May 13, 1930. R. C. STIEFEL 1,758,413

MANDREL BAR SUPPORTING APPARATUS FOR PIERCING MILLS

Filed April 5, 1928 4 Sheets-Sheet 1

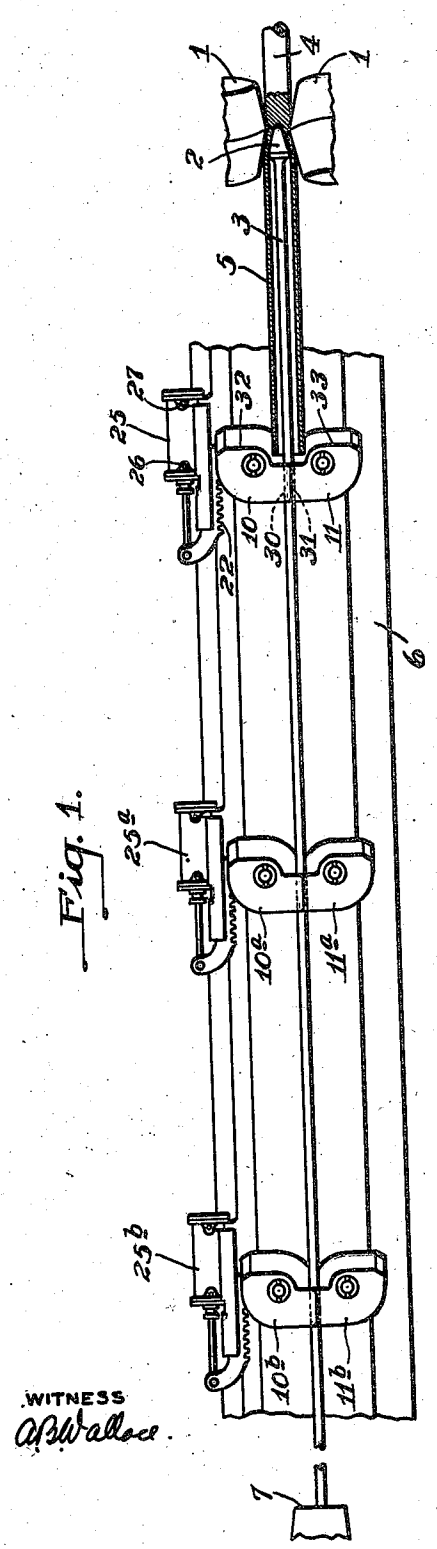


Fig. 1.

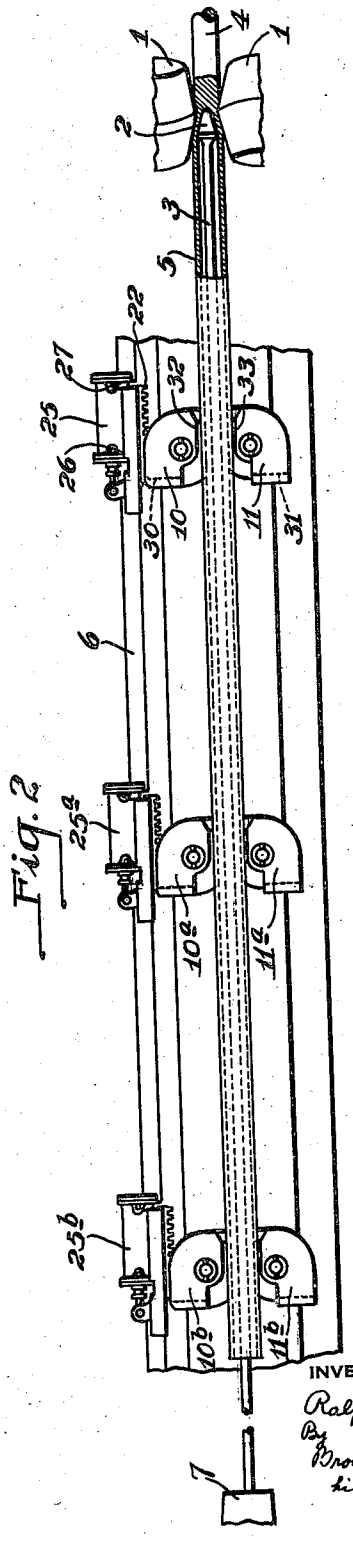


Fig. 2.

