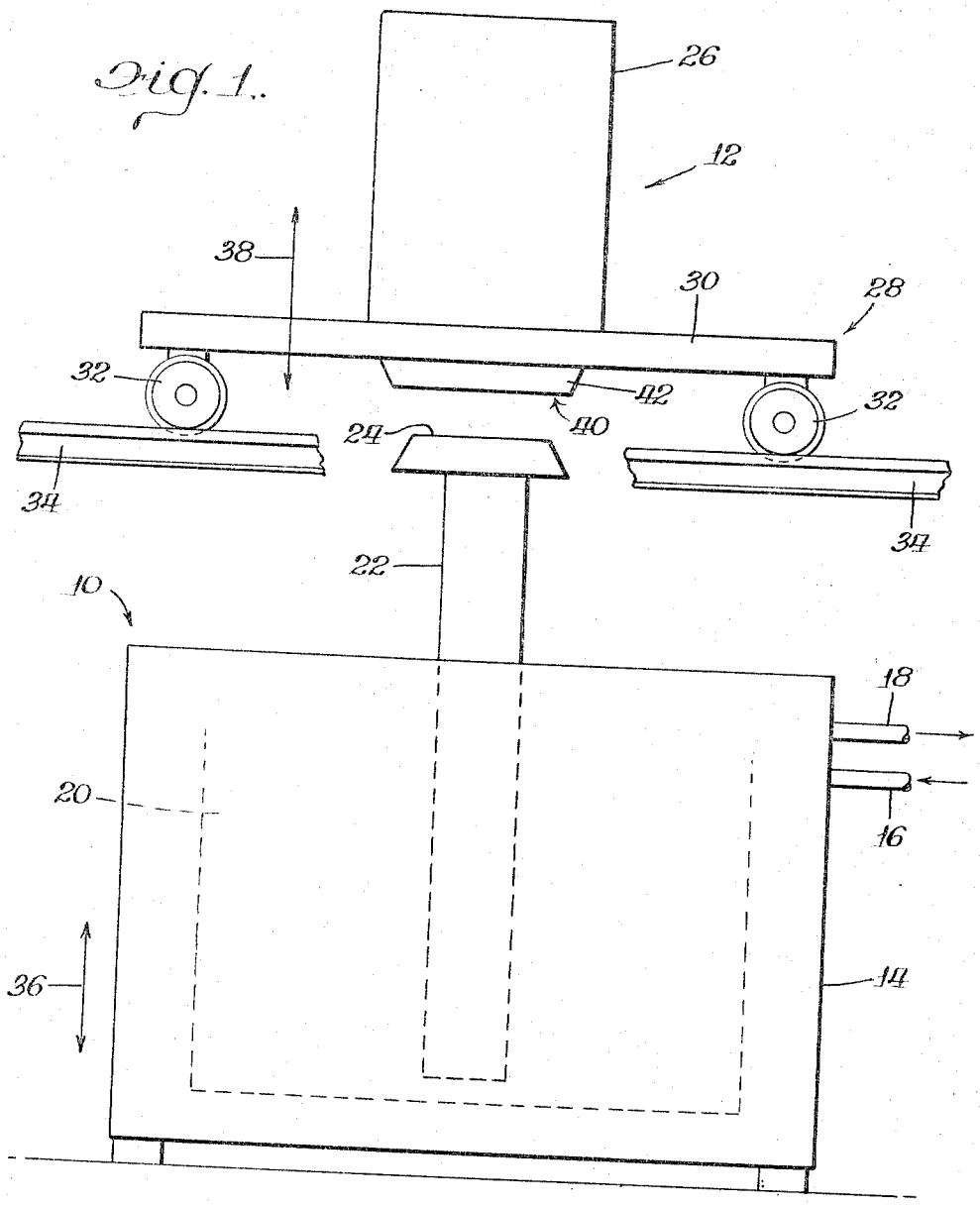
May 30, 1967 J. TAKACS, JR., ETAL 3,322,186

PRESSURE POURING APPARATUS

Filed July 13, 1966

3 Sheets-Sheet 1

Fig. 1.



