

May 5, 1931.

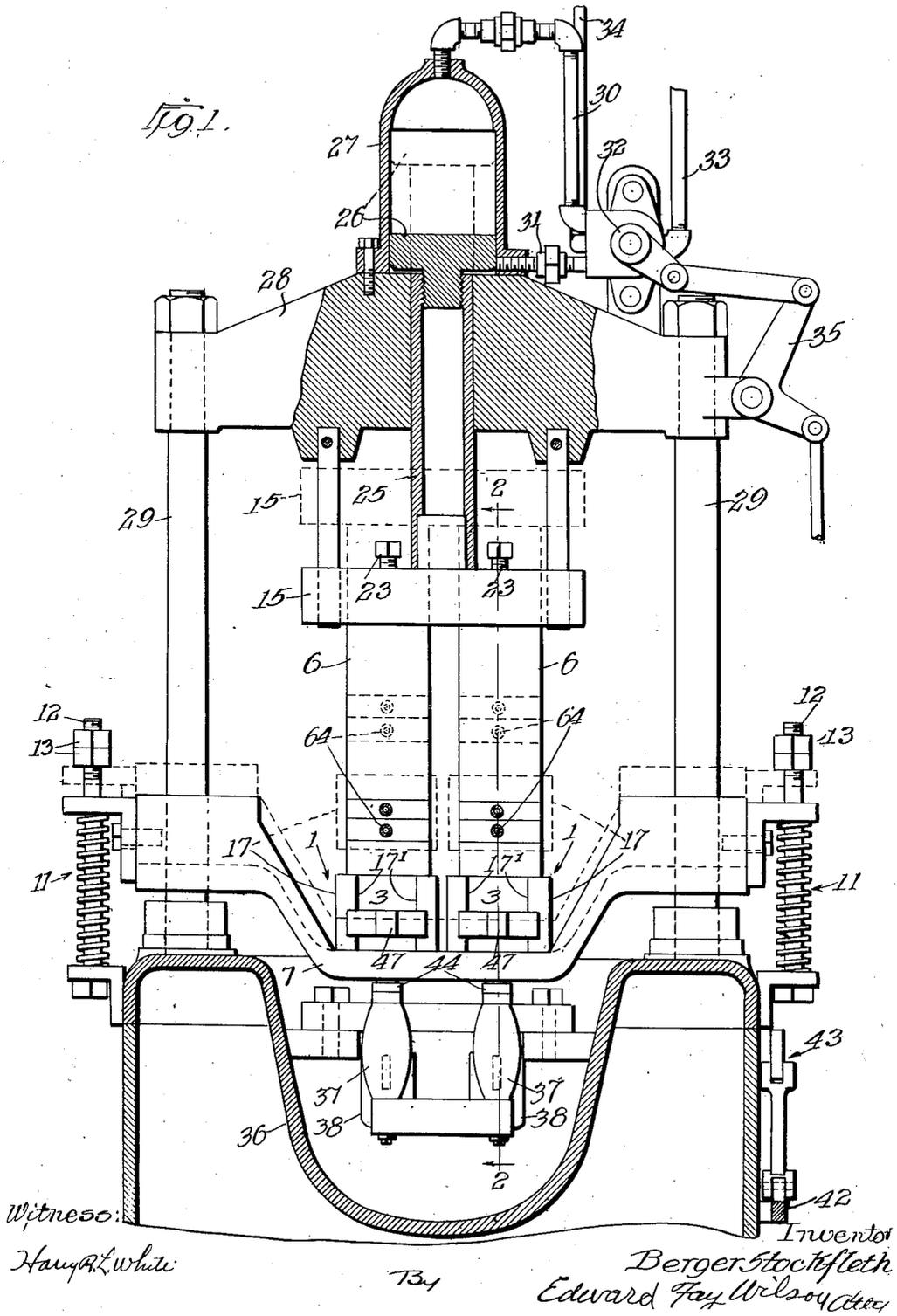
B. STOCKFLETH

1,803,513

MEANS FOR MAKING BEARING LININGS OR SLEEVES

Filed Aug. 20, 1928

4 Sheets-Sheet 1



May 5, 1931.

