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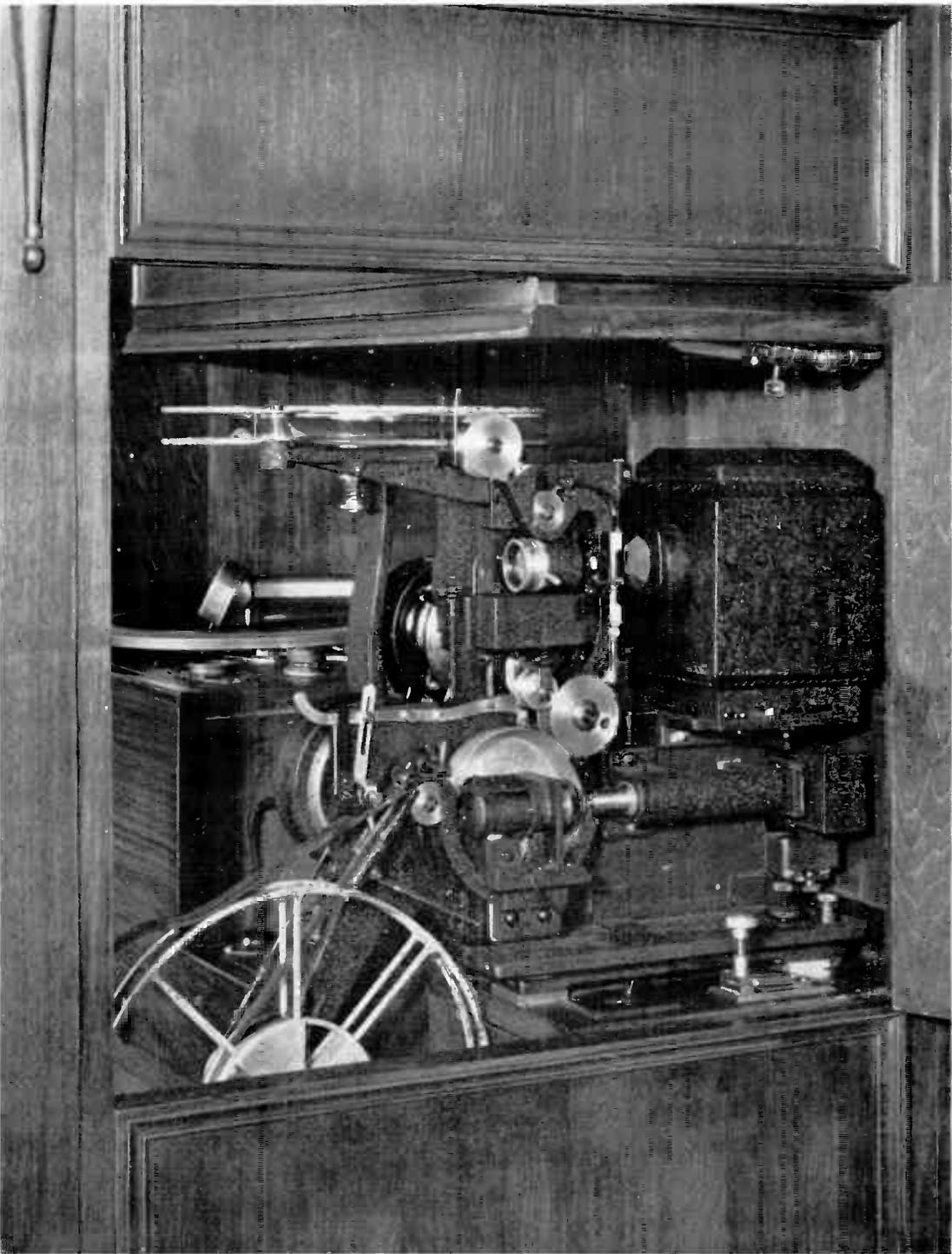


A private theatre for the showing of sound motion pictures.

Sound Motion Picture Apparatus

Vol. 58, No. 9

Dewey Classification R 580



With this type of home picture projector either sound-on-film or sound-on-disc recordings may be shown.

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Sound Motion Picture Apparatus

Commercial Apparatus

In a previous lesson you studied the principles of motion picture projection in general and the mechanism of the Powers Projector in particular. You will now study the equipment made by the following companies, the International Projector Company which is called the "Simplex" projector, the projector made by the Enterprise Optical Co. which is known as the Motiograph, the Baird projector, and the portable sound picture projectors of the R. C. A. Photophone and Western Electric Company.

An illustration of the latest type Simplex machine, known as the Super-Simplex, was shown in a foregoing lesson under the topic "The Projector." This model embodies features that are distinct improvements over earlier Simplex models and in the following text several different views of the picture head will be shown with explanations of the functions of the various parts.

Figure 1 shows the head from the "operating" side which in all machines is the right side of the machine looking toward the portholes or theatre screen. "A" is the guard shield that prevents accidental interruption of the light beam. "B" is the shutter guard inside of which the revolving shutter is located, and it will be seen that in this head the shutter is at the rear instead of in front, as in the Powers projector which you have studied. "C" is the mounting for the upper reel while "D" is the objective lens. Turning handle "E" opens the picture gate for threading the film into place. The knob "F" is used to frame the picture which as we learned, means to place one picture exactly in the aperture, and "G", is the shutter timing adjustment which regulates the revolving shutter so that it cuts off the light while the film is in motion thus preventing "travel-ghost." Turning the knob "H" moves the lens back and forth to permit focusing the image sharply on the screen. All of these adjustments, except that of the film gate mechanism, may be made while the machine is running.

In Figure 2, the same view is shown with the door removed so that the operating mechanism may be studied. The path of the film through the head is as follows: It goes from the upper magazine (not shown) down around the upper feed sprocket "A", being held in contact with the sprocket by the roller "B". Then it forms a loop upward and passes down between the flanges of the guide roller "C", continuing down through the gate "D" (shown closed) at the lower end of which the film goes around the intermittent sprocket "E", being held in engagement with its teeth by the lower and curved end of the gate "D".

From this point it forms another loop and then goes around the lower holdback sprocket "F" being held in place there by the two rollers "G". The film then passes down through the bottom of the head to the lower or take-up reel where it is rewound. The lever "H" works a sound track mask that has apertures of two sizes cut in it, one for film without sound track, such as silent film or sound-on-disc features, and the other for film with sound track on it. It is, of course, necessary

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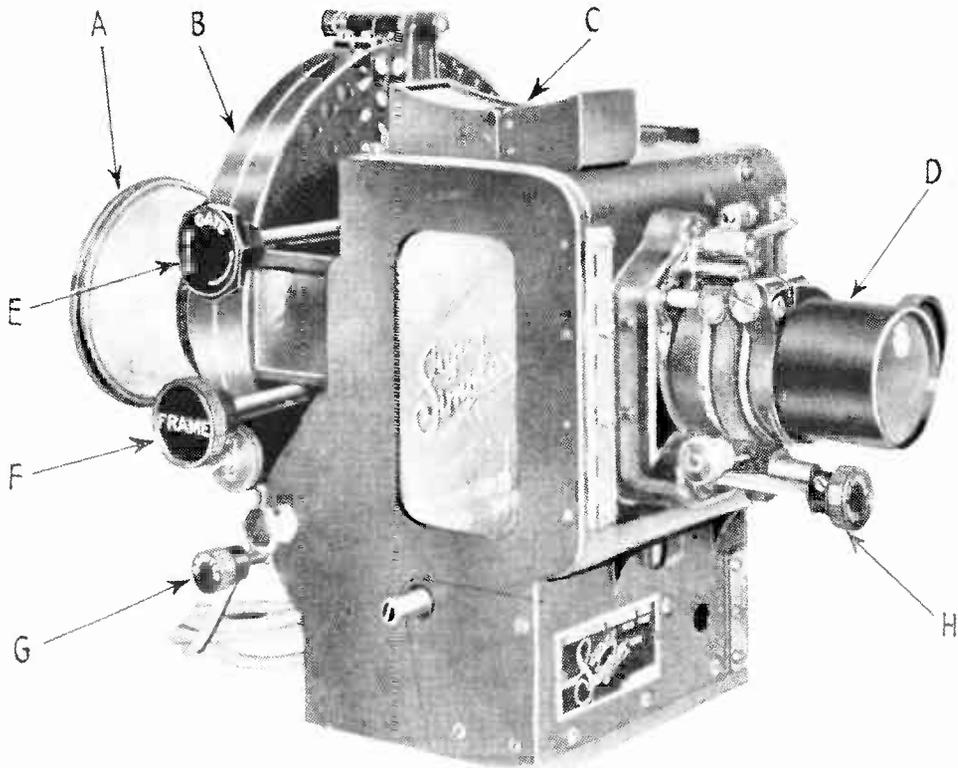


FIGURE 1—Exterior view of Super-Simplex head from operating side.

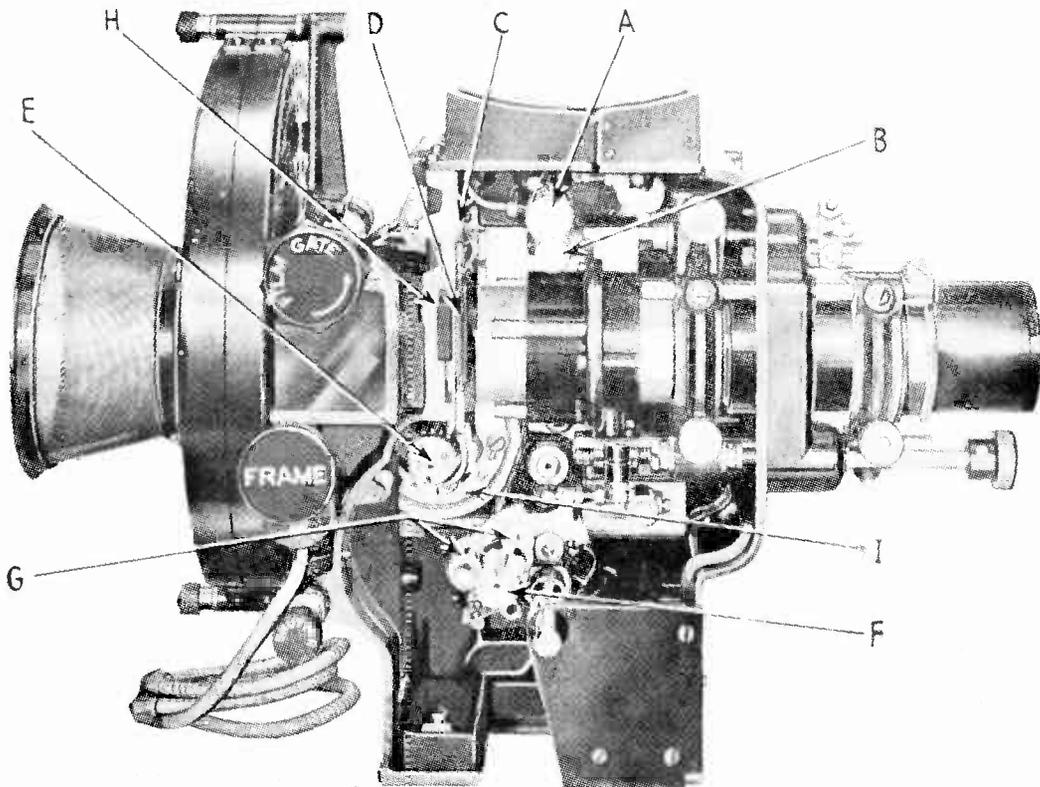


FIGURE 2—Interior view of Super-Simplex head.

that provision be made for this, because the film is the same width in both cases and if the aperture were allowed to remain wide then the sound track would show up on the screen at the side of the picture.

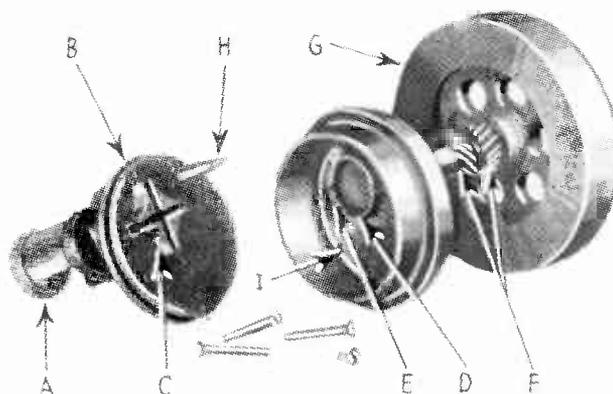


FIGURE 3—Geneva cross intermittent mechanism.

