

March 5, 1957

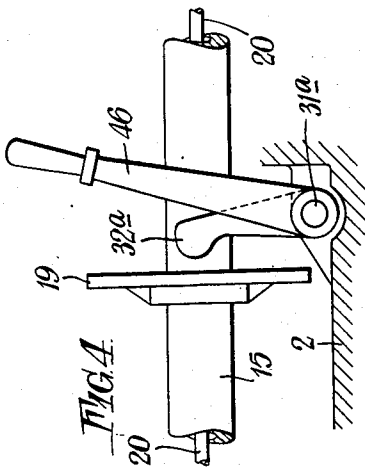
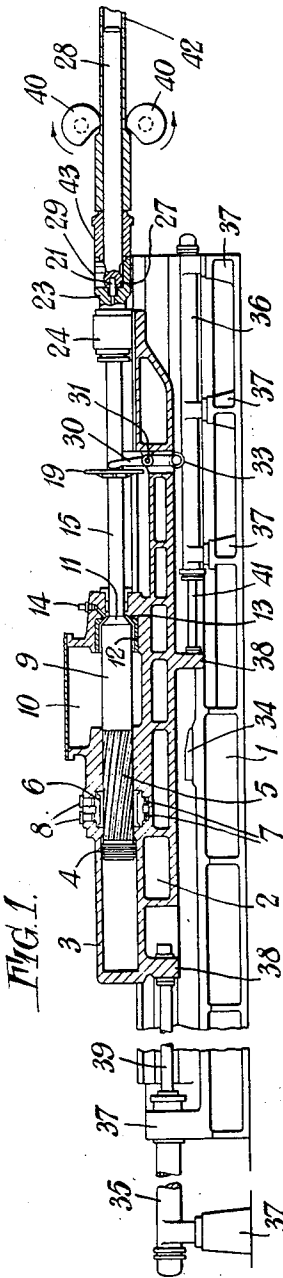
G. S. McLAY

