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Sept. 3, 1946. W. T. SHERWOOD 2,407,208

MACHINE FOR METERING CEMENT TO LENSES

Filed March 7, 1945

FIG. 1.

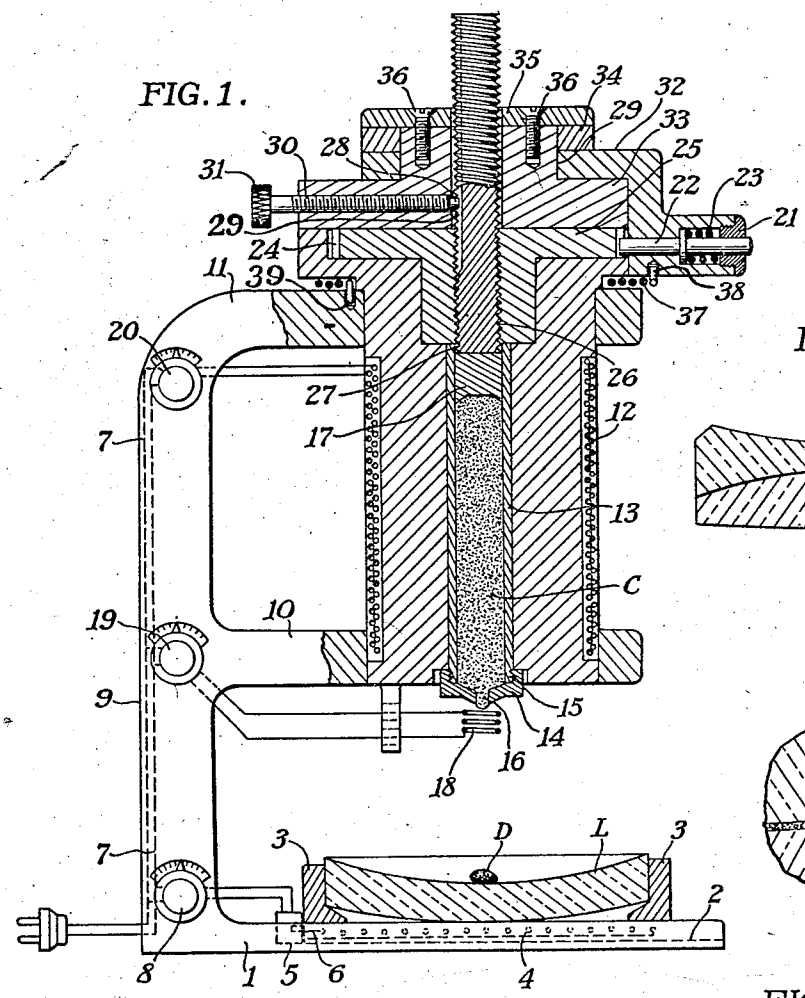


FIG. 2.

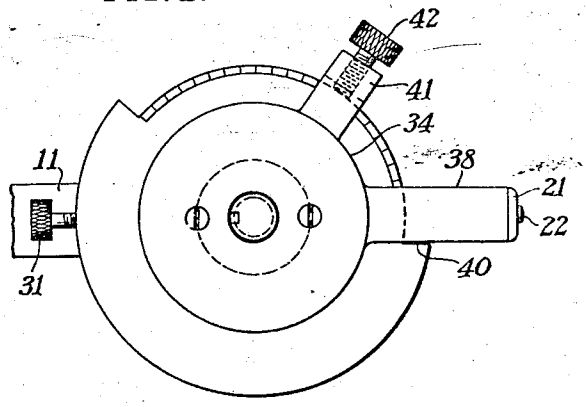


FIG. 4.

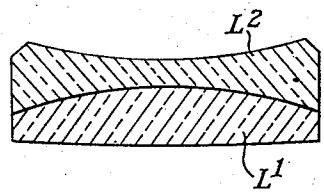


FIG. 5.

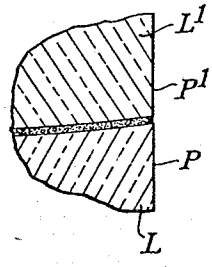
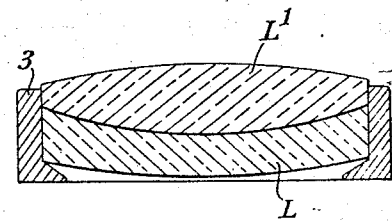


FIG. 3.



