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W. L. LIGHTBOWN.

FLUID METAL INJECTING MECHANISM.

APPLICATION FILED SEPT. 24, 1901.

NO MODEL.

Fig. 1.

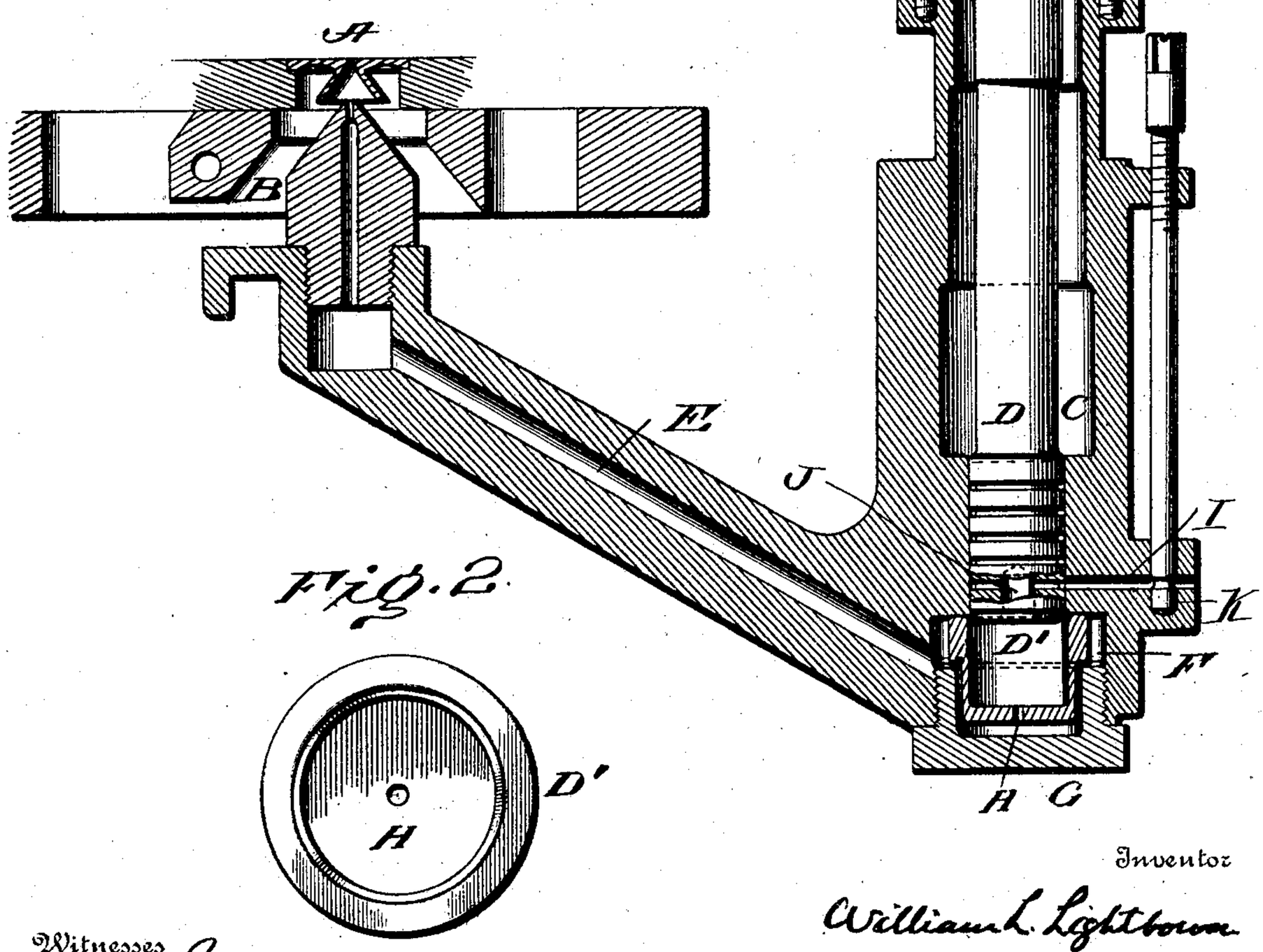

Fig. 2.

