J. F. GAIL.

MACHINE FOR BENDING TUBES.

APPLICATION FILED JULY 19, 1909.

957,199. Patented May 10, 1910.

4 SHEETS—SHEET 1.

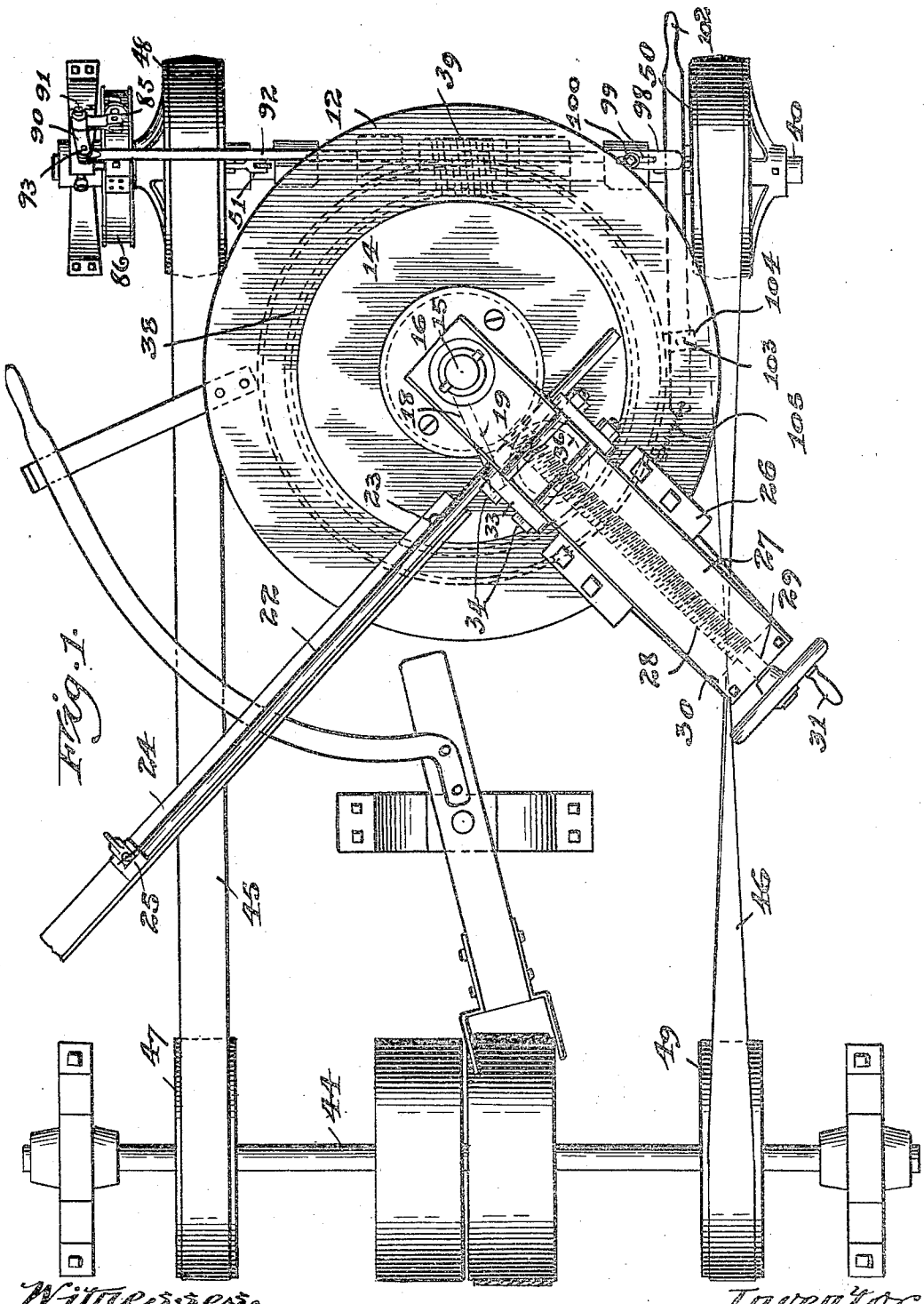

Fig. 1.