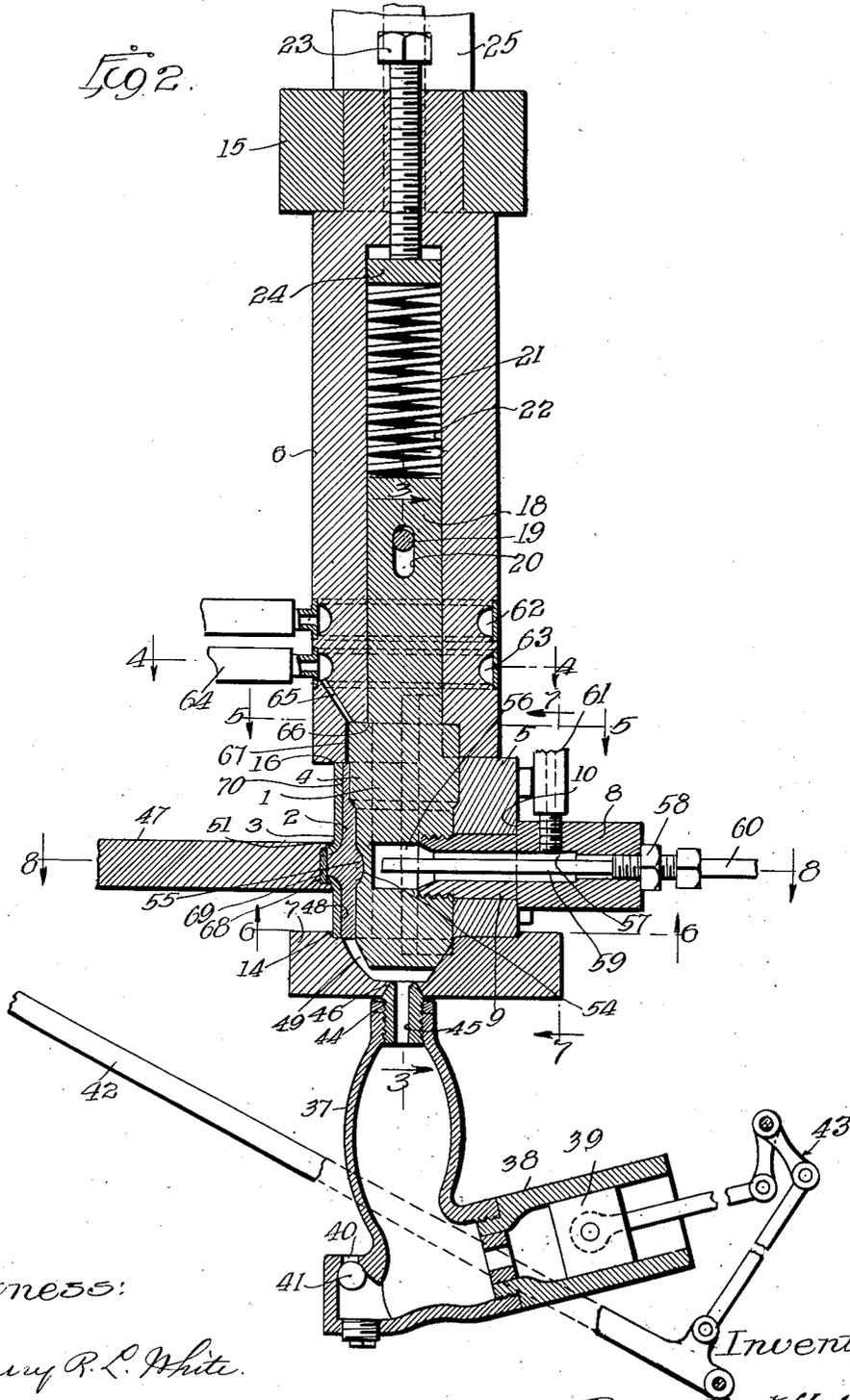
B. STOCKFLETH

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MEANS FOR MAKING BEARING LININGS OR SLEEVES

Filed Aug. 20, 1928

4 Sheets-Sheet 2



Witness:

Harry R. L. White.

Inventor

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By Edward Fox McLean atty

May 5, 1931.

