Sept. 6, 1927. 1,641,727

J. R. BRADFORD

MOTION PICTURE MACHINE

Filed July 2, 1925

Fig. 1.

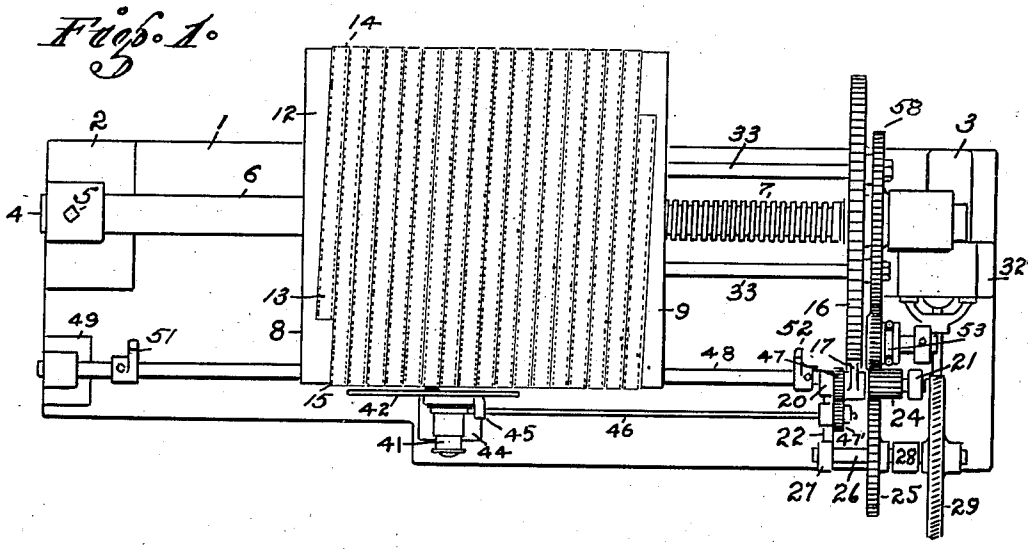


Fig. 2.

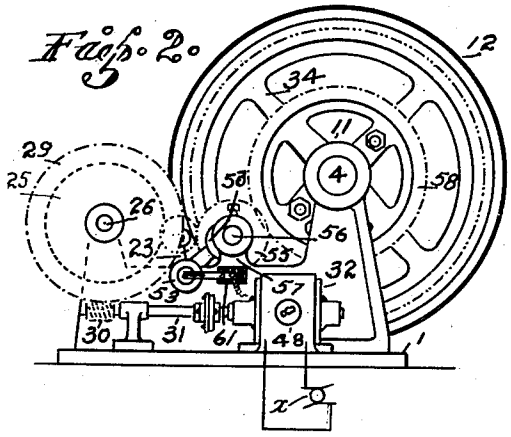


Fig. 3.

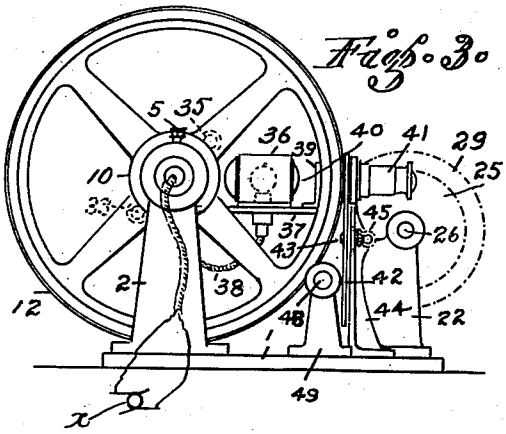
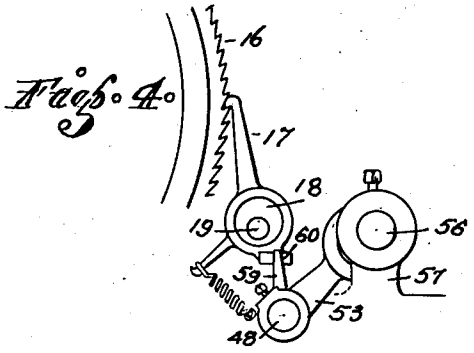


Fig. 4.



