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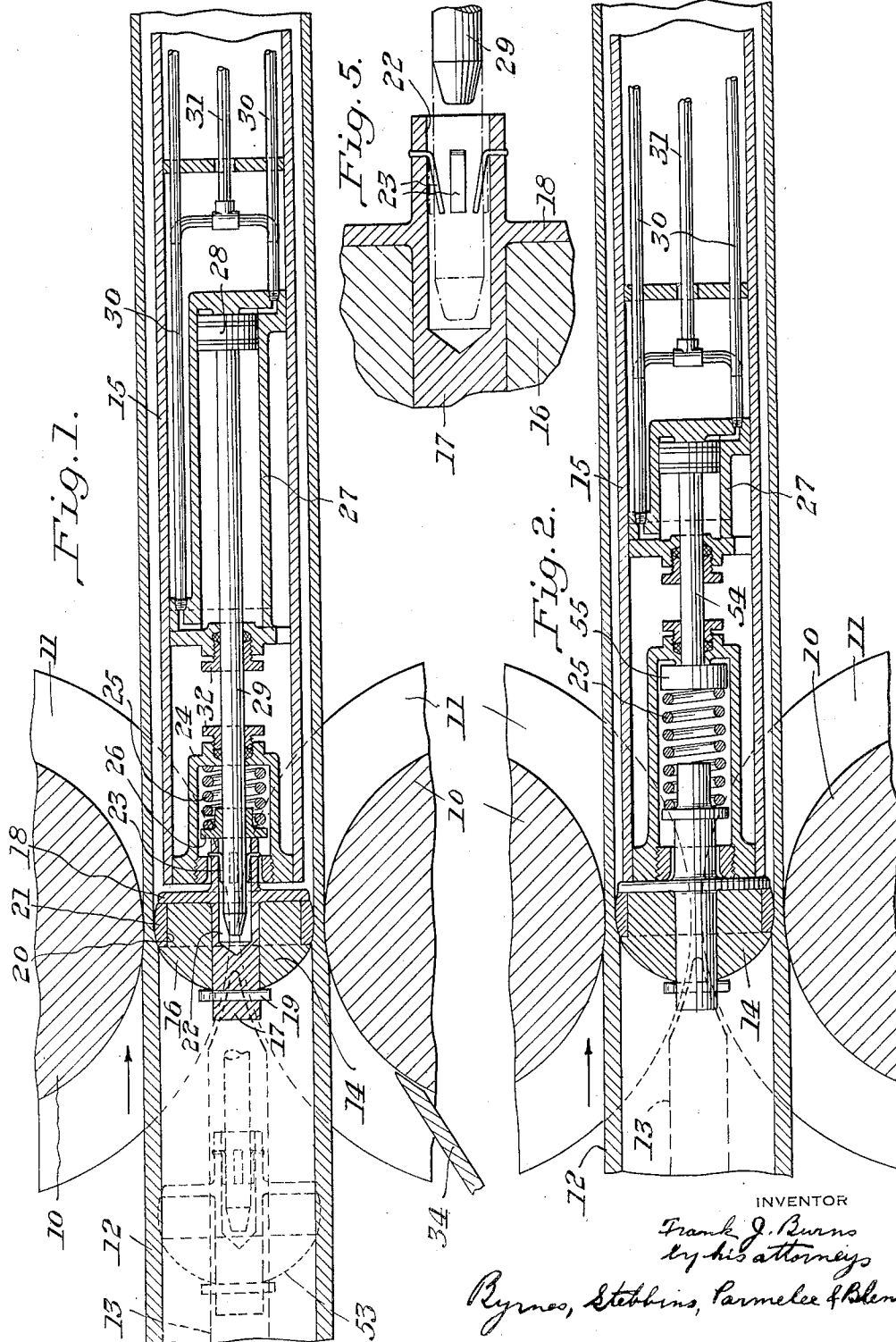
F. J. BURNS

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PLUG BAR FOR SEAMLESS TUBE MILLS

