Aug. 20, 1968 R. W. TACCONE 3,397,735

PULL AND SPRAY STATION FOR CENTRIFUGAL CASTING MACHINE

Filed Oct. 23, 1965 4 Sheets-Sheet 1

FIG. 1

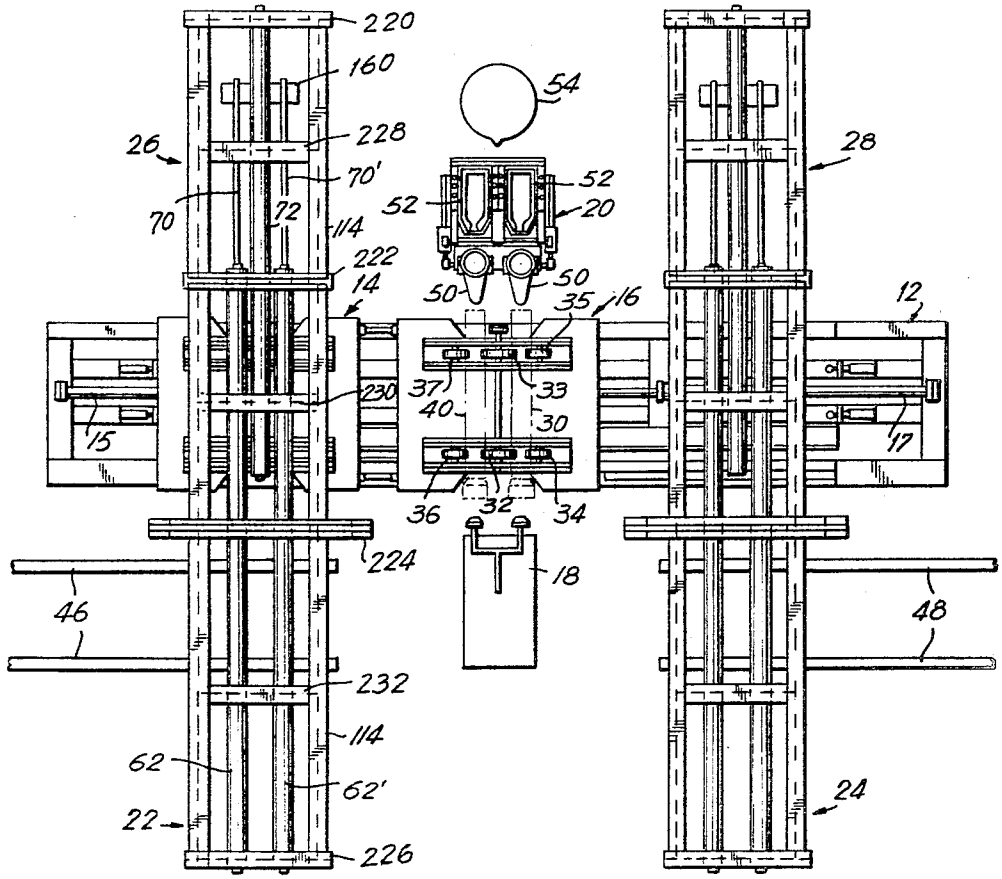
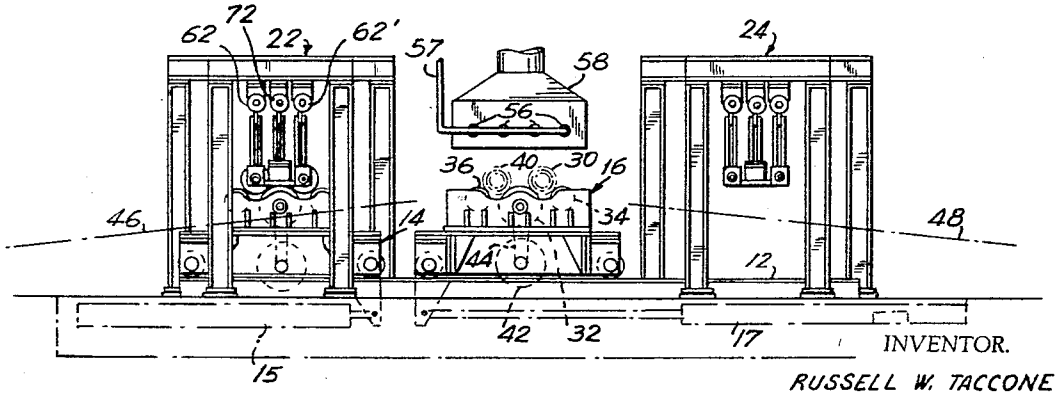