INVENTORS
John Takacs, Jr.
BY Alan G. Stebner
Walter J. Schlegel Jr. Atty

May 30, 1967 J. TAKACS, JR., ETAL 3,322,186

PRESSURE POURING APPARATUS

Filed July 13, 1966

3 Sheets-Sheet 2

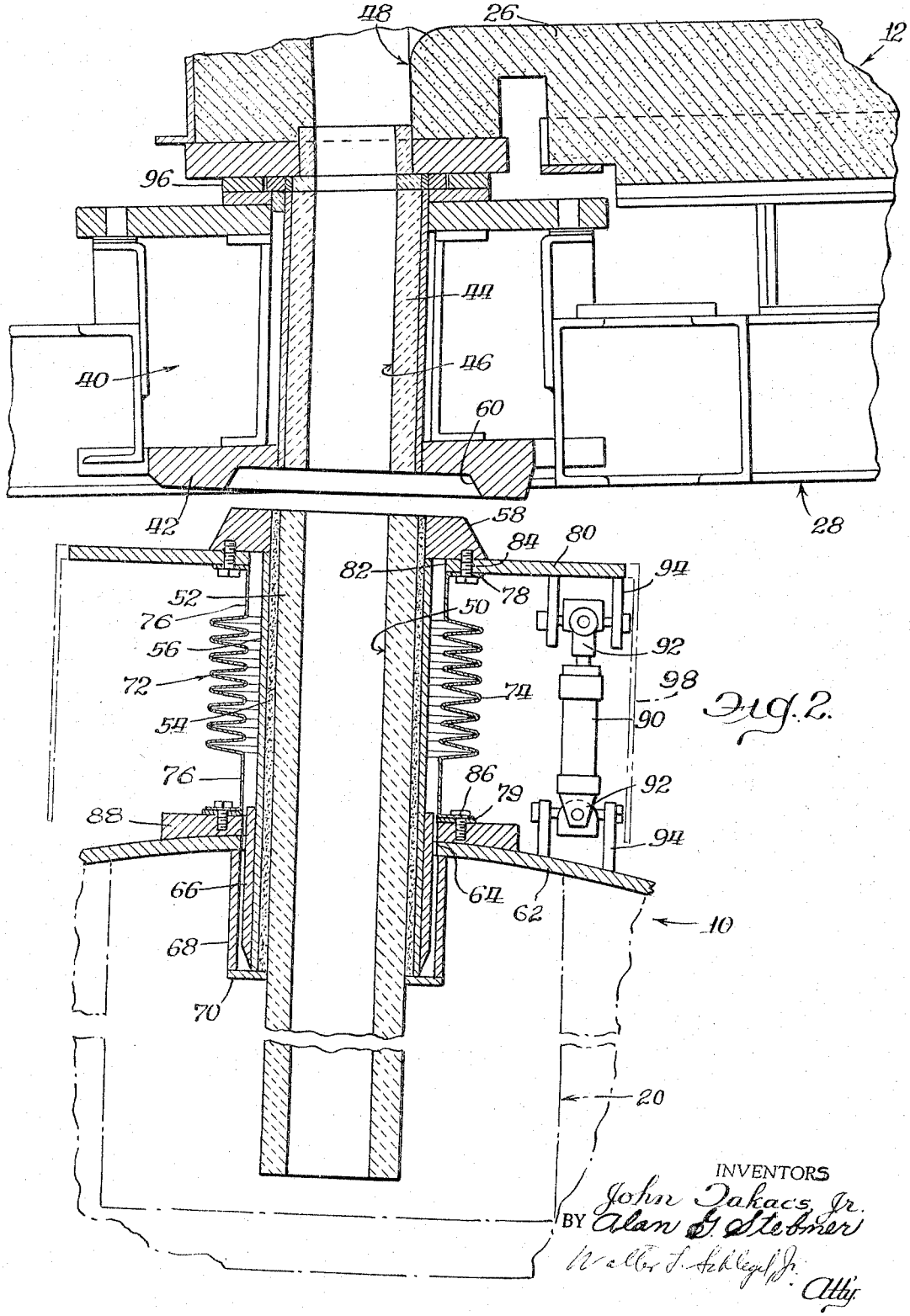


Fig. 2.