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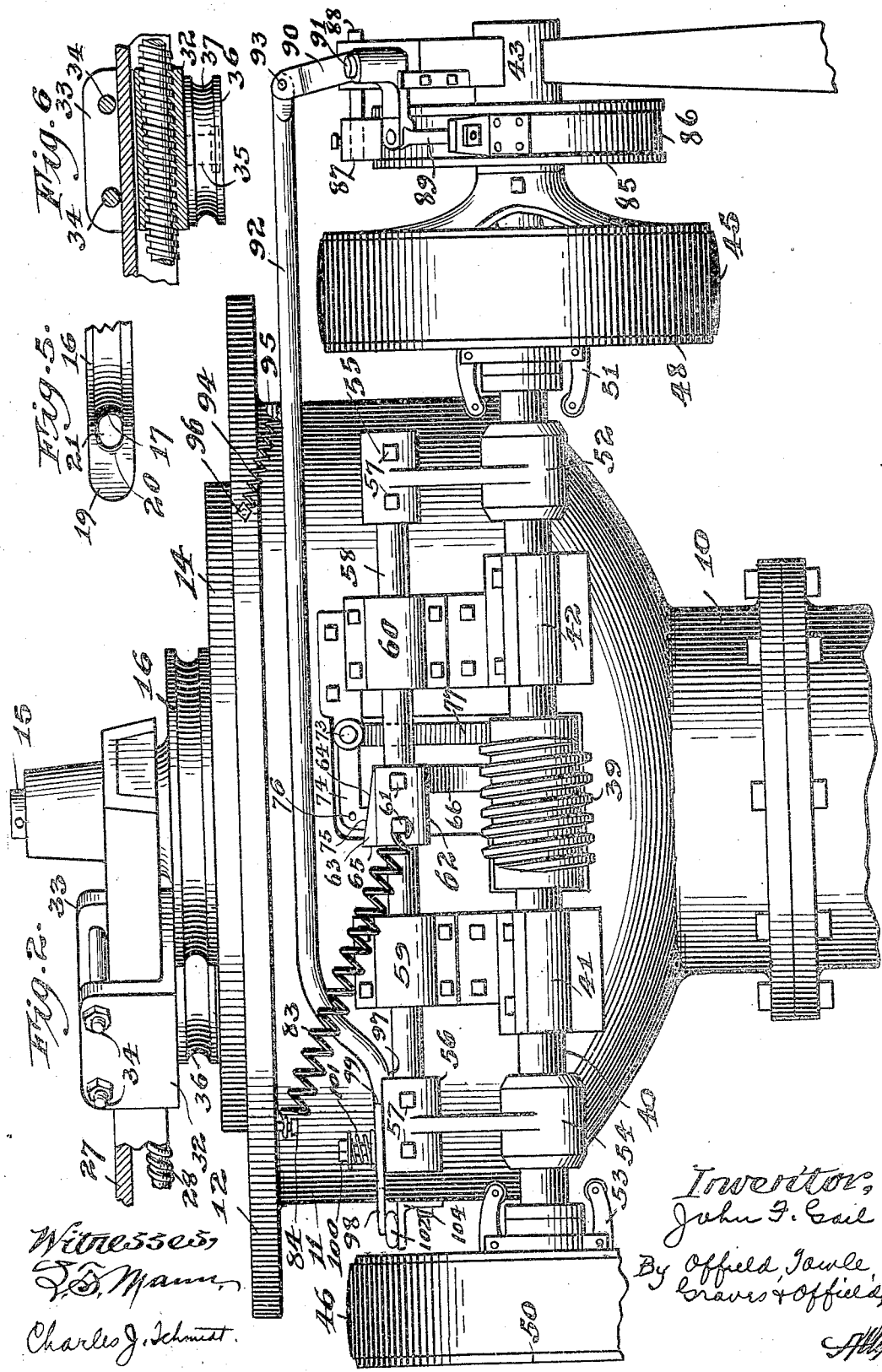