Witnesses

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FLUID-METAL-INJECTING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 720,714, dated February 17, 1903.

Application filed September 24, 1901. Serial No. 76,371. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. LIGHTBOWN, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain new and useful Improvements in Fluid-Metal-Injecting Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

The production of sharp-faced type with solid clean bodies by the injection of molten metal under pressure into a mold is attended with some degree of uncertainty, especially when the operation is performed at high rates of speed and in separable molds whose capacity is varied from time to time to accord with different characters, &c., as in machines embodying the Lanston monotype system. Among the several causes of failure in these respects none have proved more annoying and difficult to overcome than those affecting the strength and solidity of the type-bodies, due largely, if not entirely, to the presence of a relatively large volume of air in the mold.

In practice the molten metal under heavy pressure is injected in a fine stream into the interior of a closed mold, thereby compressing the air contained in the mold. Unless this air is permitted to escape before the metal chills it will prevent more or less, according to the volume and degree of compression, a complete filling of the mold, and according to its position and distribution will cause pits or other irregularities in the surface or body of the type. Owing to the high pressure employed a certain portion of the air escapes through the joints of the mold and around the nozzle; but inasmuch as the types are designed to be immediately assembled in line without first passing through a special dressing process, such as ordinary foundry-type are subjected to, it is obvious that to prevent the formation of fins the joints or openings (if they may be so designated) must be of such dimensions as to not permit the escape of molten metal; but it is not alone the air contained in the mold that has to be dealt with. The nozzle itself contains an additional supply, which has also to be disposed of. This results from the necessity which exists for withdrawing the nozzle from its seat and withdrawing the metal from the tip of the mold, the first to prevent chilling the tip of the nozzle and the second to prevent fouling the seating-surface of the nozzle by an overflow of metal thereon and the chilling of the metal at the extreme end of the passage, so as to obstruct the latter. It is obvious that if the quantity or volume of air thus drawn into the nozzle is excessive or more than can be disposed of by such venting-passages as exist it will be entrapped within the mold, either affecting the surface or, if driven into the interior, producing a honeycomb structure. In fact, under certain conditions, when the volume of air is excessive and the pressure great the air thus trapped within the body will exert sufficient pressure to expand the metal and distort the type when liberated from the mold. The withdrawal of the fluid metal from the extreme end of the nozzle to clear the latter and prevent deposits upon the seating-face is commonly effected by the piston during its return or back stroke, with the result that the molten metal is carried far back within the passage leading to the nozzle, thus greatly increasing the volume of air to be expelled into the mold when the next cast is made.

Now the principal object of the present invention is to prevent this excessive storage of air in the nozzle-passage and by limiting the volume to approximately the capacity of the venting-passages enable solid-bodied type to be cast, to which end the invention consists, primarily, in the employment, in connection with a vertical or upwardly-projecting nozzle, of a valve controlling the passage leading from the pump to the nozzle and operating to so limit or retard the withdrawal of the fluid metal during the back stroke of the piston that while a sufficient withdrawal to clear the tip of the nozzle will be effected an excessive withdrawal and consequent admission of air will be prevented.

The invention also consists in the construc-

tion and arrangement of a special form of valve for use in this connection and containing a throttling-passage for the return flow for clearing the nozzle during the back stroke of the piston.

In the accompanying drawings, representing the preferred form in which the invention has been embodied, Figure 1 is a vertical section of a fluid-metal-injecting apparatus or pump containing the invention. Fig. 2 is a top plan view of the valve.

Like letters of reference in both figures indicate the same parts.

For purposes of illustration the invention is shown as applied to the pump of Patent No. 674,374, which typifies the class to which said invention pertains.

A is the nozzle-seat adjacent the mold; B, the nozzle; C, the pump-cylinder; D, the piston; E, the passage connecting the nozzle and pump-cylinder, through which the molten metal is forced by the piston directly into the mold, and D′ a valve opening freely in the direction of the nozzle and closing in the direction of the piston.