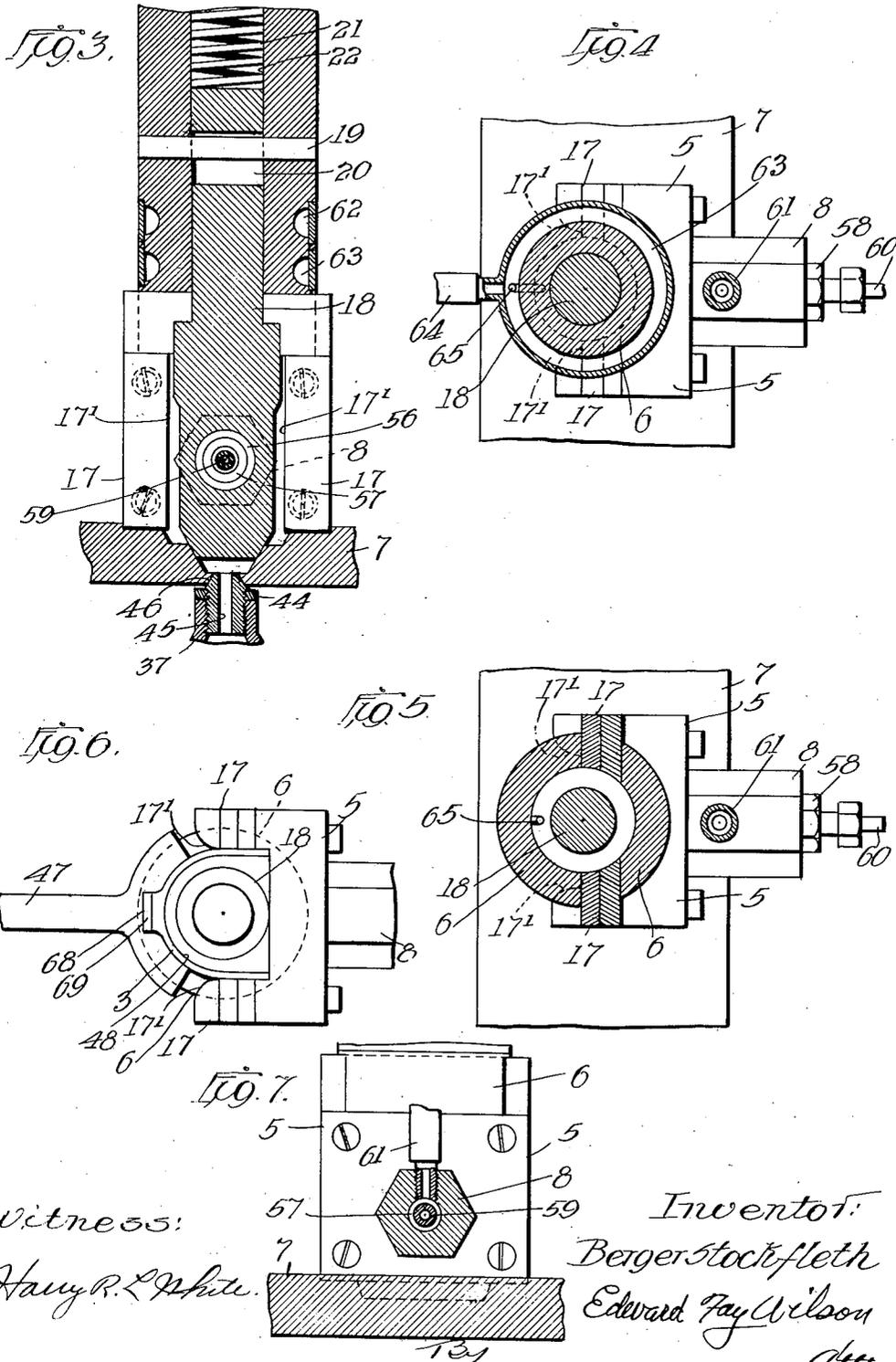
B. STOCKFLETH

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MEANS FOR MAKING BEARING LININGS OR SLEEVES

Filed Aug. 20, 1928

4 Sheets-Sheet 3



Witness:

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Inventor:

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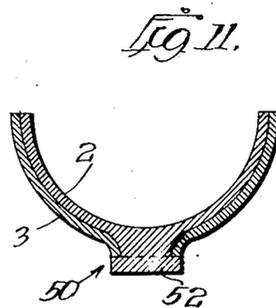
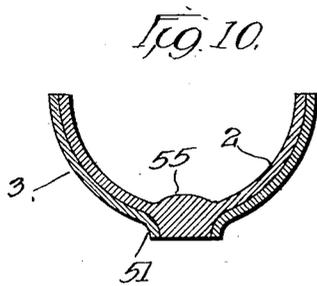
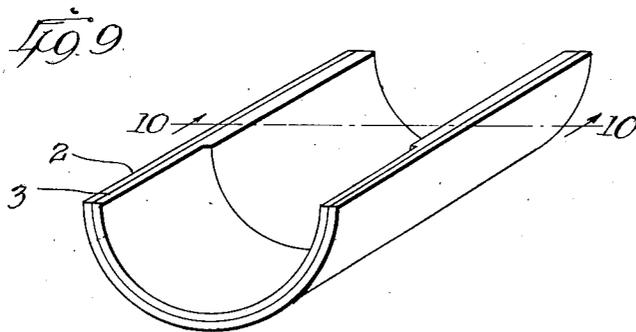
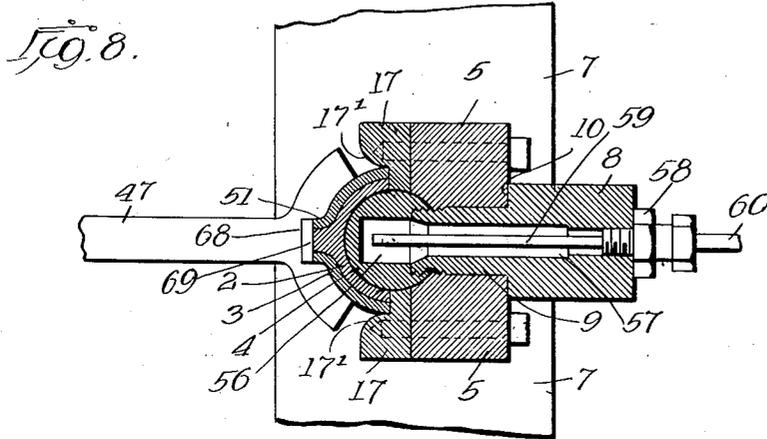
B. STOCKFLETH

1,803,513

MEANS FOR MAKING BEARING LININGS OR SLEEVES

Filed Aug. 20, 1923

4 Sheets-Sheet 4



Witness:
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Inventor:
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UNITED STATES PATENT OFFICE

BERGER STOCKFLETH, OF NILES, MICHIGAN, ASSIGNOR TO HYDRAULIC PRESSED BEARING COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE

MEANS FOR MAKING BEARING LININGS OR SLEEVES

Application filed August 20, 1928. Serial No. 300,757.

This invention relates to bearing linings or shells and has especial reference to improved means and methods of making same.

Such linings are usually made in semi-cylindrical form, they are relatively thin radially and are adapted to be renewed when worn down a certain slight amount.

These linings are either made wholly of babbitt or some similar metal or partly of some such relatively soft metal carried upon a harder metal shell or backing.

The modern methods of making parts of machinery interchangeable especially parts of automobiles and automobile engines necessitates the production of these bearing linings to dimensions within very small tolerances. Such precision of dimensions under ordinary methods of production adds greatly to the cost and may make certain desired results almost prohibitive. These usual or common methods include the production of a rough sleeve or lining and its finishing to size by the removal of the excess material by cutting tools.

By my present method I avoid all slow cutting of the metal and I also avoid the undesirable inevitable result of all cutting methods viz the exposure in the finished shell of the more or less soft or porous interior of the rough blank.

This invention contemplates the production of what may be termed the rough blank by a casting process especially adapted to bring out the best possible interior structural composition of the bearing, such blank being of less than the finished size in some dimensions and more than the finished size in other dimensions.

This rough blank is then subjected to an exceedingly high forming pressure in a suitable die mechanism, which is capable of applying sufficient pressure to force even the steel backings, when such are used, to assume the desired finished dimensions. The application of this tremendous pressure not only forms the shell to fit the die space but it also actually compacts the metal having somewhat a similar effect to forging methods.

Such bearing shells are usually held in place in the bearings by doweling projections

upon their outer surfaces which enter doweling openings provided in the bearing housing.

The provision of these doweling projections on the sleeves which are sized by cutting has always been costly and unsatisfactory. By means of my precasting and pressure method of production these projections are readily produced and with practically no additional cost.

It is well known that the wearing quality of babbitt and such like bearings, is produced by relatively hard crystals such as tin-antimonoid copper and lead or various combinations thereof and commonly spoken of as tin-antimonoid crystals, etc., embedded in a lead, tin or similar matrix metal. It is also well known that the even and thorough distribution of such crystals over the whole bearing surface, such crystals being of substantially uniform size and covering the entire wearing surface, provides a wearing surface of maximum durability and effectiveness.

One result of my improved method whether the shell has a harder metal back or not is that the wearing or inner surface of the sleeve is so produced as to give a substantially uniform and even distribution of these crystals in the casting operation and this desirable distribution is enhanced by the pressure forming step which follows.

The uniform quick cooling of a body of Babbitt metal results in the uniform distribution of the tin-antimonoid crystals and on the other hand the retarded cooling results in a tougher body.

In my improved method, I cast the Babbitt metal in a mold which is so made that I quickly cool the inner or bearing surface and in some forms I preheat the outer side of the mold, thus retarding the cooling of the outer side of the sleeve.