The Intermittent Mechanism

The intermittent housing that contains the "Geneva Cross" intermittent mechanism is shown at "I" and the intermittent movement itself is seen in Figure 3 where "A" is the intermittent sprocket wheel whose shaft goes through the plate "B" which carries on its end the "Geneva Cross" or "star" C. In the other part of the assembly "D" is a broken circle of steel with a pin "E" set in the break, and through a chain of gears this assembly is driven on the same shaft as the flywheel "G". When assembled the two parts of the intermittent are put together face to face as they stand with the tapered pin "H" fitting in the hole "I" so that the cross "C" has the proper position with regard to circle "D". When the assembly is completed it provides a single mechanism with the sprocket on one end and the flywheel on the other, as seen in Figure 4.

In actual operation the circle or cam "D" (Figure 3) driven by the projector engages its pin "E" in a slot of the cross "C", the point of the cross containing the slot moving into the center of the

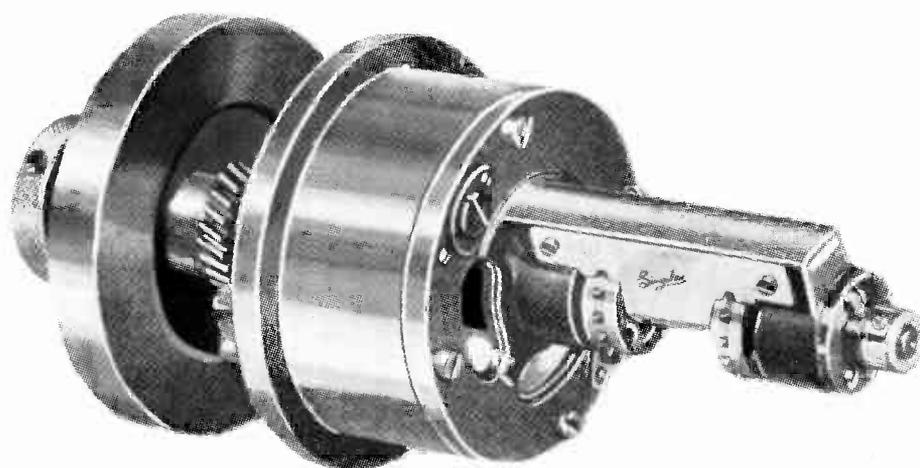


FIGURE 4—Double bearing Simplex intermittent mechanism.

circle through its "broken" part and the outside of the circle moving against the curved part of the cross. The cross is thus moved one quarter turn during a complete revolution of the cam "D" although the actual movement of the cross takes place only during a fraction of the revolution, the cross being locked in place during the rest of the revolution by the action of the outside curve of the cam running against the curve of the cross between two of its points.

The quick movement of the cross turns the sprocket on the other end of the same shaft one quarter turn, which pulls a frame of film down in the aperture where it is held during projection by the locking action of the cam and cross. During the next revolution of the cam the cross and sprocket are turned another quarter turn and locked in place and so on through the entire showing of the picture. The result of this action as far as its effect on the film is concerned is the same as that of the Powers Roller pin intermittent movement; both methods achieve the same result quite efficiently.

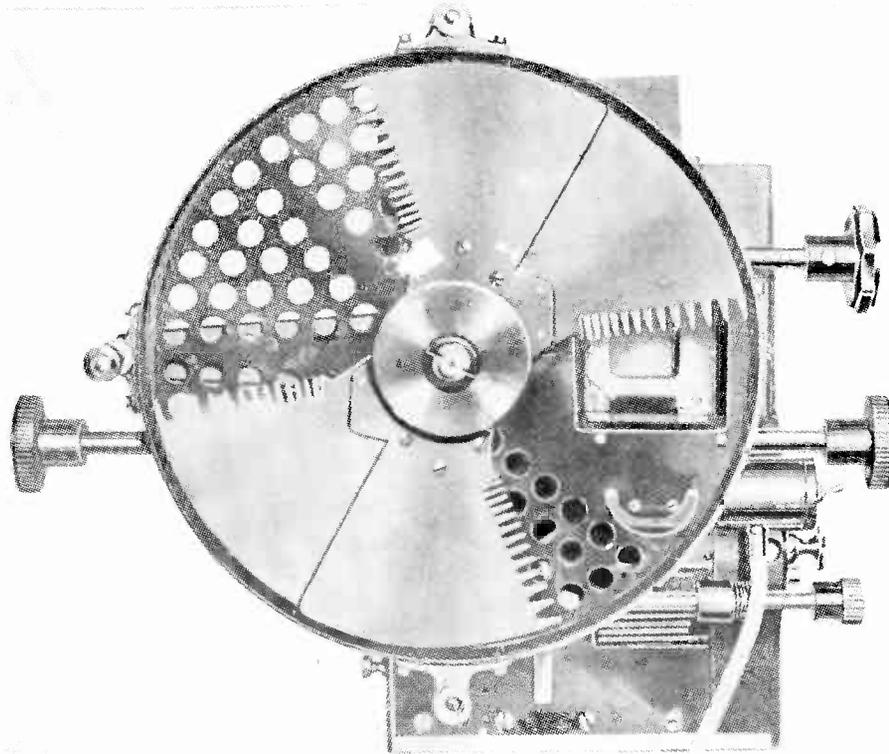


FIGURE 5—*Super-Simplex from rear showing new type shutter.*

The Shutter

The revolving shutter of a Super-Simplex is a radical departure from former models that were attached to the front of the machine and which cut off the light after it had passed through the film and lens on its way to the screen. The new type shutter is located at the rear of the head, between the lamphouse and the picture aperture, and in its operation cuts off the light before it reaches the film and lens. A view of this new shutter as seen from the rear of the head is shown in Figure 5, and while it is similar to many other shutters in that it has two blades they are seen to be of special design. One of the blades is the "master" or "working" blade and serves to cut the light from the screen while the film is being moved into place by the intermittent, and the other blade is the "flicker" blade and cuts the light from the screen for a fraction of a second while the film is stationary in the aperture. This last action as we already know is to reduce flicker and smooth out the illumination on

the screen. The advantage gained from having the shutter at the rear of the head is that the light is cut off the film for half the time which reduces the heat to which the film is subjected.

Heat causes a film to deteriorate rapidly due to drying out which makes it brittle and subject to cracking and tearing as it goes through continued showings in theatres. Therefore, any method which retards this drying out process due to heat will prolong the life of the film and incidentally reduce fire hazard. Another result of heat on the film is to cause it to "buckle", that is, to wrinkle and twist as it passes through the machine, which also tends to cause breakage of the film. The heat that would otherwise fall on the film is intercepted by the blades of the shutter and in addition, the construction of the blades is such that they act as a fan to draw the heated air away from the film and aperture and dissipate it into the surrounding air.

The saw-tooth edges of the blades are called *vignetted* edges and give a dissolving effect to the light as it is cut by the blade instead of cutting it off sharply as a straight edge would do. The result is to reduce flicker to an even greater degree. In Figure 5, the shutter appears as seen from the lamphouse and directly behind the shutter can be seen part of the aperture with the fire shutter down, covering it. Before the new model Super-Simplex came on the market, the Standard Simplex was installed in large numbers and inasmuch as a motion picture machine has a good many years of useful life there are by far a greater number of the Simplex Standard heads in use than Super-Simplex heads. A complete Standard Simplex machine appears as shown in Figure 6. This equipment makes use of a new type stand that is sturdier than the pedestals formerly used so that the additional weight of newer and more powerful lamps and added sound equipment may be rigidly supported. The identifying notations are as follows: "A" is the table switch for connecting current to the arc, "B" the arc controls, "C" the foot switch for starting and stopping the driving motor "D", "E" the standard head and "F" the revolving shutter which is located between the lens and screen in this model. The various other handles and wheels shown are for adjustments such as tilting, locking, and so on.

Figure 7 shows the same equipment with a Western Electric sound head added just below the picture head and the whole assembly tilted at a greater angle which would be necessary if the projection booth were high up in the gallery of a theatre. When the sound head is added the film travels from the top magazine "A" through the picture head "B", then through the sound head "C" and into the lower magazine "D".

Figure 8 shows the "spot" properly focused on the cooling plate of a Standard Simplex head and it will be observed that all corners of the aperture are well covered by the spot of light.

The operating side of the Standard head is shown in Figure 9, the threading of the film through the head being essentially the same as in the case of the Super-Simplex, that is, from the upper reel down around the upper feed sprocket "A", down through the gate "B", around the intermittent sprocket "C", to lower holdback sprocket "D", then down and out of the head into the lower magazine.

Figure 10 is a view of the driving side of the head showing the driving gears and the centrifugal governor weights "A". When the machine is at rest the two halves of the governor lie close together as shown but when the head is in operation the two halves fly out during rotation and by means of a lever "B" lift the fire shutter out of the aperture thus allowing the light to pass to the film. If the speed of the projector slackens too much the weights drop thus allowing the fire shutter to drop over the aperture and cut the light and heat from the film. The shutter may be opened or closed manually by means of the handle "C" which works in a slot in the head casing. The spindle shaft "D" carries the revolving shutter which can be procured in the two- or three-bladed type as shown in Figure 11. The three wing shutter will bring about a condition of less flicker than the two-bladed one but the loss of light is greater in the three-wing type due to the fact that more of the light is intercepted by the opaque blades.

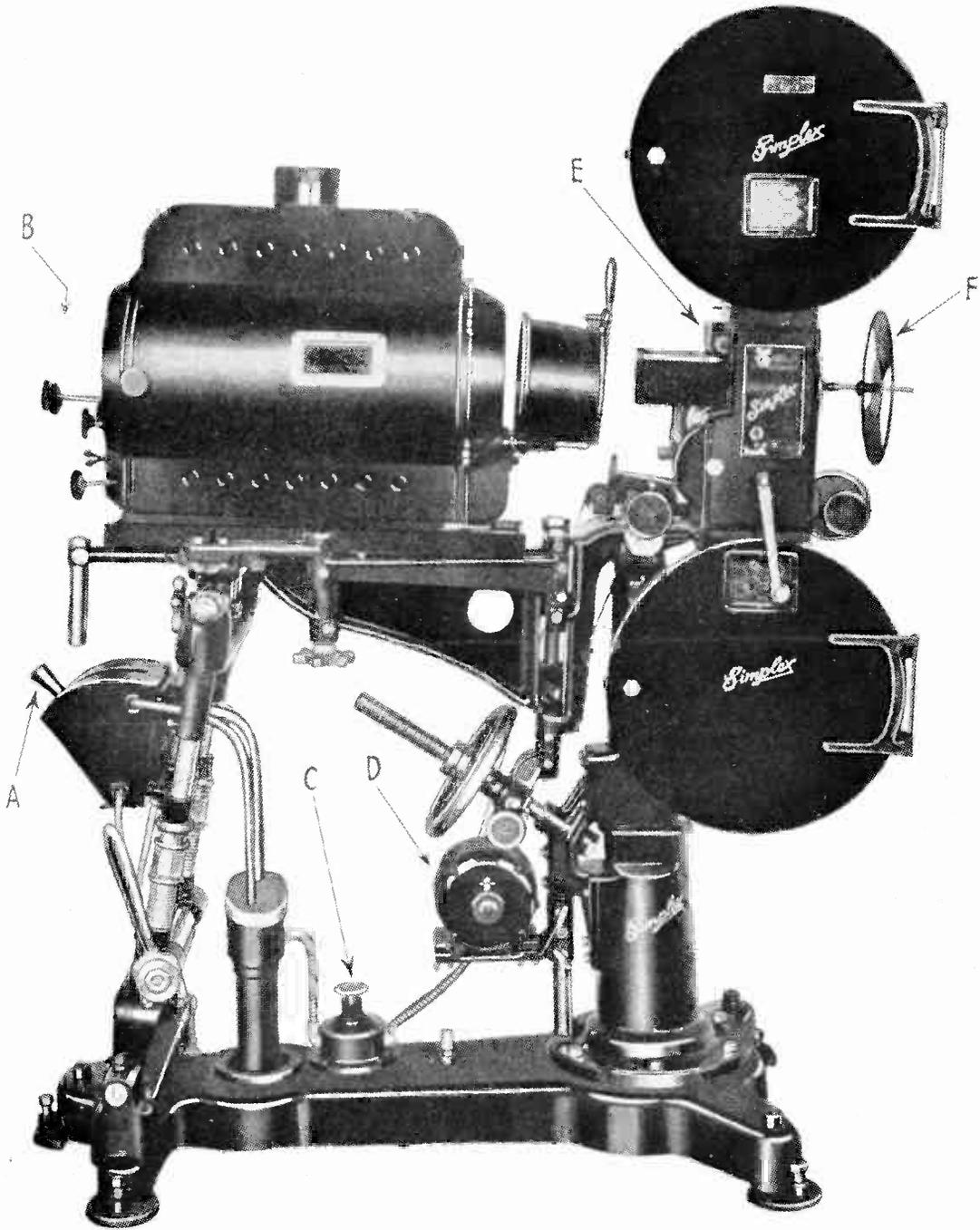


FIGURE 6—Standard Simplex machine.