FIG. 2



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FIG. 4

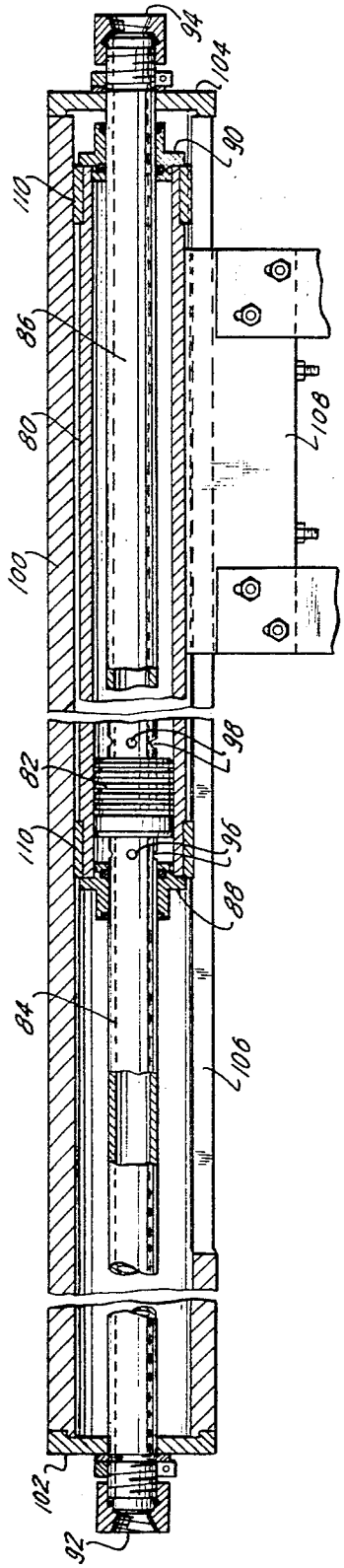
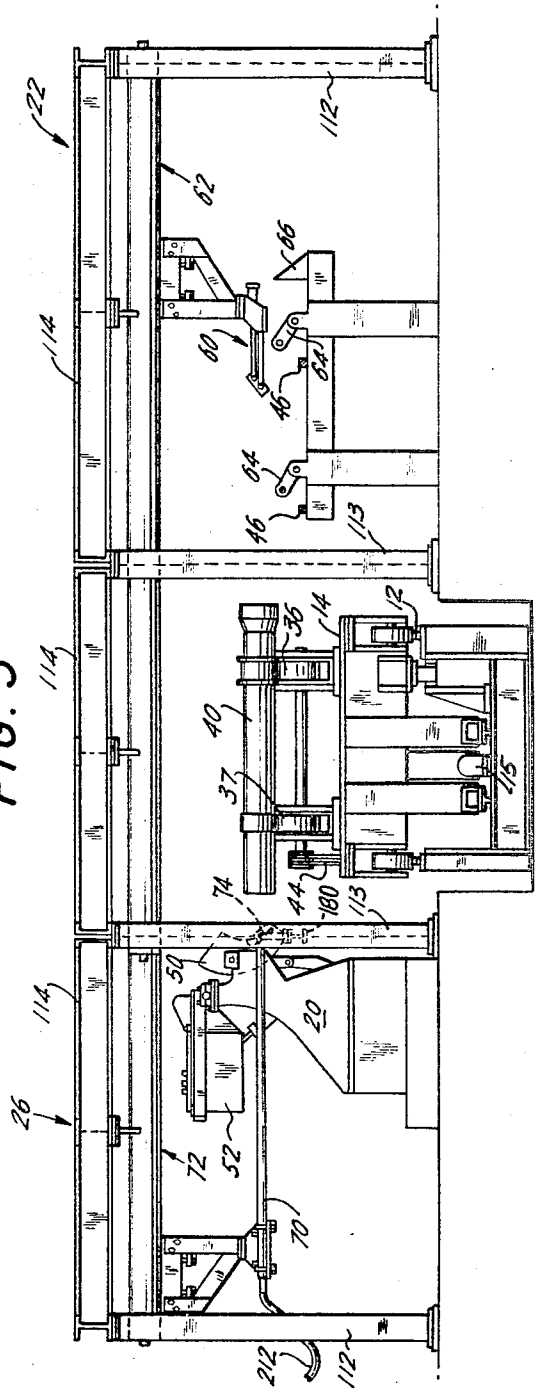


