Nov. 15, 1932. L. RANIERI 1,888,094

CINEMATOGRAPHIC PROJECTOR, CAMERA, AND THE LIKE

Filed Oct. 3, 1930 2 Sheets-Sheet 1

Fig. 1.

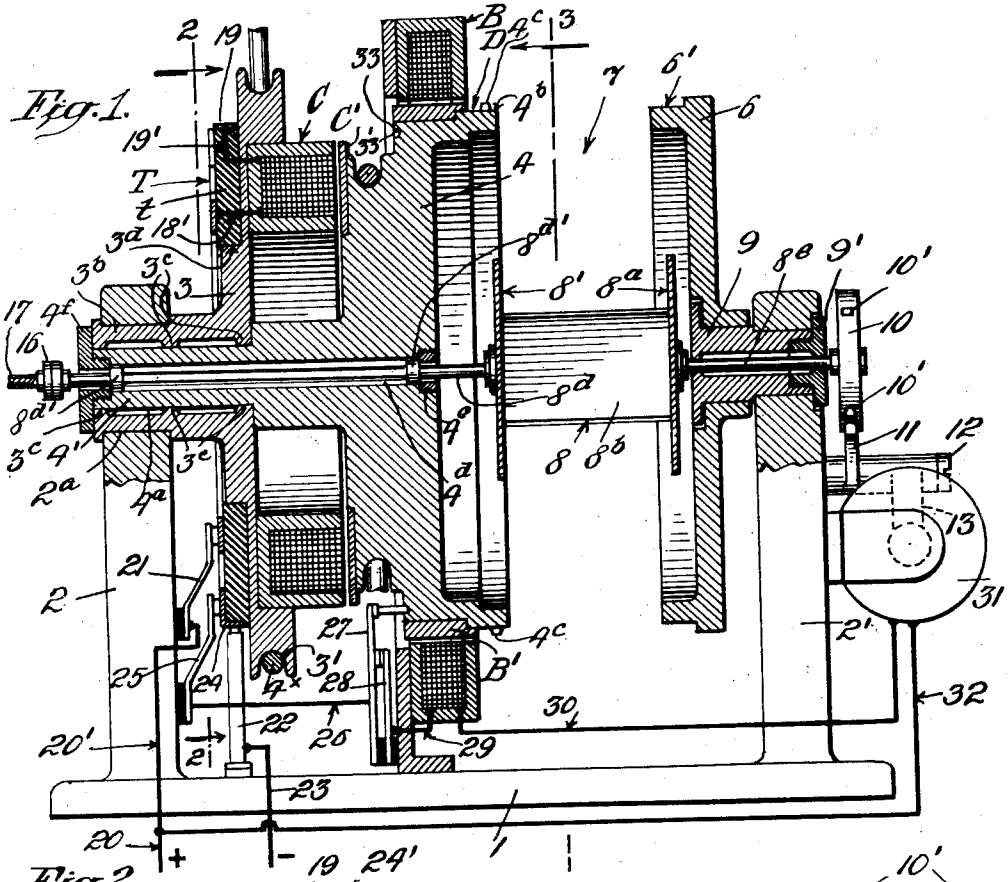


Fig. 2.

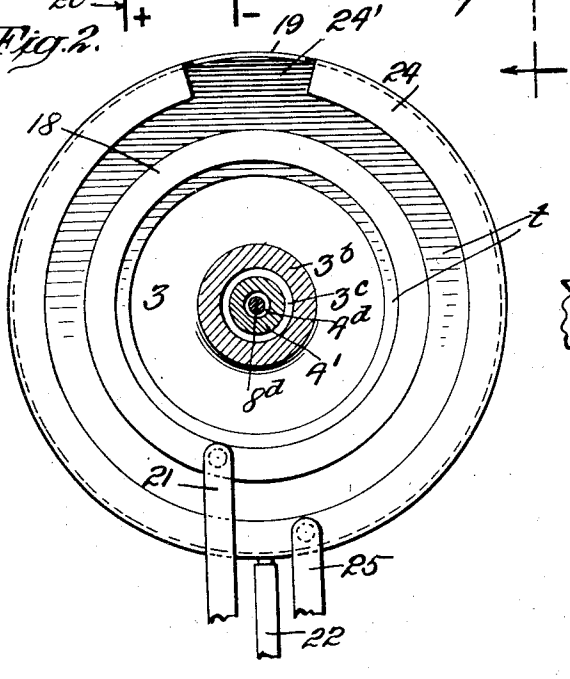
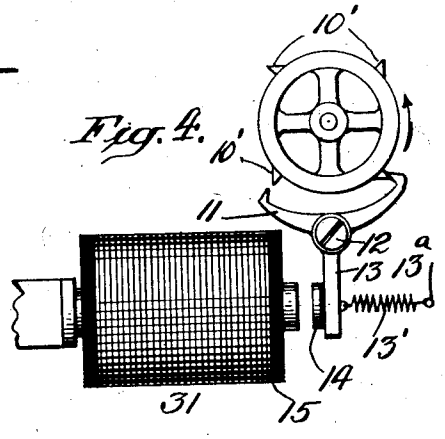


