No. 803,588. PATENTED NOV. 7, 1905.

H. C. HANSEN.

# PUMP FOR MOLTEN METAL.

APPLICATION FILED AUG. 5, 1905.

Fig. 1

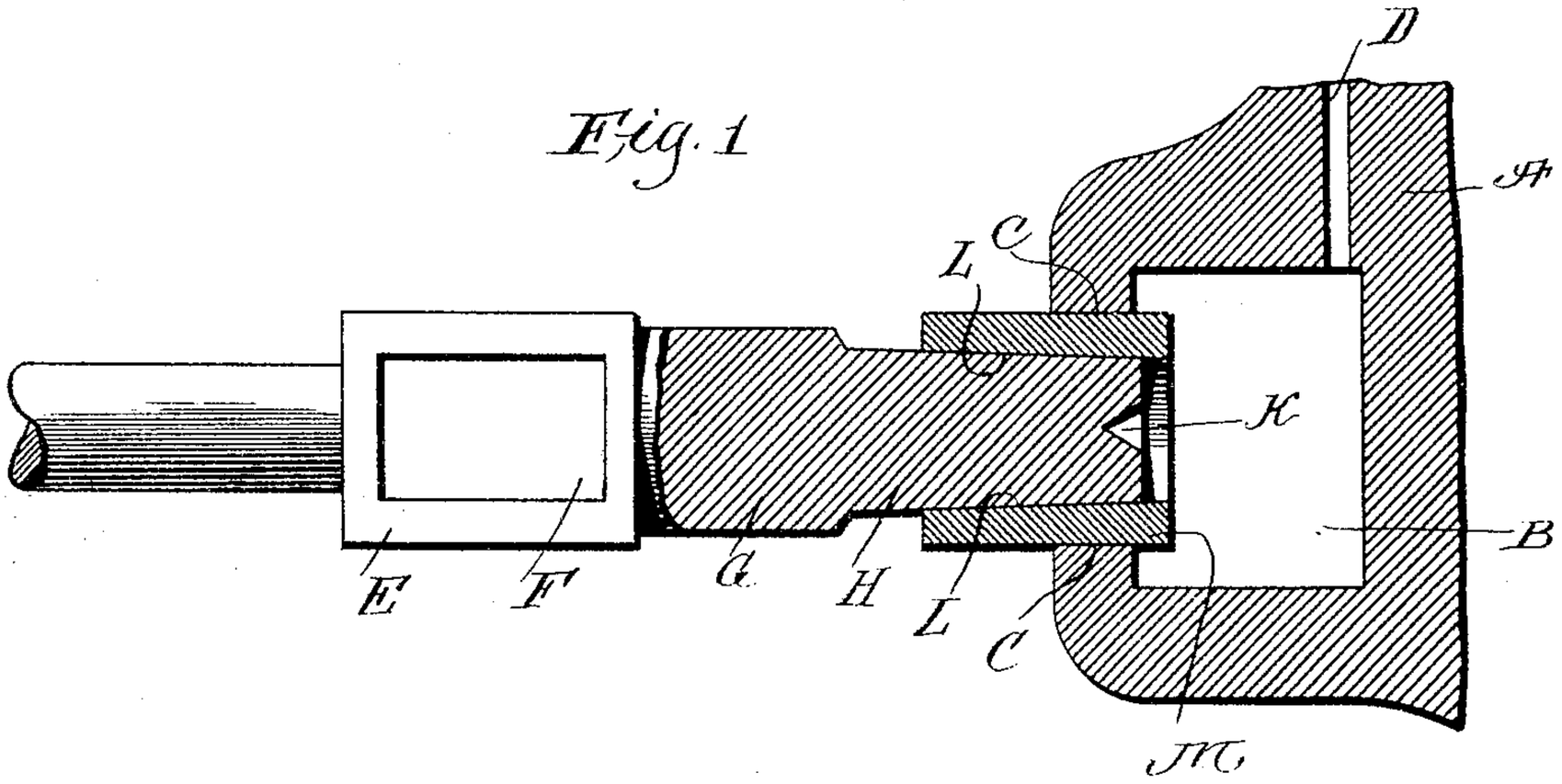
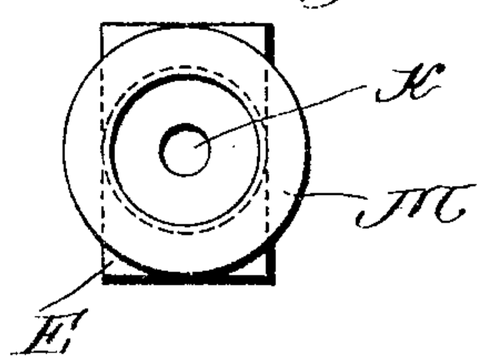



Fig. 2

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# UNITED STATES PATENT OFFICE.