The Standard Simplex on an older type pedestal is shown in Figure 12-A and Figure 12-B with an R. C. A. Photophone soundhead and disc turntable equipment added to the picture apparatus. "A" shows the complete assembly as viewed from the operating side, and it will be seen that the soundhead is located just under the picture head where it receives the film after it passes through the

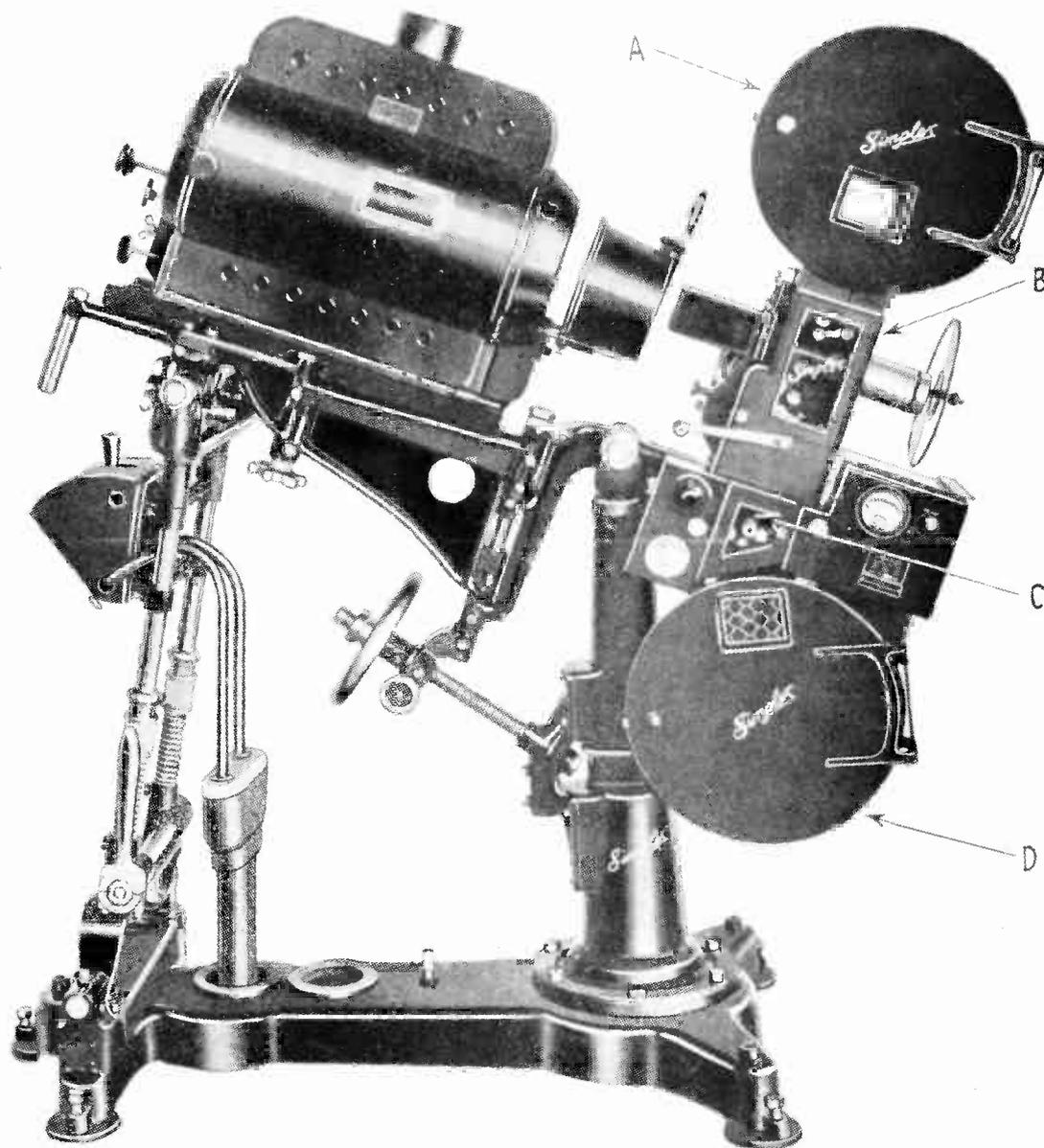


FIGURE 7—Standard Simplex in tilted position with sound head added.

picture head. "B" is a view of the same equipment as seen from the opposite side and shows the details of the disc sound attachment. The turntable of this attachment is directly connected to the projector drive so that the film runs through the machine at a speed that maintains its relation to that of the disc speed. In other words, if the film is threaded through the picture head with a certain

"starting frame" of the film in the aperture, and the disc with the sound record on it is set so that the needle is on the record at a "starting mark", then when the machine is started, the picture thrown on the screen by the picture head and the sound being "taken off" the record, will remain in synchronism, or in step, through the picture, due to the mechanically direct connection between

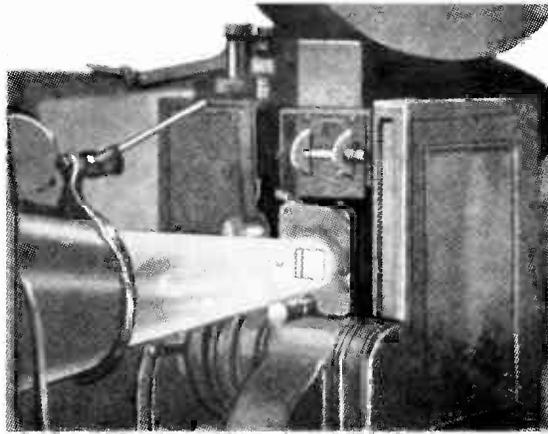


FIGURE 8—The "Spot" is properly focused on the cooling plate.

the turntable and the picture head drive. In Figure 12-B can be seen the arc control motor "M", attached to the Peerless lamphouse, while the drive motor for the picture head, sound head and turntable is seen at "D". The reproducer or pickup which holds the needle that runs in the record groove is shown at "P".

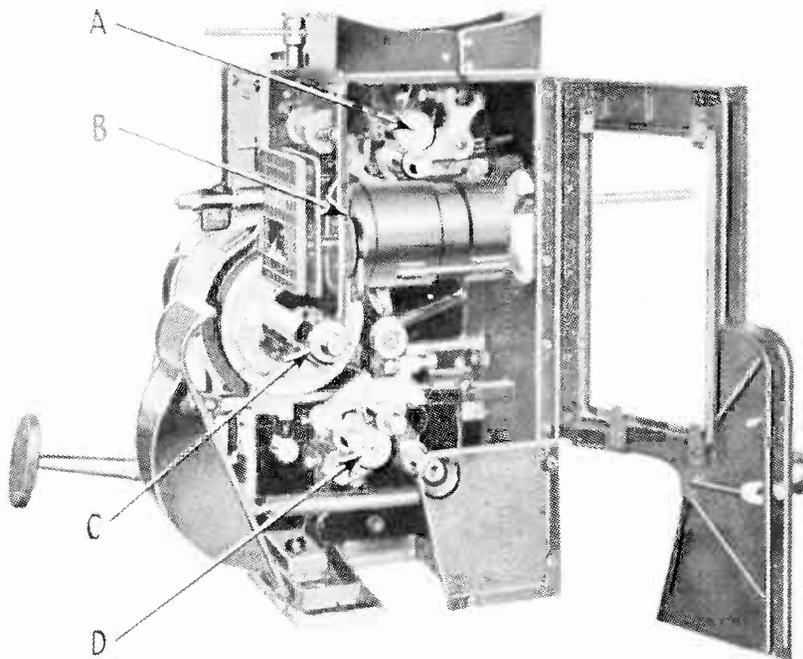


FIGURE 9—The mechanism in a Standard Simplex head viewed from the operating side.

Simplex Incandescent Equipment

In motion picture theatres where the seating capacity on the main floor is 1,000 or less and ordinary conditions as to screen and house lighting prevail, satisfactory screen results are obtained on a "throw" up to 75 ft. with a picture width not exceeding 9 feet. In cases like this there are advantages gained by using incandescent lamps instead of arcs as follows:

Economy: The electric power consumed is usually less than that consumed by the arc.

Steadiness: The incandescent lamp produces a steady light that is not subject to flickering.

Adjustment: Once focused the incandescent lamp requires no further adjustment.

Softness of light: The light from an incandescent is softer than that from an arc and gives a good color quality for colored picture projection. Fire hazard is decreased due to the fact that there is no open flame.

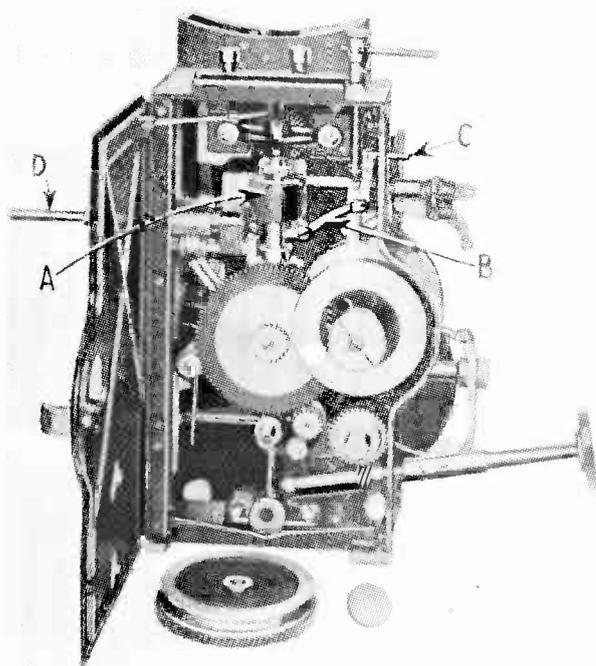


FIGURE 10—The driving side of a Standard Simplex head.

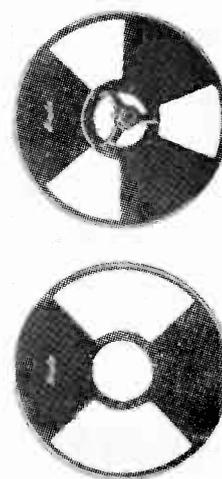


FIGURE 11—Two- and three-wing shutters.

Figure 13 shows the lamphouse carriage of the Simplex incandescent equipment. By means of knobs "E" and "F" the lamp filament "T" may be accurately centered in front of the mirror "L" and by use of knobs "A", "B", "C", and "D", the "spot" may be accurately focused to the proper size on the picture head aperture. Figure 14 is a cut of the complete lamphouse showing the double condenser lens assembly swung out for cleaning, while Figure 15 is a layout of the optical train of the equipment. Most portable sound motion picture outfits, including those made by R.C.A. Photophone and Western Electric Co., use incandescent lamps for the light source, and these portable outfits will be taken up in the latter part of this lesson.