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MOTION-PICTURE MACHINE.

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This invention relates to improvements in motion pictures and more particularly to projecting machines therefor.

Among the objects of the invention are to provide means for automatically projecting the images of a motion picture film, and to automatically repeat the operation indefinitely without human aid, except to stop and start the machine, which is another object which may also be accomplished automatically by the interposition of time clock electric switches, now in common use in other arts. Another object is to eliminate all independent movement between the film and the intermittent film feeding mechanism.

A further object is to provide against frictional film wear and the possibility of breaking the film in the operation of the machine.

A further object is to provide means for projecting only a predetermined area of film, as desired.

Other objects and advantages will appear as this description progresses.

An outstanding weakness in the motion picture projecting art is the breaking of the film by the intermittent feed mechanism. This fundamental fault in the existing types of projecting machines, renders them unfit for automatic operation, since breakage of the film, its repair and rewinding require the presence and supervision of a skilled operator continuously, during the operation of the machine.

All of the above disadvantages and many others are eliminated by this invention, in which the film is wound spirally around a transparent carrier or drum and fixed thereto. The intermittent feed is applied to the drum independent of the film. Old film, the feed margins of which have been worn useless or partially destroyed, can be successfully used by this invention.

In this specification and the annexed drawings, the invention is illustrated in the form considered the best, but it is to be understood that it is not limited to such form because it may be embodied in other forms and it is also to be understood that in and by the claims following the description it is desired to cover the invention in whatsoever form it may be embodied.

In the accompanying one sheet of drawings: Figure 1 is plan vew from above of a moton picture projecting machine constructed in accordance with this invention. Figure 2, is an end elevation of the same, from the driving end. Figure 3, is a similar view of the opposite end. Figure 4, is an enlarged fragmentary detail in side elevation of the intermittent feed and automatic reverse mechanism, viewed from the same end as Figure 3.

In detail the construction illustrated in the drawings comprises the base 1, preferably of cast iron, from which the pedestals 2 and 3 rise, to support the opposite ends of the shaft 4, fixed therein by the set screws 5. One half of this shaft is plain and smooth as at 6 and the other half is provided with the screw thread 7, see Figure 1.

The film drum comprises the annular ends 8 and 9, having spokes leading from the hubs 10 and 11, and supporting the cylindrical periphery 12, composed of celluloid, glass or other suitable transparent material, fixed to the ends 8 and 9. This periphery may also be metal, with openings registering with the picture areas.

The hub 10 is plain and has a sliding fit with the surface 6 of the shaft, and the hub 11 is threaded to engage the threaded portion 7 of the shaft. Thus mounted, the drum is capable of longitudinal movement back and forth on the shaft under control of the screw thread, when the drum is rotated on the shaft. The pitch of the thread 7 is equal to the transverse width of the film; whereby one revolution of the drum advances it one film width, thus keeping the film centered on the axis of the projecting lens. All mounting and movement of the drum should be accomplished with precision and freedom from lost motion and vibration.

To secure accuracy in the placement of the film on the drum the lead end 13 is cemented to or inserted through a slit in the periphery 12 near the end 8, then wound spirally thereon, edge to edge, its full length and the finish end is also cemented or clamped to the drum, wherever it may terminate. The drum surface is provided with an occasional upstanding fin. 14, partly severed from the body of the celluloid and bent up to engage

the registering marginal slot 15, in the edge of the standard film. (See Figure 1.) Thus attached, the film becomes a fixed part of the drum and does not come into physical contact with any other part of the machine, nor depend upon its own tensile strength in the performance of the intermittent feed mechanism.

The film is conventional in every other respect and consists of a strip of composition film having the usual photographic action pictures arranged thereon seriatim, each to be advanced, stopped and again advanced by the intermittent feed, to create the illusion of motion, when exposed upon a screen by the projecting mechanism, hereinafter described. Obviously the emulsion could be applied directly to the periphery 12 and the pictures photographically exposed or printed thereon.