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Fig. 3.

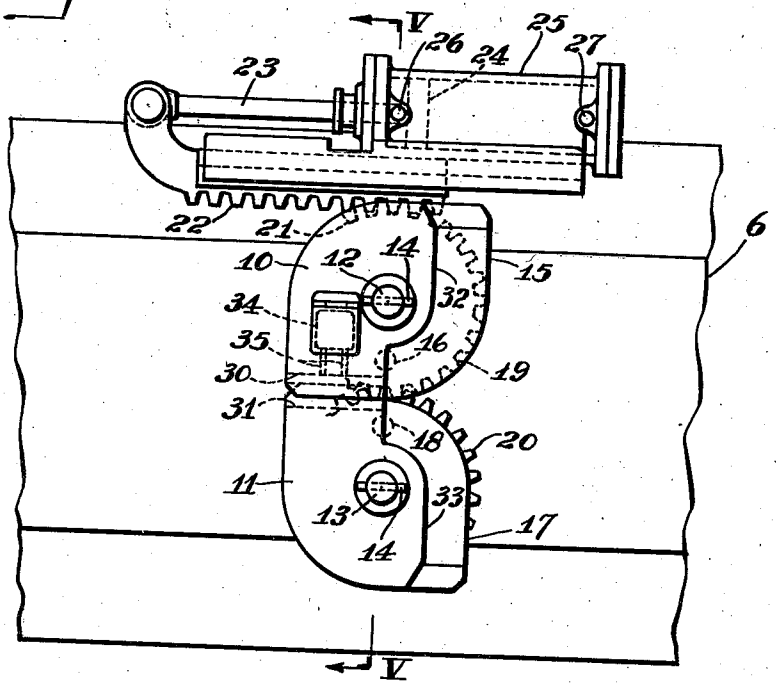
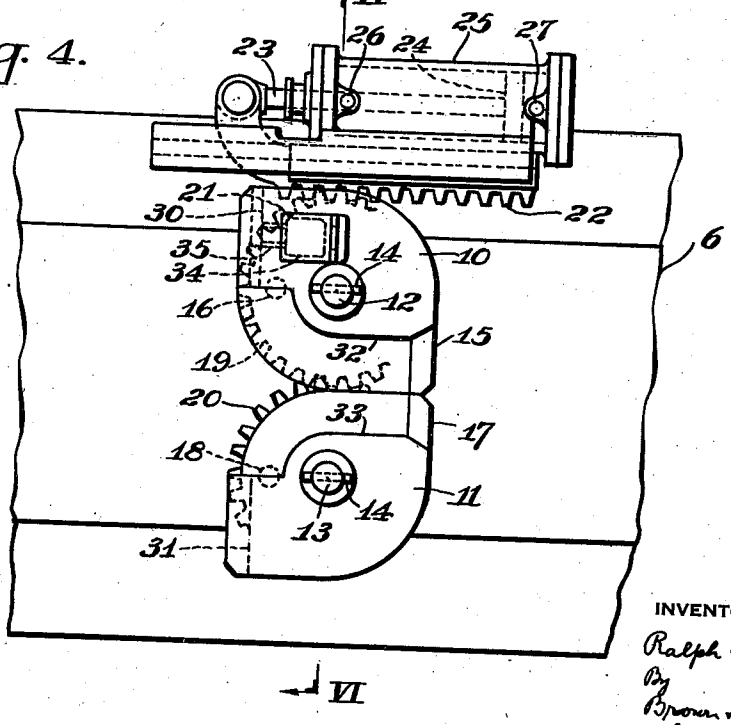


Fig. 4.