Filed Aug. 4, 1931

3 Sheets-Sheet 1



INVENTOR

Frank J. Burns
by his attorneys

Byrnes, Stebbins, Parmelee & Blenko

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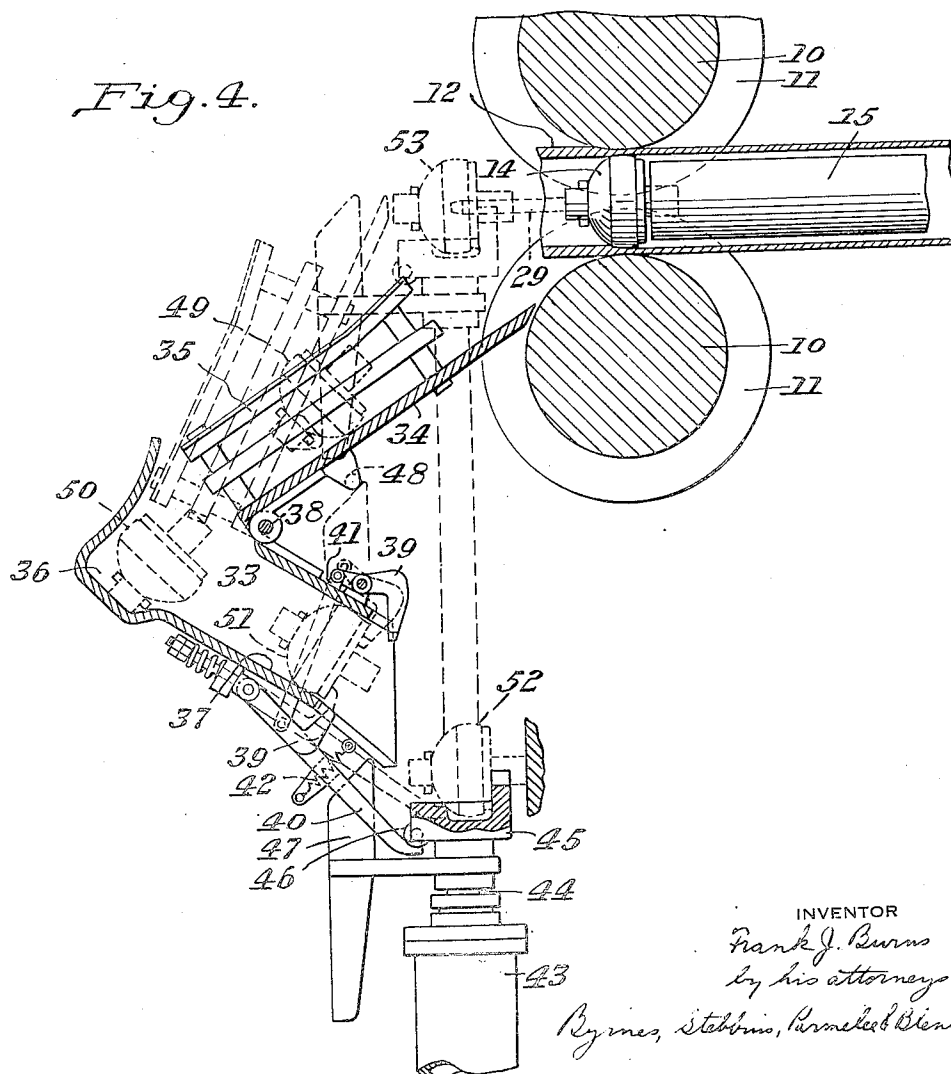