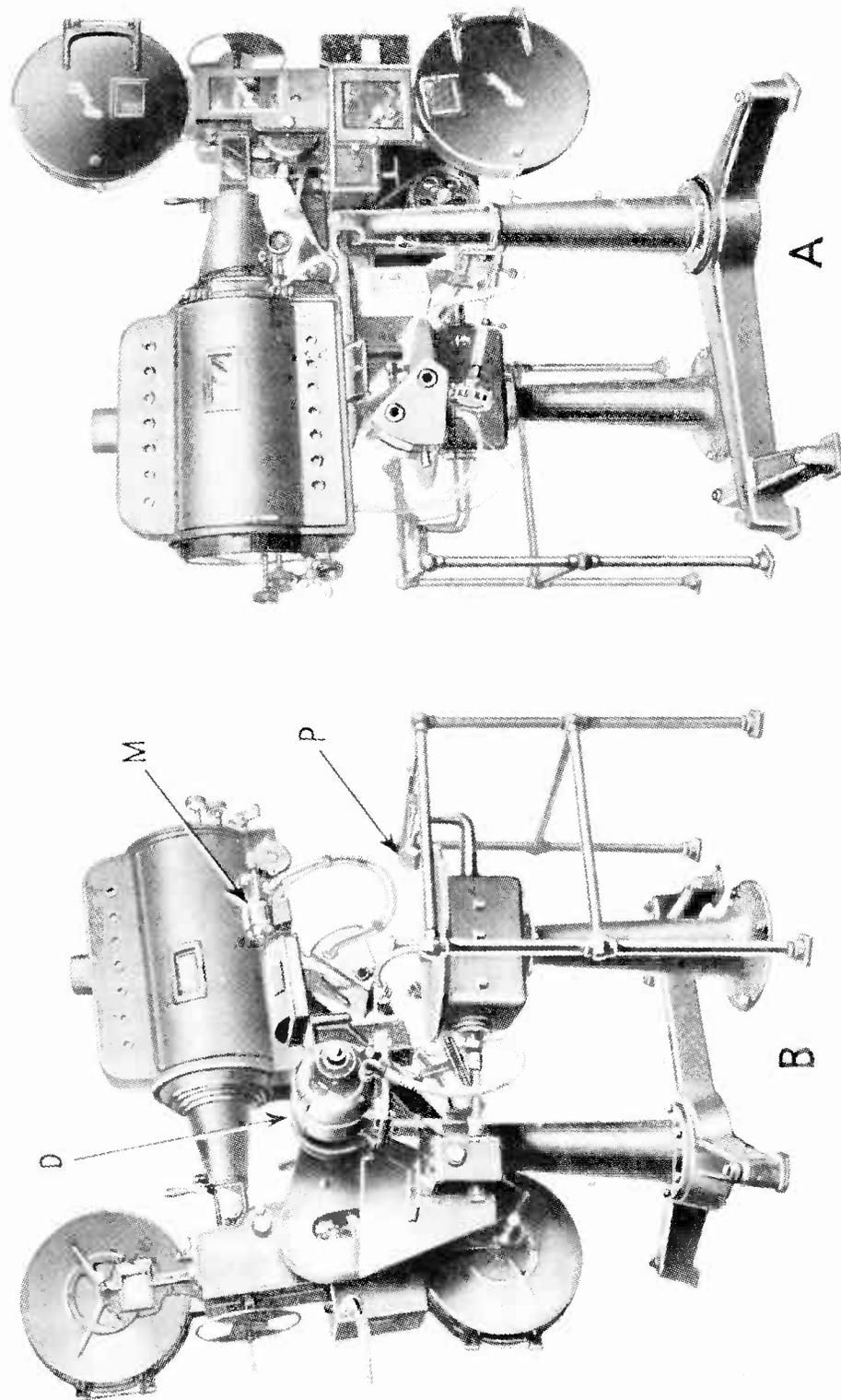


FIGURE 12—A Standard Simplex with R. C. A. Photophone soundhead and disc turntable equipment added to the picture apparatus.

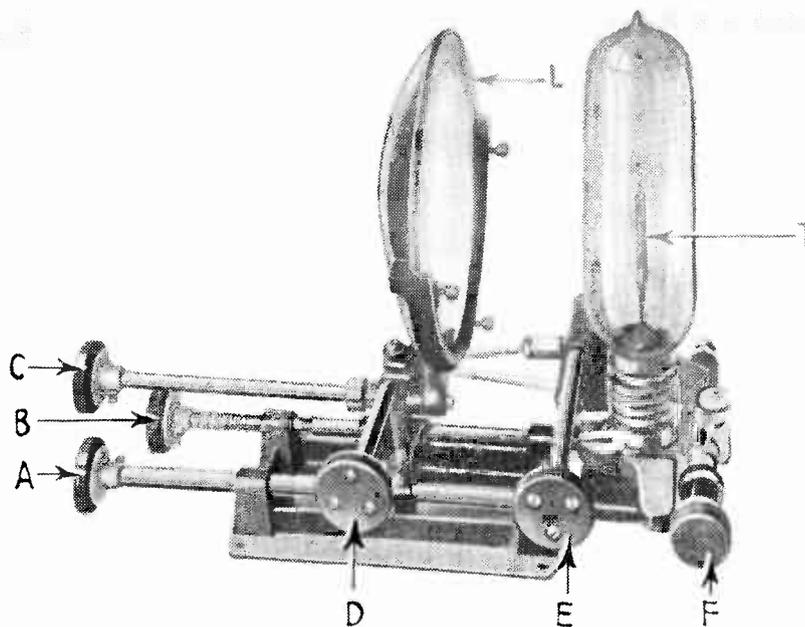


FIGURE 13—Simplex incandescent lamphouse carriage.

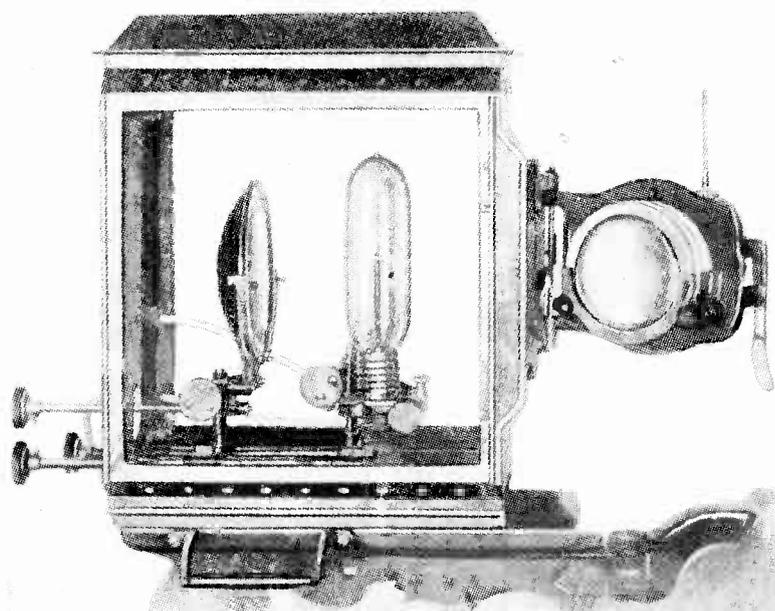


FIGURE 14—Simplex lamphouse with double condenser lens swung open.

Motiograph Projectors

Another type of projector in common use is the Motiograph, one model of which is shown in Figure 16. While this projector has a rear-type shutter, the main purpose of which is to reduce heat at the film, it can be seen that the shutter is radically different in design from that of the Simplex. Referring to Figure 16, the Motiograph projector head "M" is seen mounted on a Western Electric universal base as used in sound picture installations. The shutter "S", is a cylinder-like arrangement with wide slits or openings cut on opposite sides. The shutter has a fan-like action which draws the heated air away from the aperture and film.

In Figure 17 the operating side of the Motiograph head is shown. It will be seen that the Motiograph has three main sprockets similar to those used in the Powers and Simplex heads, namely, the upper feed sprocket "A", the intermittent sprocket "B", and the lower holdback sprocket "C".

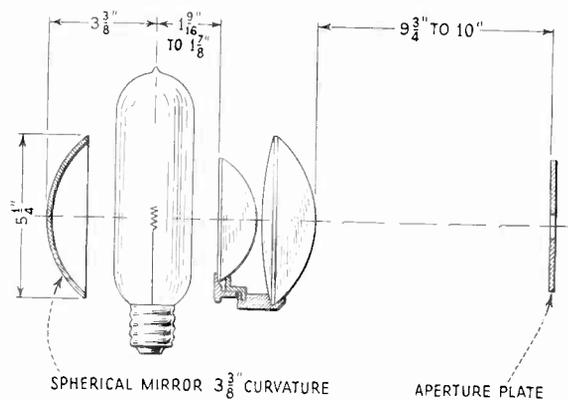


FIGURE 15—Optical train of incandescent equipment.

In order to thread the Motiograph, the whole rear panel of the head is moved backward by swinging on a hinge at the top of "D". This is accomplished by lifting the locking latch "E", pulling the gate backward and allowing it to rest in the open position on support "F". After the film is threaded the gate is allowed to swing back into place where it is locked securely by the latch "E". The "framing handle" is at "G", Figures 16 and 17, and is in the form of a small handwheel that moves the film carriage containing the intermittent up and down as the wheel is turned. The lens tube is shown at "H" and the lens focusing device at "I".

The driving side of the head shown in Figure 18 contains the gears for driving the various sprockets and the centrifugally operated device that controls the fire shutter which operates on the same principle as the fire shutter controls in both the Powers and Simplex heads. The fire shutter control is shown at "A", while "B" is a flywheel that smooths the action of the head.

A simple sketch of the shutter as seen from the rear of the head is shown in Figure 19, "A" being the aperture of the picture head showing through the slots cut in each side of the metal cylinder. As the cylinder revolves the solid metal part of it comes before the beam of light and cuts it off from the aperture at the same time that the intermittent is in motion moving the film past the aperture. This is a very efficient type of shutter due to the fact that the beam is cut from the top and from the bottom at the same time, as the top solid section of the cylinder moves downward and the bottom section moves upward. Referring again to Figure 17 the path of the film is down from the upper magazine through the fire-trap rollers, around the upper feed sprocket and after forming a loop, enters the picture gate and passes around the intermittent sprocket. The lower loop at this point feeds the holdback sprocket which passes the film to a set of firetrap rollers. Instead of going into the lower magazine, as it would in a silent installation, the film passes into the sound head, next

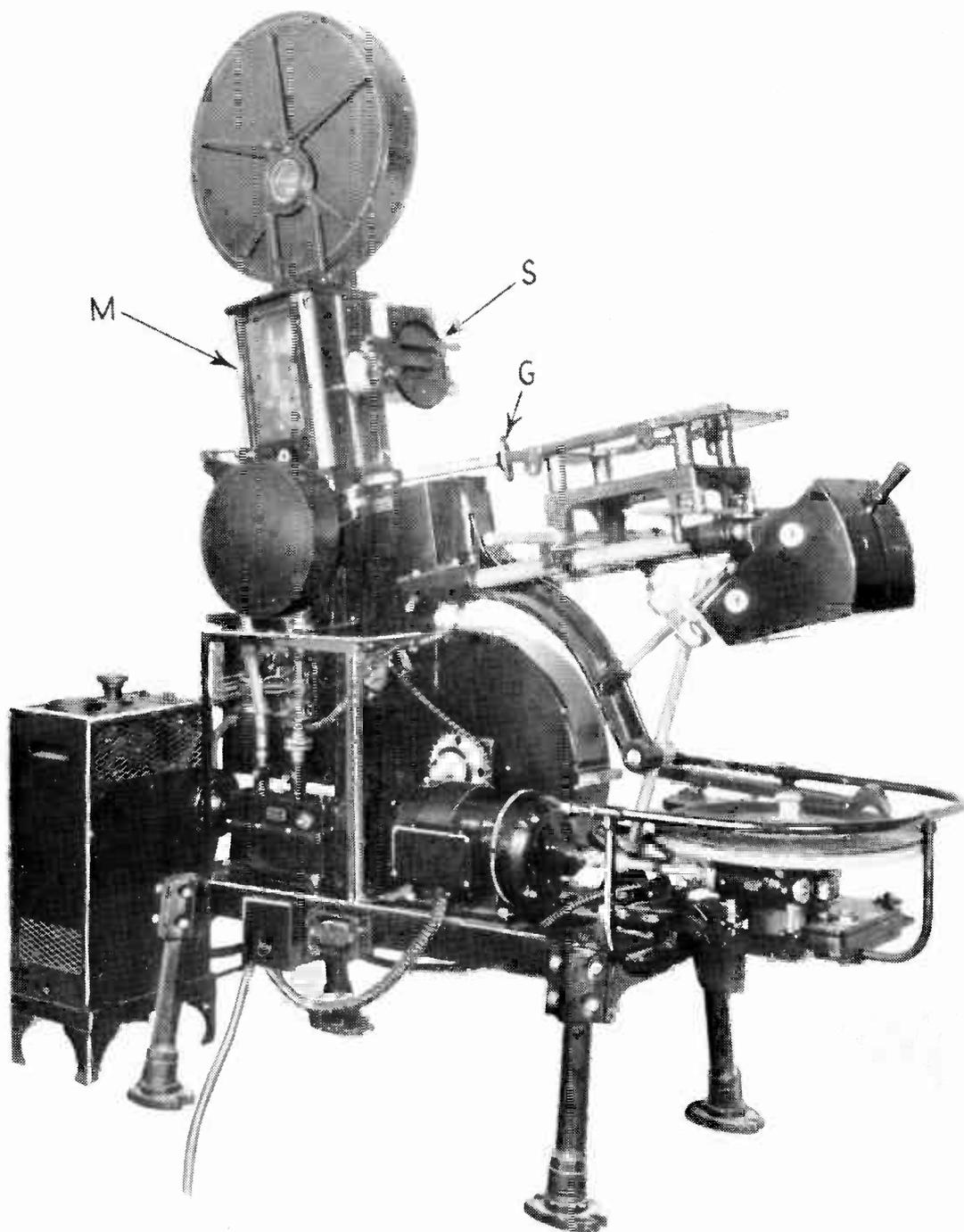


FIGURE 16—Motiograph projection head on a Western Electric sound reproducer.
(Courtesy Elec. Res. Prod., Inc.)

