Nov. 28, 1933. F. A. BERG 1,937,379

HIGH INTENSITY MULTIPLE ARC PROJECTION LAMP MACHINE

Filed Dec. 7, 1929 4 Sheets-Sheet 1

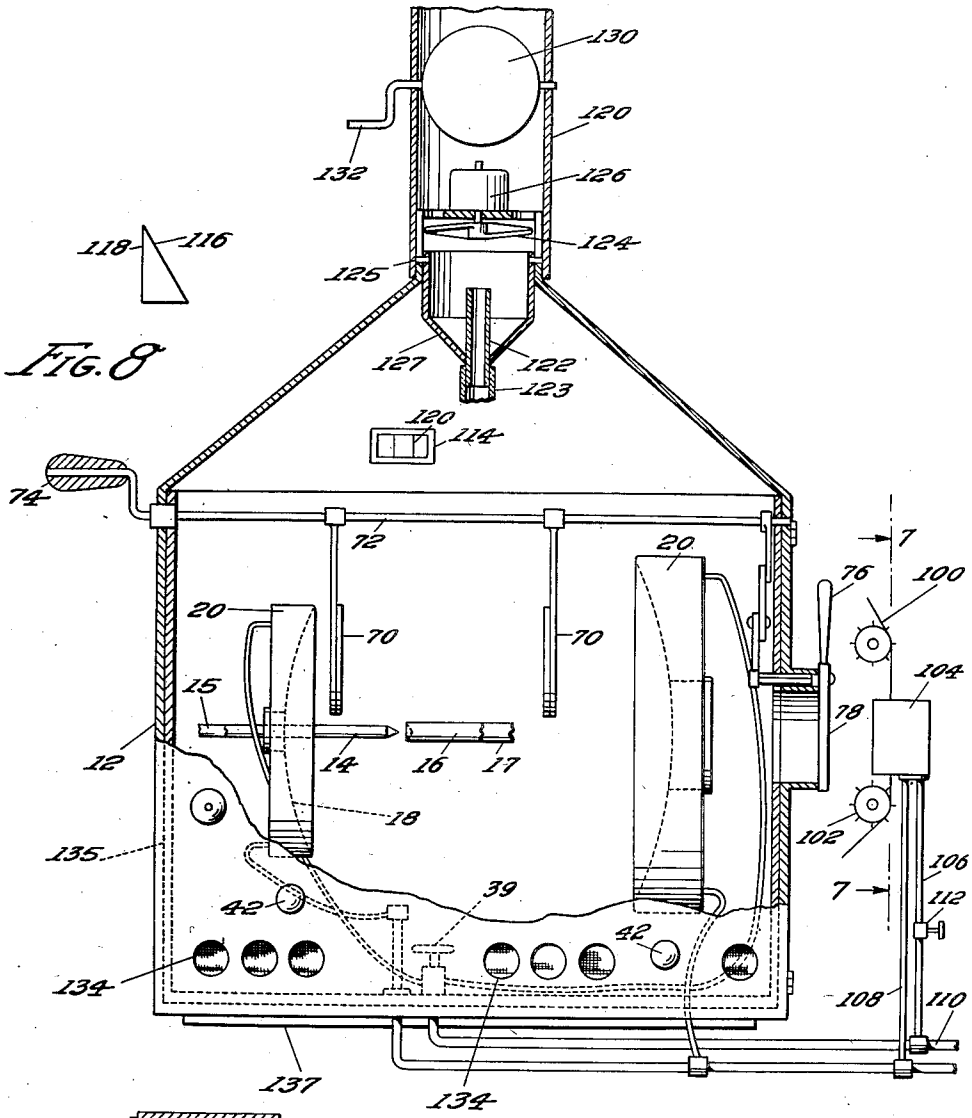