As these sleeves are relatively thin radially and especially as the Babbitt metal lining cast on harder metal backs are even thinner, one important feature of my invention relates to means for getting the Babbitt metal into the mold quick enough so that the mold is filled and perfect castings result particularly when

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the inner surface is rapidly cooled to produce the results desired as to internal structure.

For the production of the doweling button or projection upon the outer cylindrical surface of the finished bearing shell, and which projection must be very accurately sized as to diameter, I provide a suitable mass or projection of the Babbitt metal upon the inner surface of the sleeve blank sufficient in quantity so that when the sleeve is formed in the die there will be enough metal to fill the cavity provided in the outer part of the die space in which the doweling projection is produced.

To make absolutely sure of having sufficient metal present to produce the finished sleeve and allow for the compacting and elongation of the sleeve, I purposely make the casting thicker than the finished size and I provide extrusion slots, preferably at the longitudinal edges of the sleeve through which any excess metal may be forced.

In practicing my invention in the production of backed sleeves, I preferably first dip the backing in melted tin to coat the surface and cause the melted tin to adhere to the back over the whole exterior surface. In my present method of making bearing sleeves, this pretinning accomplishes two purposes, first the tin coating on the back assures the adherence of the babbitt and the fact that as the back leaves the tin bath it is hot and it is placed in the casting machine in this heated condition assists in the flowing of the Babbitt metal over the whole interior surface of the back. In other words, I preferably place the back in the casting machine while still hot from the dipping in the tin and consequently the side of the mold formed by the back is preheated and not only assists in the casting operation but delays the cooling of the cast Babbitt lining which latter is of considerable importance.

In forming these backs I may provide a pressed out projection in the place where I want a doweling projection to be formed and I may further perforate the bottom of such projection. When the bottom of the projection in the back is perforated, I provide a closure for the perforation during the casting operation to prevent the escape of the molten metal at this point. Later such perforation permits the Babbitt metal to be forced out to form the completed and sized doweling projection. When the projection is not perforated, the extra mass of babbitt which I provide on the inner side of the casting assists in forcing the partly formed projection on the back to fill the cavity and produce a properly sized doweling projection.

One feature of my invention relates to a novel method of sealing the prepared sleeve backs to the main body of the mold, to properly seal the mold cavity and prevent the escape of the molten metal therefrom.

To ensure the filling of the mold with the one chilled wall, I provide means for accelerating the removal of the air from the mold and the introduction of the molten metal into same. In other words, I withdraw the air from the top of the mold and force the metal into the bottom of the mold thus filling the mold so quickly that substantially no cold shuts can occur and the castings are substantially all perfect.

As the parts of the mold are brought into casting position, the back is automatically sealed in position and the mold is ready to receive the molten metal.

My invention will be more readily understood by reference to the accompanying drawings forming part of this specification and in which—

Fig. 1 is a fragmentary front elevation of a novel die-casting machine especially adapted for practicing my improved method of making castings;

Fig. 2, is a fragmentary vertical sectional view on the line 2—2 of Fig. 1;

Fig. 3, is a fragmentary vertical section on the line 3—3 of Fig. 2;

Figs. 4, 5 and 6 are fragmentary horizontal sectional views on the lines 4—4, 5—5 and 6—6, respectively of Fig. 2.

Fig. 7 is a fragmentary vertical sectional view on the line 7—7 of Fig. 2;

Fig. 8 is a fragmentary horizontal sectional view on the line 8—8 of Fig. 2;

Fig. 9 is a perspective view of one of the cast shells;

Fig. 10 is a transverse section of the cast shell or bearing sleeve showing it as it leaves the dies and taken on the line 10—10 of Fig. 9; and

Fig. 11, is a view similar to Fig. 10, but showing the bearing sleeve or liner as it appears when finished.

In said drawings 1 represents a die mold such as I use in casting Babbitt metal linings 2 onto the interior surface of half cylindrical metal backings 3. The die mold is set with its axis vertical and is made up of a cylindrical member 4 mounted on a block 5 and upper and lower end closure members 6 and 7, respectively.

The cylindrical mold member, which may aptly be termed the core, is secured to the block 5 by a clamping member 8 which has a threaded end 9 adapted to project through an opening in the block and clamp the block 5 between the mold member 4 and a shoulder 10 on the clamping member 8, the block 5 being formed with a half cylindrical bearing-like opening for receiving the core member 4. The clamping member 8 has another function which will be described later.