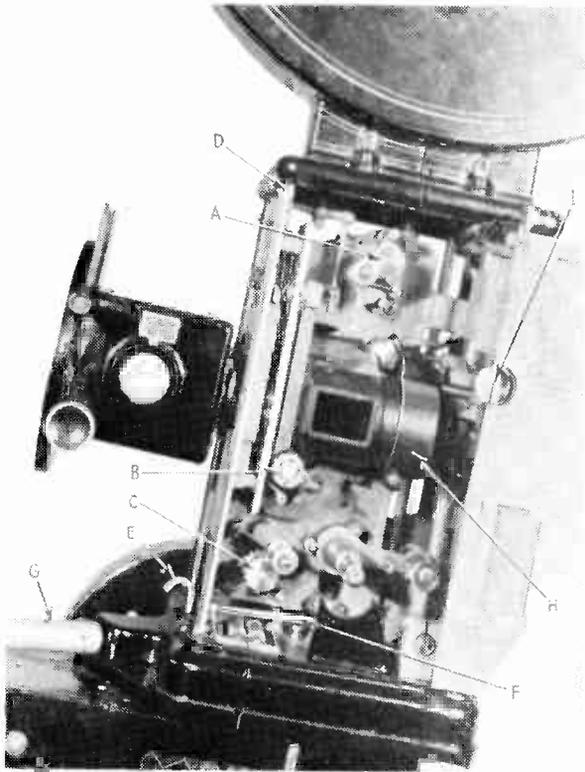


FIGURE 17—Left side of a Motiograph machine.

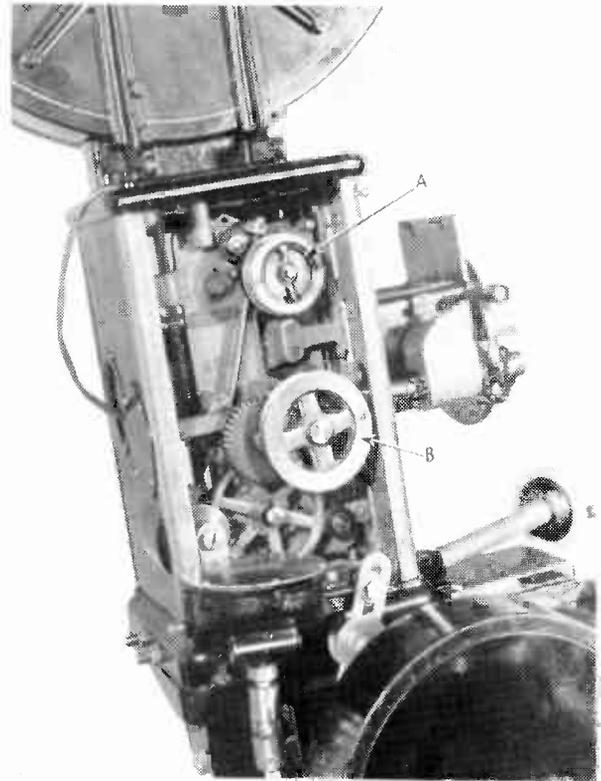


FIGURE 18—Motiograph machine.

over a guide roller, and finally over the curved surface of the sound gate where the beam of light from the optical system is focused on the sound-track. A constant speed sprocket then takes the film and it goes through the lower magazine firetrap rollers and rewinds on the take-up reel in the lower magazine.

It will be seen that the upper feed sprocket and the lower holdback sprocket have "stripper plates" adjacent to them. This is merely a strip of metal with slots cut in it to allow the sprocket

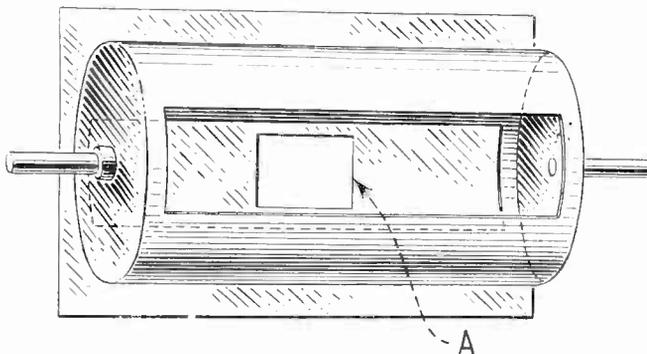


FIGURE 19—Front view of horizontal-cylindrical revolving shutter in one of the Motiograph models.

teeth to pass by, but should the film for any reason stick to the sprocket wheel and start to wind up on it, the "stripper" will lift it, or "strip" it off immediately. If ever in doubt as to which way a sprocket wheel turns you can be sure that it turns "against" the end of the "stripper", or in the opposite direction to that in which it is pointing.

The Baird Projector

The Baird Projector, while not in such widespread use as other makes so far mentioned yet it may be encountered in your duties as a Sound Service or Installation man and it will be well to look over several illustrations of this picture head so that you may become familiar with the location of the various parts.

Figure 20 is a view of the operating side of the Baird projector and shows that it is but slightly different in general operating characteristics from any of the other projectors studied. No picture

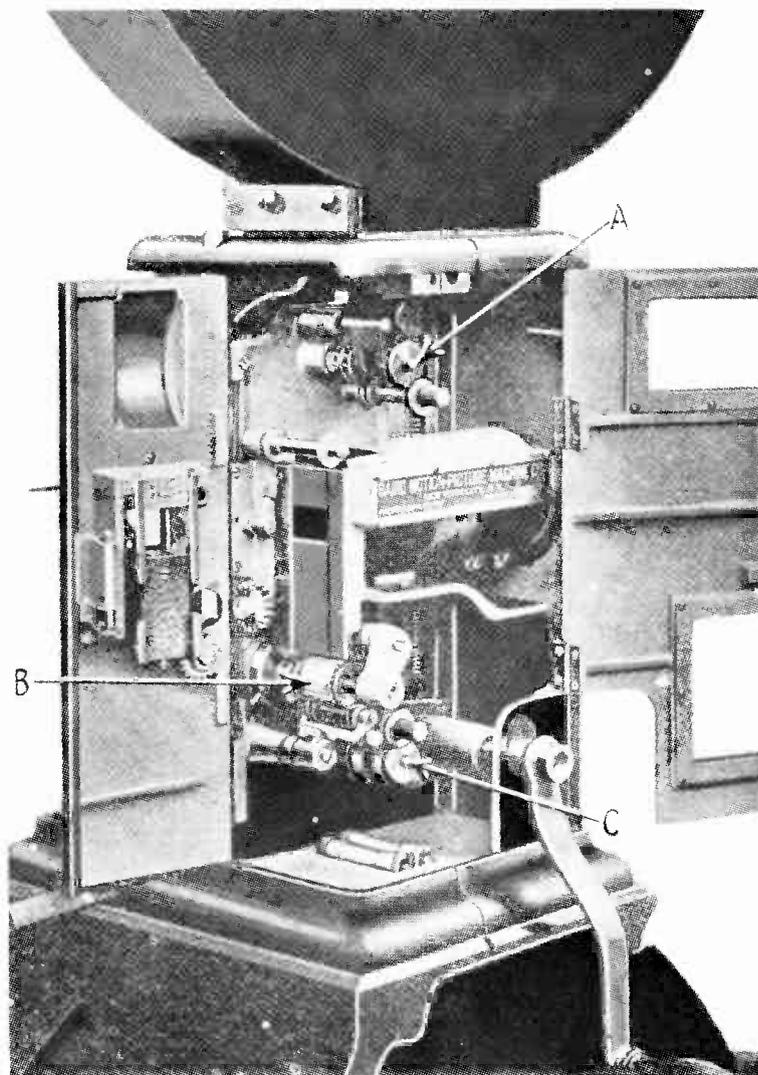


FIGURE 20—Baird projection head looking from the operating side.

head in fact should be much of a mystery to anyone who understands thoroughly the operating principles of a motion picture projector because there are but three main functions performed by any picture projector head which are as follows: 1st, pulling the film off the upper reel and feeding it to the picture gate, which is done by the upper feed sprocket; 2nd, pulling the film through the gate intermittently, and this function is performed by the intermittent sprocket; and 3rd, feeding the film steadily to the lower reel, which is done by the holdback sprocket.

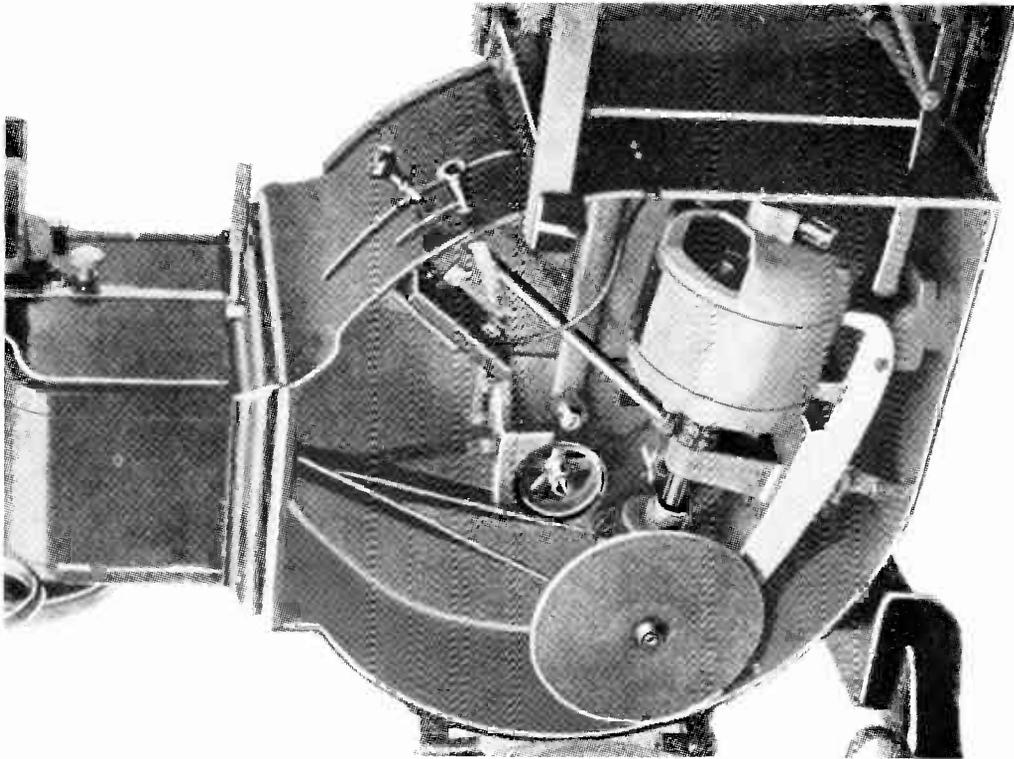


FIGURE 22.—Baird drive motor and take-up mechanism.