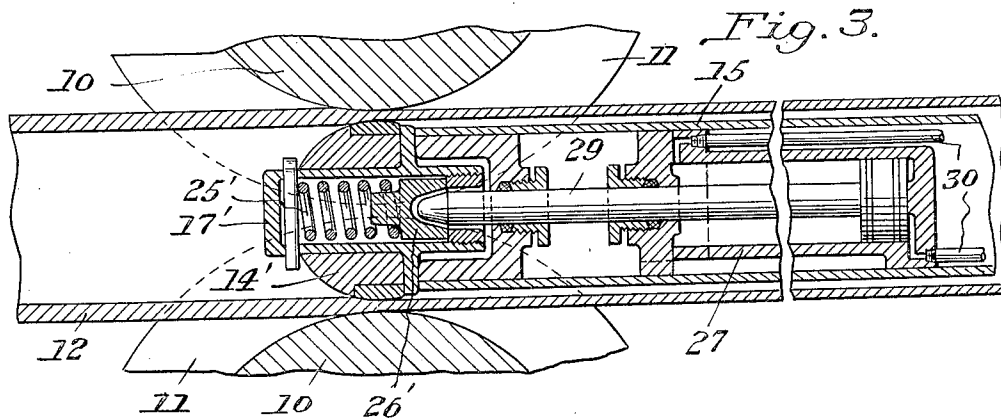
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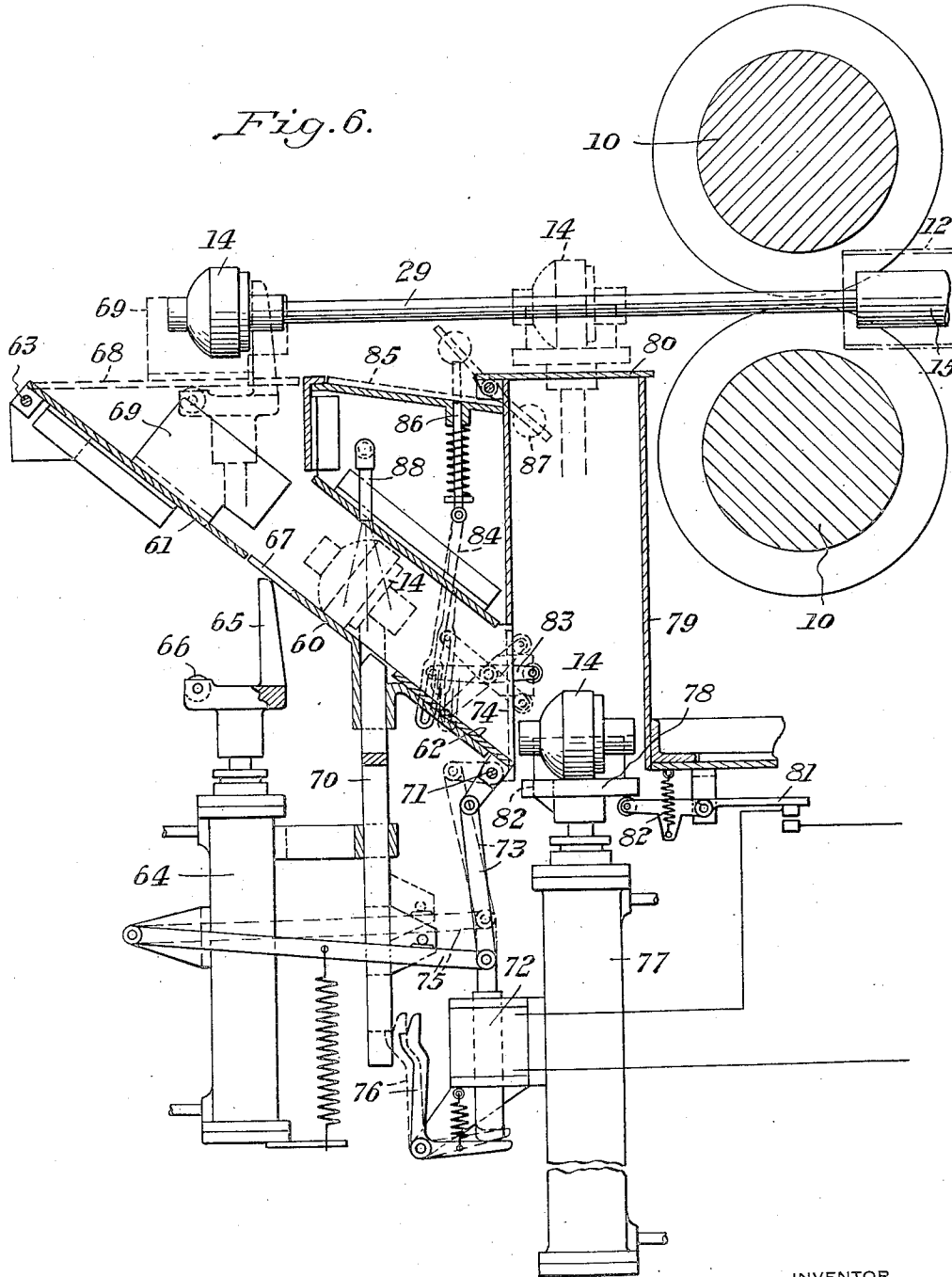
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3 Sheets-Sheet 3

Fig. 6.



