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PUSH BENCH FOR DRAWING TUBES

Filed April 17, 1934 2 Sheets-Sheet 1

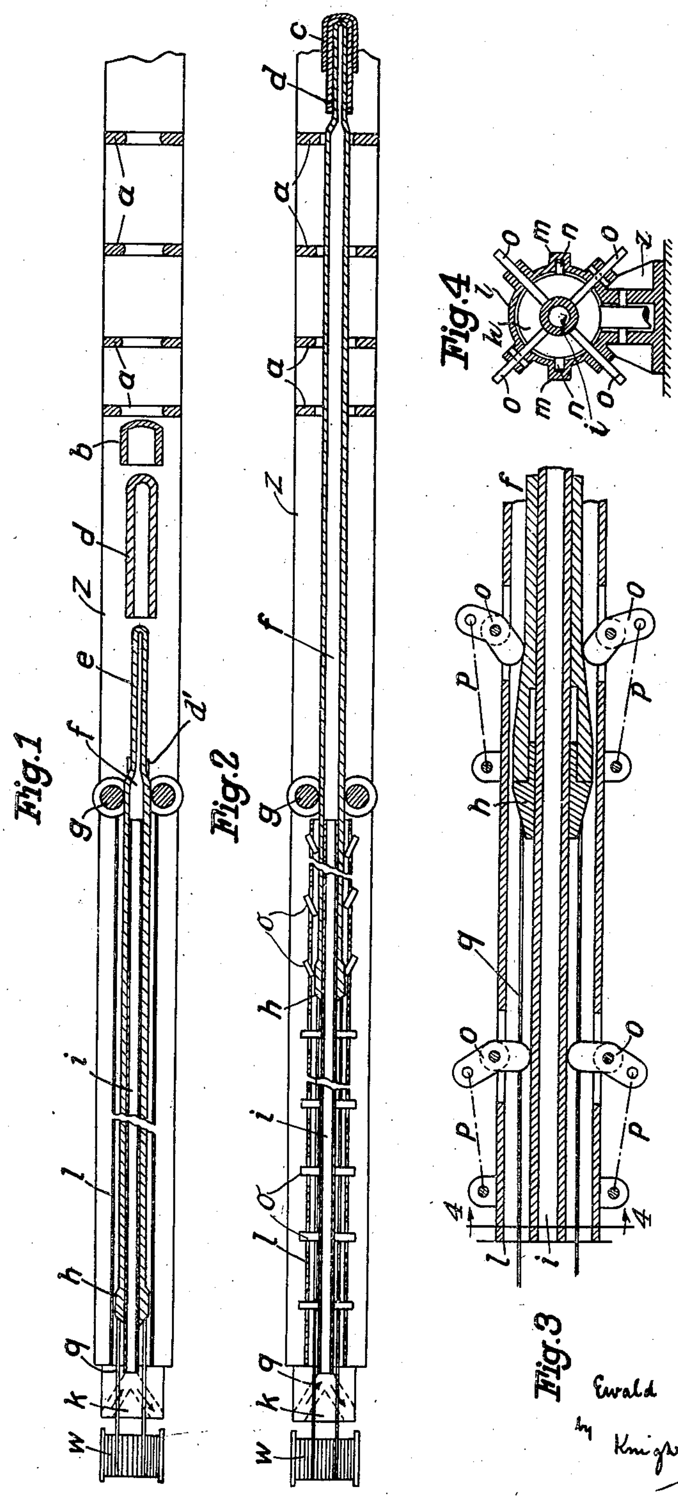

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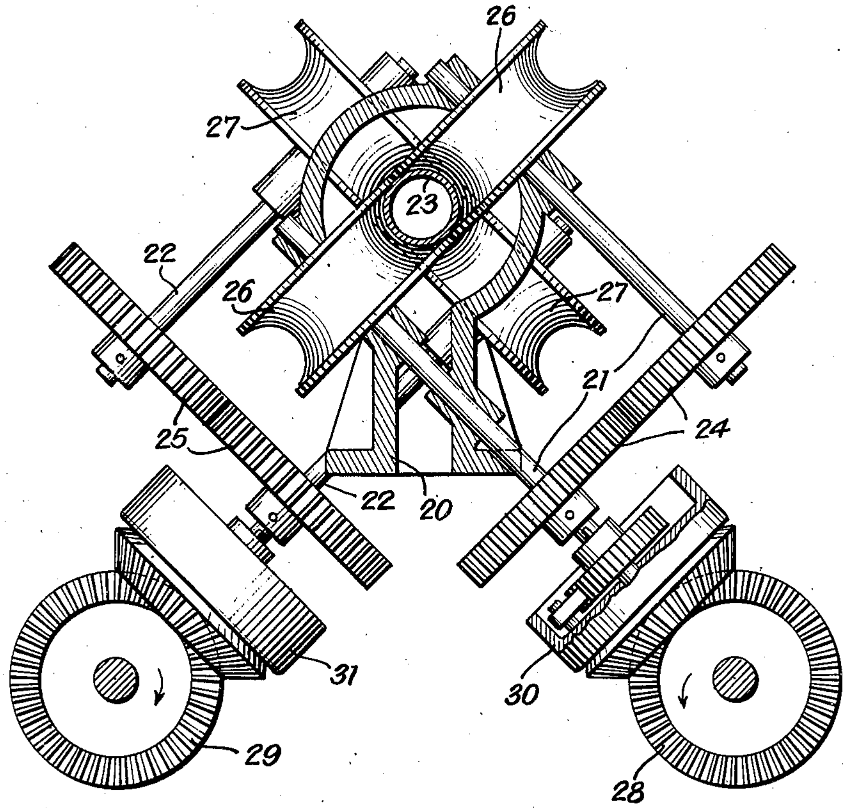
Fig. 5.



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PUSH BENCH FOR DRAWING TUBES

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5 Claims. (Cl. 205—4)

The invention relates to push benches, such as used in the production and further working up of tubes and hollow bodies.

Most of the tube push benches used now-a-days have a toothed rack drive. The toothed rack is followed by a long shaft driving the mandrel. The shaft must be carefully guided throughout its entire length in order to prevent its lateral bending out or curvature owing to the comparatively strong pressure to which it is subjected while the hollow body is being pushed through the drawing rings. The numerous guiding means devised for the purpose are either carried along in a longitudinal direction one after another by the forward motion of the shaft towards the drawing ring bed or moved laterally out of the reach of the toothed rack section. The just mentioned shaft guides have proved obstructive when the output of this type of bench is increased in regard to tube dimensions, especially when the drawing speed is accelerated. Even with the best designs it is impossible to accelerate the speed of the shaft to such an extent as will be desirable to ensure proper working of the hot material.

The present invention does away with these drawbacks. In applying the new process, guides for the shaft may be generally dispensed with altogether. In cases where this is impracticable, the lateral forces acting on the guides may be at least reduced to such a degree that the guides can be designed much lighter and more mobile.

According to the invention the push bench is driven hydraulically, pneumatically, by compressed gas or the like. For this purpose, a hydraulic, pneumatic or gas driven press is inserted into the push bench in such manner, that its cylinder is pushed, together with the mandrel and the blank mounted on the mandrel, through the drawing bed.

This process is carried out preferably in the manner that tubular thrust bars or mandrels are used, and the push bar itself is formed like a movable cylinder which is filled with the pressure medium. In this case the push bar is subject throughout the whole working process only to tensile stresses instead of compression or buckling stresses which prevail in the known push benches for tube drawing used up to now. Thus the push bar irrespective of its diameter or length, is maintained in a stretched condition throughout the whole working process and prevented from buckling even without the use of guides. With these hollow and comparatively light cylindric push bars all kinds of tubes can be produced and thinner wall thicknesses be obtained than is possible with the usual processes applied up to now. The process is applicable too for maximum stroke lengths.

