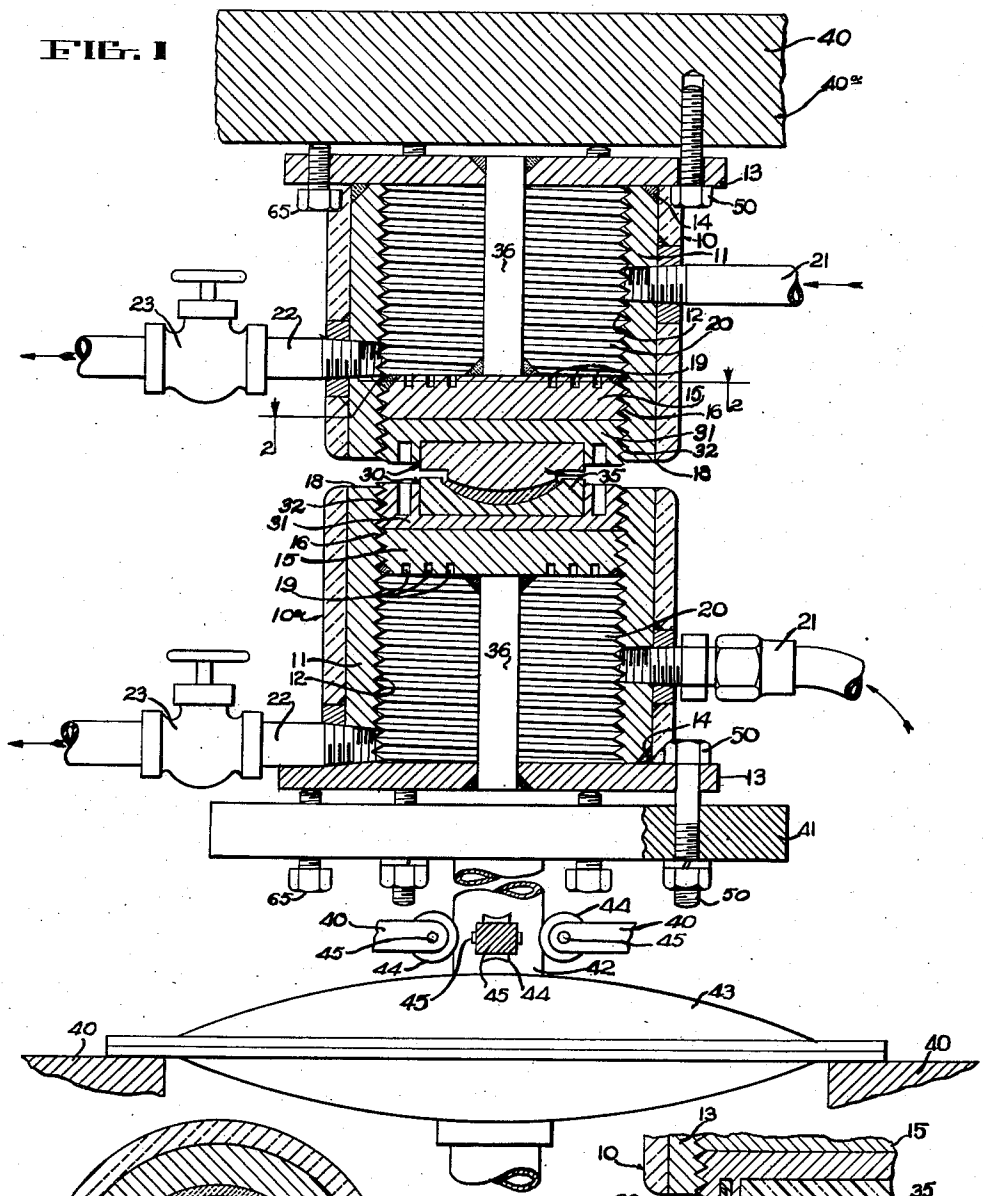
July 28, 1942. C. V. SMITH 2,290,917

LENS MOLDING PRESS

Filed Oct. 29, 1940

FIG. 1



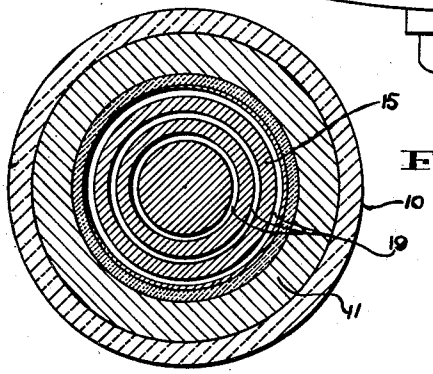


FIG. 2

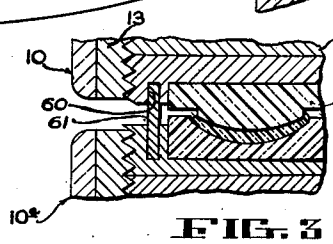


FIG. 3

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LENS MOLDING PRESS

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15 Claims. (Cl. 18—42)

This invention relates to die apparatus used in forming various materials.

It is an object of the invention to provide a simplified die holding apparatus, and one which may be constructed relatively inexpensively.

Another object of the invention is to provide a die holding device having means for the circulation of fluid therethrough, the fluid passage being finned for greater thermal transfer of heat.

Another object of the invention is to provide a die holding apparatus wherein the die element is arranged in good thermal transfer with fluid circulating therethrough, and is removably positioned within the die holding apparatus.

It is another object of the invention to provide a die holding apparatus wherein the die element is removably positioned, and wherein the means for removably supporting the die element provides means for aiding the thermal transfer of heat between the holding device and the die element.

Another object of the invention is to provide a forming die and holding apparatus wherein fluid is circulated through the die, or holding apparatus, and wherein means are provided for insuring that the fluid passage is completely filled with fluid when circulating therethrough.

Another object of the invention is to provide means for adjusting the position of the perpendicular axis of the die with respect the platen of a forming press.

A still further object of the invention is to provide means for coaxially aligning a pair of die elements, which means is removable, upon the die elements being positioned properly within a forming press.

A still further object of the invention is to provide a simplified forming press for forming small masses of material.

Another object of the invention is to provide a method for aligning a pair of die elements within a forming press.

Another object of the invention is to provide a simplified forming press for forming small masses of material, which are substantially functionless, to provide a smoothly operating pressing stroke of the platen.

