BUILDING A 9·5m.m. CINÉ PROJECTOR

NEWNES

PRACTICAL MECHANICS

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Building a Projector

It Can be Built in a Few Hours at Very Little Cost.

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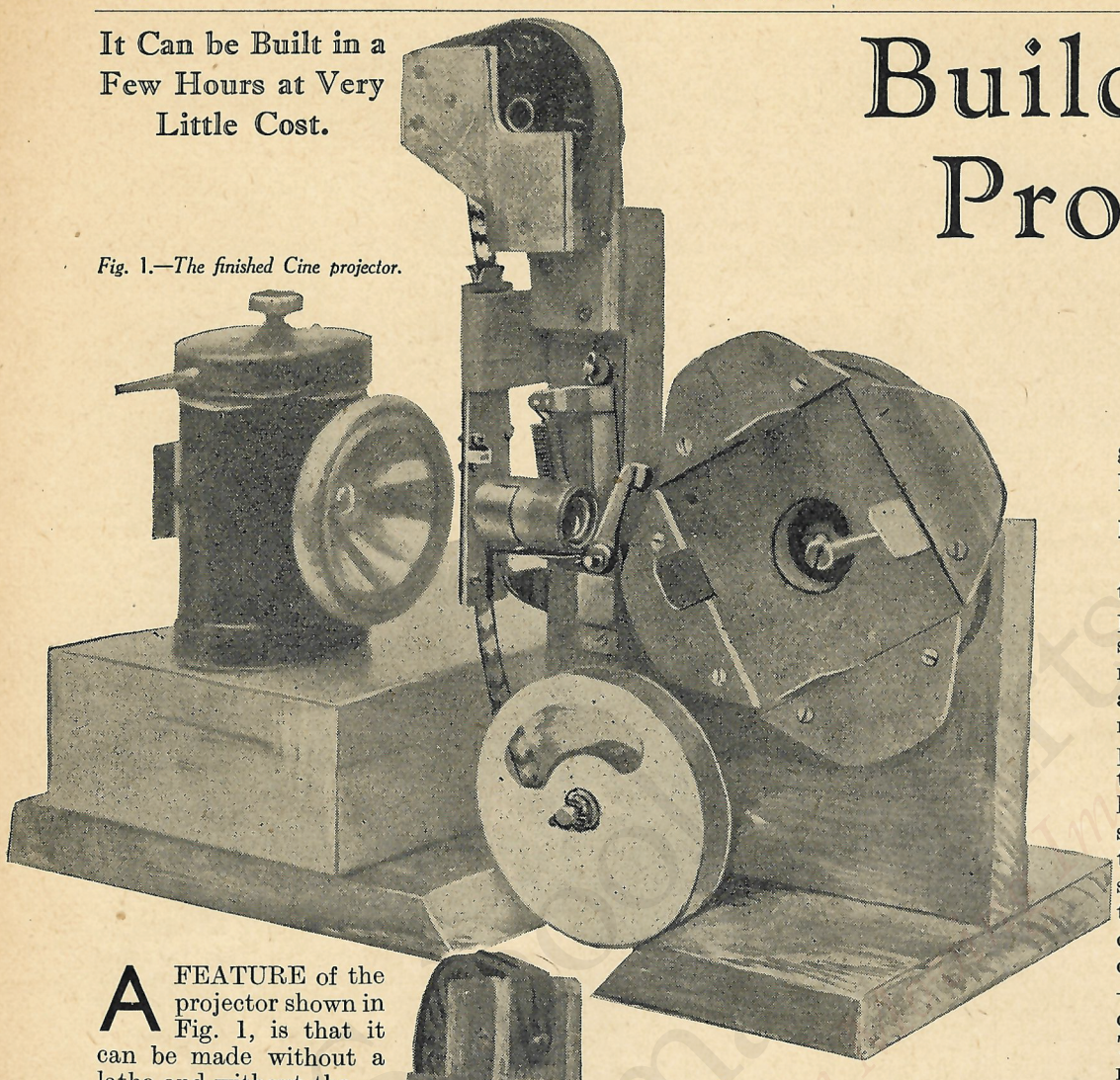


Fig. 1.—The finished Cine projector.

A FEATURE of the projector shown in Fig. 1, is that it can be made without a lathe and without the use of toothed wheels; also the mechanism has been specially worked out so that the accurate positioning of the film does not depend upon the accuracy of machined parts. Any person can therefore undertake the construction of this projector if he is handy with a drill, file, and soldering iron, and is blessed with a moderate degree of patience.