Fig. 4.



INVENTOR
BY Luigi Ranieri
Joseph F. O'Brien
ATTORNEY

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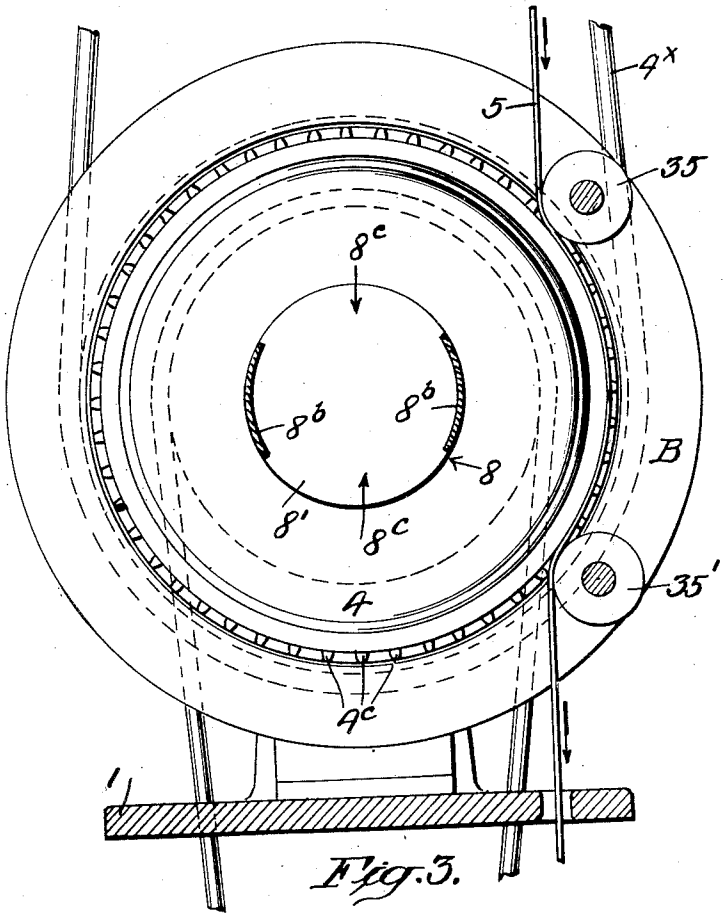


Fig. 3.

INVENTOR
Luigi Ranieri
BY Joseph F. O'Brien
His ATTORNEY

Patented Nov. 15, 1932 1,888,094

UNITED STATES PATENT OFFICE

LUIGI RANIERI, OF ROME, ITALY, ASSIGNOR OF ONE-HALF TO CARLO DENTICE DI FRASSO

CINEMATOGRAPHIC PROJECTOR, CAMERA, AND THE LIKE

Application filed October 3, 1930. Serial No. 486,126.

This invention relates to improvements in cinematographic projectors, cameras and the like.

Objects of this invention are to produce a mechanism which will provide increased steadiness and increased brilliancy of the images; which, in operation, will involve a minimum of stress of the film; which will enable a film to be driven by a toothed engagement of the film-driving member with only one edge of the film, thus providing greater utilizable space on the film; which will greatly facilitate the projection at high speed of multi-colored film; in which the film stressing is so gentle as to make possible the running and the obtaining of the many advantages of special light and non-inflammable films which owing to their lightness and delicate structural characteristics will not stand the stresses required by conventional projectors, so that the many advantages of such films were heretofore unobtainable.

Other objects of my invention are to produce a two-way mechanism which will be operable in opposite directions, so that a film may be caused to travel downwardly as in the conventional machine and also upwardly; to provide a mechanism which will eliminate the large looping of the film required in the conventional apparatus and thus to make it possible to provide a shorter or lesser distance between the projection gate and the sound gate.