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PILGER MILL APPARATUS

Filed Aug. 26, 1953

3 Sheets-Sheet 1



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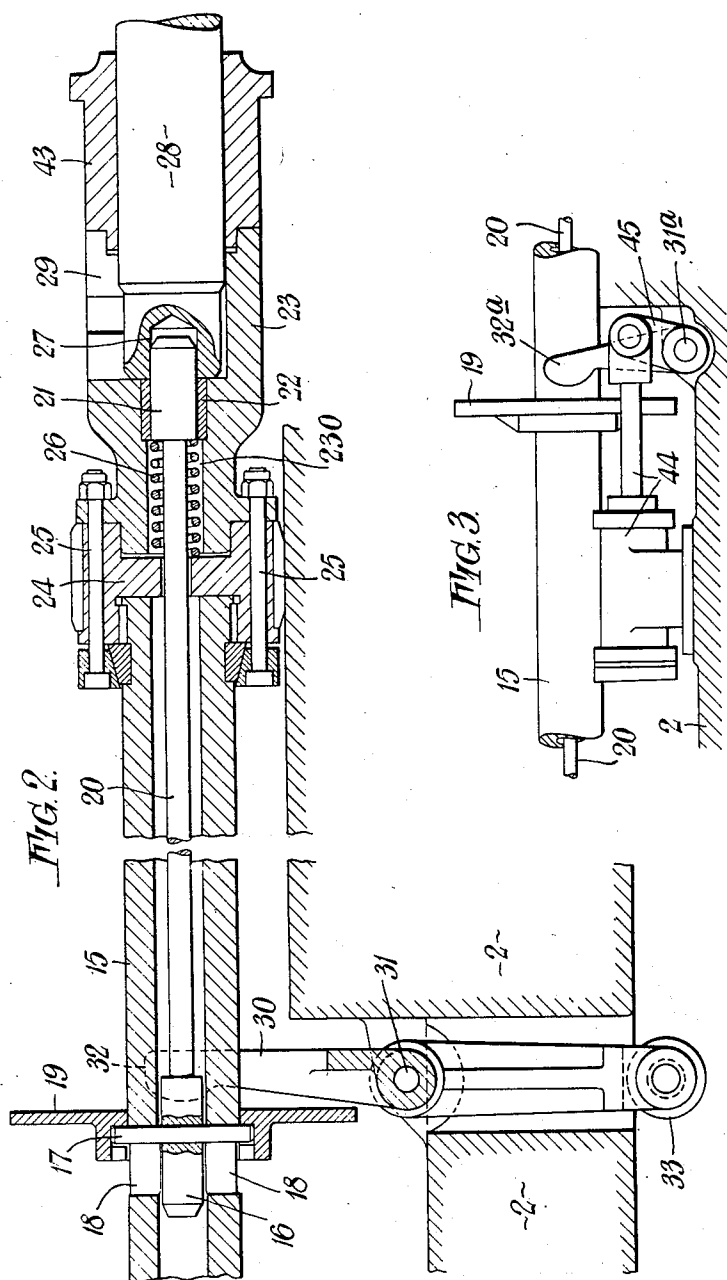
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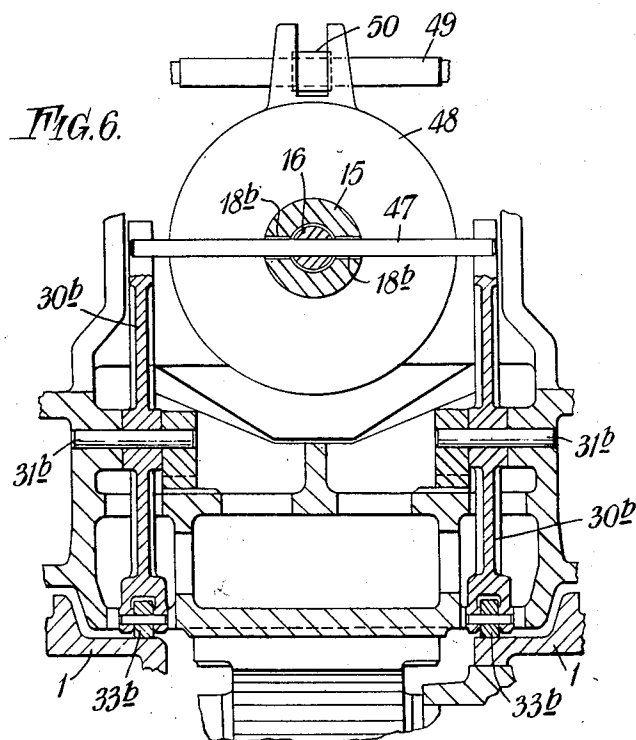
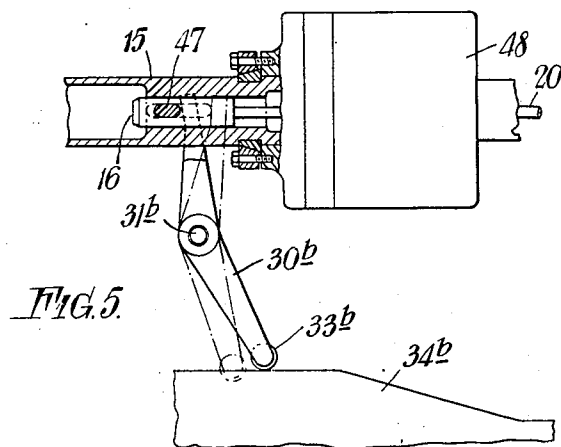
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PILGER MILL APPARATUS

Gavin Smellie McLay, London, England, assignor to
Stewarts and Lloyds Limited, Glasgow, Scotland, a
British company

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Claims priority, application Great Britain
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5 Claims. (Cl. 80—14)