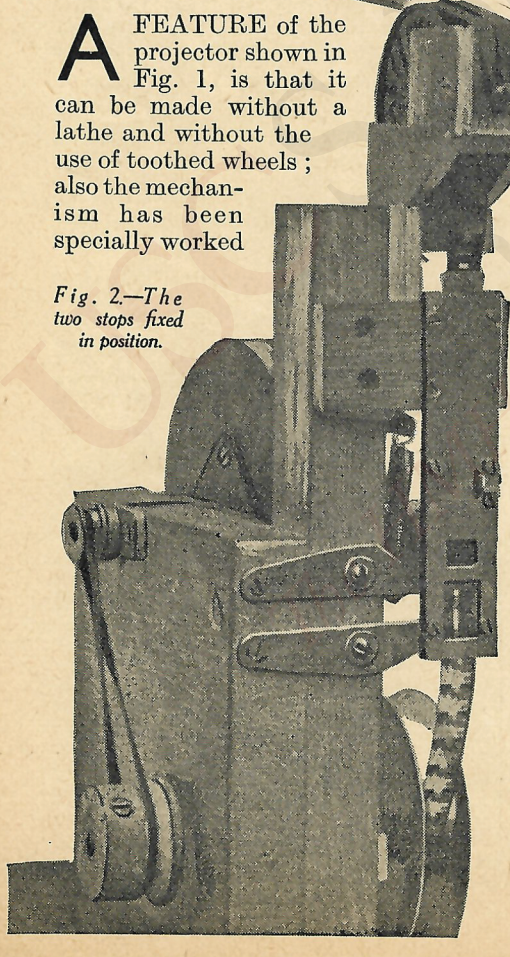


Fig. 2.—The two stops fixed in position.

The machine takes Pathé Baby Films, as these are reasonable in price, there is a good selection to choose from, and also they are non-inflammable.

It is advisable to study the photographic illustrations to get a clear idea of the working of the instrument before commencing construction. Fig. 1 is a comprehensive photograph, showing the general arrangement of the parts.

How to Operate

The metal case containing the film (every film is supplied in such a case) can be seen at the top of the picture resting in a wooden cradle and held in position by a rubber band. The film passes along a brass guide through the "gate" (i.e. the hole through which the light shines), and out on to the take-up-reel, which is conspicuous at the bottom of the picture. On the right of the picture is a wooden disc—turned by a handle—which carries four brass cams screwed on to its face. These cams operate the mechanism which moves the film; each cam causes a picture to move out of the gate and a new picture to enter. Now the pictures have to be changed at the rate of twelve a second, so it will be seen that it is necessary to turn the handle at three revolutions per second to operate the machine properly. This is quite a

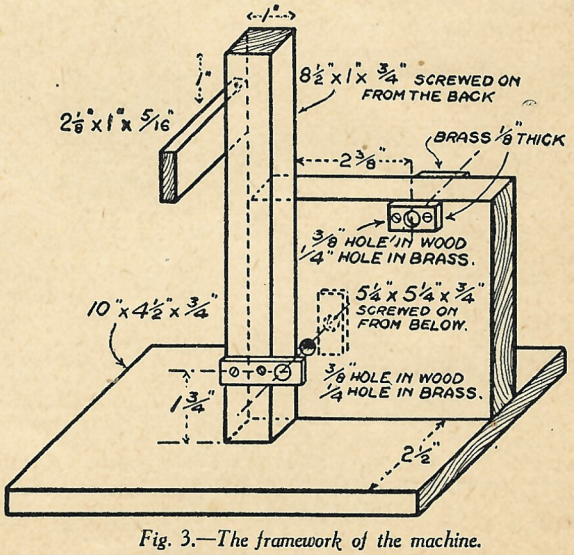


Fig. 3.—The framework of the machine.