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UNITED STATES PATENT OFFICE

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PLUG BAR FOR SEAMLESS TUBE MILLS

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12 Claims. (Cl. 80—11)

My invention relates to the production of seamless pipe and, in particular, to mechanism for handling the plugs or balls removably supported by a mandrel rod for cooperation with reducing rolls in the formation of pipe.

According to present methods of manufacturing seamless pipe, a pierced billet is fed between reducing rolls. A mandrel rod or plug rod extends into the pass and is adapted to removably support a plug or ball for forming the interior of the pipe. When the pipe has passed over the ball onto the mandrel rod, the plug or ball must be removed from the rod before the pipe is backed off the mandrel. After the pipe has been backed off, it is necessary to replace the ball before another pipe is passed between the rolls.

The manual insertion and removal of the plugs, obviously, is a laborious task, and it is one object of the present invention to provide means for automatically handling the plugs with a minimum of effort. In accordance with the invention, I provide a mandrel rod with an extensible plunger adapted to reach out and seize a plug positioned adjacent the end of the rod. Retraction of the plunger carries the plug back to a position slightly spaced in advance of the end of the rod. A spring is contained within the rod in position to be compressed by the plug when the latter is engaged by a pierced billet passing between the rolls. After the billet passes completely over the plug, the compressed spring forcibly removes the plug from the end of the rod.

A discharge chute is provided for the plug leading to a restoring device which restores the plug properly positioned to a point adjacent the end of the plug rod from which it may again be seized by the plunger.

In accordance with a modification of the invention, the plug is adapted to engage the end of the rod firmly before the pierced billet engages the plug. After such engagement, a spring within the rod is compressed and discharges the plug as soon as the pipe has passed over the plug.

In accordance with another form of the invention, the compression spring is mounted in the plug itself. This modification is otherwise similar to the form of the invention first mentioned.

For a complete understanding of the invention, reference is made to the accompanying drawings, in which

Figure 1 is a sectional view through a seamless mill showing the reducing rolls, a plug rod, a plug thereon, and a pierced billet passing over the plug between the rolls,

Figure 2 is a similar view of a modified form of the invention,

Figure 3 is a similar view of a further modified form of the invention,

Figure 4 is a sectional view similar to Figure 1 to reduced scale, showing parts in elevation and illustrating diagrammatically the means for handling the plugs,

Figure 5 is a sectional view to enlarged scale, showing a detail, and

Figure 6 is a view similar to Figure 4, showing a modified form of means for handling the plugs.

Referring now in detail to the drawings and, in particular, to Figures 1 and 4 for the present, a seamless mill comprises a pair of reducing rolls 10 having grooves 11 for engaging a pierced billet 12 externally. Guides 13 direct the billet between the rolls 10.

For forming the interior of the billet and sustaining the pressure applied by the rolls 10, a plug 14 is supported in the roll pass on a plug rod 15. The rod 15 is hollow and is supported at its rearward end by any suitable means (not shown). The plug rod, however, must be longer than the longest pipe length to be rolled.

The plug 14 comprises a hemispherical portion 16 bored out centrally to receive a stud 17 having an integral flange 18. The hemispherical portion 16 is secured to the stud 17 between the flange 18 and a cotter pin 19. The hemispherical portion 16 of the plug is recessed at 20 and is provided with a removable rim 21 seated in the recess 20. The rim 21 engages the billet directly for supporting and reducing the wall thereof. The function of the portion 16 is to provide support for the rim 21. The latter, of course, is made of hardened steel and may be removed for redressing or replacement. The rear end of the stud 17 is bored out at 22. The bore 22 is provided with axial gripping springs 23 bent inwardly of the bore.

The front end of the rod 15 is closed by a bell or cup 24 provided with a compression spring 25. The spring 25 carries a collar 26. Slightly to the rear of the front end of the casting a cylinder 27 is positioned. A piston 28 is adapted to reciprocate in the cylinder under fluid pressure to actuate the plunger 29 which traverses the bell 24 and the spring 25 axially to enter the bore 22 in the rear end of the stud 17. The springs 23 provide a firm grip of the plug on the plunger 29.