FIG. 3



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PULL AND SPRAY STATION FOR CENTRIFUGAL CASTING MACHINE

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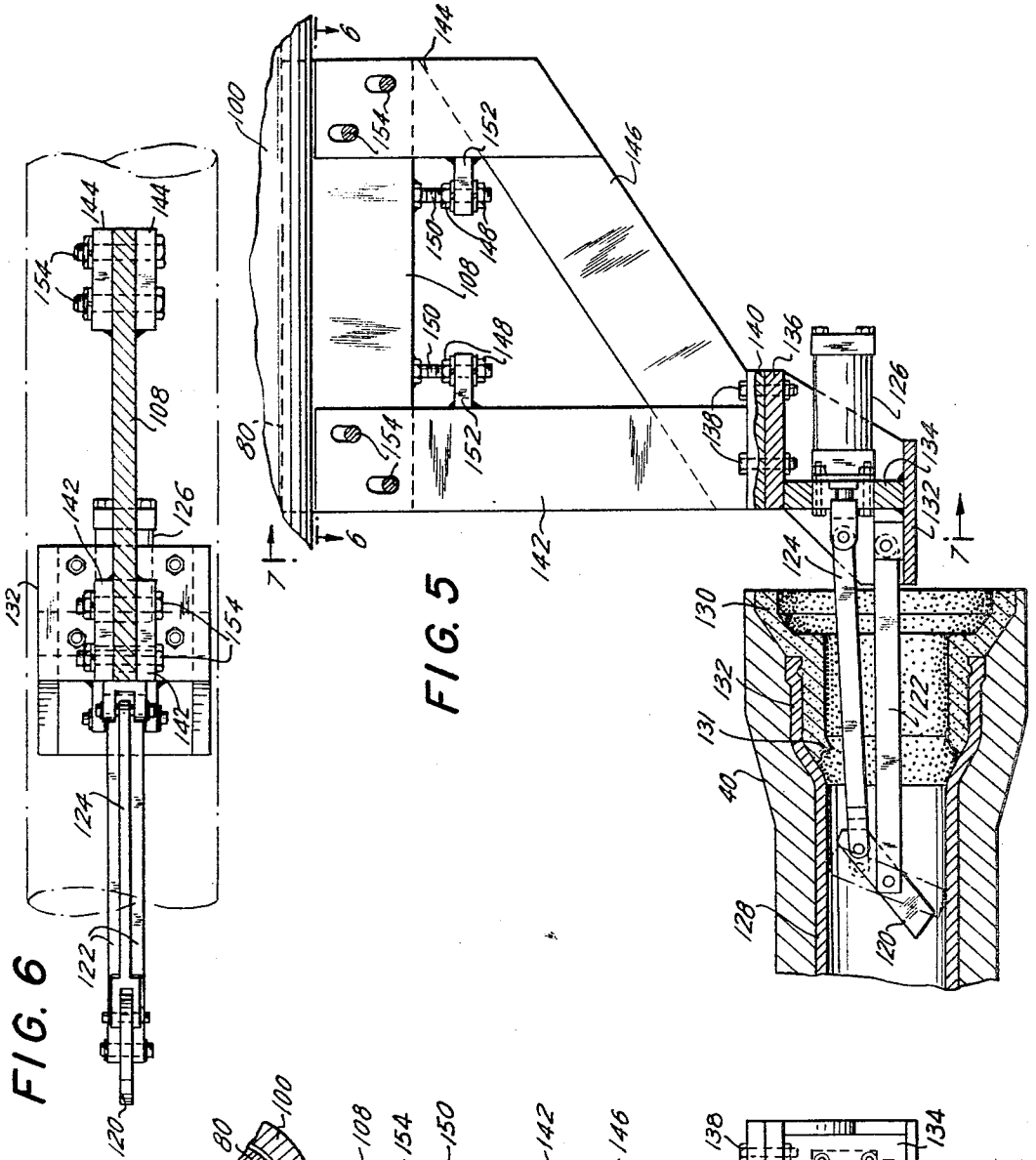


FIG. 5

FIG. 6

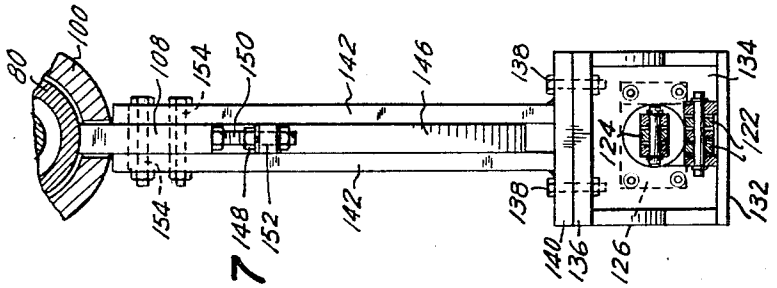


FIG. 7

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PULL AND SPRAY STATION FOR CENTRIFUGAL CASTING MACHINE

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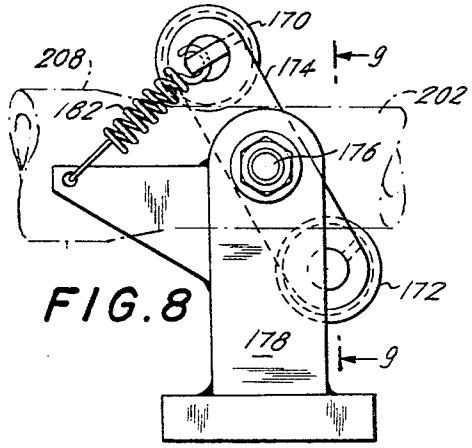


