the bevel gear *m*, m^1, the wheel m^1 being affixed on the bottom of the shaft *g*.

I claim:

1. Cinematograph film projection apparatus comprising a framing, an electric motor mounted within the framing, gearing driven by the motor, a casing carried by the framing within which the gearing is housed, two spindles and a crown wheel projecting through the casing, a clutch between the motor and the gearing to allow for the stopping of the rotation of the spindles and crown wheel independently of the motor, a Geneva wheel driven intermittently from the gearing to exhibit the film, a lamp and lens by which the film is illuminated and projected, a friction drive for the spindles to allow for a change in size of the reels during projection, an arm for reversing the friction drive for rewinding the film, a lid to close over the film during projection and a spring and levers to prevent contact with the spindles and crown wheel when the lid is raised.

2. Cinematograph film projection apparatus comprising a framing, an electric motor mounted within the framing, gearing driven by the motor, a casing carried by the framing within which the gearing is housed, two spindles and a crown wheel projecting through the casing, a clutch between the motor and the gearing to allow for the stopping of the rotation of the spindles and crown wheel independently of the motor, a Geneva wheel driven intermittently from the gearing to exhibit the film, a lamp and lens by which the film is illuminated and projected, a friction drive for the spindles to allow for a change in size of the reels during projection, an arm for reversing the friction drive for rewinding the film, a lid to close over the film during projection, a spring and levers to prevent contact with the spindles and crown wheel when the lid is raised and bevel gearing and a hand wheel for rotating the spindles of crown wheel when the clutch is disengaged.

In testimony whereof I have hereunto set my hand.

JOHN EDWARD THORNTON.