Supply and exhaust lines 30 are connected to opposite ends of the cylinder 27 and a conduit 31 supplies cooling fluid to the interior of the

rod 15. Packing glands 32 provide fluid-tight connections between the plunger 29, the ball 24 and the cylinder 27.

A receiving chute 33 (see Figure 4) is provided adjacent the entrance side of the rolls 10. This chute 33 comprises a pivoted plate 34 having side guides 35 thereon, a reversing pocket 36 and a delivery mouth 37. The pocket 36 and the mouth 37 are supported rigidly on any convenient structure and the plate 34 is pivoted to the mouth 37 at 38. The delivery mouth 37 is provided with pivoted retaining jaws 39 having a common operating mechanism including a lever 40 and a link 41. A spring 42 normally maintains the jaws in retaining position.

A cylinder 43 is provided with a piston rod 44 carrying at its upper end a seat 45 for a plug such as that described in detail in Figure 1. The seat 45 carries a roller 46 for engaging the operating lever 40 of the retaining jaws 39. The seat also carries a cam member 47 for actuating the pivoted plate 34 by engagement of the roller 48 thereon when the piston rod 44 is elevated as indicated in dotted lines in Figure 4.

In describing the operation of the plug-operating mechanism shown in Figure 1 and the plug-handling mechanism shown in Figure 4, it will be assumed that conditions are as illustrated in said figures. Under these conditions, the billet 12 is being fed between the rolls 10 and is being reduced, by the cooperation of the rolls with the plug, to pipe form. As will be apparent in Figure 1, the plunger 29 is withdrawn and the spring 25 is compressed by engagement of the rear end of the stud 17 with the spring collar 26.

When the billet 12 has passed entirely over the plug and onto the mandrel rod 15, the pressure against the plug being released causes spring 25 to expand forcibly and discharge the plug from the end of the plunger 29. It may be desirable at this time to apply back pressure to the piston 28 to prevent it being drawn forward with the plug. As the plug is discharged from the plug rod by the spring, it falls or slides downwardly onto the plate 34 as indicated by the dotted line position 49, and descends between the guides 35 to the reversing pocket 36. At this point, the front end of the plug is arrested while the rear end thereof drops down. The relation of the plug to the reversing pocket under these conditions is indicated in dotted lines at 50. When the rear end of the plug has dropped down, the plug is free to continue sliding down until it reaches the retaining jaws 39 at the lower end of the delivery mouth 37. It will be assumed that the piston rod 44 at this time is raised above its bottom position so that the jaws 39 will be in plug-retaining position.

If the piston rod 44 is now permitted to descend, the engagement of the roller 46 carried thereby with the operating lever 40 of the retaining jaws 49, causes the latter to open and release the plug held thereby in the position indicated at 51, so that it falls or slides downwardly into the seat 45 as shown at 52. When the ball has reached the position 52 it is ready to be restored to a position 53 adjacent the end of the plug rod 15. If desired, of course, a plurality of plugs may be used and, if so, the piston 44 will be raised by the admission of fluid under pressure to the cylinder 43 about the time a plug is discharged from the rod 15 into the position 49. Thus, while a plug is being raised by the piston 44 from the position 52 to the position 53, another plug may be descend-

ing the chute 33 from the position 49 to the positions 50 and 51.

When the piston rod 44 has reached the upper limit of its movement and the plug has been raised to the position 53, fluid is admitted to the cylinder 27 (see Figure 1) to advance the plunger 29 so that the end of the latter enters the bore 22 in the rear end of the stud 17 of the plug. The plunger, of course, may be operated by a mechanical drive instead of by fluid pressure. It establishes a firm grip on the plug by means of the springs 23. The piston rod 44 may then be lowered slowly and the plunger 29 retracted by supplying fluid under pressure to the forward end of the cylinder 27. When the plunger 29 has reached the rearward limit of its travel, the plug is spaced slightly in advance of the end of the rod 15. If a pierced billet is now fed through the rolls, the engagement of the billet with the plug will force the latter rearward so that the stud 17 engages the collar 26 to compress the spring 25. When the end of the billet has passed over the plug, the spring will forcibly eject the latter as previously described. By the time the billet has been ejected from the plug rod, the piston rod 44 has been lowered so that another plug has been positioned on the seat 45 and is ready to be raised to the position 53 where it can be engaged by the plunger 29. This cycle of operations, obviously, may be repeated indefinitely.