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MANDREL BAR SUPPORTING APPARATUS FOR PIERCING MILLS

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Fig. 5.

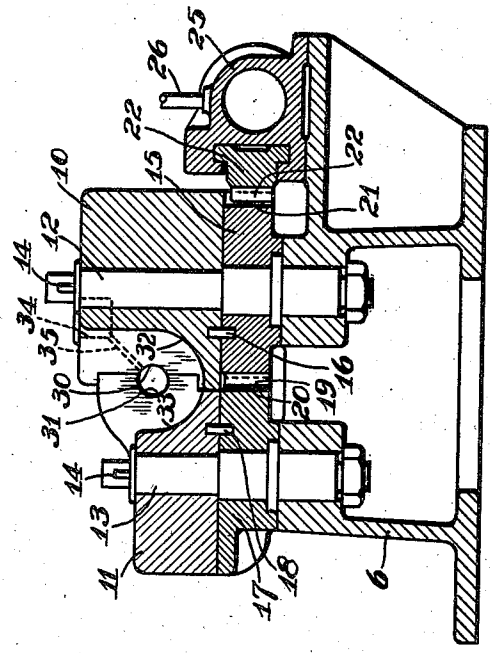
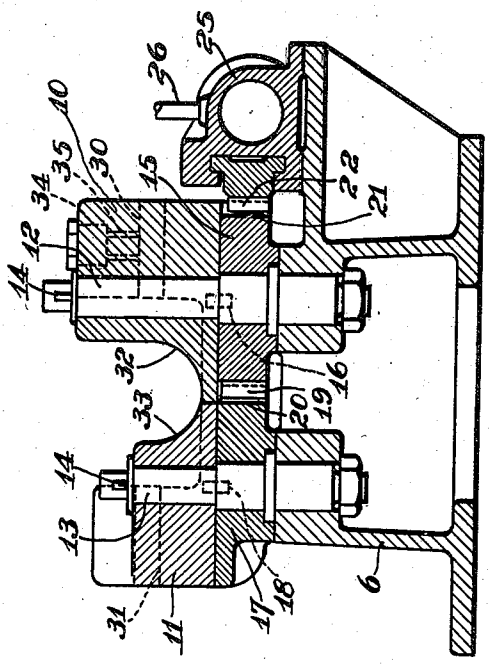


Fig. 6.



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MANDREL BAR SUPPORTING APPARATUS FOR PIERCING MILLS

Filed April 5, 1928 4 Sheets-Sheet 4

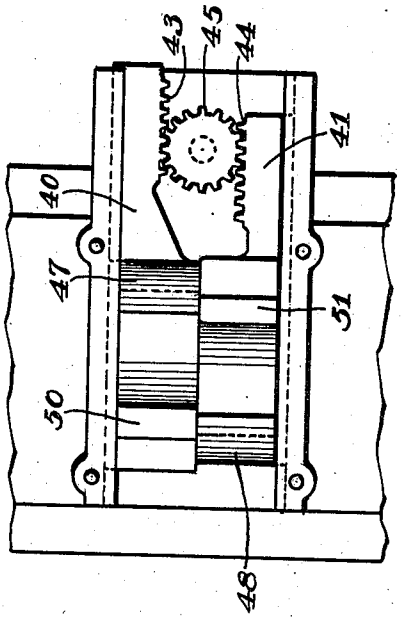


Fig. 8.