The lower closure member constitutes a cross bar or yoke which, as shown, in Fig. 1, extends across the machine and is yieldingly supported at its ends on spring mountings 11

which tend to normally hold the bar 7 at the upper limit of its movement. The movement upward of the bar 7 is limited by vertical rods or bolts 12 forming parts of the spring mounting and having adjustable abutments 13 at their upper ends in the form of a pair of lock nuts on each rod.

The machine shown has a pair of molds 1 as shown in Fig. 1. The bar 7 is provided with an inclined bearing ring part 14 adapted to contact with the outer square edge of the lower end of the bearing shell and by reason of the endwise pressure to which the bearing shell is submitted in the mold closing operation, the mold is sealed at this point. The pressure is sufficient to cause the said edge of the shell to conform to the inclined bearing surface 14 if it does not conform before the mold closes.

The bar 7 forms a connection between the mold and the supply of molten metal. This will be described later.

The upper closure 6 comprises a long cylindrical member which is mounted at its upper end in a cross bar 15 from which it hangs. As shown in Fig. 1, the two upper closures 6 are carried by the same cross bar 15 one at each end.

Each upper closure has an inclined bearing surface 16 adapted to close upon the outer square edge of the upper end of the bearing shell 3 and close the mold at this point.

To close the mold at the longitudinal edges of the backing shell the block 5 has secured to its face vertical side bars or blocks 17 (see Fig. 8) which have inwardly tapered vertically extending surfaces 17' with which the outer corners of the side edges of the backing shell contact when the mold is closed. The tapered end bearing surfaces 14 and 16 tend to force the backing shell inwardly against the vertical bearing surfaces 17' in an obvious manner.

The core member 4 has a central stem 18 extending upwardly from its upper end and within the upper closure member 6. A slight relative movement is provided between the core member 4 and the upper closure member 6. This is accomplished by a pin and slot connection between the two, a cross pin 19 being mounted in the member 6 and passing through a vertical slot 20 in the shank 18 of the core member 4. The core member is normally held at the lower limit of its relative movement by a compression spring 21 mounted in a central opening 22 in the member 6 and pressing upon the upper end of the shank 18. The spring is adjustable as to pressure by a screw 23 carried by the member 6 and carrying a spring abutment 24 on its inner end.

The relative movement between the two members 4 and 6 is for a purpose to be described.

The cross bar 15 is movable up and down

to open and close the mold. This cross bar is connected by a tubular rod 25 with a piston 26 mounted within a cylinder 27 which is carried by a fixed cross bar or yoke 28 forming part of the frame of the machine and held rigidly upon the upper end of fixed parts 29 upon which the lower closure yoke 7 is guided in its up and down movements.

The cylinder 27 within which the piston 26 is movable up and down is connected at its upper and lower ends by pipes 30 and 31 respectively with a four-way valve of usual construction shown at 32 and by means of which air pressure can be applied to and exhausted from either end of the cylinder. The air supply is shown at 33 and the exhaust at 34. This valve is adapted to be controlled by the operator through the medium of suitable valve operating mechanism 35 which usually leads to a foot pedal not shown. Suffice it to say that by this means the several parts of the mold are closed together and the yoke 15 is lifted allowing the lower yoke 7 to be lifted by its lift springs and allowing the mold member 4 to be projected from the upper closure member 6 as has been described.

The casting machine is provided with an open topped metal pot 36 for containing the molten metal for the casting of the bearing linings.

In the pot 36 is mounted a pair of nozzles 37 through which the molten metal is delivered to the two molds. These nozzles are rigidly mounted in the pot and each has formed therewith or rigidly carried thereby, a cylinder 38 in which a piston 39 is movably mounted. By means of this piston the molten metal is drawn into the nozzle from the pot through an opening 40, a relatively light weight metal ball valve 41 being provided to prevent the return of the metal to the pot upon the inward movement of the piston. The piston is adapted to be moved out and in by means of a hand lever 42 and a linkage-connection 43 suitable for the purpose.

The inlet 40 is arranged in a top wall of the nozzle casting so that a relatively light weight ball valve can be used and which will float on the heavier molten metal and be in position to float up against and be seated upon the valve seat immediately the piston 39 starts inwardly and will immediately drop away from the seat when the piston begins to move outwardly.

Each nozzle 37 is provided with a delivery nozzle 44 which is secured in the upper end of the nozzle 37 and is removable therefrom. This delivery nozzle has a central delivery passage 45 and different delivery nozzles with different sized delivery openings can be provided for different purposes. Furthermore, as the nozzles 44 may deteriorate in use, they are thus made easily removable. The nozzles 44 are cone-shaped at their delivery ends 46 and these ends are adapted to seat in similarly

coned seats in the closure bar 7 as best shown in Fig. 2.