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MACHINE FOR METERING CEMENT TO LENSES

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5 Claims. (Cl. 91—43)

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This invention relates to machines for metering cement to be applied to lenses. One object of my invention is to provide a machine for metering exact quantities of cement to lenses to enable an operator to apply cement in such a manner that two lenses may be cemented together over their entire complementary-shaped surfaces without having any cement left to be pressed out between the edges of the lenses, and, later, removed therefrom. Another object of my invention is to provide a machine particularly designed for applying a thermo-plastic cement to lenses and to a machine for maintaining the cement and lens at the desired temperature. Still another object of my invention is to provide a machine with a cement dropper which is maintained at the required temperature to drop a quantity of cement upon a lens and to provide a means for varying the quantity of cement at will. Another object of my invention is to provide a machine which may be used with a thermo-setting as well as a thermo-plastic cement. Other objects will appear from the following specification, the novel features being particularly pointed out in the claims at the end thereof.

For a great many years Canada balsam has been used for cementing together lens elements used in making up an objective. This cement is entirely satisfactory for most purposes, but unfortunately it will not stand the extremes in temperature met with at high altitude, such as is necessary for photographic objectives used in aerial cameras. It has been found that extreme cold will render Canada balsam useless as a cement and will prevent an objective utilizing this cement from producing satisfactory images.

In a copending application in the name of Messrs. Thuline, Parsons and Waugh, Serial No. 490,082, filed June 8, 1943, for Thermo-plastic cement, a number of different cement formulas are given and these cements are found entirely satisfactory, withstanding both the extreme cold due to high altitude or the extreme heat which is met with in the tropics. Such cements are somewhat difficult to apply in a satisfactory manner to lenses. If a drop of such cement is placed on one lens and the lens to be cemented is applied in the usual manner and pressed upon the first lens, difficulties are liable to be encountered in that air bubbles may be entrapped and it may be a long and difficult operation to remove the air bubbles and to thin out the layer of cement to the desired thickness. It is likewise difficult to properly center the lenses unless they are maintained at a fixed temperature. If too much

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cement is applied and is gradually worked out around the periphery of the lens as the lenses are centered, this cement must be later removed after it has become set. This operation is a difficult one to accomplish economically, and sometimes such cement prevents the lens from being properly centered in its mount unless all traces of the unwanted cement are removed. If too little cement is applied, the layer cannot be spread over the entire contacting surfaces of the lenses to be cemented and the operation must be repeated.

I have provided a cement dropping machine so designed that accurately metered quantities of cement may be applied to one lens element so that the difficulties above mentioned will not be encountered. While my machine can be used for thermo-setting cement, as well as thermo-plastic cement, it is designed primarily for the thermo-plastic type of cement.

Coming now to the drawing wherein like reference characters denote like parts throughout:

Fig. 1 is a side elevation partially in section showing a cement dropping machine constructed in accordance with and embodying a preferred form of my invention;

Fig. 2 is a top plan view of the mechanism for limiting the amount of cement delivered at each stroke of an operating handle;

Fig. 3 is a sectional view through a lens holder into which the cemented lens elements may be placed after the cement has been applied;

Fig. 4 is a section through a typical cemented lens element and illustrating elements which can be supplied with cement by my machine; and

Fig. 5 is a fragmentary detail section on a greatly enlarged scale showing how the cement flows outwardly from the center to the edge of lenses being cemented together and indicating how the proper amount of cement prevents an unwanted spread of cement beyond the edges of the lenses.

My cement metering machine consists broadly in a cylinder into which a plunger is automatically advanced a like amount each time an operating handle is moved. The cylinder is provided with a cement dropping nozzle and the movement of the plunger together with the shape of the nozzle definitely determines the exact amount of cement applied to a given lens.

My machine may consist of a base member 1 preferably carrying a slide member 2 having three upstanding posts 3 for centering a lens L beneath the cement dropper. The slide 2 may carry posts 3 spaced the proper distance for the particular lens to be cemented and it may also carry

a suitable heating element 4 connected by sockets 5 and plugs 6 to a source of power 7. A rheostat 8 may be used for controlling the temperature of the heating element 4 and consequently that of the lens L.

A bracket 9 extends upwardly from the base 1 and may be provided with a pair of arms 10 and 11 extending outwardly to support a heating element 12. This heating element surrounds a cylinder 13 and controls the temperature of the cylinder and cement C carried thereby. On the bottom of the cylinder there is a nozzle 14 which may be attached by means of a thread 15 to the cylinder, this nozzle having an orifice 16 which assists in determining the size of a drop of cement which is delivered each time a plunger 17 is lowered into the cylinder by a predetermined amount.