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## PUMP FOR MOLTEN METAL.

No. 803,588. Specification of Letters Patent. Patented Nov. 7, 1905.

Application filed August 5, 1905. Serial No. 272,820.

*To all whom it may concern:*

Be it known that I, HANS C. HANSEN, a citizen of the United States, residing at Newton, county of Middlesex, State of Massachusetts, have invented an Improvement in Pumps for Molten Metal, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to a pump for the pumping of molten metal, and in particular such pumps as are used in pumping molten metal into molds either in the casting of ordinary printers' type or the type that are used in the well-known linotype, monotype, or other metal-casting machines.

The object of the invention is to furnish a piston which shall fit with the necessary precision the pump-cylinder and be capable of ready and accurate adjustment not only in the assembling of the parts, but whenever by reason of any of the peculiar conditions of such an apparatus an imperfect fit shall have arisen. In such a pump the cylinder is commonly made of cast-iron, which is not acted upon by the molten metal, and the piston itself in its active surface is made of the same metal. In a pump of this character it is necessary that the fit between the piston and the cylinder shall be made with the utmost mechanical accuracy. If there is any leakage, it is found that the pressure upon the molten metal is reduced to such an extent that the type cast are more or less imperfect. If the fit between the parts be too close, there will be a binding of the parts and the pump becomes inoperative. If the fit be even very slightly loose, a slight oxidation of the surfaces results, there is a collection of the corrosion in spots, and this causes the parts to bind and also to leak in places. If, however, the fit is made with the proper accuracy, the surfaces of the piston and cylinder are kept smooth and bright in use, and the pump works in the proper manner. The variation between the proper fit and a fit which will cause the parts to bind, on the one hand, and the variation between the proper fit and a fit sufficiently loose to cause leakage, on the other hand, is in each instance a very small matter in actual measurement. A small fraction of the one-thousandth part of an inch either way is found in practice to cause these undesirable variations from the proper fit of the parts.

In the assembling of the pump the surface of the cylinder is formed and finished accurately to the desired diameter throughout. The piston must then be turned to a cylindrical form and slide within the cylinder and fit within a fraction of a thousandth part of an inch. This has always been an extremely difficult operation. Only with great skill and care can the cylinder be turned to the desired size without danger of getting it too small, and thus destroying it or rendering it useless. Furthermore, it is found that when the piston is finally formed to the desired diameter and put into use the conditions which arise in the use of the pump and the "seasoning" of the parts, caused, probably, by molecular readjustment, are such as frequently to disturb the fit of the parts. In an apparatus of this character the molten metal is heated up to a high degree of temperature—for example, from 700° to 800° Fahrenheit—and cooled frequently to solid condition when not in use, and this variation in the range of temperature to which the parts are subjected occurs very frequently, pumps of this character being often heated up daily. Again, a very heavy pressure is applied to operate the pump, such pressure being required to force the molten metal out from the pump into the molds. Again, the action of the piston when in use is very quick, although the motion is through but a short distance. All these conditions act to disturb the fit of the piston within the cylinder, and it is frequently necessary after the pump has been in use a short time to refit the piston within the cylinder. If the piston has become too small, it must be thrown away and a new one made. If it has become too large, it must be again turned down, with much of the difficulty incident to the forming of the piston in the first instance.

It has been customary to make the end of the piston separable from the main piston-rod to allow of the renewal of the active end of the piston. When this is done and it is necessary to renew the piston, it then becomes necessary to find the mechanical center of the piston before the turning operations can be made, and this ascertaining of the center is attended with great difficulty.

The present invention provides a piston which can be not only fitted with comparative ease to the cylinder in the assembling of the parts, but can thereafter whenever the fit of the parts has been destroyed by the conditions prevailing be readily re-formed to fit

again in a proper and accurate manner. This result is secured by reducing the piston end and forming it in the shape of a frustum of a cone and by forming the active surface of the piston in the shape of a continuous metal sleeve to fit over the tapered end of the piston-rod, the sleeve having a cylindrical effective piston-surface and an inner bore tapered to correspond with said tapered end. The effective surface of the piston can then be finished to the desired diameter in the usual way. If in doing so it has become too small, a very slight driving of the sleeve upon the tapered piston-rod will enlarge the diameter of the sleeve the necessary fraction of a thousandth of an inch required to present a new surface, which can again be turned down until the desired fit is secured. This operation can be repeated several times when necessary.