The nozzles 37 being rigidly mounted, the bar 7 is caused to be pressed down upon the nozzles in the mold closing operation of the machine.

The mold is closed by means of the air cylinder 27 at the top of the machine. The operator by means of a handle 47 places a backing shell 3 in position in relation to the mold parts 4, 6 and 7, the piston 26 and the parts carried thereby being in their upper positions; then the operator operates the valve 32 and causes the piston 26 to be pushed down. The final result is to force the upper part 6 down toward the lower part 7 and cause the backs 3 to be clamped between them.

Through the backings 3, the lower member 7 is forced down to close upon the nozzles 37, the member 7 being pushed down against the lifting action of the springs 11. At the same time the core member seats at its lower end in the lower member 7 and the upper member 6 is pushed down upon the core member. The block member 5, as shown in Fig. 2, fits in between the lower member 7 and the upper member 6, and prevents too much pressure being applied to the bearing backings in the closing operation.

Having closed the mold as described, the next operation is to force the molten metal up into the mold space. This space shown at 48 is in semi-cylindrical form, the backing shell 3 forming its outer wall, the core member 4 forming its inner wall and the closure members 6 and 7 forming its end walls. The lower closure member 7 is provided with suitable delivery openings or passages 49 connecting the nozzles 44 with the mold spaces 48.

In the form of bearing liner shown in the drawings, the liner is provided with a doweling projection 50 on its back. The backing shell 3 is formed with a doweling projection 51 on its back and as shown in the drawings, this may extend out a less distance than the finished doweling projection 50 and its outer end may be open as shown in Fig. 10. This is done to permit the Babbitt metal cast on the inside of the shell to be forced through and complete the doweling projection as shown at 52, Fig. 11. This is accomplished in a second operation by means of suitable dies and very heavy pressure. For assisting the formation of the finished doweling projection 50, the core member is provided with a depression 54 at the point opposite to the doweling projection 51 on the backing shell which provides a rounded projection 55 of the Babbitt metal on the inner surface of the cast liner and in position to assist in producing the finished doweling projection 50 in the final pressing operation.

This latter feature is not claimed herein, such forming part of the subject-matter of my co-pending application on bearing liners

or sleeves and method of making same, filed June 5, 1928, Serial Number 283,109.

The mold member 4 is provided with means for cooling it to a certain extent. This cooling of the mold member 4 not only prevents it from becoming too hot in use, but it also has the effect of causing the inside surface of the Babbitt metal casting to cool quickly. This is a benefit as it produces more regularly distributed, smaller and more numerous tin-antimonoid crystals in this wearing part of the bearing. On the contrary, the bearing backing 3 is preferably hot when placed in the machine and this tends to retard the cooling of the babbitt in contact with it. This is also beneficial as such retarded cooling tends to toughen the Babbitt metal and make it less liable to fracture.

The backing shells 3 are preferably placed in the machine immediately after they have been immersed in the tinning bath and before they have cooled. They are tinned to cause the Babbitt metal to adhere properly to them in the casting operation.

The means shown for cooling the mold member or core 4 consists of a chamber 56 in the core member 4 opposite to the depression 54. The clamping member 8 is located at this point and is hollow as shown at 57. The chamber 57 in the member 8 extends centrally through it and is closed at its outer end by a screw plug 58 which carries a pipe 59 which extends through the member 8 into the chamber 56 and through which cooling fluid can be supplied through an outer connection 60. The flow circuit is completed by an outlet connection 61 entering the side of the hollow member 8.

The member 6 is also water-cooled near its lower end by a water space 62 provided with suitable inlet and outlet connections.

As explained hereinbefore, the molten metal is forced up into the mold space by the operation of the metal pump, that is, the piston 39, it being necessary to let the air in the mold space escape so that the metal can fill same. This is sometimes effectively accomplished by the provision of suitable vent openings at the top of the mold space, the incoming molten metal pushing the air out in advance. In this present instance, however, we have a peculiar situation, in that the whole mold space is quite thin or narrow and has extensive side walls, one of which is cooled. This would tend to cause the metal to set quickly and possibly prevent it from properly filling the mold. To assist the proper and quick filling of the mold space, I provide means for removing the air in advance of the entrance of the metal, practically producing a partial vacuum in the mold space, which in effect, assists in drawing the metal into the mold space.

To prevent the metal being discharged from the top of the mold, I provide an out-

let for the air which is so thin, in other words the walls of which are so close together that the hot Babbitt metal is immediately cooled by the walls and does not enter in between them. However, the walls are spaced apart sufficiently to permit the air to be drawn out in advance of the metal.