FIG. 1

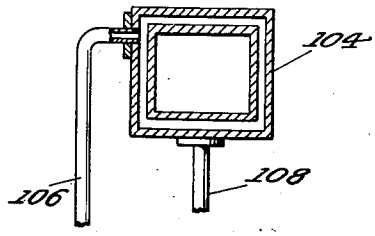


FIG. 7

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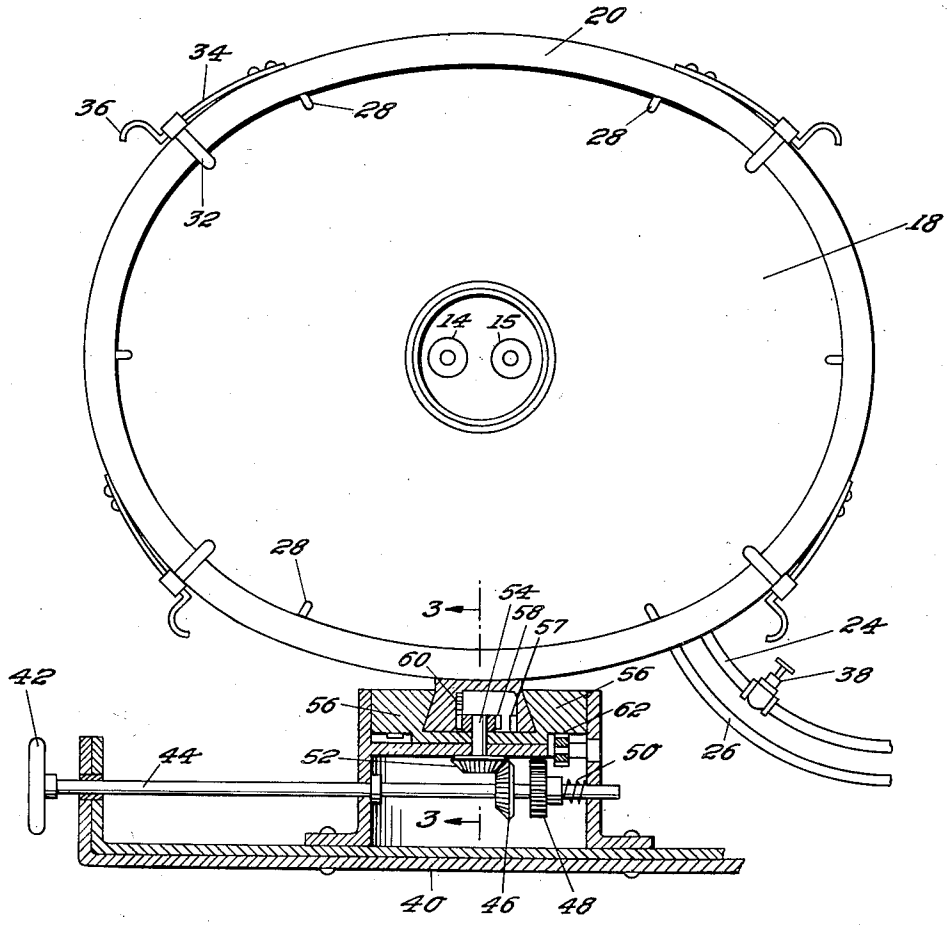