Referring now to Figure 2, a slightly modified form of the invention is illustrated. This form of the invention is similar in general to that already described and the same reference numerals will be used in referring to corresponding parts thereof. The only feature distinguishing the modification of Figure 2 from that shown in Figure 1 is the fact that the cylinder 27 within the plug rod 15 operates a short plunger 54 having a head 55 which is adapted to engage the rear end of the spring 25. Since the plunger 54 does not extend through the end of the rod 15, the plug must be positioned in the end of the rod manually. When this is done, the plunger 54 is preferably withdrawn. The plug, therefore, seats firmly against the end of the rod 15. There is, therefore, no clearance between the plug and the end of the rod when the pierced billet is advanced to the rolls and engages the plug. The plug is firmly supported at all times and there is no possibility of it failing to enter the billet properly.

After the billet has entered the rolls, I operate the plunger 54 to compress the spring 25 so that, as soon as the billet has passed through the rolls and off of the plug, the compression of the spring will immediately discharge the plug from the end of the rod 15.

The plug-handling mechanism shown in Figure 4, obviously, may readily be used with the modification of the plug-operating mechanism shown in Figure 2, except that the plugs must be moved manually from the position 53 of Figure 4 into the position shown in Figure 2. This can be done in an obvious manner with little effort.

Figure 3 illustrates a still further modification of the invention which likewise has many features similar to the modification shown in Figure 1. As shown in Figure 3, this modification of the invention includes a plug similar to that shown in Figure 1, except that it is bored to receive a hollow stud 17'. A compression spring 25' is contained in the hollow stud 17' and is provided with a collar 26'. The plunger 29 is adapted to be actuated, as already described, by the cylinder 27 in the plug rod 15. When the plunger 29 is ad-

vanced it seizes the plug as already described and returns it to a position in contact with the end of the rod 15. A billet is then fed through the rolls and engages the plug which is firmly braced by its immediate contact with the end of the rod. After the billet has entered the rolls, the plunger is advanced slightly to compress the spring 25'. When the billet has passed over the plug, the compression of the spring is sufficient to force the plug off the end of the rod. It is then disposed of and restored to position for replacement by the means shown in Figure 4.

The modification shown in Figure 3 thus combines the features of the forms of the invention illustrated in Figures 1 and 2. In Figure 1, the plug is not in direct contact with the end of the rod, but the plunger serves to pick up the plug at the beginning of a pipe forming operation. In Figure 2 the plunger does not pick up the plug, but the latter is supported in direct engagement with the end of the rod when the billet enters the rolls. In Figure 3, the plug is also in direct contact with the end of the rod when the billet enters, but the plunger is operable to pick up the plug and to compress the discharge spring. In Figure 1 the discharge spring is compressed by the movement of the plug when engaged by the advancing billet.

In the event that it is not desired to rely solely on the springs shown in Figures 1, 2, and 3, for ejecting the ball from the plug rod, I have provided means for positively removing the ball from the rod. Such means are illustrated in Figure 6. The rolls 10, the pipe 12, the plug 14, the plug rod 15, and the plunger 29 are indicated in Figure 6 by the same reference numerals previously employed.

The plug handling mechanism includes a chute 60 having a top door 61 and a bottom door 62. The door 61 is pivoted at 63. When the pipe 12 has passed completely over the plug 14 and it is desired to remove the latter, the plunger 29 is extended as shown in Figure 6. A cylinder 64 beneath the chute 60 is provided with a piston having a fork 65 and a roller 66. When the piston in the cylinder 64 is elevated, the fork 65 passes through an opening 67 in the floor of the chute 60. The roller 66 engages the door 61 and shifts it to the dotted line position 68. Simultaneously, the fork 65 engages the plug 14, whereupon withdrawal of the plunger 29 permits the plug to fall on to the door 61. The latter is provided with side guides 69, so that, when the fork 65 is lowered, the plug is permitted to slide down into the chute 60.

A detent 70, which is reciprocated by means to be described hereinafter, is provided for retaining the plug within the chute 60.