This invention relates to pilger mill apparatus for the manufacture of seamless metal tubes, and is concerned with apparatus of the kind (hereinafter referred to as "the kind described"), comprising peripherally grooved and gapped rolls, means for driving such rolls, a mandrel on which a tube blank can be placed and by which it is passed between the grooved and gapped rolls, a carriage movable forward and backward with respect to the rolls, resilient means mounted on the carriage and operative to absorb backward thrust set up by the rolls on the mandrel during the rolling of the blank and to move the mandrel and blank forward with respect to the carriage when the gap in the rolls reaches the blank and releases the mandrel, and driving means to feed the carriage forward during the rolling of the blank and to return the carriage on the completion of the rolling of the blank.

The resilient means generally has a mandrel head attached to it for the connection of the mandrel thereto and usually the connecting means employed comprises a locking plate operated by a quick-acting hand-lever fulcrummed on the mandrel head.

In the operation of a pilger mill apparatus it is usual to provide a fresh mandrel for each successive tube and the previously used mandrel has to be disconnected from the mandrel head and removed and the new mandrel put in place and secured. These operations take up valuable time and the apparatus requires ground space to enable the operation to be effected.

It is an object of the present invention to provide improved means to secure a mandrel to the mandrel head, which means may be easily and quickly operated and requires less room for the operation.

According to the present invention, we provide, for use in a pilger mill apparatus of the kind described, mechanism to connect the mandrel to the resilient means, or to a mandrel head connected to such resilient means, such mechanism comprising a member slidable in a hollow part of the resilient means or in a hollow of the mandrel head, the said member being operative to engage a hole in the mandrel and means being provided to move the member into and out of engagement with said hole.

Preferably, the member operative to engage the hole in the mandrel is rigidly connected, as by a rod, to a block slidable in a hollow part of the resilient means. In that case, the means to effect disengagement of the member from the hole in the mandrel suitably comprises a pin or bar extending from the block through slots in the wall of the hollow part of the resilient means, one or more pivotal arms or levers disposed adjacent to and operative directly or indirectly on the pin or bar, and means to move such one or more arms or levers.

Appropriate forms of apparatus according to the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a sectional elevation of a pilger mill apparatus of the kind described embodying one form of

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mechanism to connect the mandrel to the resilient means in accordance with the present improvements.

Figure 2 is a sectional view of that part of Figure 1 more nearly associated with this invention, the view being on a larger scale than Figure 1.

Figure 3 is a fragmentary elevation illustrating a modification,

Figure 4 is a similar view depicting another modification,

Figure 5 is a fragmental sectional elevation showing a further modification, and

Figure 6 is a sectional view of and taken at right-angles to Figure 5 looking on the latter from the left, this view being on a larger scale than Figure 5.

The pilger mill apparatus shown in Figure 1 comprises a sole plate 1 to be fixed to the ground and a carriage 2 mounted to slide on the upper surface of the sole plate 1. The carriage 2 is formed with a horizontal air cylinder 3 within which moves a piston 4 having at its forward end an extension of which the portion 5 adjacent the piston has a series of helical grooves cut in its surface which engage with helical grooves cut on the inner surface of a nut 6 rotatably supported on the carriage 2. The outer surface of the nut is formed with ratchet teeth 7 which co-operate with spring-loaded pawls 8 mounted on the carriage and, in conjunction with the helically grooved parts, enable the mandrel 28 of the apparatus to revolve to bring fresh parts of the work into engagement with the pilger rolls 40. The portion 9 of the extension of the piston 1 beyond the helically grooved portion 5 extends through a container 10 for liquid, such as water, and has a conical shoulder 11 which is adapted to enter an aperture or space 12 having its inner end similarly conically shaped at 13. The diameter of the space 12 is slightly larger than the portion 9 of the piston extension and its wall preferably converges slightly towards its inner end. The container 10 forms part of the carriage 2, being in an extension from the wall of the cylinder 3. The portion 9 of the piston extension and the space 12 constitute a dashpot to cushion the forward movement of the piston 4 under the action of the resilient means presently referred to, the liquid being forced out of the space 12 between its wall and the periphery of the extension as the latter moves into it. A pressure-relief valve 14 controls an outlet from the inner end of the space 12 to permit escape of liquid when the pressure reaches a predetermined amount. The piston 4 and the cylinder 3, together with the air in the cylinder and the extension of the piston herein referred to, constitute resilient means of the nature already described above and the operation of which will be well understood by those versed in the art.