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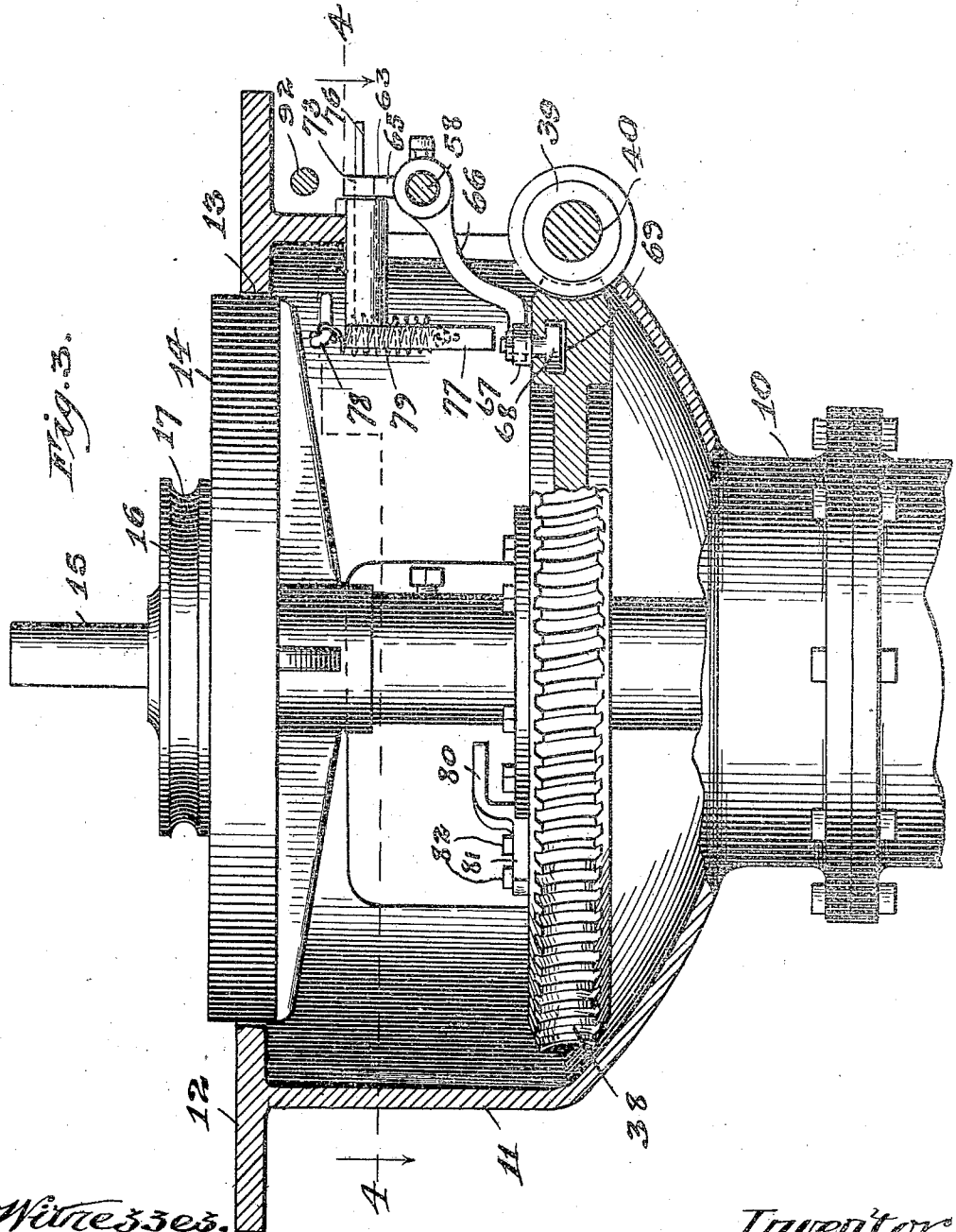
Fig. 3.