FIG. 2

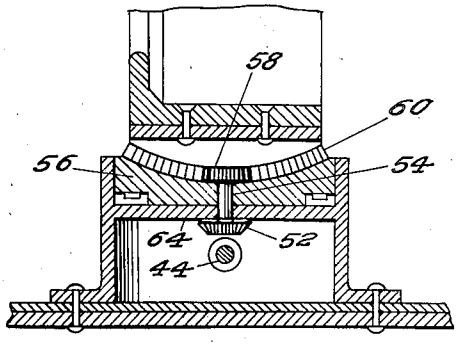


FIG. 3

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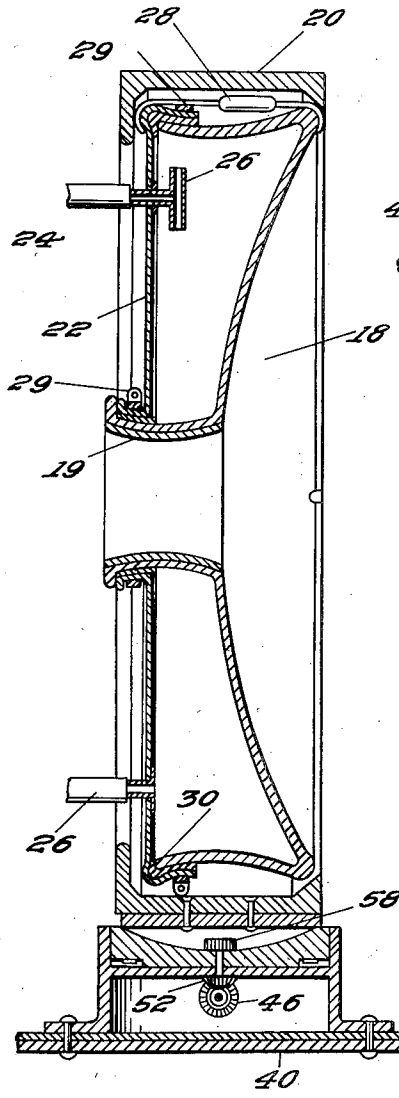


FIG. 4

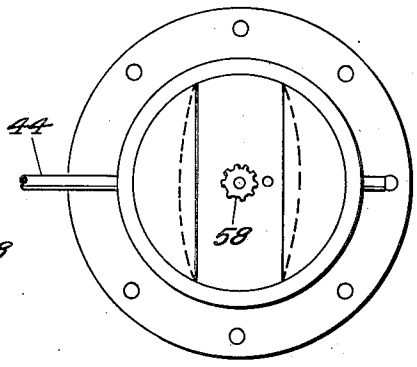


FIG. 5

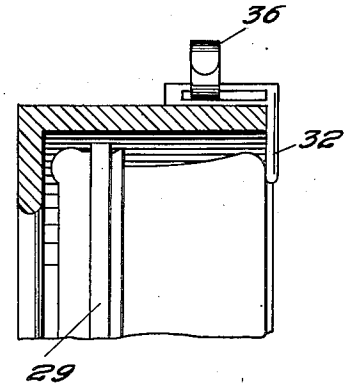


FIG. 6

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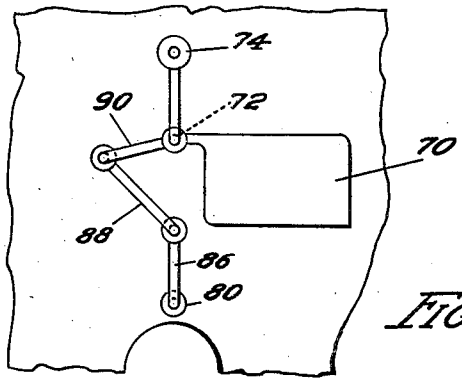