The invention will be more fully described in connection with the accompanying drawings, and more particularly pointed out in the appended claim.

The drawings represent the piston in its preferred form in connection with the cylinder of an ordinary metal-casting machine.

In the drawings, Figure 1 represents a longitudinal view, chiefly in cross-section, of the piston embodying the invention and the cylinder of an ordinary metal-casting machine; Fig. 2, an end view of the piston.

It is unnecessary to describe the parts of the pump other than those illustrated, either with respect to the cylinder or the mechanism for operating the piston or the valves. All these may be of any usual or suitable construction.

A indicates the cylinder of an ordinary form of pump, the chamber into which the molten metal and from which it is drawn being indicated at B and the cylindrical wall of the chamber in which the piston fits and slides being indicated at C. The usual passage-way for the admission and emission of the molten metal is shown at D.

The piston-rod E may be of usual form and construction except at the cylinder end. In the form illustrated the aperture F is for the operating-lever. Hitherto, owing to the necessity of frequent renewal of the piston, it has been common to form the entire forward end of the piston beyond the aperture F in a separate piece and attach it to the main body of the piston-rod by a screw-threaded connection. The present invention does away with this necessity, and the piston-rod may be and preferrably is made in one piece. The forward end of the piston H is reduced and shaped with a tapered periphery, so as to form the frustum of a cone with the smaller end outward.

The effective end of the piston in this invention is in the form of a sleeve M, cylindrical on its outer surface and having its interior surface formed with a taper corresponding to that of the tapered end L, so that the sleeve M will fit tightly over the tapered end L. The position of the taper in the sleeve M is preferably such that when the sleeve is placed in position to fit snugly on the end L it will project slightly beyond the extreme end of the end L of the piston-rod. When this is done, the blow used to drive the sleeve onto the piston-rod will not injure the end of the piston-rod or the center K, formed therein.

In assembling the parts the cylindrical surface C of the pump-cylinder is first formed in the usual manner to present an exact smooth cylindrical surface. After the piston has been formed the end H is tapered. In practice I find that a taper corresponding to that of the ordinary standard tapered reamers is very satisfactory. The sleeve is then formed with a corresponding taper and then driven onto the end H with sufficient force to hold it in place while the cylindrical surface is finished to the desired diameter by usual finishing operations.

If during the finishing operation the diameter of the piston is reduced beyond that necessary for a perfect fit or if at any time during the use of the pump the diameter is reduced or the fit between the piston and the cylinder becomes loose, the piston is removed and the sleeve M driven slightly onto the tapered end H. If necessary, the exterior of the cylinder M may be heated to cause it to expand slightly and allow it to be driven on with more ease; but in practice a few blows of the hammer upon the sleeve M will drive it down upon the tapered end of the piston-rod H sufficiently to expand the sleeve and increase the diameter of the piston to the desired extent, whereupon the surface of the piston may be refinished to the desired fit. This operation may be repeated a number of times. The sleeve is made of metal, and in the particular uses referred to herein preferably of cast-iron, and is one continuous piece, so that it presents an unbroken smooth effective piston-surface. The slight enlargement required at times to secure a perfect fit is thus secured solely by the expansion of the metal itself under the wedging action of the taper and the effective piston-surface remains unbroken and continuous.

Whenever the sleeve M is injured or becomes useless from long wear or repeated adjustment, a new sleeve may be substituted therefor. The center K at all times remains uninjured and can be used for turning or finishing the cylindrical surface at every operation.

It will thus be seen that the piston-surface can be formed with the utmost precision to the desired diameter in assembling the parts and thereafter whenever any misfit occurs between the parts without injuring the piston-rod or necessitating its renewal. The

construction is one of absolute simplicity, the parts being of the fewest possible number and presenting the necessary strength, while allowing for all adjustment which is required.

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

A piston for a molten-metal pump consisting of a metal rod having a tapered end and a continuous metal sleeve having an exterior cylindrical surface constituting the effective piston-surface and having a bore tapered to correspond with the tapered end, the angle of the taper of the two parts being such that they are firmly held together by frictional contact alone, whereby the effective diameter of the piston may be increased by forcing the sleeve upon the tapered end to cause the expansion of the metal of the sleeve.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HANS C. HANSEN.

Witnesses:

NATHAN HEARD,

MABEL PARTELOW.