Around the orifice 16 of the cylinder, I provide a heating element 18 which is connected through to the source of power 7 and which passes through a rheostat 19 so that the temperature of this coil may be controlled. The reason for this coil is that a droplet D of cement issuing out of the orifice 16 is liable to harden unless it is kept at the proper dropping temperature.

The heating element 12 is connected to the source of power 7 through a rheostat 20. Thus, the three heating elements, 12, 18 and 4 may be separately controlled in order to control the exact amount of cement which is dropped at each operation of a handle 21.

This handle 21 carries a plunger 22 pressed by a spring 23 into engagement with ratchet teeth 24 on the nut 25 threaded at 26 to turn on the thread 27 carried by the plunger 17. The threaded member 27 is held against turning by means of a pin 28 entering a key slot 29 in the threaded member. The pin 28 is carried on a screw 30 which may be moved to and from the slot 29 by means of a handle 31.

The handle 21 is carried by a disk 32 which is mounted to rotate between the annular member 33 and the collar 34, this collar being held in place by the cap member 35 by means of the screws 36.

A spring 37 having one end 38 anchored on the handle 21 and the other end 39 anchored on the bracket extension 11 tends to hold the handle 21 in the position shown in Fig. 2 in which it rests against a stop 40. However, the collar 34 can be adjusted so that an arm 41 extending radially therefrom can be positioned in different angular positions with respect to the stop 40. This can be accomplished by means of the setscrew 42 as shown in Fig. 2. When it is desired to cement a particular size of lens L, one of these lenses is placed between the holding posts 3 and the cement C in the cylinder 13 is brought up to the proper temperature for that particular cement. This temperature may be in the neighborhood of 300°. It is preferable to hold the lens L and the heating coil 18 at the same temperature, that is 300°, although these temperatures may be varied at will by means of the rheostats 8, 19 and 20. The arm 21 is then advanced to move the nut 25 through a predetermined angle, thus lowering the plunger 17 by a predetermined amount due to the threads 26 and 27. This squeezes a droplet D out of the orifice 16 and, if the proper quantity of cement is dropped upon the lens L, the lenses to be cemented can be joined by placing the lens L with its droplet D in a suitable holder such as the one shown in Fig. 3. A second lens L^1 is then laid upon the first lens L and upon the droplet D and this holder is placed in an oven. The oven

should maintain the temperatures of the lenses and cement at the dropping temperature, as for instance 300°, and it will be found that the capillary attraction of the cement and lens surfaces combined with the weight of the lens L^1 will cause the cement to gradually flow between the two lens elements until their surfaces have been entirely covered by the cement. As shown in Fig. 5, if exactly the right amount of cement has been applied, the cement will flow up to the peripheries P and P^1 of the lenses L and L^1, but it will not flow out over the edges. Thus if exactly the right amount of cement is furnished only the necessary amount is applied to provide a layer of between 10 and 20 microns of cement between the lenses and it will be unnecessary to clean any cement from the periphery of the lenses.

After the cement has properly spread between the lens elements they are gradually cooled, as by moving the lenses through an oven, gradually reducing the temperatures and, at least to some extent, annealing the lens elements. It will be found that when such a lens is cooled, as explained in the above-mentioned application, a very permanent bond between the lenses will be formed which will withstand relatively high heat, such as 200° or more, and also extremely cold temperatures, such as −50 or −60°. Such lenses are entirely suitable for aviation cameras.

It is quite possible to adjust the droplet D to the exact amount required for any size of objective and, while this is usually done by trial and error, it can be calculated in advance quite closely. When the proper stroke for the handle 21 has been determined the stop 41 can be fastened in position by the screw 42 so that each time the handle is moved between the stops 40 and 41 the correct amount of cement will be dropped through the orifice 16.

I have found it desirable to provide a number of nozzles 14 similar to the one described above except for the size of the orifice 16. It is obviously desirable to provide smaller orifices when small lenses are to be used and, no doubt, one orifice may serve for a large number of different sizes of lenses. However, it is more convenient to provide several different orifices which can be readily screwed to the bottom of the cement cylinder 13.