Home Cine

By "Home Mechanic"

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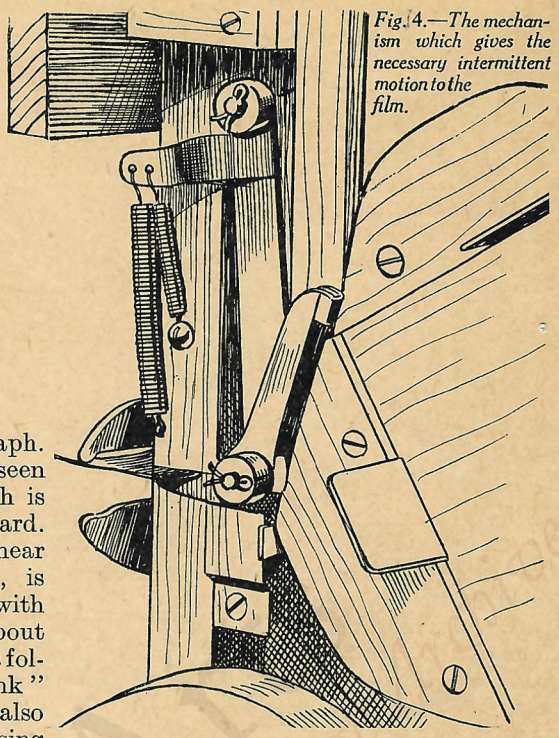


Fig. 4.—The mechanism which gives the necessary intermittent motion to the film.

convenient speed. While the picture is moving across the gate, the light is cut off by one of four flat pieces of metal which project from the face of the cam-wheel, and act as shutters. These shutters uncover the lens immediately the picture comes to rest in

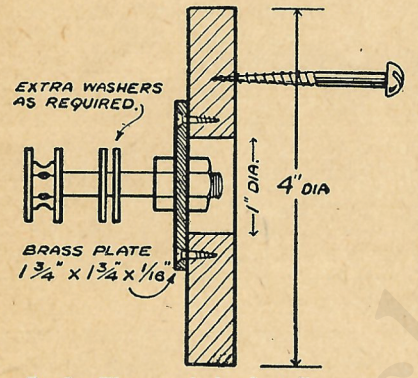


Fig. 5.—The cam-wheel and spindle.

the gate, and allow the image to be projected on to the sheet for its allotted period of a little less than one-twelfth of a second, when the next change becomes due.

The Mechanism for Imparting Intermittent Motion to the Film

The mechanism which gives the necessary intermittent motion to the film is shown in Fig. 4, which is a "close-up" view with the lens and gate removed to show the details more clearly than in a photograph.

Two "followers" will be seen in the path of the cam which is assumed to be moving upward. The lower follower, pivoted near the top of the illustration, is just coming into engagement with the cam which moves it about $\frac{1}{10}$ in. towards the left; on this follower is pivoted a "bell-crank" lever, which is, of course, also moved bodily to the left, causing the tongue of metal on the extreme left to be pushed through one of the perforations of the film (not shown in the sketch). The cam as it moves upwards then comes into contact with the second follower—which has a movement of about $\frac{1}{4}$ in.—and pushing this to the left, moves the film

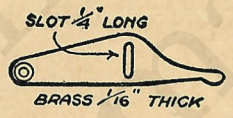


Fig. 7.—(Left) The up-and-down movement of the small tongue is limited by two stops, one of which is shown here.

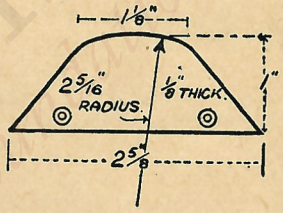


Fig. 8.—(Right) Details of the cam.

downward through the medium of the bell-crank lever. The movement of the tongue is limited by two adjustable stops, and when the cam has passed, the tongue is withdrawn from the film, and the moving parts brought back to position ready for the next cam by spiral springs in tension.

Details of the Construction of the Machine

In describing the construction of the machine only essential dimensions will be given, as it is intended that the parts should be made and assembled in the order given, each part being fitted to those made previously.

Commence by making the framework shown in Fig. 3. This does not require much description, but all the pieces of wood should be planed and fitted truly square or complications might arise during erection. Fig. 1 shows the baseboard cut away to clear the take-up-reel, but this will not be necessary if the dimensions on Fig. 4 are followed.