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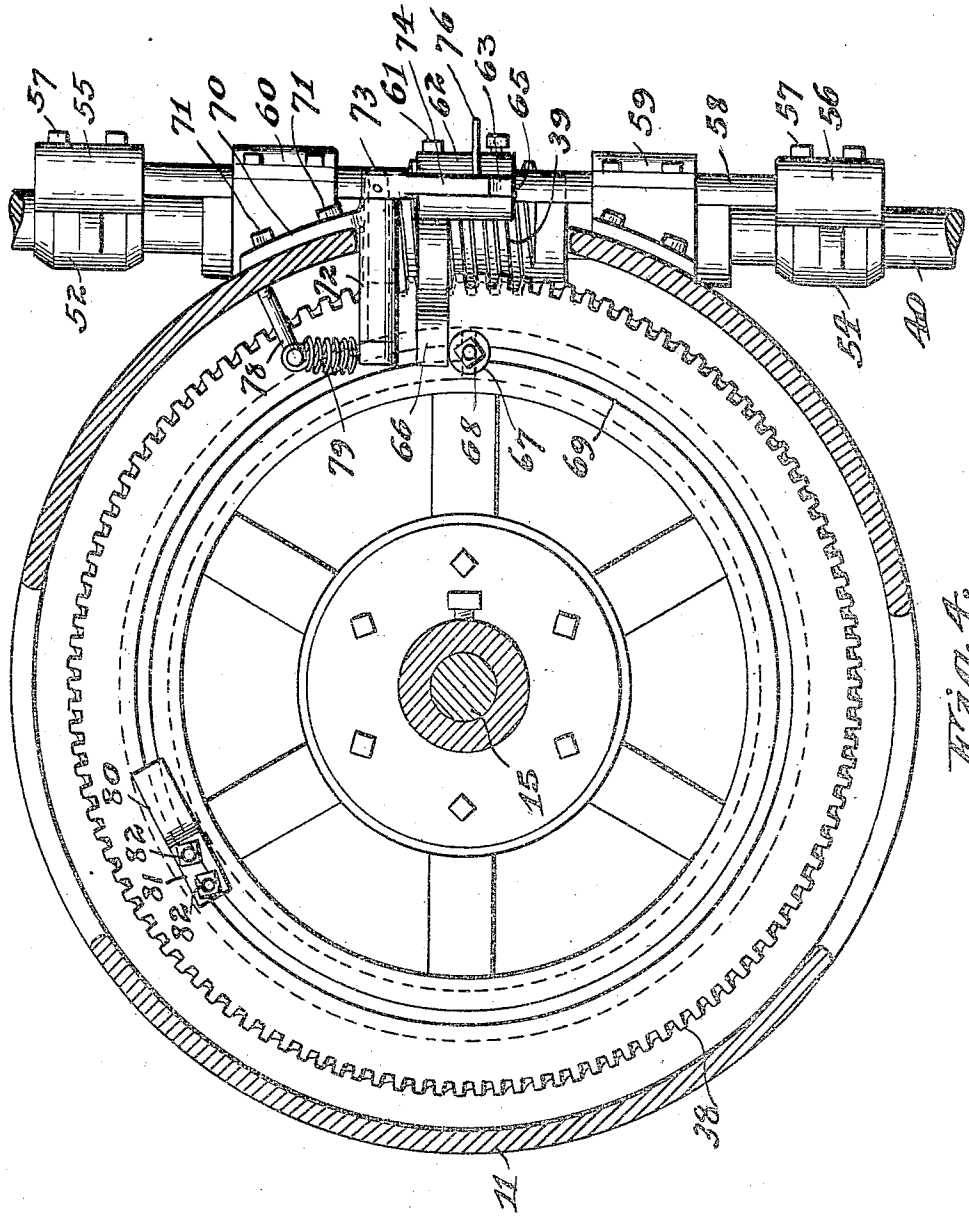

Fig. 4.

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UNITED STATES PATENT OFFICE.

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MACHINE FOR BENDING TUBES.

957,199. Specification of Letters Patent. Patented May 10, 1910.

Application filed July 19, 1909. Serial No. 508,340.

To all whom it may concern:

Be it known that I, JOHN F. GAIL, a citizen of the United States, residing at Kenosha, in the county of Kenosha and State of Wisconsin, have invented certain new and useful Improvements in Machines for Bending Tubes, of which the following is a specification.

This invention relates to machines for bending tubes, pipes and the like such as are at the present time used to a considerable extent in the manufacture of metallic bedsteads.

One main aim and object is to provide a machine of this character which when properly adjusted will automatically bend an inserted tube or pipe to the desired curvature and degree, and the parts of which will then return, without manipulation on the part of the operator, to their original or initial positions ready to receive and bend another piece or section of tube.

In the accompanying drawings, forming a part of this specification, I have illustrated a preferred and desirable embodiment of the invention, and throughout the various views like reference characters refer to the same parts.

In the drawings—Figure 1 is a plan view of one embodiment of the invention; Fig. 2 is a front elevation with parts broken away; Fig. 3 is a substantially central vertical section with parts omitted; Fig. 4 is a horizontal section on line 4—4 of Fig. 3, the parts being viewed in the direction indicated by the arrows, and with the same parts omitted; Fig. 5 is an edge view of a portion of the rotary bender and the holder secured thereto; and Fig. 6 is a vertical section illustrating the means for adjusting the roller which maintains the pipe or tube against the rotary bender.