FIG. 9

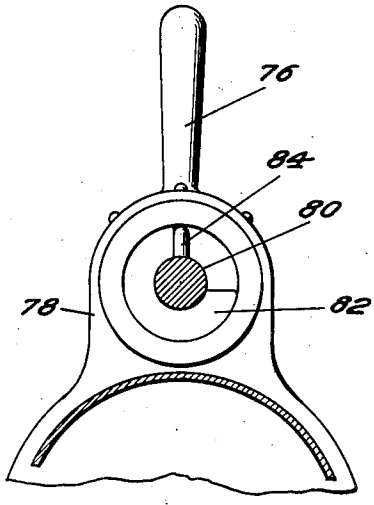


FIG. 11

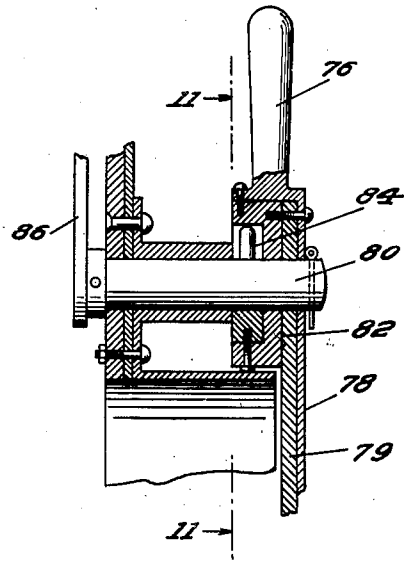


FIG. 10

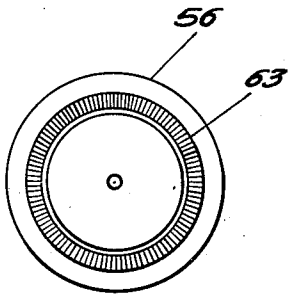


FIG. 13

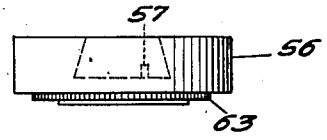


FIG. 12

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UNITED STATES PATENT OFFICE

1,937,379

HIGH INTENSITY MULTIPLE ARC PROJECTION LAMP MACHINE

Frederick A. Berg, Chicago, Ill.

Application December 7, 1929. Serial No. 412,309

24 Claims. (Cl. 88—24)

This invention relates to an improved multiple high intensity hydraulic projection lamp machine and has for one of its principal objects the provision of a multiple arc construction for motion picture projection whereby a high intensity light can be passed through the film for better projection work.

One of the important objects of this invention is to provide a hydraulic cooling system in conjunction with a high intensity lighting arrangement for motion picture projection machines whereby the film will be automatically cooled upon its passage through the machine, thus eliminating danger of overheating, warping of the film, fire or spontaneous combustion.

Still another important object of this invention is the provision in a motion picture projection lamp of means for automatically and continuously exhausting and cleaning the same so that particles of dust and carbon will be removed from the interior thereof and not allowed to accumulate on the reflectors, lens, and the like in the lamp housing.

Another and still further important object of the invention is the provision in a motion picture projection apparatus of a system of elliptical mirrors in conjunction with a multiple arc construction whereby the light from a plurality of arcs can be concentrated and focused upon the film aperture together with a special means of adjusting such mirrors and also cooling the same to insure against cracking from the intense heat developed.

Other and further important objects of the invention will be apparent from the disclosures in the accompanying drawings and following specification.

The invention, in a preferred form, is illustrated in the drawings and hereinafter more fully described.

In the drawings:

Figure 1 is a side elevation of the improved projection apparatus of this invention, parts being broken away to show the interior thereof.

Figure 2 is a front elevation of one of the novel mirrors used in the device.

Figure 3 is a detail view of the mirror support.

Figure 4 is a side elevation of the mirror.

Figure 5 is a top plan view of the mirror support, the mirror being removed.

Figure 6 is a detail view of the mirror housing construction.

Figure 7 is a front plan view of the film aperture.

Figure 8 is a side detail view of the optical prism for inspecting the condition of the multiple arc.

Figure 9 is a detail view of the operating means for the mirror dampers or protectors.

Figure 10 shows the operating handle for the dampers in side elevation.

Figure 11 is a sectional view taken on the line 11—11 of Figure 10.

Figure 12 is an end view of the mirror base.

Figure 13 is a bottom view thereof.

As shown in the drawings:

The reference numeral 12 indicates generally the casing of the improved motion picture projection machine of this invention having a multiple arc therein composed of positive carbons 14 and 15, and negative carbons 16 and 17. Obviously, a plurality of arcs may be employed if desired, providing a multiple high intensity light.