The Cam-wheel and Spindle

These should be made next (see Fig. 5). The wood disc can be cut out with a fret-saw; the spindle is a 1¾ in. by ¼ in. B.S.F. bolt. A Whitworth bolt would do, though the finer thread is preferable. A washer is

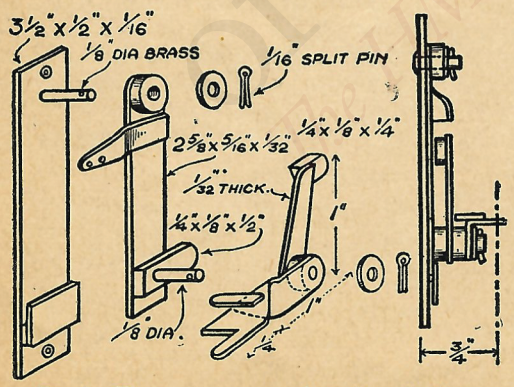


Fig. 6.—The component parts for making the film-moving mechanism.

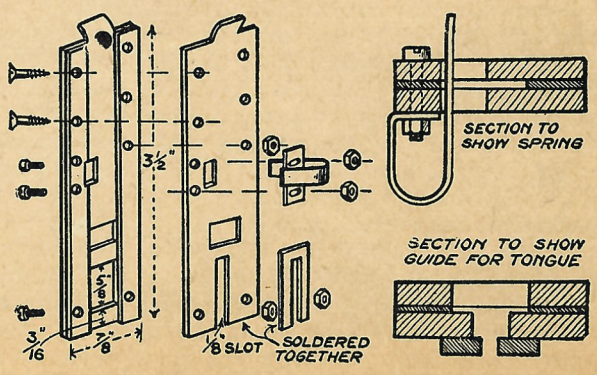


Fig. 9.—The details for making the film guide.

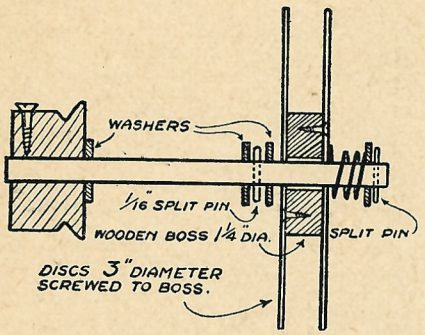
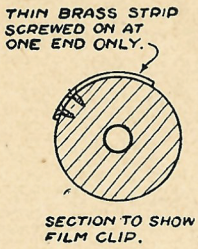


Fig. 10.—The take-up reel.



soldered on each side of the head to form a small grooved pulley for the take-up drive. Mount the wheel and spindle in its bearings, and fix a long screw into the face of the disc as a temporary handle. If the wood disc does not run true, the brass back plate can be taken off and refixed, and the face of the disc can be trued up by packing the wood away from the back plate as required. The face of the disc should stand out about $\frac{1}{16}$ in. beyond the tall upright of the frame.

The Film-moving Mechanism

This is shown complete in Fig. 2. All the separated parts are shown in Fig. 6 together with a side view of the complete assembly. The dimension marked $\frac{3}{4}$ in. from the centre of the tongue to the back of the base plate is important, and should be adhered to. The protruding end of the tongue should be well rounded off to facilitate its entry into the film perforations. The tongue itself should be considerably narrower than the perforations, but its thickness should be as great as possible consistent with free movement into and out of the film. The angle between the tongue and the point of contact with the cam on the other arm should be 120 degrees, measured about the pivot of course. This piece of mechanism is all built up from pieces of brass soldered together, and is quite an interesting part to make. It should, of course, work quite freely, and must be entirely without any tendency to sticking. When complete it should be screwed on to the tall member of the frame with the edge flush with the wood, as in Fig. 4, the vertical position being such as to bring the two cam followers equally above and below the horizontal centre line of the cam-wheel. After fixing this part, screw a small flat piece of thin brass on the other face of the upright member to act as a stop for the member carrying the lower cam follower ; the end of this stop can just be seen in Fig. 4. It engages the lower end of the vertical pivoted member, where it works in the guide and prevents the member from coming out of the end of the guide.

The Two Stops

The up-and-down movement of the little tongue is limited by two stops, as shown in Fig. 7. These are simply flat pieces of brass, about 18 gauge, and are fixed as shown in Fig. 2. The slotted holes allow for adjustment, the screws through the slots being round-headed and fitted with washers. The two stops should be fixed in a position to allow the tongue a movement of about $\frac{1}{8}$ in. above and below the horizontal (about $\frac{1}{4}$ in. in all) when the screws are in the centres of their slots. The exact adjustment must be left till later.