FIG. 8

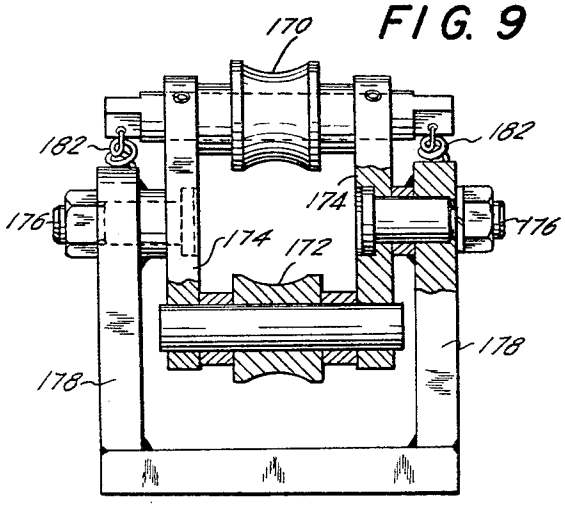


FIG. 9

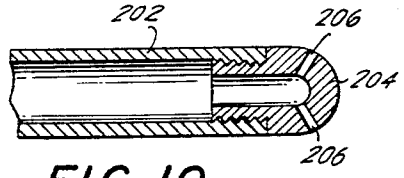


FIG. 10

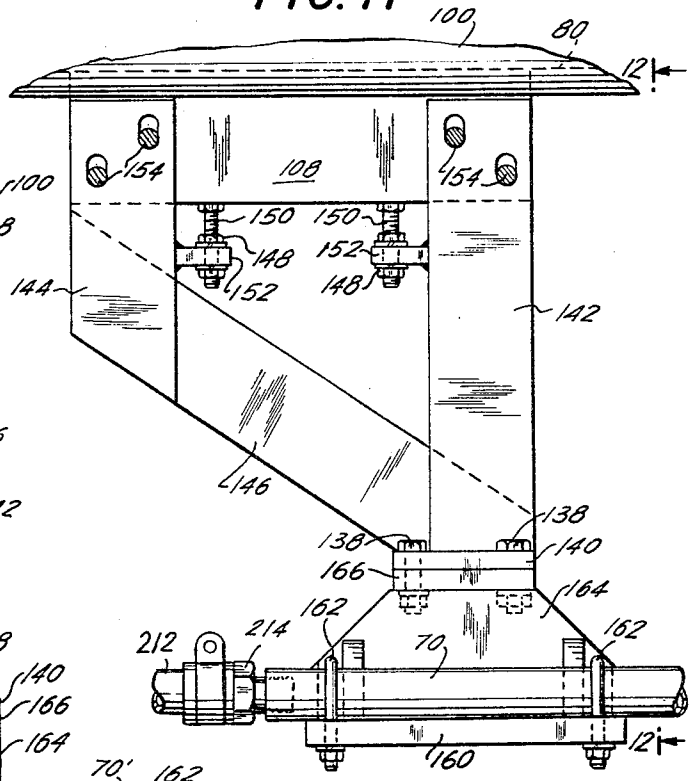


FIG. 11

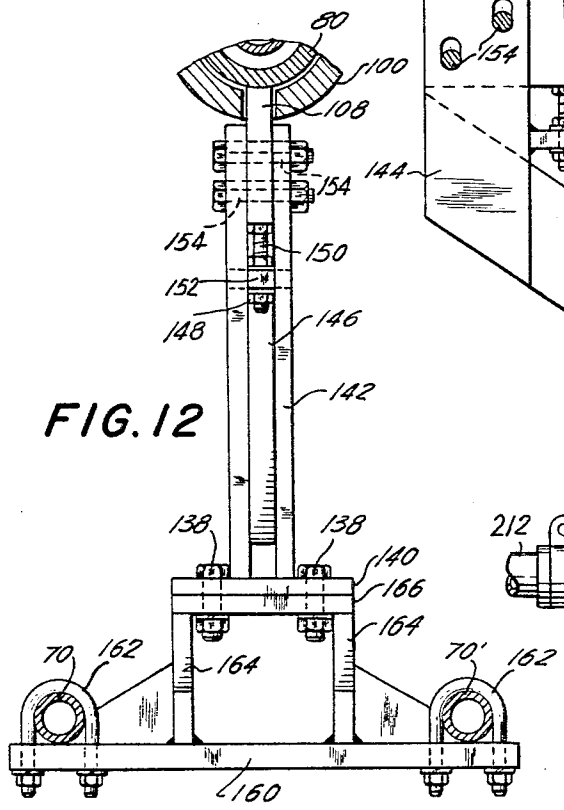


FIG. 12

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3,397,735

PULL AND SPRAY STATION FOR CENTRIFUGAL CASTING MACHINE

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Filed Oct. 23, 1965, Ser. No. 503,942
9 Claims. (Cl. 164—267)

ABSTRACT OF THE DISCLOSURE

A pull and spray station is provided for a centrifugal casting machine having a spin mold for the manufacture of pipe. The station has a pipe puller head at one end of the mold, a mold spray lance at the other end of the mold, a motive means to move the puller head, and a motive means to move the lance. Each motive means comprises an axially movable hydraulic cylinder and guide tube longitudinally slotted to receive an upright fin plate secured to its cylinder and on which a puller head or lance is mounted for connection to its respective cylinder.