My invention is illustrated in the accompanying drawings which show several modifications of the manner in which the invention may be reduced to practice. In these drawings—

Fig. 1 represents a hydraulic push bench with fixed dies, shown semi-diagrammatically in horizontal section and at the beginning of the stroke.

Fig. 2 shows semi-diagrammatically a similar section, showing the push bar after the completion of its stroke through all the drawing dies.

Fig. 3 shows a horizontal section in somewhat larger scale through the portion of the bench shown in Figs. 1 and 2 in which the plunger guiding devices are located.

Fig. 4 shows a transverse section through the bench portion 4, 4 in Fig. 3, and

Fig. 5 shows a transverse section in larger scale through a modified push bench employing draw rolls instead of drawing dies.

The push bench shown in Figs. 1 through 4 consists in its essential features of a bench bed *z* on which the drawing dies *a* are spaced certain distances apart given by experience. The push bar *f* serves as the pushing device. In the present example this bar is formed by a longitudinally movable long cylinder into which the pressure medium is supplied. By forming this push bar as a hollow cylinder the effect is obtained that the bar is subject only to tension stresses instead of buckling stresses as is the case in the ordinary prior art push benches. This occurs because the effective force of the pressure fluid now always acts directly against the interior of the front end of the bar, instead of the force acting against the rear end of the bar as in the prior art devices. The push bar is so designed in size and length that it can pass together with the blank to be drawn through all drawing dies. Since by the internal pressure exerted by the medium it is held in stretched condition during its entire work stroke, the type of guides heretofore used to prevent buckling due to the pushing forces may be entirely omitted. During its work and return stroke, the push bar slides on a fixed hollow plunger *i* on which it is mounted fluid-tight by means of a stuffing box *h* which is provided at the rear end of the push bar. Plunger *i* terminates at its front end in the push bar, at which point the fluid is supplied through the plunger into the bar, and at its rear end in the plunger head *k*. The plunger head is connected by means of conduits, shown in dotted lines, with a pressure fluid system, and further contains all control devices necessary for the admission of pressure fluid. Since the construction of these control devices is immaterial for the present invention they have been omitted in the drawings.

Behind plunger head *k* is provided a windlass *w* whose cables *q* are connected with the stuffing box *h* of push bar *f*. This windlass serves for retracting the push bar into its initial position shown in Fig. 1 after it has been thrust forward during the working stroke. Plunger *i* is surrounded by a special supporting frame *l* which carries supporting bell cranks *o* held by spiral springs *p* (indicated by dash-dot lines in Fig. 3) in a position clearly shown at the left hand side of Figs. 2 and 3, in which the free ends of these bell cranks bear against the plunger *i* so that they support the latter from four sides as is shown clearly in Fig. 4. When push bar *f* is retracted these supporting bell cranks are lifted from their plunger supporting positions against the tension of springs *p* by the stuffing box as is shown in Figs. 2 and 3 at the right-hand side of stuffing box *h*. In order to effect this change in position of these bell cranks, the stuffing box is cone-shaped at both ends as shown in detail in Fig. 3 so that it can move these bell cranks when it slides past them in either direction.

Near the right hand end of the supporting frame *l* are provided two supporting rolls *g* which serve for supporting the push bar and the plunger *i* so as to hold these elements in central axial alinement with the drawing axis of the bench. Push bar *f* is provided at its forward end with a tip *e* with which it engages the mandrel *d* on which in turn the hollow blank is placed when the drawing commences. A stop collar *d'* is provided on tip *e* for limiting the length for which the mandrel extends over tip *e*. The hollow end product resulting from drawing the blank *b* is denoted in Fig. 2 with *c*. The supporting frame *l* for the plunger *i* is provided with longitudinal guide grooves *m* (see Fig. 4) in which engage guides *n* provided on the push bar.