Referring to the drawings, it should be noted that the machine has a central hollow post or standard 10 supplied at its upper end with an apertured enlargement 11 having at its top an annular stationary horizontal table 12 surrounding a comparatively large central round opening 13 in which is fitted and adapted to turn a cylindrical rotary table 14 mounted on a vertical shaft 15, the top surface of such revolving table being disposed somewhat above the top face of the part 12, as indicated in Figs. 2 and 3. Also fixed to the upright shaft 15 above the table 14 is a detachable round bender 16 having its edge grooved or concaved at 17 to conform to the outer surface of the tube or pipe to be operated upon. As is shown in Fig. 1, the bender is slotted at 18 to accommodate a holder 19 (Figs. 1 and 5) apertured and curved at 20 to provide between the parts 16 and 19 a passage 21 through which the section of tube or pipe 22 may be passed preliminary to the bending operation.

Fastened to the rotary table 14 at 23 and revoluble therewith I provide an angle bar support 24 (Fig. 1) equipped with an adjustable gage or abutment block 25 of any suitable construction, and which is adapted to properly position the tube or pipe 22 for bending.

To the stationary annular table 12 is bolted a suitable support or bracket 26 (Fig. 1) which assists in supporting the outer portion of a radially-extended bar 27 of inverted channel shape in cross-section, as is indicated in Fig. 2, the inner end of such bar being apertured to receive the vertical shaft 15, such inner end of the bar, as is illustrated, fitting on said shaft above the rotary bender 16. In the interior of and extended longitudinally of the comparatively heavy supporting bar 27 is a threaded shaft 28 having a bearing at 29 at the outer end of the bar in any suitable block 30, the projecting end of the shaft being equipped with a rotary hand wheel 31 (Fig. 1). The elongated screw 28 passes through and engages the threads of a traveling nut 32 (Fig. 6) having a pair of upstanding ears or plate portions 33 connected together above the bar 27 by a pair of bolts 34, this nut having interiorly mounted on its under surface on a stud or pin 35 a roller 36 concave at 37 on its outer edge similar to the rotary bender 16. It will, therefore, be apparent that although the bender 16 is adapted to turn during the bending operation, the bar 27 and the parts carried thereby remain stationary, the roller 36 which is adapted to engage the outer surface of the tube or pipe being adjustable toward and from the bender by turning the handle 31 and the screw-shaft 28 fixed thereto.

As is clearly indicated in the various figures, the shaft 15 has fixed thereto, within

the portion 11 of the machine, a comparatively large worm wheel 38, the teeth of which mesh with a worm 39 fixed to a main driving shaft 40 extended across the front of the machine and rotatable in bearings 41, 42 and 43, this shaft being capable of being driven from a rear driving shaft 44 through either one of a pair of belts 45 and 46, the latter of which is crossed, as indicated. The plain belt 45 takes around a pulley 47 on the driving shaft 44 and a pulley 48 loosely rotatable on shaft 40, while belt 46 engages pulley 49 on shaft 44 and another loose pulley 50 on the front main shaft 40.

Pulley 48 is capable of being operatively connected to shaft 40 by an internal clutch mechanism 51 which may be rendered active by the sliding clutch sleeve 52 on shaft 40 being shifted to the right as the parts are viewed in Fig. 2. Pulley 50 may be likewise coupled to shaft 40 by similar clutch mechanism 53 which may be rendered active by a corresponding clutch sleeve 54 slidable longitudinally on the shaft 40, and when shifted to the left, as the parts are viewed in Fig. 2, being capable of clutching the pulley to the shaft. These clutch sleeves 52 and 54 are each supplied with a sleeve 55 and 56, respectively, integral therewith and fixedly fastened by set screws 57 to the opposite ends of a cylindrical clutch rod or shaft 58 slidable longitudinally in a pair of suitable bearings 59 and 60. This clutch rod has fixed thereto by set screws 61 a sleeve 62 located between the bearings 59 and 60, such sleeve having at its top a fin 63 having an inclined or beveled top surface 64 and an abrupt or vertical end surface or shoulder 65. The sleeve also has an integral depending inwardly-extended arm 66 which projects into the interior of the machine frame or casing 11 into the path of travel of the roller 67 on a bolt 68 adjustable in an undercut annular groove 69 on the top face of the worm 38.