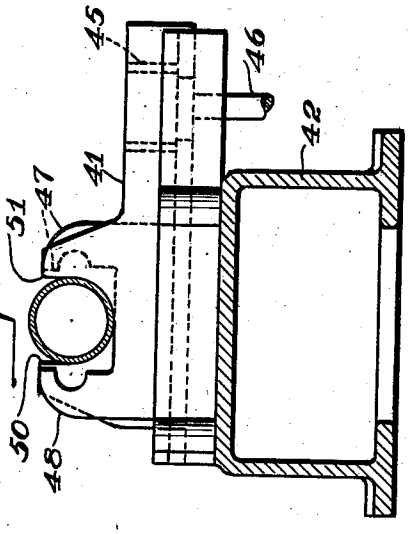


Fig. 10.

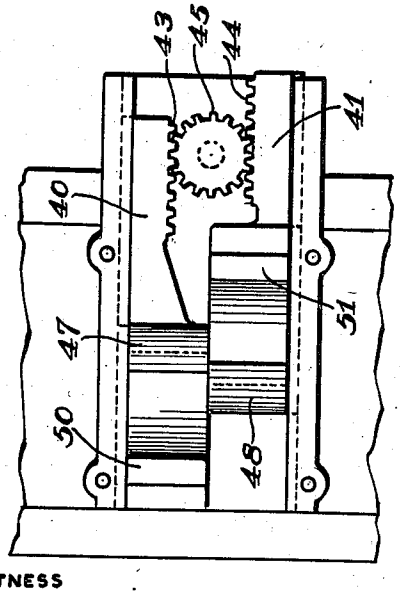


Fig. 7.

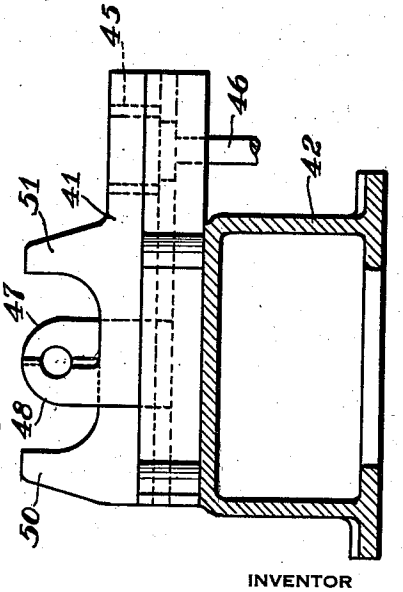


Fig. 9.

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UNITED STATES PATENT OFFICE

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MANDREL-BAR-SUPPORTING APPARATUS FOR PIERCING MILLS

Application filed April 5, 1928. Serial No. 267,577.

The invention relates to apparatus for use in connection with piercing mills.

As is well known in this art, the piercing of a billet is effected over a mandrel arranged in a pass formed between obliquely disposed barrel or mushroom shaped rolls, the mandrel being at the end of a rod which holds it in the piercing pass. As the piercing operation proceeds, the pierced portion of the billet progressively envelops the mandrel bar, which must accordingly be somewhat longer than the pierced billet or tube at the end of the operation. In some cases it is necessary to use mandrel bars of such lengths and diameters that if unsupported intermediate of their ends they buckle or otherwise fail to maintain the mandrels in their proper positions. This is particularly the case when seamless tubing is produced directly by the piercing of billets without further working of the metal except that incident to finishing operations.

An object of this invention is to provide simple and effective means for so supporting long mandrel rods that they will not buckle or otherwise fail to properly maintain mandrels in operative positions in piercing mills; and a further object is to provide mandrel bar-supporting apparatus which also serves to guide the pierced portions of tubes or billets during piercing operations, and thereby eliminate the necessity of providing special guides such as now used.

The invention is illustrated in the accompanying drawings of which Fig. 1 is a somewhat diagrammatic view of a piercing mill and mandrel bar supporting and billet-guiding apparatus associated with it, such apparatus being positioned for supporting a mandrel bar; Fig. 2 a view similar to Fig. 1 showing the apparatus positioned for guiding the pierced portion of a billet; Figs. 3 and 4 enlarged plan views of a unit of the apparatus showing it in alternate positions; Figs. 5 and 6 sectional views taken on the lines V—V and VI—VI, of Figs. 3 and 4, respectively; Figs. 7 and 8 plan views of a unit of a modification of construction of the apparatus showing the unit in alternate positions; and Figs. 9 and 10 elevations of the units of Figs. 8 and 9 in the respective alternate positions there shown.