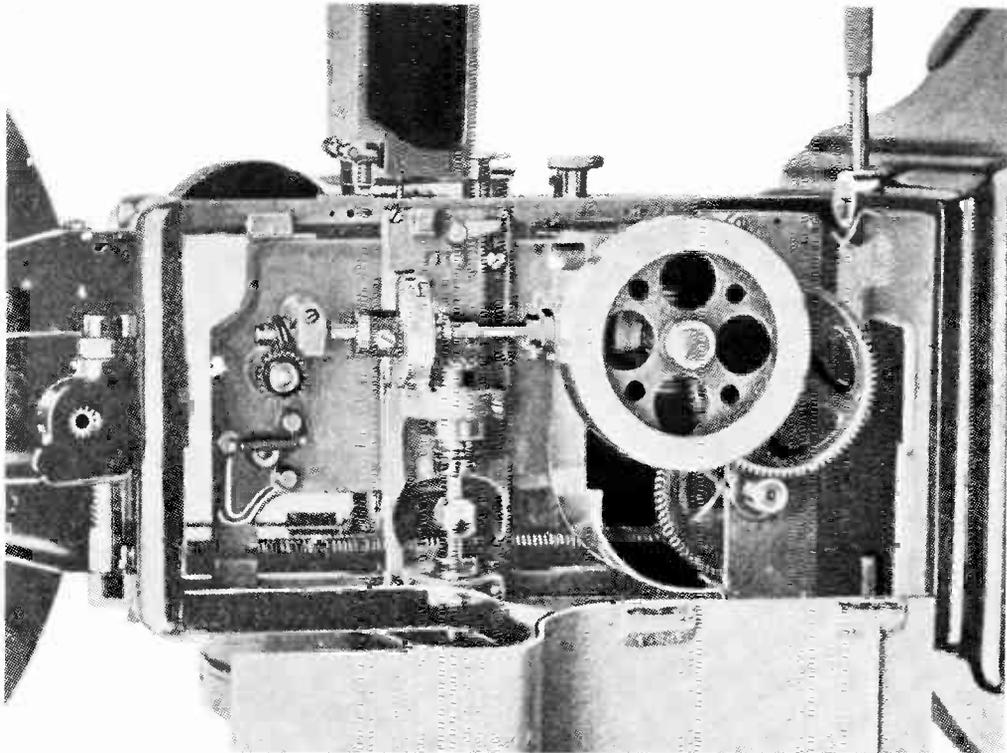


FIGURE 21.—The driving side of a Baird projection head.

In the Baird head shown in Figure 20, the sprockets are seen to be in the usual position, "A" being the upper feed sprocket, "B" the intermittent sprocket and "C" the holdback sprocket. The framing of the picture is done in different makes of projectors by slightly different methods all of which consist essentially of furnishings some means for moving the film into a new relation to the aperture, while the machine is running. Figure 21 shows the driving side of the Baird head with gears, flywheel and framing handle in full view. The drive motor and take-up mechanism of the Baird are contained in an enclosed, dustproof compartment located just below the picture head, as seen in Figure 22, the take-up reel running on the opposite side of the compartment.

R.C.A. Portable

The portable picture and sound projector put on the market by R.C.A. Photophone is designated as the PG-5 and since the main consideration is one of portability, without loss of quality of reproduction, the appearance and construction of the various parts is therefore quite unlike the theatre equipments. The projector may be set up and operated anywhere providing a 110 volt, 50 or 60 cycle a-c supply is available, but if only d-c is available, as it is in certain localities, then "converting" equipment is necessary to change the direct current to alternating current of the proper frequency. The electrical part of these projectors will be touched upon only lightly in this lesson but will be studied in detail later after you have covered the electrical subjects of this course. The entire R.C.A. Photophone Portable is quickly set up or repacked after using. The entire set including two projectors, an amplifier, loudspeaker, screen, and the accessories such as film patching and rewinding equipment and spare tubes, are contained in six trunks having a total weight of about 920 pounds. This number of trunks and their weight may not agree with the accepted ideas regarding portability, but compared with a regular theatre installation it is quite in the portable class.

Figure 23 is a layout showing the various pieces of apparatus making up the complete installation and the various cable connections between different units. Two projectors are always necessary to run a "continuous" show because most motion picture productions consist of several reels of film which must be run one after the other with no "break" between reels. This is made possible by running the first reel in one projector, meanwhile threading the next reel of film into the other projector. As the first reel nears the end of its run the second projector is started up. When a "cue mark" appears on the screen the picture from the first projector is cut off the screen by the use of the "douser" and the picture running in the second projector is thrown on the screen.

There is a certain amount of film at the end of each reel that has the same pictures and sound on it as the first part of the following reel and when the "cutover" is made it is not noticeable to the audience, hence, the showing is continuous. In old-time "movies" there was often only one projector used and the picture would stop during the change to the following reel and a slide would be thrown on the screen reading "One moment please while we change reels". Of course, that practice would not be tolerated today, so we find that practically every motion picture installation now has at least two complete projectors.

Figure 24 shows the operating side of the PG-5 with the film threaded into place and it will be seen that the picture projecting part of the unit has the three sprockets with which we have become so well acquainted in other projectors, namely, the upper feed sprocket (just under the upper magazine), the intermittent sprocket, (just below the gate) and the holdback sprocket (called in this projector the intermediate feed sprocket) which is immediately under the intermittent.

The various parts of the mechanism are named in the illustration, the film travel being as follows: It runs from the upper magazine around the upper feed sprocket down through the gate, around the intermittent sprocket and around the intermediate feed sprocket which completes its journey through the picture projection mechanism. The film enters the sound projection part of the unit by passing down through the sound gate, where the beam of light from the exciter lamp is focused on the sound-track, then around the "constant speed sprocket" which assures its passage through

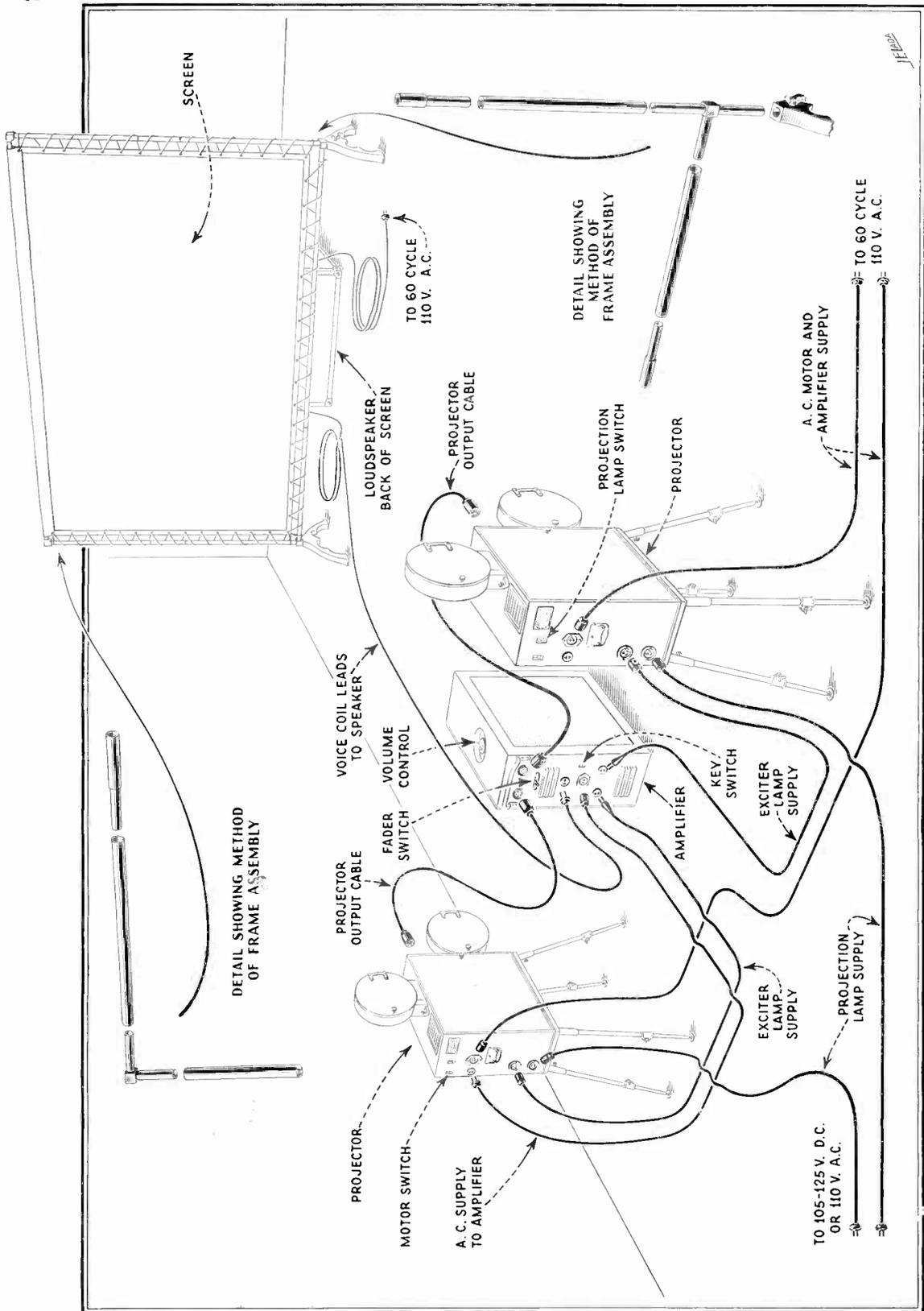


FIGURE 2-3—The general layout of a complete portable installation showing the cable connections between the units.

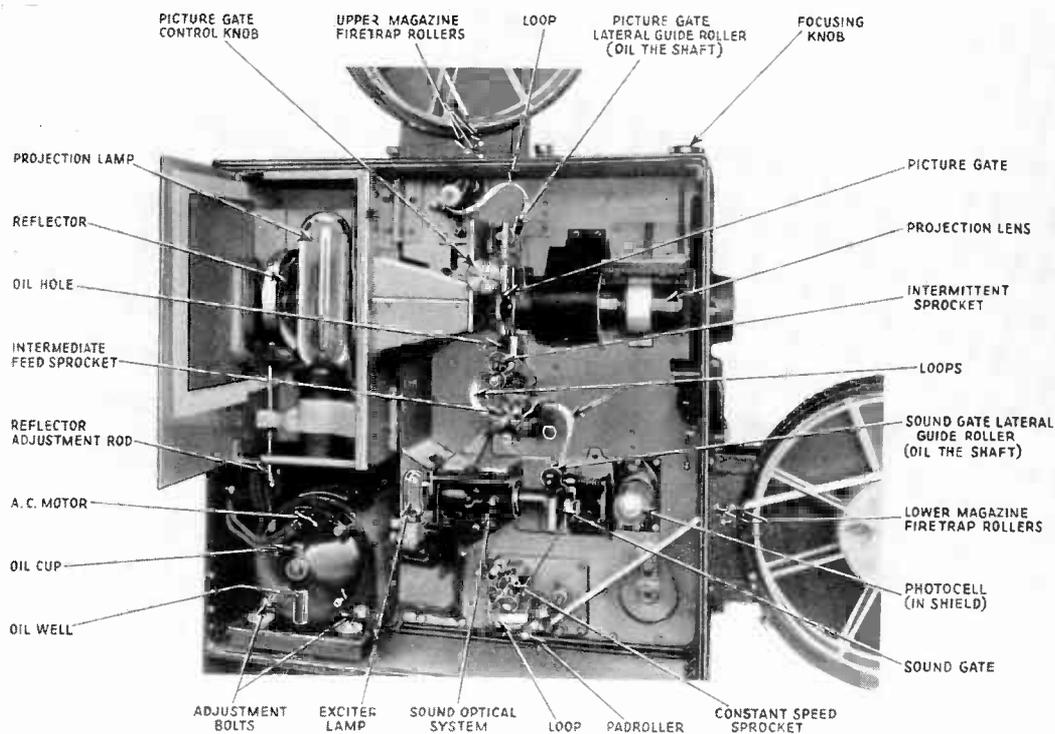


FIGURE 24—Operating side of a PG-5 portable type projector with film threaded into place.