Another object of the invention is to provide a simplified forming press wherein a diaphragm motor provides the power element for operating the press, the motor being operated either by pneumatic or hydraulic pressure.

Another object of the invention is to provide a simplified forming press for forming small masses of material at relatively low pressures.

Further objects and advantages will be apparent from the description and the drawing.

In the drawing:

Figure 1 is a vertical cross-sectional view of a forming press having die holding devices and die elements positioned therein constructed in accordance with the teachings of the invention;

Figure 2 is a horizontal cross-sectional view taken along line 2—2 of Figure 1;

Figure 3 is a cross-sectional view of a portion of the die holding device and die elements, showing the means for aligning the die elements and holding devices.

In this invention a simplified forming press is provided wherein the die holding elements are of a simplified construction, and wherein the forming die elements are removably positioned.

The die elements, and the die holding members are provided with means for coaxially aligning the die members for insertion into the simplified press. Upon positioning the die holding members with their die inserts therein within the forming press, in their aligned condition, suitable means is provided for properly supporting the die holding members upon the platen and the head of the press so that the aligned relation of the die holding members, and thus the die elements, is maintained.

The simplified die holding members 10 and 10*a* consist of an internally threaded cylinder 11. This cylinder 11 can be a common internally threaded pipe member, the accuracy of the threads 12 being of no particular value. The cylinder 11 is cut from a length of the internally threaded pipe to the desired length to provide the body for the die holding member 10. Since the die holding members 10 and 10*a* are of identical construction only one of said members will be described, it being understood that like parts are represented by like numerals. A mounting plate 13 is positioned adjacent one end of the cylinder 11, the cylinder being secured to the plate 13 by suitable means such as brazing or welding, as indicated at 14. The mounting plate 13 thus seals one end of the cylinder 11.