In accordance with the present invention, the extension of the piston 4 is continued as a hollow portion 15 (cf. Figure 2) in which is slidably mounted a cylindrical block 16 having a transverse pin 17 therethrough which extends through oppositely disposed slots 18 in the wall of this extension portion 15. This pin 17 is engaged, in the manner of a bayonet-type fastening, with a plate-like member 19 which is mounted to slide on the part 15. The cylindrical block 16 is fixed on one end of a rod 20 whose opposite end carries a cylindrical member 21 supported in a bushing 22 in a central hollow 230 of a mandrel head 23. The rod 20 passes through and is supported by a guide 24 which is fixed by bolts 25 to and between the mandrel head 23 and piston extension portion 15 and is slidable on the carriage 2. A spring 26 is disposed between the cylindrical member 21 and the guide 24 to urge the former forwards. The cylindrical member in its forward position engages in an axial hole 27 in the end of the mandrel 28. The mandrel head

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23 has an upwardly directed slot 29 through which the mandrel can be removed, since the mandrel end is so shaped and forms with the mandrel head such a connection that there can be no endwise movement of the mandrel away from the mandrel head.

A lever 30 fulcrumed at 31 on the carriage 2 has one arm with its end 32 disposed beside the piston extension 15 and adjacent the plate-like member 19. The other arm of the lever 30 carries a roller 33 at its end. An abutment 34 having a sloping upper face to be engaged by the roller 33 is fixed on the sole plate or bed 1 of the apparatus.

Opposed hydraulic cylinders 35, 36 are mounted on pillars 37 extending upwards from the sole plate 1 or the ground and the ends of their pistons engage abutments 38 on the carriage 2, the piston 39 of the cylinder 35, usually termed the feed cylinder, acting to move the carriage 2 and with it the mandrel 28 towards the peripherally grooved and gapped pilger rolls 40 and the piston 41 of the other cylinder 36, usually termed the stripper cylinder, acting in the opposite direction. A partially worked tube blank 42 is shown on the mandrel 28 in Figure 1 for reference. The part 43 is a stripper block serving after known manner for stripping a completed tube from the mandrel. This stripper block is held stationary at the end of a rolling operation, i. e. on completion of a tube, at which time the stripper piston 41 and cylinder 36 are operated to retract the carriage 2. Being thus held stationary, the block strips the completed tube from the mandrel as the latter is drawn back with the carriage. During the rolling operations, the stripper block is released from the means for holding it stationary at the end of the rolling operations; and it moves with the mandrel 28 as the latter moves back and forth. Generally, the stripper block would be removed with the mandrel and a fresh one used on the next mandrel, but this is not essential.

In operation, after a tube has been completed on the mandrel 28 the stripper cylinder 36 and piston 41 are operated whereby the tube is removed from the mandrel by the stripper block 43, the mandrel being locked to the mandrel head. Towards the end of the retraction of the carriage 2 the roller 33 on one end of the lever 30 engages the abutment 34 whereby the lever is moved about the pivot 31 to cause its other end 32 to engage and move the plate-like member 19 rearwards and with it the cylindrical block 16 to remove the cylindrical member 21 from engagement with the hole 27 in the end of the mandrel 28. The latter then being free can be lifted out through the slot 29 in the mandrel head 23 and a new mandrel substituted there. Then, after a fresh tube blank has been placed on the new mandrel, the carriage 2 is moved forward by the piston 39 of the feed cylinder 35, thus releasing the end 32 of the lever 30 from the plate-like member 19, so that the spring 26 acts to move the cylindrical member 21 into engagement with the axial hole 27 in the end of the new mandrel.