The intermittent feed comprises a ratchet gear 16, freely rotatable on the shaft 4, in alinement with the ratchet pawl 17, pivoted on the eccentric 18, fixed on the shaft 19, journaled in the bearings 20 and 21 in the standards 22 and 23, rising from the base 1. This shaft is driven by the pinion 24, fixed thereon and enmeshed with the gear 25, fixed on the shaft 26, journaled in the bearings 27 and 28. This shaft is driven by the worm gear 29 fixed thereon and enmeshed with the worm 30, fixed on the end of the motor shaft 31 of the motor 32, mounted upon the base 1. The ratchet gear 16 is provided with the same number of teeth that there are pictures in one revolution of the film drum, in this instance one hundred and twenty-six teeth, equal to the one hundred and twenty-six exposures in one revolution of the said drum. If a different type of film were used, having more or less exposures, it would be necessary to provide a consistent number of teeth in the gear 16.

The gear ratio between the motor shaft 31 and the pawl shaft 17 is calculated to give about eight movements of the pawl per second, in machines using the reduced film for short focus exposure as illustrated or sixteen exposures per second in machines using standard film.

Rotary movement is transmitted to the film drum from the ratchet 16, through the rods 33, fixed in the spokes 34 of the ratchet and slidably engaging the spokes 35 of the drum end 9. The opposite ends of these rods are fixed in the arms 35 extending radially from a hub rotatable on the shaft portion 6, for the purpose of stabilizing the action of the rods 33 in their movement around the shaft 4, to keep them from cramping in the drum end 9, in transmitting the necessary torque to rotate the drum intermittently. One rod is probably sufficient in small machines for advertising purposes, but in the larger types for standard projection two or more may be advisable, since it is important that there be no lag or lost motion in transmitting the intermittent motion to the drum, especially in high speed exposure work, such as "slow motion" pictures that may run up to two hundred or more exposures per second.

The lamp housing 36 is adjustably fixed upon the bracket 37, that is fixed upon the shaft 4 and extends transversely to a point in proximity to the inside surface of the periphery 12. The electric cord 38 for supplying current from the generator to the lighting means, in the lamp housing, is carried through the hollow center of the portion 6 of the shaft, thence outward through a hole bored into the shaft to meet said central bore. The frame 39 is adjustably fixed upon the end of the bracket 37 and is intended to "frame" the light projected through the film, to properly center the exposure on the projection screen, not shown. The lamp housing is provided with a condenisng lens 40, for focusing the light rays onto the film in the usual manner. These rays passing through the transparent drum 12 and the film thereon are projected into the telescopic lens tube 41, through which they are focused and thrown onto the screen.

The usual shutter 42 is interposed between the film and the focusing lens tube 41, to intermittently cut off the light synchronously with the operation of the pawl 17 which advances a new picture area into the exposure frame.

This shutter is mounted on the shaft 43, extending outwardly from the bracket 44, rising from the base 1. The shutter is driven through a miter gearing 45 one gear of which is fixed upon the shutter shaft 43, and the other on the end of the drive shaft 46, which is mounted in the bearing 45 on the bracket 44 rising from the base 1. The driven end of this shaft is provided with a gear 47, enmeshed with a similar gear 47', that is fixed upon the pawl shaft 19, whereby the drum drive and the shutter drive are driven in unison from a common source, to insure precise timing in their synchronous actions. The shutter may be of any of the accepted types, but the rotary type shown, with a segmental opening therethrough, representing about one fifth of its travel past the lens, is preferred, to cause the "light" and "dark" periods necessary to expose and move the film, in the conventional manner.

In starting the machine the drum is rotated on the shaft 4, until its end 9 is in proximity to the ratchet 16, which brings the first exposure on the lead end 13 of the film into axial alignment with the image projecting lens tube 41. The motor switch 48 is now turned on, which starts the motor

32, and lights the lamp which is wired in multiple in the motor circuit. The intermittent rotation of the drum exposes the film for projection, contra clockwise, bringing the film down from above as the drum is rotated. The left hand screw 7 engaging the end 9 of the drum causes it to advance to the left, see Figure 1, until all the film has been exposed through the projecting lens. The drum is returned to the starting position by reversing the drive.