The opposite end of the cylinder 11 is closed by means of a disk 15 which is provided with external threads 16. The threads 16 are adapted to match the threads 12 of the cylinder 11 so that the disk 15 can be threaded into the open end of the cylinder 11. The disk 15 is positioned a substantial distance inwardly from the end 18 of the cylinder 11 whereby a recess is provided in the end of the cylinder 11 between the disk 15 and the end of the cylinder. The disk 15 is secured in position within the cylinder 11 by suitably fastening the disk therein through such means as brazing or welding. A plurality of circular slots 19 are positioned in the inner face of the disk 15. These slots are for the purpose of providing additional surface area to the inner face of the disk 15. The mounting plate 13 and the disk 15 thereby provide a sealed chamber 20 within the cylinder 11. The chamber 20 is

provided with a fluid inlet 21 and with a fluid outlet 22. The fluid outlet 22 is provided with means for restricting the outlet 22, such as the valve 23. While a valve 23 is used for purposes of restriction in the outlet 22, the valve 23 may be dispensed with if the discharge line 22 is of smaller diameter than the inlet line 21.

This restriction to the flow of fluid through the chamber 20 is provided to insure that the chamber 20 is completely filled with fluid circulating therethrough. Since the inlet 21 can pass more fluid than the outlet 22, when the valve 23 is restricted, it may be seen that the chamber 20 will be completely filled with fluid in thermal transfer with the walls thereof. It is, of course, to be understood that the use of the valve 23 is optional, but its use is advantageous to insure complete filling of the chamber 20 and to prevent short-circuiting of fluid from the inlet directly to the outlet opening.

When using cooling and heating fluid for cooling and heating the die carrying members 10 and 10*a* it is, of course, desirable that the fluid outlet shall be arranged in a manner that the chambers 20 can be drained of fluid. Hence, the fluid outlet is usually positioned at the lowest point of the chamber 20. In the case of the upper die carrying member 10, a short-circuiting of fluid between the inlet and the outlet is not as serious as in the case of the lower die carrying member 10*a*. If the fluid circulating through the chamber 20 short-circuits between the inlet 21 and the outlet 22 of the die carrying member 10*a* it may readily be seen that the disk 15 of the die carrying member 10*a* will not have good thermal transfer with the maximum quantity of inlet fluid circulating into the chamber 20. Hence, the restrictions in the outlet 22 are of value to insure that the end closure disks 15 will be in heat exchange relation with the maximum volume of fluid passing through the chamber 20.

As heretofore mentioned, the cylinder 11 consists of an internally threaded pipe member, hence the threads 12 will extend throughout the length of the chamber 20. These threads provide means for increasing the surface area of the chamber 20 exposed to the fluid circulating therethrough, and in effect provide fins for the internal surface of the chamber 20. The circular grooves 19 provided in the end closure disks 15 increase the surface area of the disk exposed to the fluid within the chamber 20, and hence the portions between the grooves 19 serve as heat transfer fins for the disk 15.

The die element 30 is removably positioned within the recesses provided between the outer exposed face of the disk 15 and the end 18 of the cylinder 11. The die element 30 consists of a disk 31 which is provided with external threads 32 which are adapted to engage the threads 12 within the cylinder 11 to retain the die 30 in position within the recess. The threading of the disk 31 into the recess provides a means whereby the heat transfer area between the cylinder 11 and the disk 31 is increased, the threads serving this purpose. Also, the disk 31 is in thermal transfer relation with the end closure disk 15. The disk 31 of the die 30 carries a forming die insert 35. This insert 35 is suitably secured within the carrying disk 31, and may consist of any one of a number of materials suitable for forming masses of material under pressure. The exposed faces of the inserts 35 are provided with the desired contour which will produce an article of the desired shape when the die members 35 are brought into the proper adjacent relation. It is of course to be understood that the die inserts are not essential but that the contoured face could be provided upon the disk 31.

In order to strengthen the end closure disks 15 for the cylinder 11 a centrally disposed post 36 is positioned between the disk 15 and the mounting plate 13. The post 36 is suitably attached to the disk 15 and the mounting plate 13.