The bottom door 62 of the chute 60 is pivoted at 71. An electromagnet 72 and a linkage 73 are provided for shifting the door 62 to its dotted line position 74. The linkage 73, through a lever 75 is adapted to operate the detent 70. A latching member 76 serves to maintain the detent 70 in its upper position as long as the magnet 72 remains energized.

The means for restoring the plug to its position on the plug rod includes a cylinder 77 in which a piston reciprocates. The piston is provided with a seat 78 for the plug 14. When the seat 78 is elevated by means of the piston, it traverses an enclosing chamber 79 having a pivoted door 80. When the piston is first raised, a contact lever 81 is actuated by a spring 82 to close the circuit for the electromagnet 72 which

thereupon closes the door 62 and raises the detent 70.

On further upward movement of the seat 78, a projection 82 thereon engages a lever 83 having pivotal connection with a slotted link 84. The upward movement of the seat 78 swings the lever 83 to one of its extreme positions, shown in dotted lines in Figure 6.

As the upward movement of the piston in the cylinder 77 is completed, the door 80 is engaged by the ball on the seat 78 and is thrust open to its dotted line position 85. When the piston is lowered, the projection 82 again engages the end of the lever 83 and, by means of the link 84, actuates a plunger 86 to close the door 80. The door 80 is counterweighted at 87 to insure closing.

The cylinders 64 and 77 are adapted to be controlled manually by means of suitable valve controls.

The complete cycle of operations will now be described on the assumption that the initial conditions are as represented in Figure 6. The piston in the cylinder 64 is first raised so that the door 61 is shifted and the plug 14 is engaged by the fork 65. The plunger 29 is then withdrawn and the plug falls onto the door 61. The piston in the cylinder 77 supporting a duplicate plug 14 on the seat 78 is then raised slightly to permit the energization of the magnet 72 by the operation of the contact lever 81. The energization of the magnet 72 causes the door 62 to be closed to its dotted line position 74, thus providing a smooth continuous interior surface for the chamber 79 and forcing the plug 14 into position on its seat in case it is not properly placed thereon. The energization of the magnet 72 also raises the detent 70 and permits the latter to be latched in its upper position by the latch 76.

The piston in cylinder 64 is then lowered to restore the door 61 to the solid line position. The withdrawal of the fork 65 from the plug 14 permits the latter to slide down the chute 60 until it engages the detent 70. The upward movement of the piston in the cylinder 77 is then continued. The engagement of the projection 82 on the seat 78 swings the lever 83 to its extreme position but does not operate the plunger 86 because of the lost motion permitted by the slot in the link 84.

As the upward movement of the plug 14 through the chamber 79 is completed, the door 80 is swung open and the plug is positioned for engagement with the plunger 29 when the latter is again extended. When the plug has been picked up by the plunger, the piston in the cylinder 77 may be retracted. The plunger 29 is also withdrawn, carrying with it the plug 14. As the projection 82 engages the end of the lever 83, the latter is actuated to raise the plunger 86 and swing the door 80 from its open position 85 to the closed position. Further downward movement of the piston causes the opening of the circuit for the magnet 72, which is thereby deenergized to permit the door 62 to fall open, as shown in solid lines in Figure 6, and to lower the detent 70, the latch 76 having been withdrawn. The lowering of the detent 70 permits the plug delivered to the chute 60 to pass downwardly onto the seat 78 so that it can be replaced on the plunger 29 by means of the cycle of operations above described.

A spraying device 88 is incorporated in the top of the chute 60 for the purpose of cooling the plugs while they are sustained by the detent 70.

It will be apparent from the foregoing description that I provide means for automatically handling the removable plugs of a seamless pipe mill

with little effort and with considerably greater rapidity than is possible with present methods of handling. The apparatus shown can conveniently be controlled by one operator who can be
 5 stationed at a location permitting him to view the operation closely. The invention contributes to the production of seamless pipe at high speeds because the delays incident to the insertion and removal of plugs according to present methods are
 10 eliminated. The insertion of the plug, as well as its removal, is accomplished in a minimum of time and with practically no effort.