According to this invention there are provided intermediate the ends of a mandrel bar means for supporting it against lateral as well as vertical deflections or movements, the means being effective for this purpose until the forward pierced end of a blank reaches the point of support of the bar. For long mandrel bars there are preferably provided a plurality of supports arranged at spaced intervals intermediate the ends of the bars, each support being independently operable to release the bar as or when the forward end of a blank reaches it. While the customary or any desired instrumentalities may be used for guiding pierced portions of billets, it is preferred to so construct the mandrel bar supports that when each is moved from its bar-supporting position it then becomes a guide for a pierced billet or tube.

Having reference now to the illustrative embodiments of the invention, there is shown in Fig. 1 a piercing mill comprising a pair of barrel-shaped piercing rolls 1 having their axes of rotation disposed obliquely with relation to each other, and forming between them a piercing pass in which there is a mandrel 2 attached to the end of a mandrel bar 3. The mill is illustrated as piercing a solid heated billet 4 to form a seamless tube 5, but the billet being pierced may itself be tubular as a result of a previous piercing or other operation.

Adjacent to the piercing mill there is a frame 6 provided with a plurality of combined mandrel bar supports and billet guides arranged at spaced intervals intermediate the ends of bar 3, the rear end of which is suitably supported by a holder diagrammatically shown at 7. The combined supports and guides preferably comprise pairs of blocks 10 and 11, 10^a and 11^a and 10^b and 11^b of like constructions, the number of pairs of blocks used depending upon the conditions of service. Having reference to the support formed by blocks 10 and 11, illustrated to enlarged scale in Figs. 3 and 5, the blocks are pivotally mounted on vertical pins 12 and 13 attached at their lower ends to frame 6, the blocks be-

ing held upon the pins in any suitable manner, as for example by transversely extending keys or wedges 14. Block 10 rests upon a table 15 mounted for rotation upon pin 12, and is suitably connected to this table for rotation with it as by means of dowel pins 16. In a similar manner, block 11 rests upon a table 17 mounted for rotation on pin 13, the block being connected to the table by a dowel pin 18. For causing simultaneous movements of tables 15 and 17, they are provided on their adjacent faces with intermeshing teeth 19 and 20, and for effecting their movements the outer face of table 15 is provided with a segmental pinion 21 which meshes with a rack 22 suitably mounted for longitudinal movements. One end of rack 22 is attached to a piston rod 23 having attached to it a piston 24 arranged in a pressure fluid cylinder 25 provided at its ends with pipes 26 and 27 for admitting and exhausting pressure fluid. Thus by admitting pressure fluid to one end of cylinder 25 and exhausting it from the other, tables 15 and 17 and blocks 10 and 11 attached to them may be rotated upon their vertical axes. It will be understood, however, that in place of the particular mechanism shown and described various forms of prime movers and block connections may be used.

On faces disposed preferably at right angles to each other, blocks 10 and 11 are provided with cooperating pairs of grooves to receive and support a mandrel bar and to guide the pierced portion of a blank. For supporting a mandrel, blocks 10 and 11 are provided with grooves 30 and 31, respectively, and for guiding the pierced portion of a blank these blocks are provided with grooves 32 and 33, respectively. In the positions that the blocks are shown in Figs. 3 and 5, their grooves 30 and 31 are in cooperative relationship for supporting a mandrel bar, and in their positions shown in Figs. 4 and 6, their grooves 32 and 33 are brought into cooperative relationship for guiding the pierced portion of a blank. To suitably lubricate a mandrel bar engaged by blocks 10 and 11, block 10 may be provided on its top with a grease-receiving pocket 34, the lower end of which communicates with groove 30 through a duct 35.