The die carrying members 10 and 10*a* are suitably positioned within a forming press, which in this invention consists of a stationary head 40*a* which forms a part of the press frame 40 and a movable platen 41. The movable platen 41 is mounted upon the end of a plunger 42 which is connected to a diaphragm type motor 43. The motor 43 is mounted upon the bed portion of the frame 40 of the press. The bed and the head 40*a* are both parts of the press frame 40 and are stationary with respect each other. The plunger 42 is guided in its reciprocal movement by means of a plurality of rollers 44 mounted therearound. The rollers 44 are bearinged upon the press frame 40 in any suitable manner, as by the axles 45. The diaphragm motor 43 provides an extremely simplified form of press motor, and improves the performance of the forming operation in that the platform 41 can be moved in an absolutely uniform stroke. Since the diaphragm motor 43 is a friction-free piece of apparatus, and since the rollers 44 are also friction-free apparatus with respect to the movement of the plunger 42, it can be seen that slight additional pressure application to the motor 43 will produce a corresponding movement of the platen 41.

When molding or forming certain articles, such as optical articles, and more particularly lenses, it is essential that the movement of the die member shall be at an absolutely uniform rate. The use of a diaphragm motor permits the movement of the die at a uniform rate and eliminates all vibration or jerky movement of the platen 41. The diaphragm type motor 43 is particularly advantageous for use in forming optical articles since this type motor is a friction-free piece of apparatus. When using a conventional forming press there is a slight amount of vibration produced in the plunger caused by the pressure against the plunger overcoming the friction of the sealing device for the plunger. Such vibration is not produced when using a diaphragm type motor. Further, these motors can be used with either pneumatic or hydraulic presses and since the pressures involved when forming optical articles from resinous material are not high, it is quite possible to use ordinary city water pressure as the press operating means, or air pressure of like degree.

The die carrying members 10 and 10*a* are secured to the platen 41 and the head 40*a* of the press frame 40 by means of mounting bolts 50 which extend through the mounting plate 13 into engagement with the platen 41 and the head 40*a* of the press frame.

To provide for proper alignment for the die carrying members 10 and 10*a*, and thus for the die elements 35, a circular groove 60 is provided in the die supporting disks 31. These grooves 60 are concentric with the central axis of the die inserts 35, and thus concentric with the axis of the contoured surface of the die insert 35. A hollow cylinder 61 is adapted to be positioned within the grooves 60 in order to provide proper alignment of the die inserts 35. The hollow cyl-

inder 61 will thus cause the grooves 60 to be brought into proper coaxial alignment, and since the grooves 60 are concentric with the axis of the contoured face of the disk 35 it may be seen that the inserts 35 will be brought into coaxial alignment.

It is of course to be understood that the die elements 30 have been previously positioned within the respective die carrying members 10 and 10a, so that when the die elements 30 have been properly aligned, the die carrying members 10 and 10a will also be in proper coaxial alignment. The die carrying members 10 and 10a are then positioned between the platen 41 and the head 40a of the press frame of the forming press in this assembled and aligned relation. To maintain this aligned relation a plurality of adjusting screws 65 are in threaded engagement with the mounting plate 13. These screws 65 engage the surfaces of the platen 41 and the head 40a adjacent the mounting plate 13. By properly adjusting the screws 65 so that the ends thereof engage the platen 41 and the head 40a it may be seen that the mounting support for the die carrying members 10 and 10a can be adjusted in a manner that slight angular irregularities between the die carrying members and the platen and head of the press can be compensated for, to permit the maintenance of the proper coaxial alignment of the die elements 30. After the adjustable supporting screws 65 have been properly adjusted the binding bolts 50 may then be drawn tightly against the mounting plates 13 to secure the die carrying elements 10 and 10a at their proper aligned relation. The platen and head of the press can then be opened to permit removal of the ring 61 from between the die carrying disks 31.