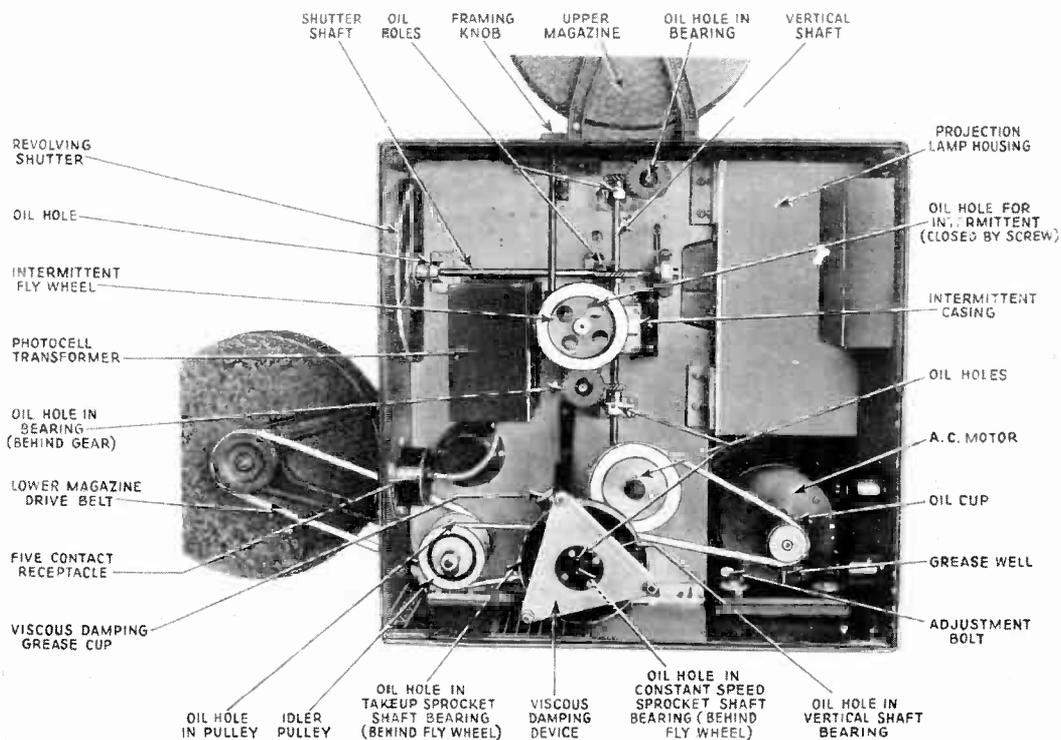


FIGURE 25—Interior of the drive side of a PG-5 portable type projector.

the sound gate at a constant rate of speed, and from there it passes around the holdback sprocket that feeds it to the lower take-up reel at the side.

The incandescent light source used for projecting the picture is enclosed in a separate compartment with its reflector that focuses the light to a "spot" on the aperture with the aid of a condenser lens. The lamp is rated at 1000 watts, 110 volts, and is mounted in a prefocused socket which insures its proper position in relation to the reflector and condenser lens. A standard "quarter size" projection lens projects a picture about 9 feet wide, at a distance of 40 feet from the screen.

The projector is driven by a one-eighth horsepower a-c motor operating on 110 volts at 50 to 60 cycles, and is equipped with two pulleys one of which is used with 50 cycle supply and the other with 60 cycle supply. This keeps the speed of film travel the same even though the motor runs slower on the 50 cycle current than it does on the 60 cycle supply.

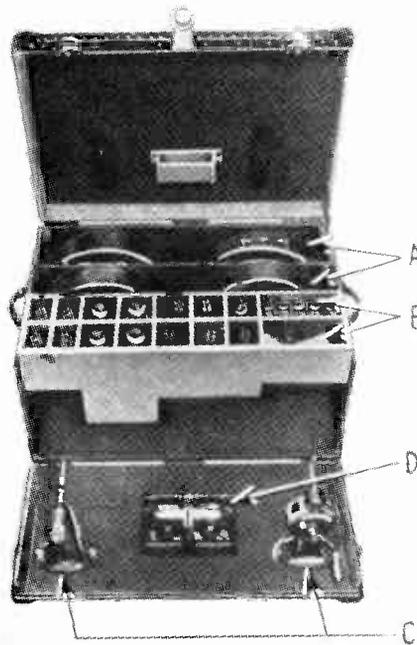


FIGURE 26—One of the trunks used in packing portable type accessories.

The drive side of the PG-5 is shown in Figure 25, the various parts corresponding pretty well with those on a standard theatre projector. The "viscous damping device" designated in this illustration is the apparatus that controls the speed of the "constant speed sprocket" about which we shall learn more under the subject of Sound Heads.

The "accessories trunk" in Figure 26, demonstrates how compactly the equipment is packed away for shipment. It contains: "A" the four film magazines, "B" a double set of incandescent lamps and amplifier tubes, "C" film rewinding equipment, and "D" a film splicer that is used to repair torn film.

E. R. P. I. Portable

The Portable sound picture equipment put out by Electrical Research Products, Inc., who control Western Electric sound picture equipments, is different from the R.C.A. Photophone Portable in many respects, most of which are constructional details, the main operating characteristics being the same. The feed reel and the take-up reel are on the same shaft, side by side, the take-up reel, of course, being driven by a slip-clutch arrangement and the feed reel being free to revolve with the pull of the film as it is unwound.

Figure 27 shows the operating side of this projector and since the illustration is so liberally supplied with descriptive notations there is little further explanation needed. The direction of film travel is indicated by the short, heavy arrows beside the film. In Figure 28, the film path is shown as viewed from the front, coming off the feed reel at the left and re-winding on the take-up reel at the right after passing through the picture and sound projector mechanisms.

A photograph of the operating side of the W. E. Co. Portable is seen in Figure 29, showing the incandescent light source, reflector and condenser lens in addition to the parts shown in the sketch in Figure 27.

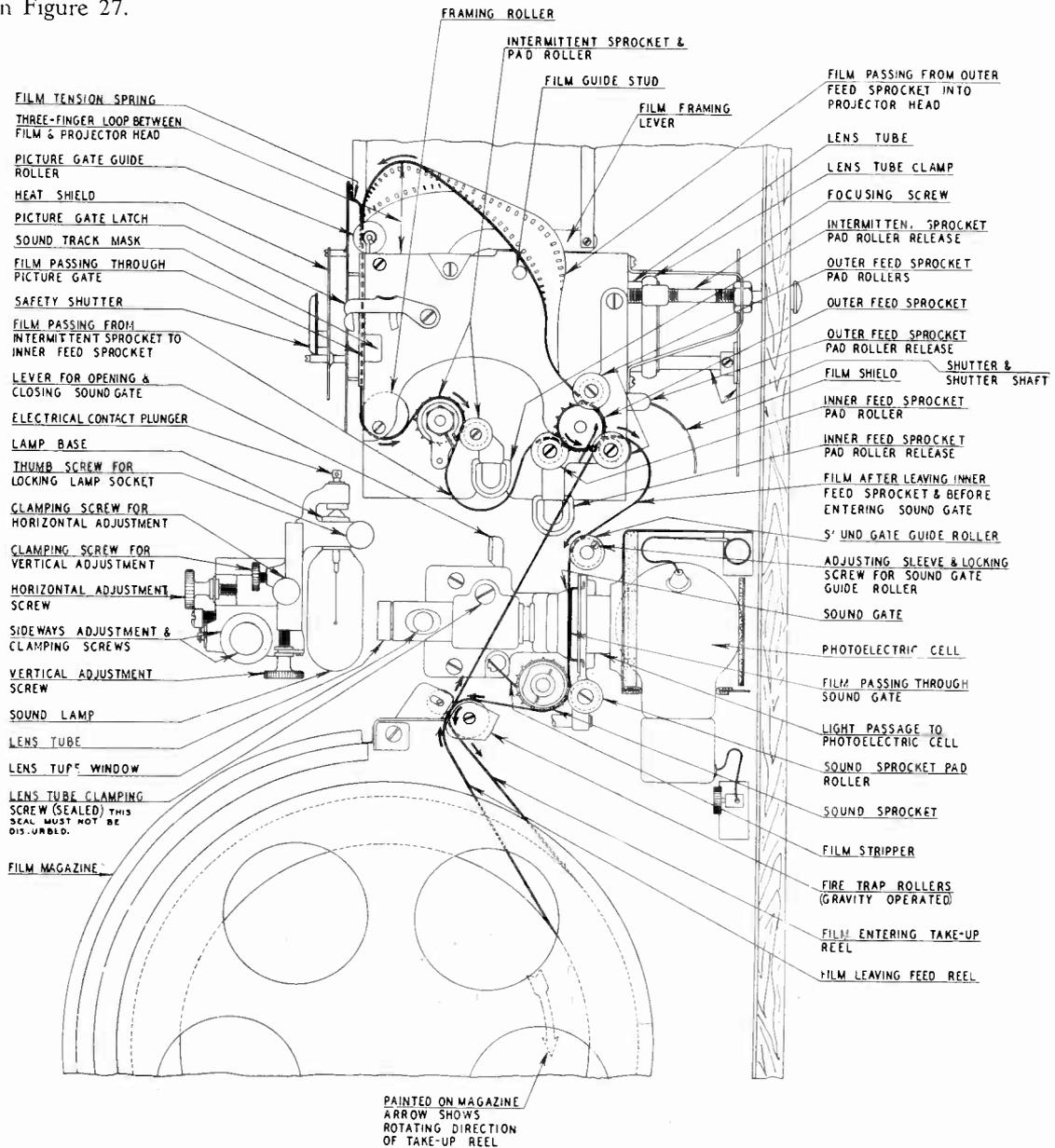


FIGURE 27—The film path through a W. E. portable sound picture machine, as seen from the operating side. (Courtesy Elec. Res. Prod., Inc.)

We will conclude this lesson with a brief description of the running of a feature picture. By far the greater number of theatres have at least two operators in the projection booth so we will

assume that this is the case in the following description. In the first place, the lamphouses are kept scrupulously clean and the projector mechanism is oiled and cleaned every day. In the oiling of the various bearings in the projector head care must be taken not to use too much oil as it has a tendency to get on the film as it runs through the head, causing poor sound and picture reproduction. One drop on each bearing is sufficient, except in the case of the intermittent mechanism which runs in a well of oil which usually has a glass window with a mark on it denoting the proper oil level to be maintained.

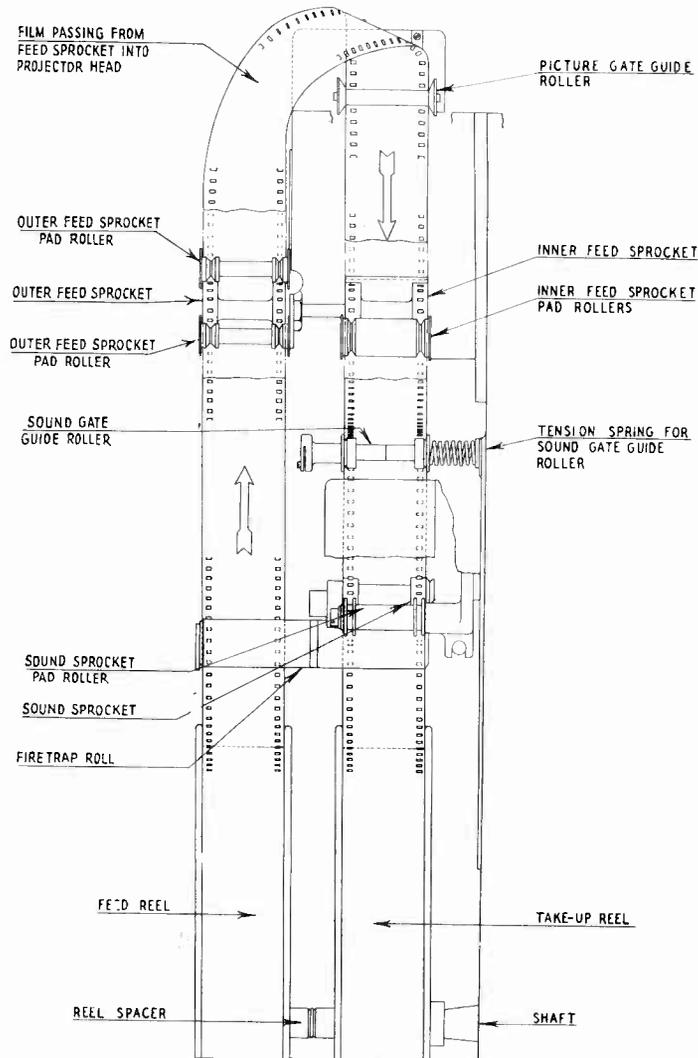


FIGURE 28—The film is shown coming off the feed reel at the left and rewinding on the take-up reel at the right.
(Courtesy Elec. Res. Prod., Inc.)