INVENTORS

John Takacs, Jr.

Alan G. Stebner

BY Walter J. Ahlegel Jr.

Atty.

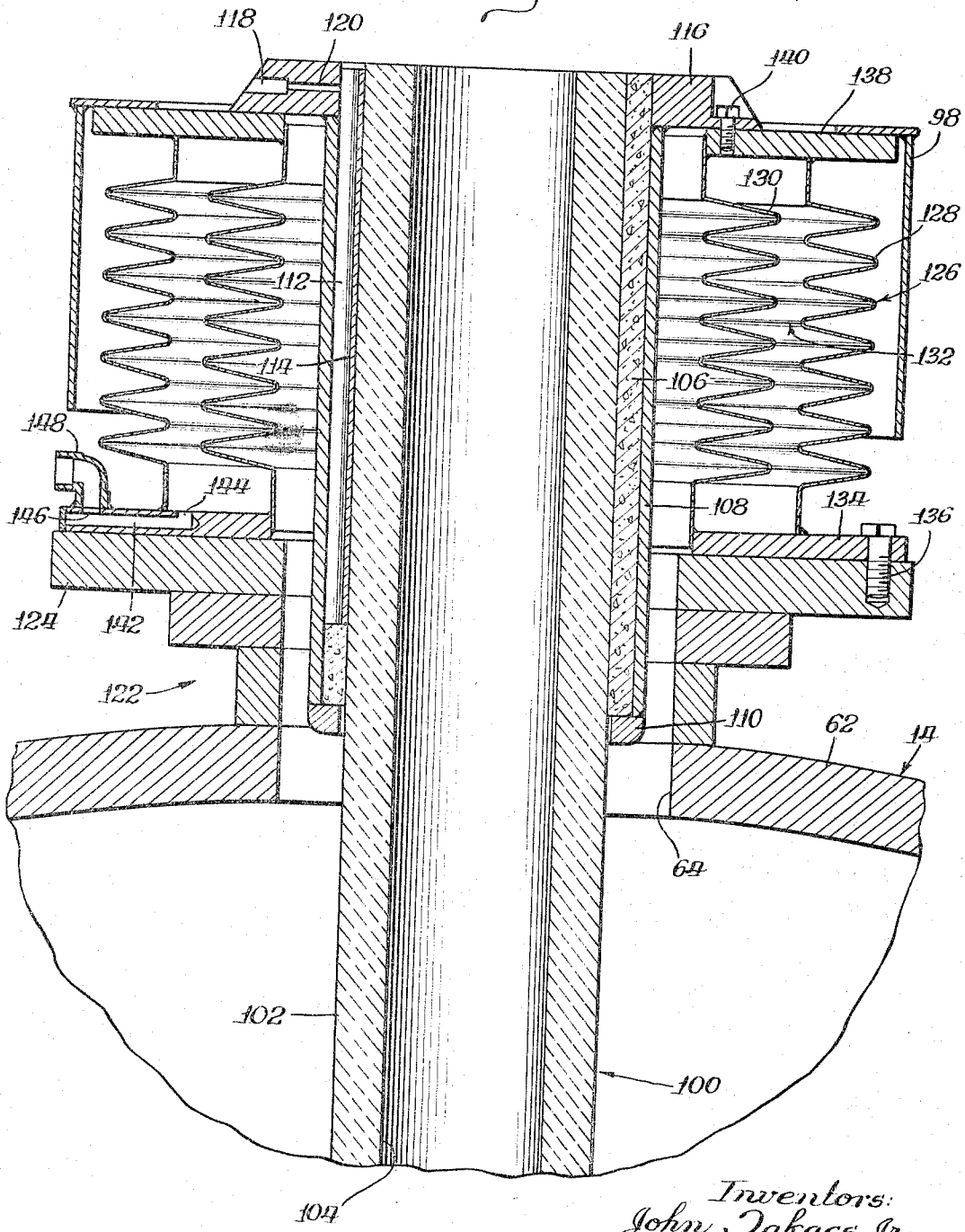
May 30, 1967 J. TAKACS, JR., ETAL 3,322,186