The device works in the following manner: At the beginning of the working stroke the push bar tip *e*, mandrel *d* and blank *b* are in the position shown in Fig. 1. If now pressure fluid is supplied through the plunger head *k* and through the plunger *i* into the interior of push bar *f*, the latter moves to the right whereby the push bar tip *e* first engages the mandrel *d*, which latter slides against stop collar *d'*. On further motion to the right the mandrel penetrates into the blank and carries the latter along successively through the several drawing dies *a* in which the blank is reduced to size emerging from the last die at the right hand end of Fig. 2 in elongated form *c*. The push bar has now completed its work stroke and has thereby run through all drawing dies *a*. During this stroke bell crank *o*, in the manner described hereinbefore, after first sliding with their inner ends along on the push bar *f* and after being lifted when the stuffing box passes them, finally assume the position shown at the left hand end of Fig. 3 in which their inner ends rest against the plunger *i*, supporting the latter in central position. In this manner bending of the plunger due to its own weight and due to the buckling forces exerted by the pressure fluid against its annular inner end surface is prevented. In order to secure an effective support of the plunger in this manner, the supporting bell cranks *o* are spaced along the plunger length at uniform intervals as is shown in Fig. 2. While in the present illustration a simple bell crank form of these supporting elements *o* is shown, their form may vary to suit the particular construction of the bench, the more or less diagrammatic illustration of Fig. 3 of the functioning of these supports merely indicating the general idea of the provision of movable supports for the plunger.

The hollow push bar is stopped at the end of its outward thrust so that it may not slide off the plunger. This may be accomplished by any suitable means, for instance by the guide rolls *g* against which the bar stuffing box abuts.

After this work stroke the windlass *w* is now set into action and pulls the push bar back to the left into the position shown in Fig. 1. This retraction may be accelerated by suitably connecting the hollow plunger *i* during this period to a suction device which draws the pressure fluid out of the push bar. Near the end of the return stroke the speed of the push bar may gradually be retarded by suitably throttling the outflow of the pressure medium.

It will be seen that in this manner, during the work stroke as well as during the return stroke and during the retardation of the speed during the return stroke, the push bar is at all times subject solely to tensile stresses, and is thus prevented from buckling. It is, of course, not always necessary to support the plunger by means such as are described with reference to Figs. 1 to 4, depending entirely on the diameter and length of the plunger. In case of small diameters and great lengths such supports will always be necessary.

With these hollow and comparatively light cylindrical push bars according to this invention all sorts of tubes can be very easily drawn with much thinner walls than is possible by the methods used heretofore. Furthermore, this novel push bench besides is particularly suited for drawing of tubes of very great length, also in case of comparatively small diameter tubes. Furthermore, in case of already drawn or rolled tubes the diameter and wall thickness can be easily changed in one stroke by means of a number of successively spaced drawing dies, and in one heat. Of course, this push bench may also be used for cold drawing.

Since push benches operated according to the present invention by a pressure medium admit of longer strokes for a given bench length than can be realized with the present day benches, the drawing dies may be replaced also by drawing rolls, the arrangement of which usually demands a greater overall length of the machine bed. Owing to the much shorter bench length required according to the present invention the use of drawing rolls would not involve an inconvenient overall length of the bench.

The manner in which drawing rolls may be arranged in place of dies is shown in Fig. 5 in an enlarged cross-section through a modified push bench. In this figure **20** represents the bench bed in which are journalled two pairs of parallel shafts **21** and **22**. The shafts of each pair are disposed on diametrically opposite sides of the blank **23** to be drawn or rolled, and the two shaft pairs are disposed at right angles to one another as shown. The shafts of each pair carry gear wheels which are in mesh with one another. Thus for instance the pair of meshing gears **24** is mounted on the shaft pair **21** and the pair of meshing gears **25** is mounted on the shaft pair **22**. The shafts of each pair carry suitably profiled rolls which surround the blank **23** as is shown in Fig. 5, where the rolls 26 are driven by the shaft pair 21 and the rolls 27 are driven by the shaft pair 22. Each shaft pair is driven by a positive drive 28, 29 respectively through an overrun coupling 30, 31 respectively. This overrun coupling is provided for each shaft pair in order to prevent during the rolling operation, and in case the speed of the push bar should not exactly coincide with the peripheral speed of the rolls, undue sliding movement between the tube and the peripheral surfaces of the positively driven rolls. Through the overrun clutches it becomes possible for the rolls to permit the free forward motion of the blank due to the pushing by the push bar. These overrun clutches are of standard construction, and their details are therefore omitted from the description. By the provision of such overrun clutches a higher output becomes possible without any danger of tearing the blank, and without the production of thicker portions in the blank wall in the proximity of the blank ends which frequently occur in the ordinary type of reducing mill. It is, of course, also possible to equip a push bench such as is shown in Figs. 1 through 4 with drawing dies as well as with rolls, such as are shown in Fig. 5. When positively driven rolls such as are shown in Fig. 5 are employed it may be of advantage to adapt the maximum working pressure of the pushing device to the admissible tensile strength of the tube to be drawn.