As shown at 63, the mold member 6 is provided with a chamber which is connected by a pipe 64 with a source of vacuum pressure. Leading from this chamber 63 are a number of small passages 65 which end at the top of the member 4, that is at the joint 66 between the members 4 and 6. As explained hereinbefore, the body of the mold member 4 enters up into the lower end of the member 6 and extends above the top mold closing and sealing the surface 16, and the joint between these two members, as shown at 67, is slightly open, that is it may be but a few thousandths of an inch but it is sufficient to permit the withdrawal of the air by means of the vacuum pressure applied through the connection 64.

I do not herein claim broadly the described method of quickly filling the mold space with the molten metal, such forming the subject-matter of my co-pending application for patent on methods and means for die casting, filed October 8, 1928, Serial Number 311,181.

It is necessary to close the open dowel 51 on the backing shell 3 when filling the mold space. This is accomplished by means of the hand tool 47 which is formed with a depression 68 to receive the formed projection 51 and also a relatively soft packing disk 69 which is adapted to be pressed against the outer edge of the hollow projection 51 and seal same.

The mold having been closed, as has been described, the vacuum draws the air out of the mold space and the molten metal is forced up into the mold by a downward movement of the hand lever 42. As soon as the metal is set in the mold, and this occurs almost instantly, the lever 42 is pulled up, thus withdrawing the piston 39. This action allows the ball valve 41 to drop from its seat and permits the molten metal to sink down in the nozzle 37 and its connections to the mold space, thus clearing these passages ready for another casting operation.

It should be noted that the upper part 70 of the mold space 48 is thinner radially than the lower part. This is for the purpose of providing practically just enough metal in this part of the lining for producing the oil grooves and rings with which many of such linings are provided. These alternate oil grooves and rings are produced in the latter pressing operation when the doweling projection 50 is finished and the lining is accurately sized. Such narrowing of the mold space at the top enhances the utility of the

pressure plus vacuum method of filling the mold.

I do not herein claim the novel method of making lined bearing sleeves, such forming the subject matter of my co-pending divisional application filed 30th March, 1931, Serial No. 526,513.

I claim:—

1. In a die casting apparatus, a semi-cylindrical mold part, an opposed thin bearing lining backing, opposed mold parts between which the backing is clamped in opposition to the semi-cylindrical mold part, centering means on said opposed mold parts concentric with the semi-cylindrical mold part for centering the backing in relation to said semi-cylindrical mold part and for sealing the ends of the backing, and means for forcing molten bearing metal into the space and upon the backing.

2. The invention as defined in claim 1, the centering means being inclined and adapted to engage the outer corners of the ends of the backing.

3. In an improved die casting apparatus for making bearing liners, a semi-cylindrical mold part, means for sealing a bearing liner backing shell opposed to said mold part to provide a mild space for casting a babbitt or similar metal lining on the backing shell, said backing shell having a partly formed doweling projection on its back, the semi-cylindrical mold part having a depression in its face opposed to said partly formed doweling projection to produce an extra thickness of metal at this point for use in completing the doweling projection by a later step, and means for forcing molten metal into said die space to fill same.

4. In a mechanism for casting babbitt or similar linings on harder thin metal liner backings and including a mold member adapted to form the inner surface of the lining, mold end closure members having beveled or inclined surfaces adapted to engage outer corners of the ends of a backing shell, and means for pressing the mold end closure members toward each other to seal these members against the ends of the backing shell.

5. In a mechanism for casting babbitt or similar linings on harder thin metal liner backings and including a mold member adapted to form the inner surface of the lining said mold member having beveled surfaces at its sides adapted to be engaged by the longitudinal outer edges of a backing shell, and means for forcing a backing shell against said beveled surfaces for sealing the mold at these points.

6. In a mechanism for casting babbitt or similar linings on harder thin metal liner backings and including a mold member adapted to form the inner surface of the lining, said mold member having beveled surfaces at its sides adapted to be engaged by

the longitudinal outer edges of a backing
shell, means for forcing a backing shell
against said beveled surfaces for sealing the
mold at these points, mold end closure mem-
bers having beveled or inclined surfaces
5 adapted to engage the outer edges of the ends
of a backing shell, and means for pressing
the mold end closure members toward each
other to seal these members against the ends
10 of the backing shell.

20 In witness that I claim the foregoing as
my invention, I affix my signature this 6th
day of August, 1928.

BERGER STOCKFLETH.

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