In order that the multiple arc may function properly, the reflecting mirrors are made elliptically oval as illustrated at 18 and 20 respectively, each of the arcs being positioned at one of the foci of the smaller mirror. This arrangement is best illustrated in Figure 2.

Each mirror is composed of some highly reflective material such as silver, glass, or the like, and as best shown in Figures 2 and 4, has a central opening for the introduction of the carbons for the arcs, and each mirror is built into a frame 20 having a back 22, leaving a hollow space for the passage of circulating cooling water or fluid which is introduced through an inlet pipe 24 having a T-shaped inlet spout as shown at 26 so that all parts of the mirror will be effectively cooled, and the water is forced out through an outlet pipe 26 let into the lower portion of the mirror housing.

In order to insure a tight construction, a number of turnbuckles 28 is spaced around the periphery of the mirror, and locking bands 29 encircle the periphery of the mirror housing and also the casing around the central opening. In this way, a water-tight joint can be made between the rear edge 30 of the mirror plate and the corresponding face of the back 22. The interior of each central opening is lined with insulating material 19, such as asbestos or the like.

The mirror may be readily removed from the frame 20, it being held in position by means of a plurality of locking pins 32, each of these pins being positioned upon a spring-impelled clamping element 34 which has as its outer end an operating handle 36. A suitable stop cock 38 is provided on the inlet pipe 24 for controlling the flow of water, and a master valve is provided at 39.

Each mirror is adjustably mounted on a base plate 40, the mounting including means for rotating the mirror about its central vertical axis and also for tilting the same forwardly or rearwardly as desired to obtain a proper focusing of the light rays. Both of these operations are accomplished by a single operating handle 42 outside the lamp housing mounted on a shaft 44 which in turn has positioned thereon a bevel gear 46 and a plain gear 48. A helical spring 50 normally impels the shaft 44 forwardly so that the bevel-gear 46 is normally in mesh with the corresponding bevel-gear 52. This gear 52 is positioned upon a supporting shaft 54 mounted in a plate 64 and upon the upper end of this shaft 54 is another gear which meshes with a rack 60 integral with the mirror support 56 whereby the mirror may be rotated about its vertical axis. The position of the handle 42 with respect to the lamp housing is best shown in Figure 1.

Upon operating the handle 42 inwardly against the pressure of the spring 50, the gear 48 is caused to mesh with a pinion 62 also mounted in the plate 64. This gear 62 is always in mesh with a circular rack 63 which is integral with and forms part of the bottom of the mirror support or base 56 as best shown in Figures 12 and 13. Obviously, a rotation of the handle 42 will impart a corresponding rotation of the mirror support 56 about its central axis 54, thereby rotating the mirror about its central vertical axis. A pin 57 is provided for retaining the mirror support 56 in its proper position, particularly with respect to the meshing of the gear 54 with the rack 60 which, as will be noted from an inspection of Figure 3 is curved upwardly, thereby providing for a forward and rearward tilting motion of the gear itself upon a rotation of the mirrors 46, 52, and 58. The relation of the parts 56 and 60 is such that a frictional sliding fit is provided which maintains this support in desired adjusted position at all times, and without any possibility of becoming loose or displaced. Further the V-shaped support cannot be forced upwardly upon operation of the gear 58.

In this way, the mirror is tilted forwardly or rearwardly at the will of the operator, and when set in this position will remain so even though the operating handle 42 is later used for rotating the mirror about its vertical axis.