I claim:

1. A tube push bench comprising a bench bed having at least one die element fixed on it in axial alinement with the drawing axis of the bench, and through which the blank is pushed, a hollow cylindrical push bar closed at its front end and having means for supplying pressure fluid from the rear end to its interior, so that the effective force of the pressure fluid acts directly against the interior of the bar front end, said bar being arranged in axial alinement with said die element to follow the blank through the die element, and a mandrel disposed at and extending a suitable distance over the front end of said bar and shaped to operatively engage said blank, to push and follow it together with said push bar through said die element.

2. A tube push bench comprising a bench bed having at least one die element fixed on it in axial alinement with the drawing axis of the bench, and through which the blank is pushed, a hollow cylindrical push bar closed at its front end and actuated by a pressure fluid supplied from the rear end to its interior and arranged in axial alinement with said die element to follow the blank through the die element, and a mandrel disposed at and extending a suitable distance over the front end of said bar and shaped to operatively engage said blank to push and follow it together with said push bar through said die element, and a fixed plunger disposed in said push bar for guiding the bar during its movement through said die element.

3. A tube push bench comprising a bench bed having at least one die element fixed on it in axial alinement with the drawing axis of the bench, and through which the blank is pushed, a hollow cylindrical push bar closed at its front end and actuated by a pressure fluid and arranged in axial alinement with said die element to follow the blank through the die element, and a mandrel disposed at and extending a suitable distance over the front end of said bar and shaped to operatively engage said blank to push and follow it together with said push bar through said die element, and a fixed hollow plunger disposed in said push bar for guiding the bar during its movement through said die element and for supplying pressure fluid into said bar, whereby the effective force of the fluid acts directly against the interior of the front end of the bar, and a frame fixed to said bed and surrounding said push bar and plunger, for supporting said latter elements in their axial alinement.

4. A tube push bench comprising a bench bed having at least one die element fixed on it in axial alinement with the drawing axis of the bench, and through which the blank is pushed, a hollow cylindrical push bar closed at its front end and actuated by a pressure fluid and arranged in axial alinement with said die element to follow the blank through the die element, and a mandrel disposed at and extending a suitable distance over the front end of said bar and shaped to operatively engage said blank, and a fixed hollow plunger disposed in said bar for guiding the bar during its movement through said die element and for supplying pressure fluid into said bar, whereby the effective force of the fluid acts directly against the interior of the front end of the bar, a frame fixed to said bed and surrounding said bar and said plunger, and yielding guide lugs for said plunger movably arranged in said frame and spaced along the length of said plunger, for supportingly engaging the portions of said plunger exposed by the push bar when the latter is thrust through the die element during the drawing operation.

5. A tube push bench comprising a bench bed having a plurality of ring dies spaced along the bench bed in axial alinement with the drawing axis of the bench, and through which the blank is pushed, a hollow cylindrical push bar closed at its front end and having means for supplying pressure fluid from the rear end to its interior, so that the effective force of the pressure fluid acts directly against the interior of the bar front end, said bar being arranged in axial alinement with said die element to follow the blank through the die element, and a mandrel disposed at and extending a suitable distance over the front end of said bar and shaped to operatively engage said blank, to push and follow it together with said push bar through said dies.

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