Still other objects of my invention are to produce a mechanism in which electro-magnetic force is utilized as the power-coupling and braking element, and in which the driving, stopping and braking will be electrically timed to cause the stop period to have a predetermined ratio in relation to the moving period and preferably to have a stop or picture-projection period which will continue and endure for a period at least ten times longer than the period of darkness subsequently allowed between pictures, it being understood that in the conventional apparatus with fly-shutters, a much more limited ratio exists between the darkness and light periods.

With these and other objects in view, the invention comprises the combination of members and arrangement of parts so combined as to co-act and cooperate with each other in the performance of the functions and the accomplishment of the results herein contemplated, and comprises in one of its adaptations the species or preferred from illustrated in the accompanying drawings, in which:—

Fig. 1 is a central longitudinal section showing an apparatus embodying my invention;

Fig. 2 is a section on the line 2—2 of Fig. 1, looking in the direction of the arrow;

Fig. 3 is a section on the line 3—3 of Fig. 1, looking in the direction of the arrow; and

Fig. 4 is an end view of the shutter-actuating escapement and electro-magnetic operating means therefor shown in side elevation in Fig. 1.

Referring now to these drawings, which illustrate a preferred embodiment of my invention, a film-driving element D is so mounted and arranged in relation to a power coupling element C as to provide for an intermittent driving and releasing through electro-magnetic force of the film-driving element D through said coupling element and said film-driving element is also so mounted and arranged in relation to an electro-magnetic braking element B as to provide for a braking by electro-magnetic energy of said film-driving element upon release by the coupling element and for release of the braking element simultaneously with the driving movement of the electro-magnetic coupling element, said electro-magnetic driving and releasing and said electro-magnetic braking and releasing being timed by an electric timing mechanism preferably comprising suitable electric switch mechanism to provide predetermined intervals of stoppage and movement. In order to accomplish these results, I position the driving element in close adjacency to both the power-coupling element and to the braking element and mount on or in fixed relationship to said driving element armatures of electro-magnetic coils embodied in said coupling and braking elements. I also preferably utilize electro-mag-

netic means for actuating the light shutter simultaneously with the actuation of the braking means and preferably the driving, braking and operation of the light shutter are controlled by a single rotatable timing member T adapted upon each cycle of movement or rotation to successively energize and de-energize the power-coupling, braking and light-shutter actuating mechanisms. This timing element T preferably rotates synchronously with the power coupling element and, in the preferred embodiment of my invention, power-coupling electro-magnetic coils C and said timing element T are conjointly mounted upon a single rotating member or pulley and will thus be movable synchronously and conjointly.

In the embodiment of my invention illustrated, 1 indicates a base having at opposite ends bearing-brackets 2, 2′ in which I mount my improved projection apparatus. Thus I mount in the bearing 2^a of the bracket 2 a pulley 3 which is provided at its outer periphery with a groove 3′ and is continuously driven, as shown, by a driving belt 4^x from any suitable source of power not shown. As illustrated, the said pulley 3 is mounted in the bracket 2 by providing at one side of said pulley a hollow arbor 3^b which has in its outer circumference a grooved bearing surface bearing in and embracing the edges of the bearing aperture 2^a of said bracket.

The said pulley 3 carries at one side thereof a power coupling element comprising electro-magnetic coils C and preferably has mounted on the other side thereof a timing member T, the details of which will be hereinafter more particularly described.

Mounted to rotate co-axially with the pulley 3 is the film-driving element D comprising, as shown, a sprocket-wheel 4 carrying at one side an armature C′ arranged in such close adjacency to the coils C as to enable effective magnetic attraction between said armature and the coils C when the latter are energized. Said sprocket-wheel 4 also carries at its periphery an armature B′ arranged in similar close relationship with the braking coil B.

As illustrated the said sprocket-wheel 4 is mounted coaxially within the hollow arbor 3^b of the pulley 3 and is provided at one side with a hollow shaft or arbor 4′ having a bearing at its outer periphery 4^a with a series of bearing rings 3^c arranged on the interior surface of said hollow arbor 3^b. The sprocket-wheel 4 is also provided at its periphery with a film-engaging portion 4^b and sprocket teeth 4^c adapted to enter into perforations 5′ in the edge of a film 5, (Figs. 5 and 6).