This invention relates to pull and spray mechanism for casting machines, and more particularly centrifugal casting machines for the casting of pipe.

The general object of the present invention is to improve centrifugal casting machines, and more especially machines for the casting of soil pipe. In usual practice a core is set in one end of the mold, the mold is spun, the molten metal is poured, the mold and resulting cast pipe are cooled, the solidfied pipe is pulled from the mold, and the inside of the mold is sprayed with a suitable protective coating. Main objects of the invention are to provide an improved pull station, and also an improved spray station, for such centrifugal casting machines.

A more specific object is to provide pull and spray stations for use in a machine of the type disclosed in my companion application Ser. No. 502,917, filed on even date herewith, and entitled "Centrifugal Casting Machine." The said machine is a double machine, that is, a pair of collateral molds are simultaneously spun and poured, and in accordance wtih a further feature and object of the present invention, individual motive means are provided for pulling pipe from the molds, thereby increasing the pull available, and compensating for the fact that a pipe in one mold may stick more than in the other, with a consequent difference in extraction time. This difficulty does not arise with the spray lances, and accordingly the two lances may be simultaneously moved by a single motive means.

Further objects of the present invention are to provide an improved motive means, and also an improved disposition and mounting of the aforesaid three such motive means for the two molds.

To accomplish the foregoing general objects, and other more specific objects which will hereinafter appear, my invention resides in the pull and spray station elements and their relation one to another, as are hereinafter more particularlydescribed in the following specification. The specification is accompanied by drawings in which:

FIG. 1 is a plan view of a centrifugal casting machine embodying features of the invention;

FIG. 2 is an elevation thereof;

FIG. 3 is an end elevation looking toward the left end of FIG. 1;

FIG. 4 is a longitudinal vertical section through one of the motive means;

FIG. 5 is a fragmentary partially sectioned elevation showing a pulling head;

FIG. 6 is a horizontal section taken on the line 6—6 of FIG. 5;

FIG. 7 is a vertical section taken on the line 7—7 of FIG. 5;

FIG. 8 is an elevation of a lance guide;

FIG. 9 is a section taken on the line 9—9 of FIG. 8;

FIG. 10 shows the nozzle end of a lance;

FIG. 11 is a fragmentary elevation showing the mounting of the spray lances; and

FIG. 12 is a vertical section taken on the line 12—12 of FIG. 11.

Referring to the drawing and more particularly to FIGS. 1 and 2, the machine of my aforesaid patent application Ser. No. 502,917 comprises a shuttle track generally designated 12, with two shuttle cars 14 and 16 thereon. There is a core setting station 18, which is schematically indicated in FIG. 1, but omitted in FIG. 2, this if automatic being located at one side of the track 12 midway between the ends. A pour station generally designated 20 is located at the other side of the track 12 at a point opposite the core setting station. There are two pulling stations generally designated 22, 24 on one side of the track 12, one near each end, and two spray stations generally designated 26, 28 on the other side of the track 12 at points opposite the pulling stations 22 and 24, respectively. Each shuttle car has a pipe mold 30 resting on spin wheels 32 and 34. In practice the operation preferably is doubled and another spin wheel 36 is provided, receiving a second mold 40 which is collateral to the mold 30 and which rests on the spin wheels 32 and 36. In such case the core setting station 18, the pour station 20, the pull stations 22 and 24 and the spray stations 26 and 28, are all double stations for simultaneous operation on the double molds 30 and 40 on the shuttle car.

The spin wheels 34 and 36 may be idle while the spin wheel 32 is driven, in this case by means of a motor 42 (FIG. 2) and multiple V-belt drive 44. The motor may be energized through a flexible cable (not shown) which accommodates the shuttle movement of the car. As usual, and as shown in FIG. 1, the molds rest on two axially spaced sets of spin wheels, the additional wheels being indicated in FIG. 1 at 33, 35, 37, the wheel 33 being mounted on the same shaft as and being driven in unison with the wheel 32, and the wheels 35 and 37 being idlers.

It will be understood that car 14 is similar to car 16, and has motor driven spin and idler wheels carrying a pair of molds as described for car 16. As here illustrated the cars are moved independently by means of cylinders 15 and 17. The cars and shuttle track are shown and described in greater detail in my aforesaid copending application Ser. No. 502,917. The finished pipe is rolled away on inclined tracks indicated at 46 and 48.

The pour station 20 is shown in the background in FIG. 3, as well as in FIG. 1, and comprises boots 50 which are tiltable between the down position shown in FIG. 3, and a raised or pouring position in which the lower end of the boot enters the spigot end of the mold. The station also comprises ladles 52 which are pivotally mounted and may be turned from the horizontal position shown to a tilted position which discharges molten metal into the boots and thence into the spigot end of each mold. This mechanism is not described in detail because it forms a part of my companion application Ser. No. 502,918, filed on even date herewith, now Patent No. 3,358,887, and entitled "Pouring Mechanism for Centrifugal Casting Machine." The ladles 52 act as measuring ladles for the desired quantity of molten metal. For this purpose the metal is measured by weight and an alarm is sounded when the ladle (then in horizontal position) has received from a holding ladle 54 (FIG. 1) the predetermined weight of metal.