Positioned before the upper part of each of the mirrors and between it and the arc is a damper or protecting plate 70 which prevents sparks and molten carbon from metal or the like from striking the surface of the mirror when the arc is struck. These dampers are preferably composed of mica or some other suitable material, and are supported from the rod 72 which passes longitudinally through the casing 12 of the machine. The rod may be rotated by means of an operating handle 74 which is of considerable weight so that it will serve as a counterweight to retain the dampers in a withdrawn position when the device is in operation. The dampers can also be operated simultaneously with the opening of the passage for the light rays through the forward face of the housing, this being accomplished by means of an operating handle 76 which shifts a plate 78 to one side. The plate 78 has an insulating backing 79 of asbestos or the like. This plate when shifted to one side allows passage of the light rays out through the forward opening in the casing. The handle 76 and the plate 78 comprises a unitary construction, and are loosely mounted upon a shaft 80, the handle and plate assembly also comprising a cam element 82 which forms a part thereof and which also comprises a portion of a bearing support for this assembly on the shaft 80. The handle 76 is heavy enough to provide a counterbalance for the weight of the upright dampers. A pin 84 is fixed in the shaft 80 and from an inspection of Figure 11, it will be seen that a rotation of the counter weighted handle 76 with its cam element 82 will move the pin 84 in a clockwise direction, thereby turning the shaft 80. Into the rear end of the shaft 80 is fixed a link 86 which in turn is pivotally mounted to a connecting rod 80, this being in turn pivoted to a further link 90 which is fixed to the shaft 72 upon which the damper or protector plates 70 are mounted. Obviously, a 90° movement of the handle 76 will produce a corresponding 90° upward movement of the dampers 70 and also a corresponding downward motion of the handle 74 which is counter-weighted so as to remain in its downward position, thereby retaining the dampers 70 in their withdrawn position. The plate 78 can then be shifted to cover the aperture in the protector without again moving the dampers 70, if this is desired.

The entire interior of the housing is lined with asbestos or other suitable heat and fire insulating material as shown at 135.

Again the housing as a whole can be adjusted to and from the film aperture plate 104, by sliding the housing on its supporting rails 137. This is for the purpose of properly focusing the light rays at their point of passage through the film, and after an original focusing has been accomplished by adjustment of the elliptical mirrors.

The film is illustrated at 100 in Figure 1 and passes over the usual sprockets 102 before the usual aperture formed in a plate 104, as best shown in Figure 7.

This plate is made hollow and has passages therein for the circulation of cooling water which enters at the top inlet pipe 106 and is forced outwardly at the bottom through the outlet pipe 108. The inlet pipe 106 is connected to the main supply pipe 110 which leads circulating water to the mirrors and is also fitted with a stop cock 112 whereby the flow of water through the aperture plate can be regulated.

In the top of the housing 12 is an opening fitted with an optical prism 114 having its rear face covered with silver or other reflecting element as shown at 116 in Figure 8, and this prism is set at such an angle that the condition of the arcs 14—17 can be readily inspected. The forward face of the prism 118 is frosted and is provided with two hair lines 120 so that the location of the arcs can be accurately determined and positioned without the necessity of gaining access to the interior of the apparatus, the carbons themselves being controlled and manipulated by the ordinary operating handle not shown.

In the top of the housing is fitted a ventilating shaft 120 which has at its lower end a Venturi or other restricted tube 122 so that a considerable current of air may be drawn therethrough by means of a fan 124 operated by motor 126. The upper edge of the Venturi tube is above the lower level of the housing 120 leaving a space for the collection and retaining of dust carbon particles and the like which are drawn through the Venturi tube 122 but which are too heavy to be forced out past the fan. A

damper is provided in the shaft as illustrated at 130, this being operated by means of a handle 132 and a series of inlet vents for air is provided in the lower portion of the housing 12 as illustrated at 134. A flexible hose 123 is attached to the lower end of the tube 122, whereby the interior of the housing may be thoroughly suction-cleaned, the tube being of a length sufficient to reach all corners of the housing.

A pair of locking pins 125 is provided whereby the housing 127 supporting the tube 122 and hose 123 may be removed for disposal of accumulated dust or dirt, also when in operation.