By the use of the ring 61 and the adjusting bolts 65, it may be seen that I provide means for coaxially aligning the die elements 30 and the die members 10 and 10a, and also provide means whereby the angularity of the axis of the die carrying members perpendicular to the platen and head of the press can be altered slightly to correct misalignment. It is also possible to use the adjusting bolts 65 as means for obtaining angular relation between the perpendicular axis of the die carrying members 10 and 10a, should such angular misalignment be desired.

The structure of the die carrying members, the adjustments therefore, and the structure of the press, as described in this invention, are particularly adaptable for use in connection with the forming of optical articles from resinous materials. When forming a mass of resinous material it is not required that tremendous pressures be used, hence the construction of the die carrying members and the dies, can be greatly simplified to the extent wherein lighter structure can be used than has heretofore been common when molding or forming masses of material. Further, I have been able to simplify the die structures, and die carrying members to such an extent that the production cost of the dies and press are considerably reduced, whereby the advantages of single mold cavities for the production of optical articles can be used advantageously. When producing articles of resinous material it is required that all articles be heated or cooled uniformly. Such uniform cooling or heating is not possible in a multiple mold since fluid passing through the mold will lose some of its heat transfer value, whereby certain portions of the mold are not at exactly the same temperature as other portions. Since optical work requires exacting production, it may be seen that such inaccuracies as would result from slightly different expansion of different parts of the mold would be detrimental. Further, since the production of optical articles requires that the mold surfaces be in constant engagement with the articles during forming and also while the articles are being set, it may be seen that any non-uniformity of spacing of the mold elements would cause some of the mold surfaces to permit the formed mass of material to draw away from the mold surfaces. Hence, the follow up of the mold surface, required by shrinkage of the material, would not be uniform, and would result in non-uniformity of the articles produced in the multiple mold. Hence, by simplifying the mold structure, the advantages of single mold structures, such as uniformity of heating and cooling, uniformity of follow up, and uniformity of surface alignment, are brought within the economical range for production use.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A forming apparatus comprising a die carrying member, means for securing a die to said member, means for supporting said die carrying member, flange means extending from one end of said member, means extending through said flange means for angularly adjusting the axis of said member with respect to the supporting means, and means extending through said flange means into engagement with said supporting means for securing said member to said supporting means.

2. A forming apparatus comprising a die carrying member, means for securing a die to said member, means for supporting said die carrying member, flange means extending radially from one end of said member, means extending through said flange means in threaded engagement therewith for angularly adjusting the axis of said member perpendicularly with respect to the supporting means, and means extending through said flange means into threaded engagement with said support for retaining said member in adjusted angular position upon said support.

3. A carrying member for a forming die comprising, a body having an open ended threaded bore, a closure plate abutting one end of said body and sealed thereto, and a second closure plate threaded into engagement with the threads in the opposite end of said bore and sealed thereto, the outer face of said last mentioned plate being positioned inward of the end of the bore to provide a recess having a threaded wall to receive and support a die member.

4. A carrying member for a forming die comprising, a body having an open ended threaded bore, a closure plate secured to said body for sealing one end of said bore, and a second closure plate threaded into engagement with the threads in the opposite end of said bore and sealed thereto to provide a closed chamber, the outer face of said last mentioned plate being positioned inward of the end of the bore to provide a recess having a threaded wall to receive and support a die member, said chamber having a fluid inlet and a fluid outlet for the circulation of fluid therethrough.

5. A carrying member for a forming die comprising, a body having an open ended threaded

bore, a closure plate secured to said body for sealing one end of said bore, a second closure plate threaded into engagement with the threads in the opposite end of said bore and sealed thereto to provide a closed chamber, the outer face of said last mentioned plate being positioned inward of the end of the bore to provide a recess having a threaded wall to receive and support a die member, said chamber having a fluid inlet and a fluid outlet for the circulation of fluid therethrough, and means for restricting the flow of fluid from said chamber to insure complete filling of said chamber with fluid in thermal exchange therewith.

6. A forming apparatus comprising an internally threaded cylinder, a mounting plate abutted against one end of said cylinder and sealed thereto, an externally threaded disk threaded into the opposite end of said cylinder a substantial distance to provide a recess in the end of said cylinder and sealed in said position, a plurality of annular recesses in the inner face of said disc, a fluid inlet and a fluid outlet for said cylinder and a die member removably positioned in said recess.