In operation, the several pairs of blocks 10 and 11, 10^a and 11^a, etc., are first so positioned that their grooves 30 and 31 surround and adequately support mandrel bar 3 against both lateral and vertical deflections, the several pairs of blocks being shown in Fig. 1 as so positioned. When the forward end of the pierced portion 5 reaches the first pair of mandrel bar supporting blocks 10 and 11, these blocks are caused to rotate through an angle of 90° in the direction of longitudinal movement of the blank to cause their supporting grooves 30 and 31 to disengage the bar and to also cause their grooves 32 and 33 to come to billet-guiding positions. This procedure is repeated for each of the several pairs of blocks as the forward end of a blank reaches them. For thus controlling movements of the blocks, fluid pressure lines 26 and 27 may extend to an operator's pulpit and be there controlled by the operator as he observes the advance of a pierced blank. When it is desired to produce blanks of different sizes, pairs of blocks 10 and 11 having different sized mandrel-supporting and billet-guiding grooves may be readily placed upon their supporting tables 15 and 17. However, it is unnecessary to provide different blocks for each size of blank produced and for each diameter of mandrel bar used, because it is unnecessary to have neat engagements of the blanks and bars by the blocks.

In Figs. 7 to 10, inclusive, there is shown a modified form of a combined mandrel bar support and billet guide unit comprising a pair of blocks 40 and 41 slidably mounted upon a frame 42 for movements transversely of the line of a piercing pass. The ends of these blocks are provided with oppositely disposed racks 43 and 44, respectively, which mesh with a pinion 45 arranged between them and attached to a shaft 46 which may be rotated by pressure fluid mechanism similar to that shown in Figs. 3 and 4, or by any other suitable means. The tops of blocks 40 and 41 are provided with upwardly extending arms 47 and 48, respectively, having grooves in their vertical faces which, when the blocks are in their relative positions shown in Figs. 7 and 9, form a support for a mandrel bar. The tops of the blocks are also provided with upwardly extending arms 50 and 51 which, when the blocks are in their relative positions shown in Figs. 8 and 10, form a guide for the pierced portion of a billet.

The operation of the apparatus when provided with a series of units such as shown in Figs. 7–10 is similar to that previously explained with reference to the apparatus shown in Figs. 1–6. At the beginning of a piercing operation the several pairs of blocks 40 and 41 are first so positioned that their arms 47 and 48 engage and adequately support a mandrel bar against both lateral and vertical deflections, the blocks then being in the position shown in Figs. 7 and 9. When the forward end of the pierced portion of a tube or billet reaches the first pair of these blocks, pinion 45 is rotated to simultaneously move the blocks to the position shown in Figs. 8 and 10 in which their arms 50 and 51 form a billet guide. By varying the positions of the blocks, their arms 50 and 51 may form guides for different sized pierced tubes or billets.

In botl. embodiments of the invention, the pierced portion of a tube or billet affords adequate protection against harmful deflec-

tion of a mandrel bar when a pair of blocks are moved from their bar-supporting to their billet-guiding positions.

According to the provisions of the patent statutes, I have explained the principle and mode of operation of my invention, and have illustrated and described what I now consider its best embodiments. However, I desire to have it understood that, within the scope of the appended claim the invention may be practiced otherwise than as specifically illustrated and described.

I claim as my invention:

In a billet piercing mill, the combination of piercing rolls, a mandrel bar provided at its forward end with a mandrel lying in the pass formed by said rolls, a plurality of pairs of movably mounted combined bar-supporting and open-top billet-guiding blocks arranged at spaced intervals intermediate the ends of said bar and having extended bar and billet engaging surfaces, and independent mechanism for separately moving each of said pairs of blocks from its mandrel-supporting to its billet-guiding position.

In testimony whereof, I sign my name.

RALPH C. STIEFEL.