It will be evident that herein is provided a multiple arc high intensity hydraulic optical system for projection machines which in addition to providing an amount of available light at least double that of the present system will automatically provide for the dissipation of the heat necessarily involved in this additionally high intensity projection. This is accomplished by means of the novel hydraulic system incorporated into the apparatus which also includes an automatic cooling of the film itself as it passes the light aperture. This cooling is further accentuated by the action of the automatic ventilating and blower system incorporated into the construction.

I am aware that many changes may be made, and numerous details of construction varied throughout a wide range without departing from the spirit of this invention, and I therefore do not purpose limiting the patent granted hereon otherwise than as necessitated by the prior art.

I claim as my invention:

1. A high intensity multiple arc projection lamp machine including a plurality of aligned opposed reflector mirrors of elliptical shape, and arcs positioned at each of the focal points of said mirrors, each mirror having an opening therein for passage of light rays.

2. A high intensity multiple arc projection machine including a plurality of aligned opposed reflector mirrors of oval elliptical shape, an arc being positioned at each of the focal points of one of the mirrors, each of the mirrors provided with a central opening, one for the positioning of the carbons, and the other for the passage of light rays therethrough.

3. A high intensity multiple arc projection lamp machine including a plurality of hydraulic cooled aligned opposed mirrors, and means for adjusting said mirrors, both tiltable and rotatable, said means comprising a single operating handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tiltable movement of the reflector mirrors and the plain gear accomplishing rotation thereof.

4. A high intensity multiple arc projection machine including a plurality of mirrors, and means for adjusting said mirrors, both tiltable and rotatable, said means comprising a single operating handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tiltable movement of the mirror and the plain gear accomplishing rotation thereof, the bevel-gear normally meshing with a corresponding bevel-gear mounted on a shaft in the mirror base, a pinion on the other end of the shaft, and a rack in the mirror support in mesh with the pinion.

5. A high intensity multiple arc projection machine including a plurality of mirrors, and means for adjusting said mirrors, both tiltable and rotatable, said means comprising a single operating handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tiltable movement of the mirror and the plain gear accomplishing rotation thereof, the bevel-gear normally meshing with a corresponding bevel-gear mounted on a shaft in the mirror base, a pinion on the other end of the shaft, and a rack in the mirror support in mesh with the pinion, the said rack being curved upwardly along an arc having its center in the center of the mirror.

6. A high intensity multiple arc projection machine including a plurality of mirrors, and means for adjusting said mirrors, both tiltable and rotatable, said means comprising a single operating handle for each mirror, a bevel-gear and a plain gear on the handle, means for selectively operating said mirrors, said bevel-gear accomplishing tiltable movement of the mirror and the plain gear accomplishing rotation thereof, the plain gear adapted to be meshed with a similar plain gear mounted in the mirror base upon an inward movement of the handle, said second-named gear in mesh with a circular rack integral with the mirror support frictionally held in place.

7. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors and means for automatically cooling said mirrors.

8. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors and means for cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of water.

9. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors, at least one of the mirrors having an opening therein for the passage of light rays reflected from the other mirrors, and means for automatically cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of fluid, and casings behind the mirror and forming part thereof for the reception of said cooling fluid.

10. A high intensity multiple arc projection machine including a plurality of opposed aligned elliptical mirrors having the reflecting surfaces opposed, arcs at the focal points of the mirrors, at least one of the mirrors having an opening therein for the passage of light rays reflected from the other mirrors, and means for automatically cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of water, and casings behind the mirror and forming part thereof for the reception of said cooling water, said casings comprising metal boxes, and a system of turnbuckles and clamps for removably mounting the mirror face in said boxes.

11. In a motion picture lamp projector, a plurality of adjustable oval elliptical mirrors having aligned openings in their centers the reflecting surfaces of said mirrors being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture.

12. In a motion picture lamp projector, a plurality of elliptical mirrors having aligned openings in their centers the reflecting surfaces of

said members being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plate, and means connected with said operating means for automatically protecting the mirrors from sparks.