While my cement dropper can be used satisfactorily with thermo setting as well as with thermo-plastic cements, it is primarily intended for use with thermo-plastic cement. It is, however, important with any type of cement to be able to drop or meter out the exact quantity of cement required, because by so doing a second cleaning operation can be completely avoided. Moreover, it is desirable to furnish the exact quantity of cement for another reason. If the exact quantity is furnished for any two lenses to be cemented, the thickness of the cement layer between the two lenses can be accurately controlled and thus the corrections calculated for the particular lenses can be maintained regardless of the number of lenses manufactured. In other words, there will be no appreciable variation between two lenses having known optical characteristics because the cement layer may be accurately held to the desired thickness. When cementing lenses by hand, and when cement is applied without metering, the two lens elements must be carefully worked together by a skilled operator so that the lenses are brought into the proper relationship, gradually working out any air bubbles which may occur due to the spreading of the cement so that

any excess cement passes out around the periphery of the lenses. After the lenses have been centered and set, this excess cement must be manually removed and this operation must be carefully performed in order to preserve the proper relationship between the lens elements and in order to remove all the cement from the peripheries P so that the lenses may be later mounted in their usual mounts.

With my improved dropper, by controlling the exact amount of cement deposited on each lens, the cleaning operation is unnecessary, the layer of cement can be maintained accurately at an accurate thickness and the hand centering of the lenses can be entirely omitted. Since the stroke of the plunger can be accurately controlled after the size of the droplet D required for the particular work at hand has been determined, repeated operations of the lever will cause each succeeding drop of cement issuing from the orifice to be exactly the same as the preceding drop. Thus cement can be applied rapidly and accurately with the machine as above described.

While I have described a preferred embodiment of my cement dropper, it is obvious that various changes can readily be made in the details of construction thereof. I consider as within the scope of my invention all such forms as may come within the scope of the appended claims.

I claim:

1. A machine for applying metered quantities of cement to lenses comprising a support, a lens holder mounted thereon, a cement cylinder mounted above the lens holder, a plunger movably mounted in the cylinder, a pawl and ratchet for advancing the plunger into the cylinder by predetermined amounts, a coupling on the cylinder positioned over the lens holder, a nozzle having an orifice adapted to be attached to the coupling and to extend downwardly therefrom and over the lens holder, said plunger being adapted to extrude measured droplets of cement through said nozzle and upon a lens held by said holder, and a heating element extending about said orifice and out of contact therewith for maintaining said droplets of cement issuing from the nozzle at a temperature facilitating dropping.

2. A machine for applying metered quantities of cement to lenses comprising a support, a cement cylinder mounted above the lens holder, means for heating the cylinder, a plunger movably mounted in the cylinder, a pawl and ratchet for advancing the plunger into the cylinder by predetermined amounts, a nozzle carried by the cylinder for directing cement to a lens carried by the lens holder, a heating element outside of and extending below the aperture of the nozzle to heat a droplet issuing therefrom to a dropping temperature, and means for determining the stroke of the pawl and ratchet mechanism whereby at each movement thereof a definite quantity of cement may be delivered upon a lens resting on said lens holder.

3. A machine for applying metered quantities of cement to lenses comprising a support, a lens holder mounted thereon, a cement cylinder mounted above the lens holder, means for heating the cylinder, a plunger movably mounted in the cylinder, a pawl and ratchet for advancing the plunger into the cylinder by predetermined amounts, a nozzle carried by the cylinder for directing cement to a lens carried by the lens holder, a heating element outside of and extending below the aperture of the nozzle to heat a droplet issuing therefrom to a dropping temperature, and means for determining the stroke of the pawl and ratchet mechanism whereby at each movement thereof a definite quantity of cement may be delivered upon a lens resting on said lens holder, and means for heating a lens carried by said holder.

4. A machine for applying metered quantites of cement to lenses comprising a support, a lens holder mounted thereon, a cement cylinder mounted above the lens holder, means for heating the cylinder, a plunger movably mounted in the cylinder, a pawl and ratchet for advancing the plunger into the cylinder by predetermined amounts, a nozzle carried by the cylinder for directing cement to a lens carried by the lens holder, a heating element outside of and extending below the aperture of the nozzle to heat a droplet issuing therefrom to a dropping temperature, and means for determining the stroke of the pawl and ratchet mechanism whereby at each movement thereof a definite quantity of cement may be delivered upon a lens resting on said lens holder, means for heating a lens carried by said holder, said cylinder heating means, said droplet heating means and said lens heating means all including a variable heat adjusting member whereby predetermined relative temperatures of the heating means may be obtained and droplets of cement may be deposited on a lens in the lens holder.

5. A machine for applying metered quantities of cement to lenses comprising a support, a lens holder slidably mounted thereon, a cement cylinder mounted above the lens holder, a plunger movably mounted in the cylinder for advancement by predetermined amounts, a nozzle carried by the cylinder for directing cement to a lens carried by the lens holder, a heating element below and positioned substantially axially of the nozzle for heating a droplet issuing therefrom, said lens holder including a mount for lenses movable with the lens holder on the support for positioning a lens held by the mount beneath the droplet nozzle.

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