The molds are cooled by water spray, and FIG. 2

shows spray pipes **56** supplied at **57** and carried by a steam hood **58**. These are omitted in FIG. 1 in order to show the car **16**. The cars too may have cooling water pipes (not shown) below the molds, and supplied through flexible hoses which accommodate the shuttle movement of the car.

Referring to FIG. 3, a cooled cast pipe in mold **40** is extracted by means of a puller head generally designated **60**, said head being moved horizontally by a motive means generally designated **62**. As the pipe is pulled from the mold toward the right it is received on support means **64**, which then lower it to the inclined rails **46** previously referred to. The horizontal movement of the pipe may be limited by appropriate stop means **66**.

The mold spray station **26** is on the other side of the track directly opposite the pull station, and it comprises a hollow tubular lance **70** which, like the pull head **60**, is located axially of the mold **40** when the car **14** is at the pull-spray station. The forward end of lance **70** has a spray head for spraying a suitable liquid for lining the mold. This liquid may be supplied through the tubular lance by means of a flexible hose connected at the rear end of the lance. The lance is moved axially through the mold by motive means generally designated **72**. The lance may be additionally supported and guided by a pair of rollers located at **74**.

A preferred form of motive means for use at **62** or **72** may be described with reference to FIG. 4 of the drawing. It comprises an axially movable hydraulic cylinder **80**, and a stationary piston **82** therein, with hollow piston rods **84** and **86** extending from the piston **82** in opposite directions through the ends **88** and **90** of the cylinder. There are fixed hydraulic pipe connections to the ends of the piston rods, as by means of adapters shown at **92** and **94**, and because the piston and rods are stationary it is not necessary to use flexible hose. The rod **84** has ports or openings **96** adjacent the piston **82** for flow of hydraulic fluid on its side of the piston, and the other rod **86** has ports **98** adjacent the piston **82** for flow of hydraulic fluid on its side of the piston. Either a puller head or a lance may be mounted on cylinder **80** for movement with the cylinder.

In preferred form there is a long stationary guide tube **100** which is fixedly mounted around the movable cylinder **80** and the stationary piston rods **84** and **86**. The latter pass through the ends **102** and **104** of the tube **100**, but there is no relative movement. The bottom of the tube is longitudinally slotted as indicated at **106** to slidably receive a fin plate **108** which is secured to cylinder **80**, and the pull head or the lance is mounted on and is carried by the fin plate **108**. The ends of the cylinder **80** preferably carry bearing rings **110** which slide inside the guide tube **100**. The latter acts as a protective housing, as well as a guide. The guide tube is preferably steel and the bearing **110** is preferably bronze. It could also be cast iron. It is to be a material softer than the guide tube, and replaceable, so as to take the wear. The bearing rings are widely spaced, for good stability of the travelling cylinder.

Reverting to FIG. 3, the pull and spray stations include an elevated frame which fixedly mounts the guide tubes **62** and **72** in a position parallel to and higher than the pipe molds. As here illustrated the frame comprises upright columns **112** and **113** carrying horizontal beams **114**. They also carry transverse horizontal beams shown in FIG. 1 at **220**, **222**, **224** and **226**. There are additional intermediate cross bars at **228**, **230** and **232** to more rigidly support the long guide tubes **62**, **62'** and **72**.

The pull mechanism may be described in greater detail with reference to FIGS. 5, 6 and 7 of the drawing. There is an expansion shoe **120** which is tiltably mounted at the end of a support arm **122**. As here shown it is a double arm, astride the shoe **120**. A link **124** generally collateral to the support arm **122** has a clevis end which is connected to the shoe **120** to tilt the same. An actuator **126**, which may be an air cylinder supplied through a flexible hose (not shown), is connected to the link **124** to cause the shoe **120** to grip or to release the pipe **128**. It will be understood that the core **130** at the enlarged or bell end **132** of the pipe is a destructible sand core which is readily broken through, as suggested at **131**, by the puller head when the latter is moved into the end of the mold **40**.

The mechanism so far described is carried by horizontal and vertical plates **132** and **134** secured to a top plate **136** which is mounted by means of bolts **138** on a plate **140** forming the lower end of a bracket which is secured to the fin plate **108** previously mentioned. The bottom plate **132** acts also to limit downward movement of arms **122**. The fin plate **108** depends from the movable cylinder **80**, and passes through the bottom slot in the guide tube **100**. The bracket as here constructed comprises a pair of spaced uprights **142**, and a shorter pair of spaced uprights **144**. Their lower ends straddle and are secured to a diagonal strut **146**. Their upper ends straddle and are bolted to the fin plate **108**.