PRESSURE POURING APPARATUS

Filed July 13, 1966

3 Sheets-Sheet 3

Fig. 3.



Inventors:
John Takacs, Jr.
Alan F. Stebner
By: Walter S. Schlegel, Jr.
Atty.

United States Patent Office 3,322,186 Patented May 30, 1967

3,322,186

PRESSURE POURING APPARATUS

John Takacs, Jr., Cleveland, and Alan G. Stebner, Parma, Ohio, assignors to Amsted Industries Incorporated, Chicago, Ill., a corporation of New Jersey

Filed July 13, 1966, Ser. No. 569,546
9 Claims. (Cl. 164—306)

This case is a continuation-in-part of application No. 366,432, now abandoned.

The present invention relates to pressure pouring apparatus.

The invention relates more particularly to apparatus of the character stated in an arrangement where a mold is moved into a pouring position relative to a vertical pouring tube. In such an arrangement, the molds are usually moved into that position as by a car running on tracks. The vertical pouring tube is under the car, and when the pouring operation is to be performed, the pouring tube is brought into communication with the mold by relative vertical movement, there having been a space therebetween to permit movement of the car over the pouring tube. The pouring tube, as is known, is incorporated in a ladle and tank assembly, and the relative vertical movement mentioned heretofore has been accomplished by either raising the ladle and tank assembly or lowering the car and mold. Either case involves substantial or massive movement.

A broad object of the present invention is to provide apparatus for and method of overcoming the kind of relative vertical movements referred to above, and more particularly to provide an arrangement in which the pouring tube itself is movable vertically relative to the tank and ladle assembly in which it is incorporated whereby to enable the remainder of the tank and ladle assembly, which is large, to remain stationary, and similarly to enable the car and mold to remain stationary, for establishing communication between the pouring tube and the mold.

A more specific object of the invention is to provide novel mechanical construction of movable pouring tube in a tank and ladle assembly of the character mentioned.

Another object is to provide, in one embodiment of the invention, pressure pouring apparatus of the foregoing general character which embodies power driven cylinder rams for positively both raising and lowering the pouring tube.

A further object is to provide, in another embodiment of the invention, pressure pouring apparatus of the foregoing general character having sealing means between the movable pouring tube and the fixed tank, in the form of flexible bellows secured between the pouring tube and the tank, wherein the bellows include a pair of inner and outer circular bellows members forming therebetween an air-tight chamber, and wherein provision is made for introducing air or other gas under pressure in that chamber for raising the pouring tube.

Another object is to provide an arrangement wherein a continuous casting mold may be secured to the top of a pouring tube and oscillated therewith as the cast article is withdrawn in an upward direction.

Other objects and advantages will appear from the following detailed description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a diagrammatic illustration of a tank and ladle assembly in association with a car and mold utilized in the pouring operation;

FIGURE 2 is a vertical sectional view through the upper portion of the pouring tube and tank, as well as the car and a portion of the mold, this view showing one embodiment of the invention; and

FIGURE 3 is a vertical sectional view through the pouring tube and a portion of the tank, in a second embodiment of the invention.