7. A forming apparatus comprising an internally threaded cylinder, a closure plate secured to one end of said cylinder for sealing said end, an externally threaded disk threaded into the opposite end of said cylinder a substantial distance to provide a recess in the end of said cylinder and secured in said position, said disk sealing said end of said cylinder whereby an internal chamber is provided, fluid inlet and outlet means for said chamber, and a die member removably positioned in said recess in threaded engagement with said cylinder threads and in thermal contact with said disc.

8. A forming apparatus comprising an internally threaded cylinder, a mounting plate secured to one end of said cylinder for sealing said end, an externally threaded disk threaded into the opposite end of said cylinder a substantial distance to provide a recess in the end of said cylinder and secured in said position, said disk sealing said end of said cylinder whereby an internal chamber is provided, fluid inlet and outlet means for said chamber, and a die member removably positioned in said recess in threaded engagement with said cylinder threads and in thermal contact with said disk whereby said die is heated or cooled by fluid circulating through said chamber.

9. An apparatus for forming a mass of material comprising, a pair of forming die elements, means for supporting said die elements in operative relation, means for securing said die elements upon said supporting means, and means for coaxially aligning said dies when positioning the same upon the supporting means, comprising an annular recess in each of the adjacent faces of the die elements concentric with the axis of said elements, and a loose hollow cylinder removably positioned in the adjacent cooperating recesses to coaxially align the same.

10. A forming die comprising, an internally threaded cylinder, a mounting plate secured to one end of said cylinder forming a closure therefore, an externally threaded disk in threaded engagement with said cylinder threads and positioned a substantial distance inward from the end of the cylinder to provide a recess, means for securing said disk in said position, a fluid inlet and outlet for the chamber provided by the cooperation of the cylinder and end closure devices, and a forming die removably positioned within said recess by engagement with said cylinder threads.

11. A forming die comprising, an internally threaded cylinder, a mounting plate secured to one end of said cylinder forming a closure therefore, an externally threaded disk in threaded engagement with said cylinder threads and positioned a substantial distance inward from the end of the cylinder to provide a recess, means for securing said disk in said position, a fluid inlet and outlet for the chamber provided by the cooperation of the cylinder and end closure devices, a forming die removably positioned within said recess by engagement with said cylinder threads, and means for adjusting the angular relation of the axis of the die with respect to the supporting means therefore.

12. The method of aligning a pair of die elements within a forming press comprising, the step (*a*) of positioning an aligning device upon one of the forming dies in coaxial alignment with the axis thereof, the step (*b*) of coaxially positioning the cooperating forming die upon said aligning device, the step (*c*) of positioning said aligned assembly within a forming press, the step (*d*) of adjusting the die supporting means to the angularity of the press pressure plates to maintain the coaxial die alignment, and the step (*e*) of securely fastening the dies to the press pressure plates in said coaxially aligned position.

13. A carrying member for a forming die comprising, a body having an open ended threaded bore, a closure plate abutting one end of said body and sealed thereto, a second closure plate threaded into engagement with the threads in the opposite end of said bore and sealed thereto, the outer face of said last mentioned plate being positioned inward of the end of the bore to provide a recess having a threaded wall to receive and support a die member, and a support member extending between said closure plates.

14. A carrying member for a forming die comprising, a body having an open ended threaded bore, a closure plate abutting one end of said body and sealed thereto, a second closure plate threaded into engagement with the threads in the opposite end of said bore and sealed thereto, the outer face of said last mentioned plate being positioned inward of the end of the bore to provide a recess having a threaded wall to receive and support a die member, and a support member extending between said closure plates and secured to each of said plates.

15. A carrying member for a forming die comprising, a body having an open ended threaded bore, a closure plate abutting one end of said body and sealed thereto, a second closure plate threaded into engagement with the threads in the opposite end of said bore and sealed thereto, the outer face of said last mentioned plate being positioned inward of the end of the bore to provide a recess having a threaded wall to receive and support a die member, and a support member extending between said closure plates and positioned coaxially with said bore.

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