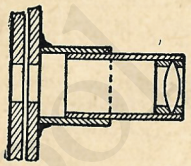
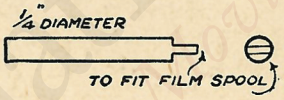


Fig. 11.—(Left) The lens should be mounted in a tube, as shown.

Fig. 12.—The key for rewinding the film.



The two spiral springs may now be fitted ; the longer cam operating the bell-crank should be of a " light and lively " type having a pull of between one and two ounces when fitted. The other springs must be definitely stiffer and stonger, so as to ensure the tongue being withdrawn from the film before its upward movement begins.

Now make four cams as shown in Fig. 8. Fix one of these on to the face of the cam-wheel as in Fig. 4 so that the cam projects $\frac{5}{16}$ in. Turn the cam-wheel slowly and see that the lower follower is moved about $\frac{1}{10}$ in. by the cam ; if the movement exceeds this amount appreciably, it should be reduced by filing down the follower a little, if less than $\frac{1}{10}$ in., shift the cam out to give the required movement. Next turn the wheel until the upper follower is fully lifted, and, leaving the wheel in this position, adjust the lower stop (Fig. 7), until it presses quite firmly against the under side of its lever, but leave the adjustment of the upper stop till later. The other three cams may then be screwed in place, taking care that they all give the correct movement to the lower follower. If everything has been done properly the tongue should move up and down too rapidly to be seen when the wheel is turned smartly by its temporary handle.

The Film Guides

Before starting to make the film guide shown in Fig. 9, the reader is strongly advised to buy a film and make sure that the parts fit the film as he proceeds. Thirty foot films can be obtained new for 2*s.* 6*d.*, or second-hand (from dealers who specialise in film exchanges), for less. A second-hand one should do for the purpose of fitting up, as it will probably become scratched or torn before the instrument is finished. The construction of this part should be quite clear from Fig. 9. The copper foil should be slightly thicker than the film and the width between the two strips of foil should be very little greater than the width of the film, only just enough to allow the film to slide freely. The little bolts, 10 B.A. by $\frac{1}{4}$ in. can be obtained from a model engineers supply store. The little spring shown larger in the sectional view is to keep the film over to one side of the guide, and to steady the film by introducing a little friction ; the blade that rubs on the film should be rounded off to prevent scraping, and slotted holes for the bolts allow the spring to be moved to increase or reduce the pressure on the film. The blade of the spring should project far enough to be pushed aside by your finger when the film is being threaded down the guide. The slotted piece of brass at the bottom is a guide for the tongue, which moves the film ; it should fit the tongue closely, but not too tightly, and should be carefully centred before being soldered on.

The hole forming the gate should be left uncut for the present. Screw the film guide on to its wooden support (see Fig. 2) in such a position that the tongue works freely in its slot

(*Continued on page* 98)

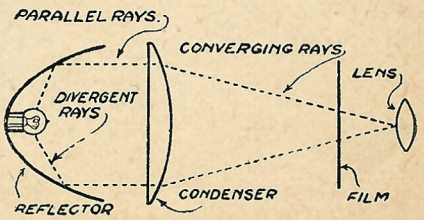


Fig. 13.—The arrangement of the condenser.

The Park Model Aircraft League (Mitcham and Tooting)

November 4th, at Streatham Hall, Hints and Tips, led by H. W. King.

December 1st, Photographic Competition closes.

December 9th, at the Bedford Hotel, Bedford Hill, Balham (near Balham Station). Second Annual Dinner, Prize-giving, and Social Evening. Tickets 3s. 6d. each from Officers. At 7.45 p.m. for 8 p.m.

January 27th, at the Farnan Hall, as above, Third Annual Dance, Exhibition, and Social Evening. Tickets 2s. each from Officers. 7 p.m. till 12.

February 3rd, at Streatham Hall, Sixth Annual General Meeting and Election of Officers.

March 3rd, at the Streatham Hall, General Debate. Motion: "That from the point of view of model aircraftsmanship heavyweights are superior to lightweights." Mover, G. S. Broadway; opposer, R. T. S. Gillett.

Mr. Mulholland's idea for automatic rudder control.