As is indicated in Figs. 2, 3 and 4, a bracket 70 is bolted to the exterior of the pillar or standard 11 at 71 and is supplied with a bearing 72 extending into the interior of the standard, such bearing accommodating a rock-shaft 73 having fixed to its outer end a latch 74 with a beveled end 75 adapted to ride on the surface 64, and also supplied with an outstanding pin or handle 76. The other end of this rock-shaft has a depending arm 77 connected to a pin or support 78 projecting inwardly from the interior surface of the casing 11 by a coil contractile spring 79, which, as will be readily understood, acts on the latch 74 to turn the same downwardly. As is indicated, the lower end of this arm 77 is in the path of travel of the elevated portion 80 of a block 81 likewise adjustable in the undercut curved groove 69 and capable of being held in adjusted position by a pair of bolts 82. On the outside of the machine a comparatively powerful coil contractile spring 83 (Fig. 2) is connected at one end to a pin 84 extending downwardly from the under surface of the stationary table 12, and at its other end to one of the set-screws 61 of the sleeve 62, tending, as will be obvious, to shift the clutch rod 58 and clutch sleeves 52 and 54 to the left.

Adjacent to the bearing 43 the main shaft 40 is provided with a brake wheel 85 encircled by a brake strap or band 86, one end of which is fixed at 87 to a suitably-supported stud 88, while the other end is connected by a link 89 to one arm of a bell-crank 90 fulcrumed on a suitable support at 91. It should, therefore, be apparent that by rocking this bell-crank the brake strap may be thrown on to or off of the brake wheel, thereby rendering the brake active and inoperative. A comparatively long brake rod 92 is pivoted at 93 to one arm of the bell-crank and is normally pulled to the left as the parts are viewed in Fig. 2 by a contractile spring 94 connected to the rod at 95 and to the standard of the machine at 96. The left-hand end of this rod is bent downwardly somewhat and is provided with a latch or hook 97 adapted to co-act with one end of the sleeve 56, the portion of the rod 92 above this sleeve being flattened at 98 and supplied with an elongated slot 99 through which passes upwardly a screw 100 threaded into the sleeve and having interposed between the head of the screw and the flat portion 98 of the brake rod a small expansion spring 101 which acts on the rod to throw the latch or hook 97 downwardly into sleeve-engaging position, as shown in Fig. 2.

A controlling lever or handle 102 is fulcrumed at 103 on a suitable bracket 104 mounted on the outside of the standard, the front portion of such lever or handle being disposed beneath the part 98 of the brake rod and normally shifted to the left, as the parts are viewed in Fig. 2, by a coil spring 105 connected to its rear end and to the post or standard of the machine.

The operation of this improved mechanism is practically as follows: Assuming that the proper bender 16 and its holder 19 are in position on the shaft 15, that the roller 36 is in proper adjusted position, and that the roller 67 and the block 80 are properly placed and fixed in groove 69, the workman inserts the pipe or tube 22 to be bent between the bender 16 and roller 36 and through the passage 21 between the holder and bender until the end of the pipe or tube strikes the gage or stop 25, which has been fixedly placed in adjusted position. The operator then grasps the handle 102 and lifts the same slightly, the mounting of such handle lever

permitting such movement. This raising of the handle acts to lift the brake rod 92 sufficiently to free the latch 97 from the end of sleeve 56, whereupon the spring 94 contracts, shifting the rod 92 to the left and rocking the bell-crank 90 on its fulcrum in the direction to loosen the brake strap on the brake wheel. The workman then turns this handle 102 on its fulcrum to the right, the handle striking the end of the sleeve 56 and sliding the clutch rod 58 in opposition to the contractile action of spring 83 sufficiently to cause the sleeve 52 to render the clutch 51 active, whereupon belt 45 rotates the shaft 40 and worm 39 in the proper direction to cause the bending of the pipe or tube. It is to be understood that when the rod 58 is thus shifted to the right, the clutch sleeve 52 is held in its shifted position by engagement of the latch 74 with the shoulder or end wall 65, the latch, as will be readily understood, traveling up the incline 64 during the sliding of sleeve 62 with the clutch rod 58. As soon as the pulley 48 is clutched to the shaft 40 the rotation of the latter is transmitted through the worm 39, worm wheel 38, and shaft 13 to the bender 16 and holder 19, the two latter and the supporting bar 24 turning (clockwise as viewed in Fig. 1) with the shaft and causing the bending of the tube or pipe which is held snugly against the curved edge of the bender by the coöperating roller 36. When the proper amount of bending has been accomplished, the block 80 strikes the arm 77, causing the lifting of latch 74, thereby permitting the clutch rod 58 and attached parts to be slid to the left under the action of spring 83, thereby unclutching the pulley 48 from the shaft and stopping the forward rotation of the bender. The movement of clutch rod 58 to the left at this time is sufficient to cause the clutch sleeve 54 to render the clutch 53 active, thereby coupling the pulley 50 to shaft 40 and causing a reverse rotation of the bender, holder, and support 24. It should also be noticed that when this clutch rod 58 is slid to the left to clutch the pulley 50 to shaft 40 it moves sufficiently to permit the hook or latch portion 97 of the brake rod 92 to engage the right-hand end of sleeve 56. The parts maintain this relation until the bender has returned to its initial or former position, at which time the roller 67 on the top of worm 38 strikes the arm 66 and pushes the sleeve 62, the clutch rod 58, both clutch sleeves 52 and 54, and the brake rod 92, which is operatively connected to the clutch rod by the hook or latch 97, in opposition to the action of spring 83 and sufficiently to render both clutch mechanisms inoperative and to throw the brake into action, thereby abruptly stopping the rotation of all the parts, whereupon or previously the bent tube may be withdrawn or extracted from the machine. The parts are now in the positions indicated in Fig. 2 and are ready for a repetition of the operation described above.