When the equipment has been properly cleaned and oiled the first reel is threaded into one of the machines with the "start" picture exactly "in frame". It is quite necessary that this "start" frame be in the aperture when sound-on-disc features are run because the needle of the disc reproducer is started at an exact place on the record and the film and disc must run in proper relation to each other to maintain synchronism. It is not so necessary in the case of sound on film recordings, because the sound track and the picture are on the same film and cannot get out of synchronism.

After the film is threaded a few feet are run through to see that it is "meshing" properly with all the sprocket wheels. This first reel may now be run to open the show and as it runs for about thirteen minutes there is ample time to thread the second reel of the same feature into the other projector.

Reel Changing

With each film feature the film exchange sends out a "cue sheet" which tells when to switch from one reel to the next and usually consists of a description of a particular part of the picture, and its corresponding sound, at which the "change-over" is to be made. For instance, if the "change-over" is to be made during the scene of a holdup, the picture cue might read "bandit draws gun" while the sound cue would be "hands up". When the projectionist saw the bandit draw his gun in

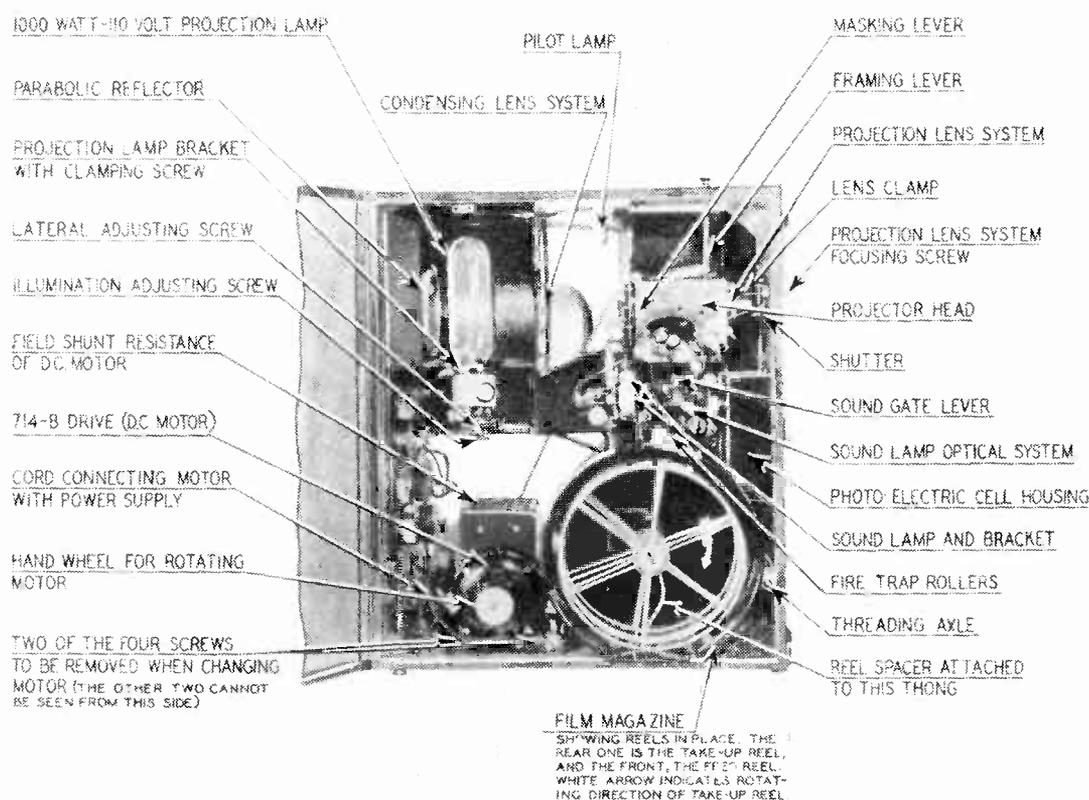


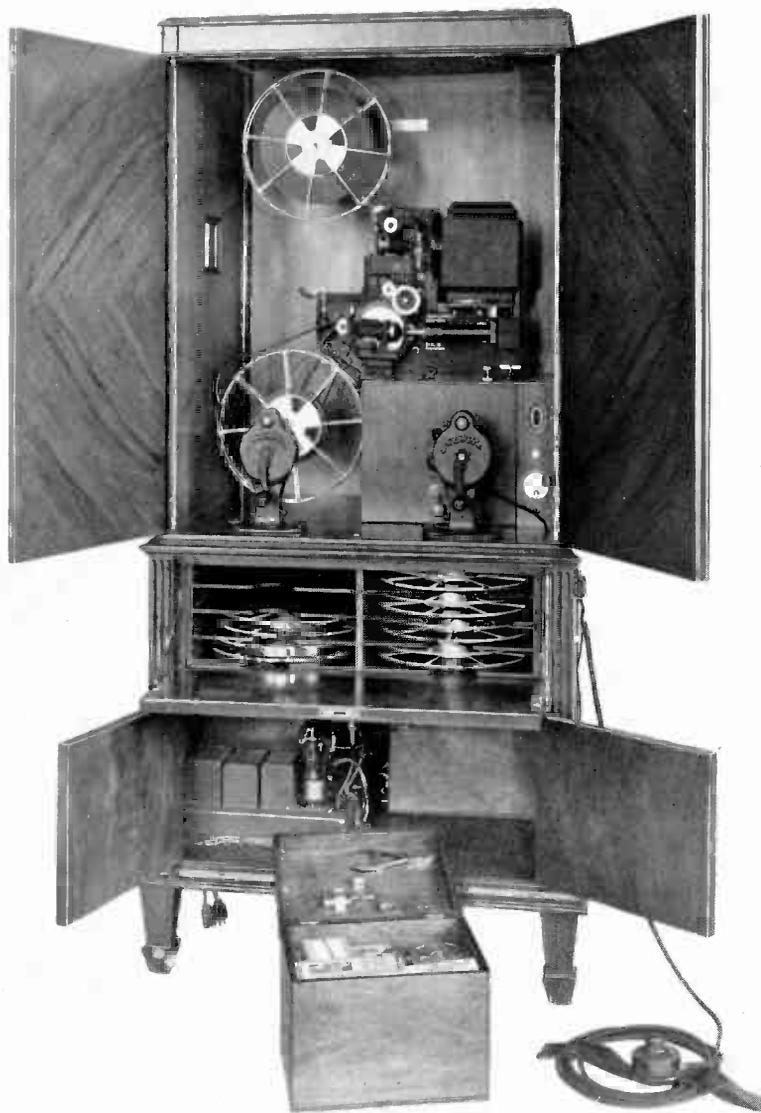
FIGURE 29.—A Western Electric portable projector with the incandescent light source, reflector, condenser lens and other parts, as viewed from the operating side. (Courtesy Elec. Res. Prod., Inc.)

the picture on the screen or heard the bandit's voice coming from the "monitor horn" in the booth saying "hands up" he would immediately switch off the picture and sound from one projector and turn the other on. There are two cue places for each change-over, however, one to let the projectionist know when to start the second projector up and the next cue to let him know when to switch the light and sound over to the "incoming" machine, for an incoming projector must be "up to speed" before it is "cut in". When the change-over from the first to the second reel has been made the first reel is allowed to "run out" until it is all wound on the take-up reel. This reel is then removed to the rewind room, rewound back on another reel and put in its proper place for the next running.

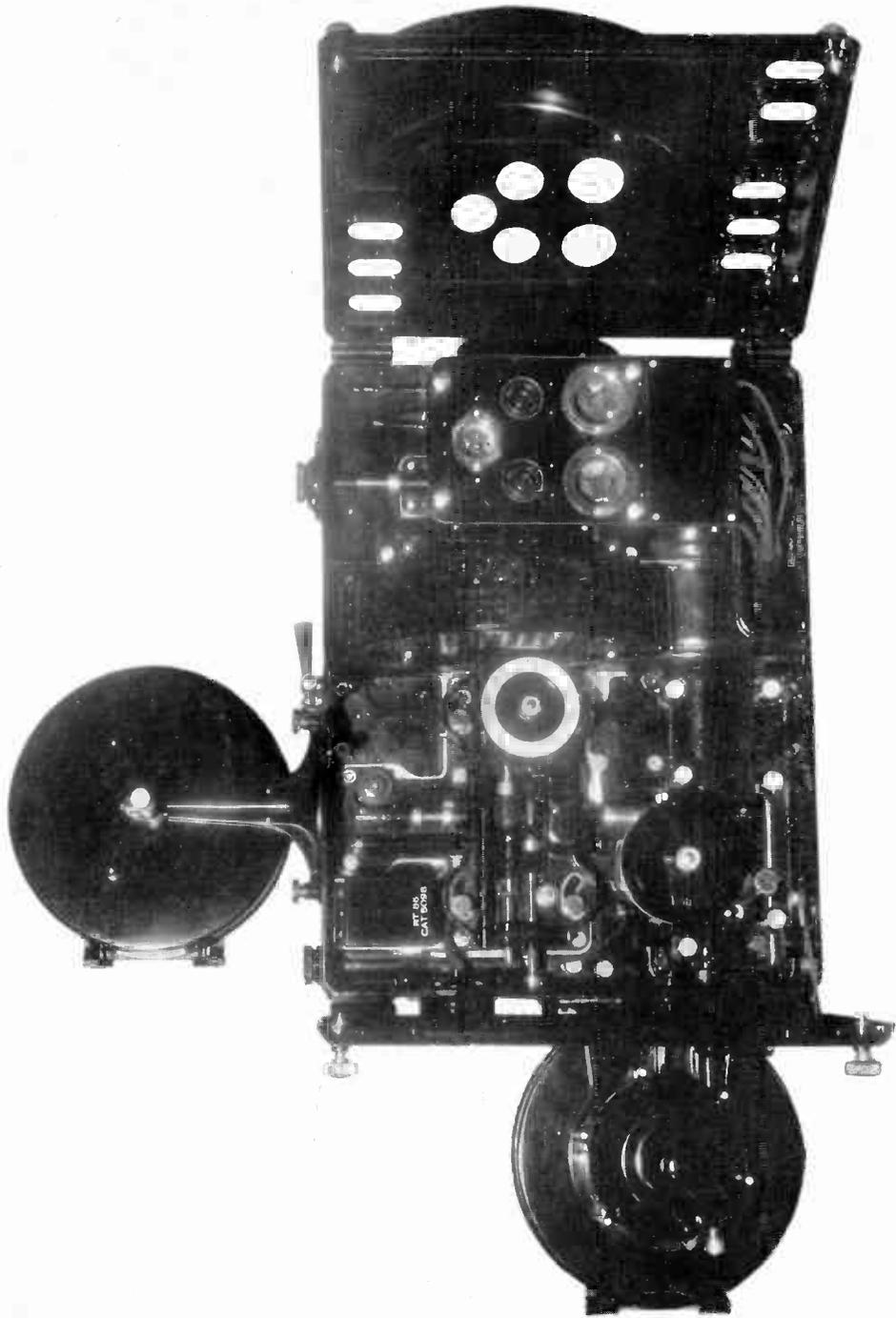
The third reel of the feature is threaded into the first machine, however, before the rewinding is done in order that it may be ready for the change-over from the second to the third reel. In this manner all the reels comprising the picture are sent through alternate machines without a "break" in the show, the change-overs being unnoticed by the audience. The arc of each projector is turned on only a minute or so before the projector is started and is turned off again when the reel is finished so that the only time both arcs are in operation is for a short time during change-over preparations. When the entire feature has been run the first reel is threaded back into the free projector and the same routine is gone through for another show.

EXAMINATION QUESTIONS

1. What three sprockets are common to all types of motion picture projectors?
2. What are the advantages of a "rear type" revolving shutter over a "front type"?
3. What other forms of light source than the arc are used in projectors and what advantages do they offer? What disadvantage?
4. Name the parts of a picture head encountered by the film in its journey from the feed reel to the take-up reel.
5. What are "strippers" and what is their purpose?
6. What function is performed by "pad rollers" in a picture head?
7. Which type of revolving shutter produces less flicker, the two blade, or the three blade type? Why?
8. Draw a free hand sketch of the path of film through a Motiograph head, showing sprockets, guide rollers, pad rollers, and strippers.
9. Is it necessary that the "start" frame of a sound-on-disc production be threaded "in frame"? Why?
10. When is the "change-over" made from one reel to the next?



Sound-on-film motion picture projector for home entertainment.



Portable motion picture projector used by U. S. Navy. (Courtesy Inter. Proj. Corp.)



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