The cylinder of the pump is immersed in molten type-metal, which enters the pump when the piston is retracted through an induction-passage I in the cylinder and a central cavity J in the lower end of the piston, said cavity communicating through lateral openings with one of the circumferential grooves in the piston. A valve K serves to regulate the flow of metal through the induction-passage. The pump as a whole reciprocates toward and from the mold, and in addition thereto independent reciprocatory motion is communicated to the piston to expel the metal from the cylinder.

The nozzle is shown separated from its seat, which is the normal position assumed by these elements, for two reasons—first, to prevent undue heating of the mold, and, second, to prevent chilling the metal in the tip of the nozzle. At the instant a cast is to be made the nozzle and its seat are brought into close contact, immediately followed by a complete stroke or reciprocation of the piston, after which the nozzle and seat are again separated and so maintained until the next cast is to be made. The forward stroke of the piston discharges the metal through the nozzle into the mold; but on the return movement and before the induction or feed passage is uncovered a partial vacuum is created in the cylinder, which, coupled with the slight leakage about the nozzle-seat and subsequent uncovering of the nozzle, effects a recession of the metal contained in the nozzle and its passage E, accompanied by a corresponding influx of air, which latter at the next stroke of the piston will be driven into the mold in advance of the metal, and as it cannot all escape it will of necessity prevent a complete filling of the mold and the formation of a sharp-faced clean-bodied solid type. The larger the type and consequent discharge of metal the greater the amount of air admitted, for at the relative high rate of speed at which the pump is operated the intervals between successive reciprocations of the piston are not of sufficient duration to permit the metal in the passage E to come to rest at the level of the metal in the pot, besides which this level is below the discharge end of the nozzle and is subject to considerable variation. This is the action which takes place in the absence of valve D′, whose office it is to so restrict and control the backflow of metal in passage E during the back or return stroke of the piston that only sufficient metal to effectually clear the tip of the nozzle shall be withdrawn and the entrance of an excess of air be prevented. To this end the valve D′ (preferably cup-shaped, composed of metal, such as iron, of less specific gravity than type-metal and located in a chamber F in the lower end of the pump-cylinder, where it is rendered readily accessible by the removable plug G) is located intermediate the piston D and nozzle B, in position to control the backflow of metal in passage E. As shown, the valve seats upward or toward the piston, so that it offers little, if any, appreciable resistance to the flow of metal when the piston descends; but the moment the motion of the piston is reversed the valve is immediately seated and interposes itself as an obstacle to the return of metal in passage E, thereby preventing the drawing in of an excess of air. It is very desirable, however, that there should be a slight withdrawal of metal from the tip of the nozzle, in order to prevent fouling, and this is secured by providing a throttled passage through or around the valve, through which a relatively small quantity of metal may enter the pump-cylinder. Preferably the valve is provided for this purpose with a small aperture H, proportioned to the capacity of the pump, so that during the withdrawal of the piston before the inlet-orifice is uncovered a fine stream of metal will enter from passage E, thereby causing the lowering of the metal in the nozzle. By this means a material reduction in the quantity of air injected into the mold is effected, with the result that solid-bodied type of varying dimensions can be cast in the same mold by a single pump and at a high rate of speed without readjustment of the pump, and at the same time the tip of the nozzle is kept clear and its seating-surface free from deposits.

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

1. In a fluid-metal-injecting mechanism, such as described, the combination with the injecting-nozzle, the piston and its cylinder and the passage connecting said cylinder and nozzle through which the liquid metal is forced by the piston, of a valve controlling said passage and closing toward the piston, said valve being provided with a restricted opening or passage for limiting the return

flow of metal during the back stroke of the piston; substantially as described.

2. In a fluid-metal-injecting mechanism such as described, the combination with the piston, cylinder, nozzle and supply-passage, of the valve-chamber at the lower end of the cylinder, and the float-valve located in said valve-chamber and seating toward the cylinder; substantially as described.

3. In a fluid-metal-injecting mechanism, the combination of the following elements, to wit; a pump, a nozzle, a supply-passage connecting pump and nozzle; a valve controlling said passage; and a restricted always-open passage communicating with said supply-passage on opposite sides of the valve.

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Witnesses:

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