Reference is first made to FIGURE 1 showing diagrammatically the complete apparatus for the pouring and casting operation which includes a tank and ladle assembly indicated generally at **10** and a car with the mold unit indicated generally at **12**. The tank and ladle assembly includes a closed pressure tank **14** having inlet and outlet passages **16** and **18** respectively for communication with a source of compressed gas (not shown) in response to operation of which pressure is developed in the tank **14** or removed therefrom in accordance with known pouring and casting operations. Within the tank **14** is a ladle **20**, of known construction, and a vertical pouring tube **22** which has its lower end closely adjacent the bottom of the ladle and its upper pouring end **24** extending out of and above the tank and adapted for communication with the mold in the car and mold unit **12**, as described in detail herein below. The car and mold unit **12** includes a mold **26** resting on a car **28** having a top deck **30** and mounted on wheels **32** running on tracks **34**. The car and mold in themselves may be of conventional construction.

In the course of a pouring and casting operation, the unit **12** is moved along the tracks **34** to a pouring position indicated in FIGURE 1. The upper end of the pouring tube **22** is normally spaced downwardly from the car, as indicated, to enable the car to pass thereover. Previously, pouring communication between the pouring tube and the mold was accomplished by either raising the complete tank and ladle assembly **10**, and later lowering it as indicated by the double headed arrow **36**, or lowering the unit **12** and again raising it after the pouring operation, as indicated by the double headed arrow **38**. Either of these movements required substantial effort or energy because of the massiveness of the apparatus. The apparatus of the present invention overcomes such disadvantage by providing for vertical movement of the pouring tube itself, relative to the remaining portions of the apparatus which remain stationary.

Attention is now directed to FIGURE 2 which shows substantial detail construction of one embodiment of the apparatus. In this figure, both the car and mold unit **12** and the tank and ladle assembly **10** are shown fragmentarily. The car **28** includes a shut-off gate assembly **40** which includes a bottom plate **42** which is also shown in FIGURE 1. The assembly includes a core **44** defining a pouring passage **46** which leads to and communicates with the cavity **48** of the mold. This pouring passage **46** also opens downwardly where it communicates with the passage **50** in the pouring tube. The pouring tube includes a central element **52** which may be any of a number of suitable materials, such, for example, as refractory, a sand liner **54** surrounding the element **52**, and an outer tubular metal casing **56**. The upper end of the pouring tube includes a head element **58** which fits into a recess **60** in the bottom member **42** when communication between the tube and the shut-off assembly is established. The casing **56** is welded to the head element **58**.

The tank **14** is also shown fragmentarily in FIGURE 2 and includes a wall element **62** having an aperture **64** in which the pouring tube is slidably mounted. Surrounding the outer metal casing member **56** is a sleeve **66** welded to the casing member preferably at both top and bottom and positioned relative to the height of the pouring tube so that it is at all times disposed in the aperture **64** in the tank wall in the normal range of movement of the pouring tube. This sleeve is relatively short and the casing member **56** and the sand liner **54** terminate downwardly adjacent the lower end thereof. A tubular member **68** is sealed, as by welding, to the inner surface of the wall ele-

ment 62 and extends downwardly in surrounding relation to the pouring tube, an annular plate 70 being secured to the lower end of the tubular member. The annular plate 70 preferably snugly receives the element 52 of the tube which extends downwardly to nearly the bottom of the ladle, as stated above.

The compressed air, or other gas, developed in the tank for the pouring operation is confined against escape around the pouring tube by means of a bellows 72, preferably of metal and in itself of known kind, having a corrugated central portion 74 and cylindrical end portions 76 respectively secured to annular rings 78 and 79 by a known process such as by welding. These rings are secured in the assembly in the following manner: The upper ring 78 is secured to the under surface of an annular actuating plate 80 having a central aperture 82 receiving that portion of the tube under the head element 58. The plate is secured in place by a plurality of cap screws 84 which also secure the ring 78 to the plate. The lower ring 79 is secured in similar fashion by means of cap screws 86 threaded into a boss 88 fixed to the wall element 62 of the tank. The securement of the rings 78 and 79 with the respective mounting members establishes air tight engagement therewith.