It will be seen from the above that I have provided means whereby the power derived from the belt 4^x and pulley 3 will be transmitted to the film-driving wheel by the attractive power of the electro-magnetic coil C for its armature C′ and that the braking power will also constitute the attractive magnetic force between the braking coils or element B and its armature B′.

In the preferred form of my invention illustrated, I am, in view of the gentle stress applied on the film because of the utilization for the driving and braking of the film-driving wheel of electro-magnetic attraction, enabled to drive the film 5 by engagement of the sprocket teeth 4^c with one side only of the film 5 and, in the preferred embodiment of my invention illustrated, the film is supported and driven by a toothed-engagement of one edge only with the sprocket wheel 4, the opposite edge being unperforated and supported or engaged in a toothless groove 6′ on an idling pulley or wheel member 6 mounted, as shown, on a hollow bearing sleeve 9 extending in the bearing-bracket 2′.

This idling pulley 6 is spaced from the sprocket-wheel 4 to provide a light channel 7 within which I rotatably mount also on the same axis as the pulley 3 and sprocket wheel 4 a rotatable light shutter element comprising a sectional spool 8 composed of a pair of disks 8′, 8^a connected by a pair of segmental shutter members 8^b and having arranged therebetween a light-exposure channel 8^c. As illustrated, the light shutter element or spool 8 has fixed to the disks 8′, 8^a oppositely-extending shafts 8^d, 8^e. The shaft 8^d extends axially through the sprocket-wheel 4 and its hollow arbor 4′ and is provided with bearing rings $8^{d'}$ bearing against the interior surface of an axial bore 4^d through said wheel 4 and arbor 4^a. This shaft 8^d is maintained against longitudinal movement in said bore at one end by a nut 4^e and at the other end by a nut 4^f. The shaft 8^e extending in the opposite direction from the disk 8^a passes axially through the bearing sleeve member 9 which is locked to the bracket-bearing 2′ by a threaded connection with a nut 9′ and said shaft 8^e is provided at its outer end with an escapement wheel 10 provided with escapement teeth 10′ engageable by a bifurcated escapement member 11 pivoted at 12 and being rocked about its pivot 12 by an arm 13 carrying at one side an armature 14 of an electro-magnet 15. Said arm 13 is moved in the opposite direction by a spring 13′ stretched between the said arm and any suitable fixed point such as a pin 13^a which extends outwardly from the bearing-bracket 2′. The shaft 8^d extending in the opposite direction from the light shutter is continuously rotated from any suitable source of power, not shown, and a friction clutch 16 is preferably interposed between a flexible power-transmission shaft 17 and said shaft 8^d in order to cause the same to be continuously but yieldably driven.

I will now describe the electrical circuits to the coils C, B and 31 and the methods of

operation of my electro-magnetic power-coupling, braking and light-shutter operating mechanism.

In said preferred embodiment of my invention shown, the timing element T constitutes a multi-switch mechanism inserted in the circuits of the coils C, B and 31. Thus it embodies an annular disk of insulating material *t* which is supported on a hub-portion 3ª of the pulley 3 and is provided on its outer face with a completely annular metallic contact ring 18 which comprises one terminal of a timing switch for the power-coupling coil C and is connected by a wire 18′ to one terminal of said coils C. The outer periphery of the said disk *t* is provided with an insulated segmental contact member 19 which comprises the other terminal of the switch for said coils C and is electrically connected by a wire 19′ with the other terminal of said annular coil C. The magnetic coil C is in a circuit extending from any suitable source of power not shown to the wires 20, 20′ and spring-contact element 21, the continuous ring 18, coil C, segmental contact member 19, and a spring-contact element 22 which is connected to a wire 23 extending back to the source of power, not shown. When the insulated disk *t* is rotated the segmental contact member 19 will, during a minor portion of its cycle of movement of said disk, contact with the contact element 22 and during such minor portion of its movement over said segmental contact member the circuit will be closed and current will flow through wires 20, 21, contact element 22, contact ring 18, through the wire 18′, to the coil C, thence through the wire 19′, segmental contact member 19, spring-contact member 22 and wire 23 to the source. During the contact of the segmental contact member 19 with the spring-contacting element 22, the coil C will be energized to attract and electro-magnetically couple with the annular armature C′, thus partially rotating the sprocket-wheel 4. So soon as the spring-contact 22 passes over the segmental contact plate 19, the coil C will be de-energized and the armature C′ and the sprocket-wheel 4 released.