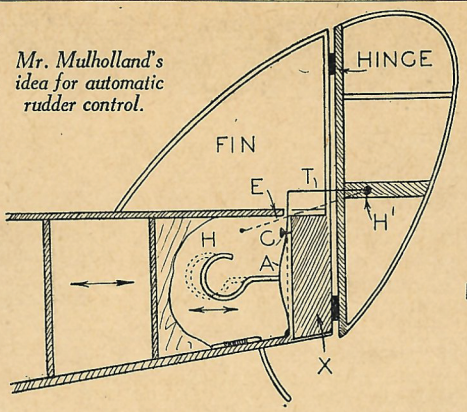


Fig. 1.—A near side elevation. The elevators and elevator fin are omitted for clearness.

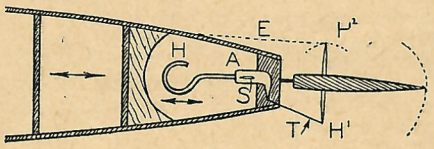
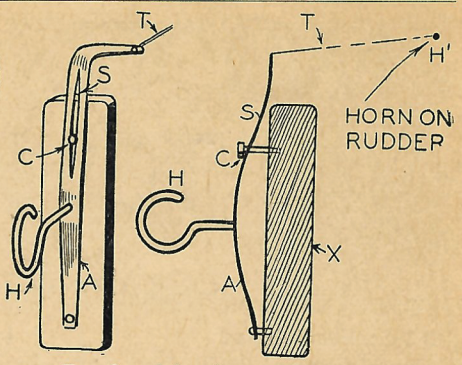


Fig. 2.—A plan view.



Figs. 3 and 4.—A near side section.

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BUILDING A HOME CINE PROJECTOR

(*Continued from page* 70)

within the limits of the large holes opposite. Then adjust the top stop (Fig. 7), so that the tongue has exactly the required movement to bring it directly opposite to a perforation in the film. It should withdraw from one hole when at the bottom stop and come directly opposite the next hole when at the top. The position for the gate should then be marked out, so that when the tongue is in a perforation at the top of its movement there is one picture between the tongue and the bottom of the gate.

The Lens

This should now be fitted. An ordinary magnifying glass of about 1½ in. focus will give a fairly good result, though, of course, a better lens will give a sharper picture. The glass should then be mounted in a tube as shown in Fig. 11, this tube being a sliding fit (for focusing purposes) in another tube which is soldered on to the film guide centrally over the gate.

The Shutters

They are simply thin brass ½ in. by 1½ in. bent at right angles and clipped under the cams. Position them so that they come opposite the lens while the film is being moved, but leave the lens uncovered when the film is at a standstill. A permanent handle can then be fitted tight behind one of the shutters (Fig. 1).

The take-up reel, Fig. 10, is simple, the centre is part of a cotton reel and the cheeks of aluminium; the hole in the outer cheek is to allow the film to be pushed into its clip by one's finger. The pulley is the remainder of the same cotton reel fixed by a radial wood screw, and a rubber band serves for a driving belt. The take-up reel is loose on the spindle and driven only by the pressure of the very light spiral spring, so that it can slip readily without putting appreciable tension on the film.

The Film Cradle

The cradle for carrying the film can be made of three-ply wood, as shown in Figs. 1 and 2. No spindle is required as this is embodied in the metal case. For rewinding the film after a show a key like Fig. 12 should be made. It can be "twirled" between the fingers, this being a quicker method of rewinding than a tiny handle.

The Lamp

A lamp of the type illustrated in Fig. 1, but provided with a "bull's-eye" condenser, will give a good picture about 12 in. wide. A condenser is an absolute necessity and should be arranged to make the light converge right into the lens, as illustrated in Fig. 13. The more powerful the light, the larger the picture. A motor-car headlight could be arranged to give excellent results.

TRADE NEWS

Ellison Plastic Compound

ELLISON Plastic Compound has almost innumerable uses. It will insulate electrical apparatus, protect metal from corrosion by acid, and seal a leak in a motor-car radiator. It is proof against petrol, oil, water, most chemicals and acids, and is not attacked by vermin. There are two grades of plastic. Grade A, for electrical work, is a stiff plastic compound at normal temperatures. It does not shrink in a dry atmosphere, and does not run or drip when warm. The plastic is applied by first warming to make it easily workable, and then pressing on to the part to be covered. It can be shaped with the fingers to the thickness required.

Grade D is softer than grade A at normal temperatures, and consequently takes longer to harden. It is intended for use where heating is impossible. Grade A costs 3*s.* 9*d.* per 2 lb. tin and grade D 3*d.* a lb. extra. It is produced by Ellisons Insulations Ltd., Perry Barr, Birmingham, 20.

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