The pouring tube is raised and lowered by power means preferably in the form of a plurality of hydraulic cylinder-ram units 90. These are preferably four in number and are provided with universal joints 92 at their upper and lower ends which are operatively mounted in brackets 94 respectively secured to the wall element 62 and the actuating plate 80.

Upon extension of the hydraulic cylinder-ram units, the actuating plate 80 is raised, which carries the pouring tube with it, the pouring tube sliding through the wall element 62 of the tank, this movement of the pouring tube also including sliding movement of the refractory element 52 through the annular plate 70. This raising movement brings the upper end of the pouring tube into operative engagement with the bottom member 42 of the shut-off assembly and establishes pouring communication between the passages 50 and 46 of the mold. Upon contraction of the cylinder-ram units, the pouring tube is, of course, lowered, it being understood that all other functions of the pouring operations are performed in a normal manner, such as moving the shut-off slide which is here indicated at 96. A shield 98 may be secured to the plate and carried therewith, for enclosing the parts between that plate and the wall element 62.

Preferably, the size of the bellows and other relations between the various parts are so selected that the bellows assumes its normal unstressed condition at an intermediate point between full-raised and full-lowered positions of the pouring tube, and thus when the pouring tube is contracted or lowered, the bellows is compressed, while on the other hand, when the pouring tube is in raised position, the bellows is stretched.

The previous disadvantageous maneuvers of vertically moving the complete tank and ladle assembly, or the car and mold assembly, are thus eliminated. By this novel construction, only relatively small movement is required, namely movement of the pouring tube itself, which is a relatively small component of the complete apparatus. When the pouring tube is in lowered position, the car and mold unit can be moved along the track into and through the pouring position without interference from the pouring tube or any other part of the tank and ladle assembly.

Attention is now directed to FIGURE 3 showing a second embodiment of the invention. The present embodiment is similar to the first in that bellows means is provided for sealing the space between the movable pouring tube and the fixed tank. In the present instance two bellows members are arranged concentrically, one within the other, both bellows members being secured to the movable pouring tube and fixed tank in air-tight relation thereto, and the inner one directly functioning to seal the space between the pouring tube and tank and both together forming a chamber therebetween for the introduction of air under pressure for raising the pouring tube. Referring in detail to the construction of FIGURE 10, it will be seen that many of the principal components of the pouring tube and tank of FIGURE 2 are included herein, namely the tank 14 including a wall element 62 having an aperture 64 therein. A pouring tube 100 is similar to the pouring tube 22, having a refractory central element 102 defining a pouring passage 104. Surrounding the element 102 is a sleeve 106 of cement enclosed in a metal sheath 108. Secured to the lower end of the sheath is a ring 110 which serves to retain the cement in place.

A plurality of, such as three, vent pockets 112 are provided, each formed by a metal strip 114, curved in cross-section, included within the sheath 108. These vent pockets extend from adjacent the lower end of the sheath 108 to the top, where they are exposed to the exterior through the head element 116 which is similar to the head element 58. A plurality of lifting slots 118, such as three in number, are cut in from the peripheral edge of the head element 116, and leading from the inner ends of these slots are vent holes communicating with the vent pockets 112.

Mounted on the tank wall 62 surrounding the aperture 64 is a plate assembly 122 including a top plate 124, and other plates secured together as by welding and secured to the tank wall. A bellows assembly 126 is provided including an outer bellows member 128 and an inner bellows member 130 concentric therewith, and each generally similar to the bellows 72, and defining an annular chamber 132 therebetween. The lower edges of the bellows members are secured to an annular plate 134 secured to the plate 124 by suitable means such as bolts 136, while the upper ends of the bellows members are secured as by welding to another annular plate 138 in turn secured to the undersurface of the pouring head 116 by suitable means such as cap screws 140.

Means is provided for introducing air under pressure into the annular chamber 132 which may include a passage 142 formed in the plate 134 and having a terminal portion 134 opening into the annular chamber, and an outer portion 146 opening to the exterior where a suitable fitting 148 is applied for connection with a source of compressed air (not shown).