Although I have illustrated and described certain specific modifications of the invention, it will
 15 be apparent that many changes in the structure herein described may be made to adapt the invention for various installations. The invention however, is not limited to the exact form disclosed, but includes also any changes in the details there-
 20 of which may be made without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. In a removable plug for seamless mills, a
 25 spherical portion, a stud secured thereto, a bore in said stud for receiving a plunger, and means in said bore for gripping said plunger.

2. In a seamless pipe mill, the combination with a plug rod, a plunger reciprocable therein for
 30 seizing a plug adjacent the end of the rod and moving it into engagement with the end of the rod, of a spring within the plug adapted to be compressed by said plunger when the plug has been engaged by a billet passing through the mill.

3. In a seamless tube mill, the combination with reducing rolls, a mandrel and a plug adapted to
 35 lie between the rolls engaging said mandrel for support against rolling thrust, of means for supporting a plug adjacent the mandrel, an extensible plunger for engaging the plug while resting
 40 on said means and moving it to working position against said mandrel, and power means for extending and retracting the plunger.

4. The combination with a seamless pipe mill
 45 including reducing rolls, a mandrel rod for receiving rolled pipe, and water-cooling means for the rod, of an extensible plunger within the rod adapted to engage a plug to support it at the
 50 end of said rod, power means for operating the plunger to eject the plug from the mill after passage of the pipe onto the rod, means for removing the plug from the plunger, and means for
 55 positioning the plug adjacent the mill after the pipe has been removed therefrom, said plunger, when extended by said power means, being effective to engage and support said plug and, when retracted, to restore it to the end of the rod.

5. In a seamless mill, a plug rod, water-cooling means therefor, a plug removably carried thereby,
 60 means for receiving the plug on removal from the rod, means for restoring the plug to a position adjacent the end of the rod, an extensible plunger in the rod and power means for extending the plunger into engagement with a plug on said
 65 restoring means, said plunger, when retracted,

being effective to replace the plug in its normal position against the end of the rod.

6. The combination with a plug rod in a seam-
 80 less mill, and water-cooling means therefor, of a plug removably carried thereby, an extensible plunger in the rod for removing the plug from the rod, means for engaging the removed plug, means for restoring it to a point adjacent said rod, and
 85 power means for extending the plunger to engage the plug while supported on said restoring means, and for retracting the plunger to replace the plug against the rod.

7. In a seamless tube mill, a plug rod, a recip-
 90 rocable plunger carried by said rod, a plug removably mounted on said plunger, means for engaging said plug when said plunger is extended, for removing the plug from the plunger on retraction
 95 of the latter, and means for restoring the plug to a position adjacent the end of the rod and in axial alignment therewith, power means for operating the plunger to cause it to extend and en-
 100 gage said plug and for retracting the plug to restore it to its position against the end of the rod.

8. In a seamless mill, a plug rod, a plug remov-
 100 ably positioned at the end of the rod, a spring for ejecting the plug, and power operated means for compressing said spring after the plug is engaged by an advancing billet.

9. Means for handling plugs in a seamless tube
 105 mill, comprising a mandrel having an extensible plunger for supporting plugs thereon, means for removing plugs from the plunger, a chute for removed plugs, a retractible stop in the chute, means for receiving plugs from the chute and
 110 restoring them to a point for engagement by the plunger on extension thereof, and power means for moving the plunger to cause it to engage a plug and replace it against the mandrel.

10. In a seamless tube mill, the combination
 115 with reducing rolls and a mandrel, of a plug removably associated with the mandrel for cooperating with the rolls in working on tube blanks, a plunger in the mandrel reciprocable axially thereof for holding the plug in operative position,
 120 means for supporting a plug in position to be engaged by said plunger on extension thereof, and power means for extending the plunger to engage a plug on said supporting means and for retracting it to replace the plug against the mandrel.

11. The combination with a seamless tube mill
 125 of a mandrel, a plunger reciprocable in the mandrel, a mandrel plug positioned adjacent the mandrel for receiving the plunger, and power means for extending the plunger to engage the
 130 plug, and for retracting the plunger to replace the plug.

12. In a seamless tube mill, the combination
 135 with reducing rolls, a mandrel adapted to support a removable plug between the rolls against rolling thrust, and means including a power operated plunger for engaging a plug positioned adjacent
 140 the mandrel and positively moving it into position between said rolls.

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