13. In a motion picture projector, a plurality of elliptical mirrors having aligned openings in their centers the reflecting surfaces of said mirrors being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plate, and means connected with said operating means for automatically protecting the mirrors from sparks, said means comprising a shaft extending longitudinally of the casing above the mirrors, a plurality of dampers on the shaft, and connections between the plate operating means and the shaft.

14. In a motion picture projector, a plurality of elliptical mirrors having aligned openings in their centers the reflecting surfaces of said mirrors being opposed, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plates, and means connected with said operating means for automatically protecting the mirrors from sparks, said means comprising a shaft extending longitudinally of the casing above the mirrors, a plurality of dampers on the shaft, and connections between the plate operating means and the shaft, together with means for independently operating the dampers.

15. In a motion picture projector, a plurality of arcs, a plurality of reflectors for the arcs, said reflectors comprising opposed aligned elliptical mirrors, having their reflecting surfaces facing each other and means for automatically and continuously disposing of carbon particles from the arcs, said means comprising a ventilating and suction system.

16. A motion picture projector including a plurality of aligned opposed mirrors, a high intensity arc comprising a plurality of light sources, said light sources being focused and positioned through an opening in one of the mirrors, and the light from both mirrors passing through an opening in the other mirror forwardly out of the projector, a film aperture before said projector opening and means common to the mirrors and the film aperture for fluid cooling the same and means for adjusting the projector with relation to the film aperture.

17. A motion picture projector including a plurality of water-cooled aligned opposed mirrors, a high intensity arc comprising a plurality of light sources, and a water-cooled film aperture, and a common source of cooling liquid for the mirrors and the film aperture.

18. A high intensity multiple arc projection machine including a plurality of aligned opposed mirrors and means for adjusting said mirrors, both tiltable and rotatable, said means comprising a single operating handle, a bevel-gear and a plain gear on the handle, said bevel-gear accomplishing tiltable movement of the mirror and the plain gear accomplishing rotation thereof, the plain gear meshing with a similar plain gear mounted in the mirror base, said second-named gear in mesh with a circular rack integral with the mirror support, and additional means for slightly adjusting both mirrors simultaneously.

19. A high intensity multiple arc projection machine including a plurality of aligned opposed mirrors, and means for automatically cooling said mirrors, said means comprising a system of inlet and outlet pipes for the circulation of water, and casings behind the mirror and forming part thereof for the reception of said cooling water, said casings comprising metal boxes, and a system of turnbuckles, clamps, and bands for removably mounting the mirror face in said boxes.

20. In a motion picture projector, a plurality of elliptical aligned opposed mirrors having openings in their centers, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, and an insulating lining in each of said openings.

21. In a motion picture projector, a plurality of elliptical aligned opposed mirrors having openings in their centers, one opening for the insertion of a plurality of carbons for arcs and the other opening for the passage of light rays to the projector aperture, a plate for covering said aperture, means for manually operating the plate, and means connected with said operating means for automatically protecting the mirrors from sparks, said means comprising a shaft extending longitudinally of the casing above the mirrors, a plurality of dampers on the shaft, and connections between the plate operating means and the shaft, together with means for independently operating the dampers.

22. A high intensity multiple arc projector machine including aligned opposed mirrors and a film aperture, hydraulic cooling means for the mirrors and aperture, and a combination cooling and dust removing system in the projector housing.

23. A motion picture projection lamp, comprising in combination, a pair of carbon arcs, carbons for the arcs, a pair of elliptical mirrors for reflecting the rays from the arcs forwardly through the film aperture of the machine, and means for mounting the carbons for reducing light interference between the mirrors.

24. A motion picture projection lamp, comprising in combination, a pair of carbon arcs, carbons for the arcs, a pair of water-cooled elliptical mirrors for reflecting the rays from the arcs forwardly through the film aperture of the machine, and means for mounting the carbons for reducing light interference between the mirrors.

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