The invention is not restricted to the apparatus above particularly described because modifications are possible without departing from the scope of the appended claims delimiting the invention. For instance, instead of being operated automatically on movement of the carriage 2, the cylindrical member 21 may be operated by a pneumatic or hydraulic cylinder and piston, an electric solenoid or a hand lever. Thus, according to the modification illustrated in Figure 3, an arm 32a operative on the plate-like member 19 and pivotally mounted at 31a is operated by a pneumatic or hydraulic cylinder and piston combination 44 of which the cylinder is fixed to the carriage 2 and the piston connected to a second arm 45 mounted fixedly on the pivot of the arm 32a. The cylinder and piston combination 44 could, of course, be substituted by an electric solenoid and plunger as will be understood without further illustration. The modification depicted

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in Figure 4 comprises a hand-lever 46 fixed to the pivot 31a of the arm 32a which, as in Figure 3, is pivotally mounted on the carriage 2. According to the modification shown in Figures 5 and 6, the cylindrical member 21 (not shown in these figures), is operated by levers 30b through a bar 47 extending through and fixed in the block 16 and passing through slots 18b in the piston extension portion 15. The levers are fulcrumed at 31b and co-operate with abutments such as 34b on the sole plate or bed 1 of the apparatus. This modification dispenses with the plate-like member 19 aforesaid and thus results in some saving of reciprocating weight. The arrangement would be such that the bar 47 would be opposite and its ends adjacent to the operating levers 30b, immediately prior to the rollers 33b on these levers contacting the abutments 34b. The part marked 48 is a stop for limiting the forward position of the piston of the resilient means relative to the carriage 2. It is adjustable in length by helical parts, for purposes which will be understood, and 49, 50 indicate screw and nut adjusting means respectively which could be used in making the adjustment.

Features of the pilger mill apparatus described in the co-pending applications Serial Nos. 333,544 of 1953 and 340,792 of 1953, filed January 27 and March 6 respectively, may be incorporated in the apparatus according to the present invention.

What I claim is:

1. Pilger mill apparatus comprising a set of pilger rolls, a carriage movable back and forth with respect to said rolls, resilient means disposed on said carriage and comprising a first element slidably mounted on said carriage, and a second element fixedly disposed on said carriage and operative to resiliently absorb backward movement of said first element under the action of said rolls, said first element embodying a mandrel head, to be engaged with a mandrel, a mandrel engaging member mounted slidably in a hollow in said mandrel head, such member being engageable with the mandrel by the end of one entering a hole in the other on forward slidable movement of said member, a block slidable in a hollow bore of said first element and rigidly connected to said mandrel engaging member, a transverse member extended from said block through slots in said first element, a pivotal arm disposed adjacent to and operative to move said transverse member along said slots, and means operative to move such arm on the retraction of the carriage in the direction away from the rolls whereby the mandrel engaging member is disengaged from the mandrel.

2. Apparatus according to claim 1, wherein the means operative to move the pivotal arm comprises an abutment disposed in a fixed position on the apparatus.

3. Apparatus according to claim 1 comprising a guide embodied in the first element between the mandrel head and the slots in said first element, said guide being slidable on the carriage, and a rod extending in the hollow bore of said first element and through a central aperture of said guide and rigidly connecting the mandrel-engaging member with the block.

4. Apparatus according to claim 3, comprising a coil spring encircling the rod and acting between the guide and the mandrel-engaging member to move said member into engagement with the mandrel.

5. For use in pilger mill apparatus according to claim 1, a mandrel having a hole in its rear end operative for reception of the mandrel-engaging member.

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