Having herein set forth in detail the construction and operation of this particular embodiment of my invention, it is to be understood that the invention is not limited to the precise and exact structural features herein detailed, because they may be modified to a considerable extent without departure from the substance and heart of the invention and without sacrificing any of its benefits and advantages.

I claim:

1. In a machine of the character described, the combination of a rotary table, a gage secured to and rotatable with said table, a bender rotatable with said table, means to maintain the piece against said bender, means to compel the piece to turn with said table, means to rotate said bender a predetermined amount, and means to automatically return said bender to its initial position after having completed said predetermined rotation, substantially as described.

2. In a machine of the character described, the combination of an oscillatory bender, a shaft, means connecting said shaft to said bender whereby rotation of the former is transmitted to the latter, a brake for said shaft, a pair of oppositely-rotating pulleys loosely mounted on said shaft, a pair of clutches adapted to couple either of said pulleys to said shaft, a clutch rod connecting operating members of said clutches, a handle to shift said clutch rod to render one clutch operative and the brake inactive, means to lock said clutch rod in such shifted position, means acting on said clutch rod to shift the same to render the other clutch active, means to unlock said clutch rod when said bender has completed a predetermined angular movement, thereby permitting the second clutch to become operative and cause a reverse turning of said bender, and means to move said clutch rod into neutral position with both clutches out of action and to throw said brake into action when the bender has returned to its initial position, substantially as described.

3. In a machine of the character described, the combination of an oscillatory bender, a shaft, means connecting said shaft to said bender whereby rotation of the former is transmitted to the latter, a brake for said shaft, a pair of oppositely-rotating pulleys loosely mounted on said shaft, a pair of clutches adapted to couple either of said pulleys to said shaft, a clutch rod connecting operating members of said clutches, a brake rod connected to said brake, a spring acting on said rod tending to throw said brake out of action, means on said brake rod adapted to operatively connect said clutch rod and brake rod, a handle to shift said clutch rod

to render one clutch operative and the brake inactive, means to lock said clutch rod in such shifted position, means acting on said clutch rod to shift the same to render the other clutch active, means to unlock said clutch rod when said bender has completed a predetermined angular movement, thereby permitting the second clutch to become operative and cause a reverse turning of said bender, and means to move said clutch rod into neutral position with both clutches out of action and to throw said brake into action when the bender has resumed its initial position, substantially as described.

4. In a machine of the character described, the combination of an oscillatory bender, a driving shaft, means connecting said shaft to said bender whereby rotation thereof is transmitted to the bender, forward and reverse drive pulleys loosely mounted on said shaft, a number of clutches adapted to couple either of said pulleys to said shaft, a clutch rod connecting operating members of said clutches, a handle to shift said clutch rod to render one clutch operative, latch mechanism to lock said clutch rod in its shifted position, cam mechanism controlled by the operation of the oscillatory bender to unlatch said latch mechanism from the clutch rod after a period of movement of the oscillatory bender, means for automatically rendering the second clutch mechanism effective upon release of the latch mechanism whereby the oscillatory bender is driven in reverse direction, and cam mechanism controlled upon reverse movement of said oscillatory member to shift the clutch rod back to neutral position after a predetermined interval of reverse movement of the oscillatory bender.

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