The timing switch mechanism on the element *t* for the braking coils B causes the energizing of said coil during a major segmental portion of the cycle of movement of said insulated disk *t*, and for this purpose, the insulating element *t* is provided with a major segmental contact member 24 which in circuit, reversely stated, comprising wire 23, spring-contact member 22, segmental movable contact member 24, spring-contact member 25, wire 26, make-and-break contact members 27 and 28, wire 29, to one terminal of the coil B, the other terminal being connected by wire 30, through the electro-magnet 31, and wire 32 to the source wire 20. Obviously, the coil B will be energized during the major cycle of movement of the timing disk *t* and while the contacts 22 and 25 are connected through and maintained in contact with the angle plate 24 which is mounted on the corner between the periphery and side edge of the disk *t*. This circuit will be broken and the coils de-energized during the passage of the spring-contacts 22 and 25 over the plate 19 and insulated segmental section 24′. It will be seen that the contact members 24 and 19 are complemental and together substantially cover the complete cycle of movement of the timing disk *t*.

Notwithstanding the fact that the braking coil B is energized and de-energized through the time-switch element 24, I have found it desirable also to control the braking of the sprocket-wheel D through the movement of said wheel itself and for this purpose, I have provided in the energizing circuit the make and break elements 27 and 29 and have caused said make and break elements to be positively actuated to open and close the circuit to the coil B by track 33′ and a series of spaced notches 33 formed in the side of said wheel 4, which track and notches cooperate with a finger 27′ on the spring-contact 27 to move the same into and out of contact with the fixed make and break member 29 and thus to prevent energizing of the braking coils except during the extension of the finger 27′ into a notch 33, it being understood that at all other times the finger will ride upon the track-surface 33′ and thus retain the circuit in broken condition until the contact fingers enter one of the notches 33. The notches 33 are so arranged in spaced relationship to each other as to provide between each pair of them a space similar to or corresponding with the exact height or length of a single picture on the film.

It will be seen that the circuit just described includes the electro-magnet 31 and consequently this circuit will simultaneously energize said magnet 31 to attract the armature 14 which will swing the pivoted arm 13 to rock the forked escapement member 11 and to cause the teeth 11′ thereof to engage the teeth 10′ of the escapement wheel 10, it being understood that this escapement wheel will be continuously but yieldingly rotated as hereinabove described and that it will be normally held against rotation by the engagement of one of the teeth of the member 11 held by the spring 13′ until the member 11 is released through the attraction of the armature 14 by the energizing of the magnet 15 which, as aforesaid, is accomplished simultaneously with the energizing of the braking element hereinabove referred to. The shutter will thus be rotated to permit light to pass through the film and to maintain it in this position until the coil is de-energized as hereinabove specified whereupon the spring 13′ will again

act to move the shutter into light-blocking position, it being understood that these operations will be caused to occur successively in the operation of the projecting mechanism.

In the preferred form of my invention illustrated, I also provide means for rewinding the film. This is accomplished by providing in the periphery of the sprocket-wheel 4 a groove 34 and utilizing a belt in said groove for the purpose of reversely rotating the sprocket-wheel 4 to rewind the film, when desired.

In the preferred embodiment of my invention, the film is maintained in contact with the film-driving element or carrier D by rollers 35, 35′ (see Fig. 3) which may be mounted in any conventional manner and it will be seen that the conventional loop adjacent to the film-driving sprocket wheel may be substantially eliminated with the results hereinabove specified.

Having described my invention, I claim:—

1. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, and means for braking said film-driving element also by electro-magnetic force.

2. A cinematographic projector embodying, in combination, a source of power, a rotatable film-driving element, having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, and electro-magnetic means for operating a light shutter simultaneously with the operation of said braking mechanism.

3. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, and timing means operable during a cycle of movement thereof to energize and de-energize the magnetic coupler to move and release the film and to energize and de-energize the magnetic braking mechanism to hold the film-driving element in stationary position.

4. A cinematographic projector embodying, in combination, a source of power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, electro-magnetic means for operating a light shutter simultaneously with the operation of said braking mechanism, and timing means operable during a cycle of movement thereof to energize and de-energize the magnetic coupler to move and release the film and to energize and de-energize the magnetic braking mechanism to hold the film-driving element in stationary position.

5. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, a rotatable power-coupling element arranged adjacent to said film-driving element, an electro-magnet carried by said coupling element, an armature for said electro-magnet carried by said film-driving element, and means for periodically energizing and de-energizing said electro-magnet during a cycle of rotation of said coupling element to attract and release the said armature to cause an intermittent movement of said film-driving element.

6. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, a rotatable power-coupling element arranged adjacent to said film-driving element, an electro-magnet carried by said coupling element, an armature for said electro-magnet carried by said film-driving element, another stationary braking electro-magnet also arranged adjacent to said film-driving element, an armature for said stationary electro-magnet carried by said film-driving element, and means for energizing and de-energizing said power coupling and braking magnets successively.

7. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, a rotatable power-coupling element arranged adjacent to said film-driving element, an electro-magnet carried by said coupling element, an armature for said electro-magnet carried by said film-driving element, another stationary braking electro-magnet also arranged adjacent to said film-driving element, an armature for said stationary electro-magnet carried by said film-driving element, and means for energizing and de-energizing said power coupling

and braking magnets successively including a source of current supply, an electric circuit, a rotatable timing switch element movable synchronously with said coupling element and operable in each cycle of movement to cause an energizing and de-energizing of said coupling and braking magnets.

8. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, a rotatable power-coupling element arranged adjacent to said film-driving element, an electro-magnet comprising an annular coil carried by said coupling element, an annular armature for said electro-magnet carried by said film-driving element, and means for periodically energizing and de-energizing said electro-magnet during a cycle of rotation of said coupling element to attract and release the said armature to cause an intermittent movement of said film-driving element.

9. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, a rotatable power-coupling element arranged adjacent to said film-driving element, an electro-magnet comprising an annular coil carried by said coupling element, an annular armature for said electro-magnet carried by said film-driving element, another stationary braking electro-magnet comprising an annular coil also arranged adjacent to said film-driving element, an annular armature for said film-driving element, and means for energizing and de-energizing said power coupling and braking magnets successively.

10. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, and timing means comprising segmental contact plates mounted in complementary relationship upon a rotary element to conjointly substantially comprise a complete circle and operable during a cycle of movement of said rotary element to energize and de-energize the magnetic coupler to move and release the film and to energize and de-energize the magnetic braking mechanism to hold the film-driving element in stationary position.

11. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, timing means operable during a cycle of movement thereof to energize and de-energize the magnetic coupler to move and release the film and to energize and de-energize the magnetic braking mechanism to hold the film-driving element in stationary position, additional make and break switch elements arranged in circuit with said timing means, and means on the rotatable film-driving element operable to make and break said circuit and to cause the action of the braking element to be accurately synchronized with the movement of the film.

12. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, timing means operable during a cycle of movement thereof to energize and de-energize the magnetic coupler to move and release the film and to energize and de-energize the magnetic braking mechanism to hold the film-driving element in stationary position, additional make and break switch elements arranged in circuit with said timing means, means on the rotatable film-driving element operable to make and break said circuit and to cause the action of the braking element to be accurately synchronized with the movement of the film, and a track on said film-driving element having contact-braking means spaced apart the length of a picture and operable to cause accurate synchronization of the energizing and de-energizing of the braking element with the beginning and ending of a picture.

13. A cinematographic projector embodying, in combination, a source of driving power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, timing means comprising segmental contact plates mounted in complementary relationship upon a rotary element to conjointly substantially comprise a complete circle and operable during a cycle of movement of said rotary element to energize

and de-energize the magnetic coupler to move and release the film and to energize and de-energize the magnetic braking mechanism to hold the film-driving element in stationary position, additional make and break switch elements arranged in circuit with said timing means, and means on the rotatable film-driving element operable to make and break said circuit and to cause the action of the braking element to be accurately synchronized with the movement of the film.

14. A cinematographic projector embodying, in combination, a source of power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, a rotatable light shutter operable by electro-magnetic means simultaneously with the operation of said braking mechanism to move into light-passing position, and operable by spring means upon release by said electro-magnetic means to move into light-blocking position.

15. A cinematographic projector embodying, in combination, a source of power, a rotatable film-driving element having means for engaging a film, rotatable power-coupling means arranged to cause a coupling and uncoupling of said film-driving element with said power source to drive and release the said driving element intermittently at predetermined intervals through electro-magnetic force, means for braking said film-driving element also by electro-magnetic force, a rotatable light shutter operable by electro-magnetic means simultaneously with the operation of said braking mechanism to move into light-passing position, and operable by spring means upon release by said electro-magnetic means to move into light-blocking position, said shutter-actuating means comprising an escapement movable alternately by said electro-magnetic means and spring.

In witness whereof, I have signed my name to the foregoing specification.

LUIGI RANIERI.