The drive is reversed by means of the slide rod 48, that is slidable in the guides 49 and 50 rising from the base 1, see Figure 4. The marginal trips 51 and 52 are adjustably fixed upon this slide rod by set screws and are adapted to abut the ends 8 and 9 of the film drum. By means of these trips 51 and 52 the drum may be stopped, started and reversed at any point in its travel; whereby any selected part of the film subject may be chosen for projection and repetition, by limiting the lateral travel of the drum to the area predetermined by the trips 51 and 52.

The end of the slide rod 48 has the yoke 53 fixed thereon which engages the grooved hub 54 of the sliding gear 55, enmeshed with the driven pinion 24 at all times. This gear 55 rotates and is slidable on the stud shaft 56, fixed in the standard 57, rising from the base 1, and slidably meshes and unmeshes with the crown gear 58, fixed to the side of the ratchet 16, to which it imparts a reverse movement for retracting the film drum on the thread 7. The "reverse" movement is clockwise or to the right, while the movement of the drum for projection is contrawise. At the same time that the sliding gear 55 is slid into or out of mesh with the ratchet wheel gear 58, the pin 59 fixed on the rod 48, engages the cam 60, on the pawl to lift it out of engagement during the "reverse" movement, but permits it to reengage the ratchet 16, for the normal intermittent feed. The introduction of the sliding gear 55, makes it possible to interpose a gear ratio between the motor 32 and the gear 58, that will reverse the film drum very quickly.

Since it is desirable that the drum be reversed during the period of darkness, the circuit for the lamp in the housing 36 is wired through the contact switch 61, that is arranged on the standard 57, in such a position that it springs open and opens the lamp circuit, when the rod 48 slides forward to accomplish the "reverse" above described. When the sliding rod is retracted it compresses the contacts of the switch 61 and closes the lamp circuit.

The present embodiment of the invention illustrated is especially adapted to the projection of advertising films, ranging in capacity from small machines for projecting pictures on prepared portions of automobile wind-shields or show windows up to larger units for bill-board and out door work; but it is equally adaptable to use for theater projection, with modifications obvious to those skilled in the art. For instance, drums of sufficient capacity could be made to carry thousands of feet of film and such drums or the cylindrical peripheries 12 could be changed on the machine, in preference to the present time wasting and film destroying method of "rewinding" after each run.

The details of the projecting lens, shutter and light elements have not been specifically described, because any of the types of same now in the art are available.

For stereopticon projection the shutter mechanism may be omitted, and the "still" pictures flashed onto the screen without the "dark" period. To further simplify the stereopticon, the screw feed 7, may be omitted and an alined single series of pictures arranged on the drum end to end for a continuous projection, without "reversing" the mechanism; thus retaining all the advantages of film carrying drums.

It is advisable to equip the projecting mechanism with a safety shutter that will automatically drop into the path of the projecting ray of light, should the motor accidentally stop. Such centrifugally operated devices are now regularly supplied with projecting machines to prevent burning the film in the event that the film stops.

The designation "motion picture machine" as used herein, is intended to define a complete apparetus or machine for taking or projecting motion pictures; certain portions or combinative elements of which have been modified by this invention to accomplish new, novel and improved results by a new mode of operation, as defined in the claim, which are simplified by the inclusion of sub-combinations under this inclusive designation.

The term "film" is used in the broad sense to mean a series of pictures of progressive motion, still life, headings, captions and projectable matter, which may be upon a strip or ribbon film or individually framed on the drum or printed thereon. The present embodiment of the invention is designed to utilize the conventional forms of films now on the market, for economic reasons, without the intention of limiting the invention thereto.

The "cycle of the projection" is the period including the projection of a series of pictures and the return to the starting point.

Having thus described this invention what I claim and desire to secure by Letters Patent is:

1. A motion picture machine comprising a

base having shaft supports thereon; a shaft fixed in said supports and having a screw thread on a portion of its length; a film drum having one end threaded on said shaft and the other end slidable thereon; an image film on said drum; a ratchet revolvable on said shaft; rods fixed in said ratchet and slidably engaging said drum; a pawl engaging said ratchet; pinion means for operating said pawl; a spur gear fixed to said ratchet; a sliding gear adapted to engage and disengage between said pawl pinion and spur gear; a reversing slide rod guided on said base and engaging said slideable gear and having trips thereon in the path of the film drum; an electric light projecting means within said drum and an image projecting lens in juxtaposition to said light means.