The precise alignment of the pipe puller may be adjusted by means of nuts **148** on screws **150** the upper ends of which are welded to the lower edge of the fin plate **108**, and the lower ends of which pass through ears **152** welded to the uprights **142** and **144**. To accommodate this adjustment the bolts **154** pass through slots rather than round holes, and after the desired position has been established by adjusting the nuts **148**, the clamp bolts **154** may be tightened to maintain the desired adjustment.

The shoe **120** (FIG. 5) may be dimensioned to grip the enlarged bell **132** of the pipe, instead of the body **128** of the pipe as shown in the drawing. This has the advantage of more completely breaking up the sand core **130**.

The nozzle end of a typical lance is shown in FIG. 10 of the drawing. The forward end **202** of the lance is closed by a removable nozzle **204** having discharge holes **206**. The lance is longer than the pipe, and the latter may be say ten feet long. The lance may be lightened by making its forward portion of less diameter than its rear portion, this being indicated in FIG. 8 by the change from part **208** to part **202**.

The mounting of the lances may be described with reference to FIGS. 11 and 12 of the drawing. Many of the parts shown correspond closely to parts already described for the puller, but are shown reversed or in "mirror image" because the lance is moved from left to right as viewed in FIG. 3, instead of from right to left as is the case with the puller head. Like numerals are employed for such like parts, the fin plate **108** being secured to the bottom of a cylinder **80** (FIG. 12) which slides in a guide tube **100**, the fin plate passing downward through and sliding along a bottom slot in the guide tube. The fin plate carries spaced uprights **142** (FIG. 11), and shorter spaced uprights **144**, joined by a diagonal strut **146** located therebetween. This bracket assembly terminates in a bracket plate **140** the height of which may be adjusted by means of nuts **148** on screws **150** secured to the lower edge of fin plate **108**, and passing through ears **152** welded to the uprights **142** and **144**. As before, the mounting bolts **154** pass through slots to accommodate the adjustment, which, more broadly, is an adjustment of the alignment of the lance.

Two lances are moved by a single cylinder, and as seen in FIG. 12, lances **70** and **70'** are secured to a plate **160** by means of U bolts **162**. The lances are spaced at the spacing of the two pipe molds (**30** and **40** in FIG. 1). Plate **160** is secured to uprights **164**, which in turn are carried by a top plate **166** which mates with and is bolted to the bottom plate **140** of the bracket by means of bolts **138**, as previously described for the puller head.

The lance may be supplied under pressure through a flexible hose indicated at **212** in FIG. 2, and connected

by a suitable coupling indicated at **214** in FIG. 11. The liquid may be a suspension of silica flour and bentonite in water, or it may be some other suitable liquid for protectively lining the mold. The mold is spun at this time, as well as during pouring of metal, and is stationary during pulling and during core setting.

Because of its length it may be desired to steady the free end of the lance as it moves into the mold, and for this purpose resiliently carried guide rollers may be provided, as illustrated in FIGS. 8 and 9 of the drawing. Upper and lower rollers **170** and **172** are rotatably carried on arms **174** which are pivoted at **176** on fixed bearings **178** carried on an I beam or other cross member which is secured to the main frame as indicated at **180** in FIG. 3. The arms **174** (FIG. 8) are urged counterclockwise by pull strings **182**, thus holding the rollers **170** and **172** against the lance, and accommodating any change in diameter of the lance along its length, as it rides between the rollers.

Reverting now to FIG. 4 of the drawing, the fin plate **108** preferably is mounted at the rear or outer end of its cylinder **80**. The cylinder has a long stroke because of the length of the pipe being handled. Soil pipe may have a standard length of say five feet in one case, and ten feet in another case. In consequence the guide tube **100** is quite long, for it must accommodate the cylinder **80** in its forward as well as its rearward postion.

Accordingly, and by reverting to FIG. 1, it will be seen that the inner end of guide tube **62** overlies the track **12** and car **14**, and similarly the inner end of guide tube **72** overlies the track **12** and car **14**. Each puller head has its own cylinder, as is indicated by the guide tube **62'** disposed collaterally of but spaced from the guide tube **62**. The arrangement is compact because the inner ends of the two puller tubes **62**, **62'** may be located astride the inner end of the single lance tube **72**. For reasons previously explained it is anyway desirable that the pull cylinders be independent, whereas the spray lances may be moved in unison. These factors all combine advantageously in the present arrangement.

In FIG. 1 the automatic core setter **18** is shown opposite the pouring station **20**, but as explained in my aforesaid patent application Ser. No. 502,917, if core setting is to be performed manually it may be performed at the pulling station, where more cycle time is available.

It is believed that the construction and operation of my improved pull and spray stations, as well as the advantages thereof as here combined, will be apparent from the aforegoing detailed description. It will also be apparent that while I have shown and described the invention in a preferred form, changes may be made without departing from the scope of the invention, as sought to be defined in the following claims.