The operation of the present pressure pouring apparatus is substantially the same as that of the first embodiment, in that the pouring tube is raised to establish communication with the mold, and thereafter pressure is introduced into the tank for forcing the molten metal up through the pouring tube. In the present instance, the pouring tube is raised by introducing air under pressure into the annular chamber 132 which functions to raise the pouring tube, and of course upon release of the pressure, the pouring tube descends by gravity.

Preferably the bellows members in this case, similarly to the previous embodiment, are in normal unstressed condition at an intermediate point between full-raised and full-lowered positions of the pouring tube.

It is obvious that the above-described arrangements may advantageously be utilized in a continuous casting operation wherein a mold may be secured to the upper end of the pouring tube. Molten metal may then be pressure poured into the lower end of the mold, wherein the metal solidifies, and is withdrawn from the upper end of the mold. In such an operation, it has been found to be advantageous to oscillate the mold and the present invention accommodates such oscillation in a simple efficient manner.

While I have disclosed herein a preferred embodiment of the invention, it will be understood that changes may be made therein within the scope of the appended claims.

We claim:

1. Pressure casting apparatus comprising a sealed tank, means for developing gas pressure in said tank, a ladle in said tank, a vertical pouring tube extending through

a top wall element of the tank and having its lower end adjacent the bottom of the ladle and its upper end exterior to the tank, said tube being vertically slidable in said tank, means interposed between said pouring tube and tank operative for raising and lowering the pouring tube, and means for sealing said tank against escape of gas through spaces between the pouring tube and the opening in the tank in which it is disposed.

2. The invention set out in claim 1 wherein said sealing means includes a flexible bellows.

3. The invention set out in claim 2 in which said bellows is metal and the ends thereof are sealed as by welding respectively to the tank around said opening therein and to the upper end of the pouring tube.

4. The invention set out in claim 3 wherein the normal and unstressed condition of the metal bellows is intermediate the limits of the range of movement of the pouring tube.

5. The invention set out in claim 1 wherein the pouring tube includes a transverse plate at its upper end, and a plurality of power means are provided between said plate and said element of the tank and operative for positively both raising and lowering the pouring tube.

6. The invention set out in claim 5 wherein a generally cylindrical shield is included having an upper end secured to said plate and extending downwardly and substantially encompassing the remaining portion of the tube exterior of the tank and the power means, and movable with the pouring tube.

7. The invention set out in claim 1 wherein a pair of inner and outer bellows members are provided, both secured in air tight relation to the pouring tube and tank, and a means is provided for introduction of air under pressure to the annular space between the bellows members which is then operative for raising the pouring tube.

8. The invention set out in claim 7 wherein one of the bellows members constitutes the sealing means between the pouring tube and the tank.

9. Casting apparatus of the character disclosed comprising in combination a movable support and a mold with a bottom opening positioned on the support, said support being movable into and through a pouring position, a sealed tank at said pouring position, means for developing gas pressure in said tank, a ladle in said tank, a pouring tube having a lower end adjacent the bottom of said ladle and extending upwardly through an opening in the tank, said pouring tube being vertically reciprocable through said opening, means interposed between said pouring tube and tank and operative for elevating the tube for engagement with a mold on said support in pouring communication therewith, and means sealing the space between the pouring tube and tank in said opening, said sealing means being flexible and extensible and contractable with the raising and lowering movements respectively of the pouring tube.

References Cited

UNITED STATES PATENTS

2,232,886	2/1941	Robertson et al.	22—79
2,825,104	3/1958	Jones	22—57.2
2,889,596	6/1959	Savage et al.	22—79 X
2,905,989	9/1959	Black	22—209 X
3,163,897	1/1965	Sylvester	22—69
3,201,837	8/1965	Sylvester	22—69

J. SPENCER OVERHOLSER, *Primary Examiner.*

R. S. ANNEAR, *Assistant Examiner.*