2. A motion picture machine comprising a base having shaft supports thereon; a shaft fixed in said supports and having a screw thread on a portion of its length; a film drum having one end threaded on said shaft and the other end slidable thereon; an image film on said drum; a ratchet revolvable on said shaft; rods fixed in said ratchet and slidably engaging said drum; a pawl engaging said ratchet; pinion means for operating said pawl; a spur gear fixed to said ratchet; a sliding gear adapted to engage and disengage between said pawl pinion and spur gear; a reversing slide rod guided on said base and engaging said slideable gear and having trips thereon in the path of the film drum; a cam on said pawl engaging a pin on said reversing rod, whereby said pawl disengages during the reversal of the drum; an electric light projecting means within said drum and an image projecting lens in juxtaposition to said light means.

3. A motion picture machine comprising a base having shaft supports thereon; a shaft fixed in said supports and having a screw thread on a portion of its length; a film drum having one end threaded on said shaft and the other end slideable thereon; an image film on said drum; a ratchet revolvable on said shaft; rods fixed in said ratchet and slideably engaging said drum; a pawl engaging said ratchet; pinion means for operating said pawl; a spur gear fixed to said ratchet; a sliding gear adapted to engage and disengage between said pawl pinion and spur gear; a reversing slide rod guided on said base and engaging said slideable gear and having trips thereon in the path of the film drum; an electric light projecting means within said drum and an image projecting lens in juxtaposition to said light means; a switch in circuit with said electric light means, operated by said reversing rod, whereby the light is extinguished during the reversal of the drum.

4. A motion picture machine comprising a base having shaft supports thereon; a shaft fixed in said supports and having a screw thread on a portion of its length; a film drum having one end threaded on said shaft and the other end slideable thereon; an image film on said drum; a ratchet revolvable on said shaft; rods fixed in said ratchet and slideably engaging said drum; a pawl engaging said ratchet; pinion means for operating said pawl; a spur gear fixed to said ratchet; a sliding gear adapted to engage and disengage between said pawl pinion and spur gear; a reversing slide rod guided on said base and engaging said slideable gear and having trips thereon in the path of the film drum; an electric projecting means within said drum; an image projecting lens in juxtaposition to said light means; a cam on said pawl engaging a pin on said reversing rod; a switch in circuit with said electric light means, operated by said reversing rod, whereby the light is extinguished and the pawl disengaged during the reversal of the drum.

5. A motion picture machine comprising a base having shaft supports thereon; a shaft fixed in said supports and having a screw thread on a portion of its length; a film drum having one end threaded on said shaft and the other end slideable thereon; an image film on said drum; a ratchet revolvable on said shaft; rods fixed in said ratchet and slideably engaging said drum; a pawl engaging said ratchet; pinion means for operating said pawl; a spur gear fixed to said ratchet; a sliding gear adapted to engage and disengage between said pawl pinion and spur gear; a reversing slide rod guided on said base and engaging said slideable gear and having trips thereon in the path of the film drum; an electric light projecting means within said drum and an image projecting lens in juxtaposition to said light means; a shutter interposed in the beam of light from said light means and synchronously operated with said pawl by said pawl pinion.

6. A motion picture machine comprising a base having shaft supports thereon; a shaft fixed in said supports and having a screw thread on a portion of its length; a film drum having one end threaded on said shaft and the other end slideable thereon; an image film on said drum; a ratchet revolvable on said shaft; rods fixed in said ratchet and slideably engaging said drum; a pawl engaging said ratchet; pinion means for operating said pawl; a spur gear fixed to said ratchet; a sliding gear adapted to engage and disengage between said pawl pinion and spur gear; a reversing slide rod guided on said base and engaging said slideable gear and having trips thereon in the path of the film drum; an electric projecting

means within said drum; an image projecting lens in juxtaposition to said light means; a cam on said pawl engaging a pin on said reversing rod; a switch in circuit with said electric light means, operated by said reversing rod, whereby the light is extinguished and the pawl disengaged during the reversal of the drum; a shutter interposed in the beam of light from said light means and synchronously operated with said pawl by said pawl pinion.

In testimony whereof I have hereunto affixed my signature.

JAMES R. BRADFORD.