I claim:

1. A pull station for a centrifugal casting machine for the manufacture of pipe, said station having a pipe puller head, and motive means to move the same, said means comprising an axially movable hydraulic cylinder longer than the pipe being cast, a stationary piston therein, hollow piston rods extending from said piston in opposite directions through the ends of said cylinder, a long guide tube having a length about double that of the cylinder fixedly mounted around the movable cylinder and the stationary piston rods, the bottom of said guide tube being longitudinally slotted and receiving an upright fin plate which is secured to the cylinder and on which the puller head is mounted for movement with the cylinder, the ends of said cylinder having bearing means which slide on the inside of the guide tube, an elevated frame fixedly mounting the ends of said guide tube and said rods at an elevation higher than the mold, and in a position parallel to the mold, and fixed hydraulic pipe connections to the ends of said rods, one rod having openings adjacent the piston for flow of hydraulic fluid on its side of the piston, and the other rod having openings adjacent the piston for flow of hydraulic fluid on its side of the piston, said guide tube having a thick wall for rigidity and serving also to protectively enclose the rods and cylinder.

2. A spray station for a centrifugal casting machine for the manufacture of pipe, said station having a mold spray lance longer than the pipe being cast, and motive means to move the same, said means comprising an axially movable hydraulic cylinder longer than the pipe being cast, a stationary piston therein, hollow piston rods extending from said piston in opposite directions through the ends of said cylinder, a long guide tube having a length about double that of the cylinder fixedly mounted around the movable cylinder and the stationary piston rods, the bottom of said guide tube being longitudinally slotted and receiving an upright fin plase which is secured to the cylinder and on which the rear end of the lance is mounted for movement with the cylinder, the ends of said cylinder having bearing means which slide on the inside of the guide tube, an elevated frame fixedly mounting the ends of said guide tube and said rods at an elevation higher than the mold, and in a position parallel to the mold, fixed hydraulic pipe connections to the ends of said rods, one rod having openings adjacent the piston for flow of hydraulic fluid on its side of the piston, and the other rod having openings adjacent the piston for flow of hydraulic fluid on its side of the piston, said guide tube having a thick wall for rigidity and serving also to protectively enclose the rods and the cylinder.

3. A pull and spray station for a centrifugal casting machine having a mold for the manufacture of pipe, said station having a pipe puller head at one end of the mold, and a mold spray lance at the other end of the mold, a motive means to move the puller head, a motive means to move the lance, each of said motive means comprising an axially movable hydraulic cylinder longer than the pipe being cast, a stationary piston therein, hollow piston rods extending from said piston in opposite directions through the ends of the cylinder, fixed hydraulic pipe connections at the ends of the piston rods, one rod having openings adjacent the piston for flow of hydraulic fluid on its side of the piston, the other rod having openings adjacent the piston for flow of hydraulic fluid on its side of the piston, and a long guide tube having a length about double that of the cylinder fixedly mounted around the movable cylinder and stationary piston rods, the bottom of the guide tube being longitudinally slotted and receiving an upright fin plate which is secured to its cylinder, said puller head being mounted on one fin plate and said lane being mounted on the other fin plate for connection of each to its respective cylinder, the ends of said cylinders having bearing means which slide on the inside of the guide tube, and an elevated frame fixedly mounting the guide tubes and rods in a position parallel to and at an elevation higher than the pipe mold, said guide tubes having a thick wall for rigidity and serving also to protectively enclose the rods and cylinders.

4. A pull and spray station as defined in claim **3**, for use with a casting machine having two parallel pipe molds disposed side by side, in which said station comprises two collateral pipe puller heads, one for each mold, two collateral lances, one for each mold, and three motive means as defined in claim **3**, one of said motive means carrying one puller head, a second motive means parallel and collateral to the first motive means carrying the second puller head, and the third motive means carrying the two lances, the inner end portion of the guide tubes overlying the pipe molds, the inner end portion of the lance guide tube being disposed between the inner end portions of the two puller guide tubes.

5. A pull and spray station as defined in claim **4**, combined with a car carrying the two parallel pipe molds, and rails beneath the car on which wheels of the car ride, said rails extending transversely of the three guide tubes and being located beneath the inner end portions of the three guide tubes.

6. A spray station as defined in claim 2, in which there are guide and support means comprising resiliently separable rollers receiving the forward end of the lance when the lance is retracted, and between which rollers the lance moves when advanced.

7. A pull and spray station as defined in claim 3, in which there are guide and support means comprising resiliently separable rollers receiving the forward end of the lance when the lance is retracted, and between which rollers the lance moves when advanced.

8. A pull station as defined in claim 1, in which the puller head comprises a support arm, an expansion shoe mounted at the end of said support arm, a link collateral to said support arm and connected to said expansion shoe to expand the same, and an actuator connected to said link.

9. A pull and spray station as defined in claim 3, in which the puller head comprises a support arm, an expansion shoe mounted at the end of said support arm, a link collateral to said support arm and connected to said expansion shoe to expand the same, and an actuator connected to said link.

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