

June 26, 1934.

J. H. ABRAMSON ET AL

1,964,550

BENDER

Filed July 7, 1930

3 Sheets-Sheet 1

Fig. 1.

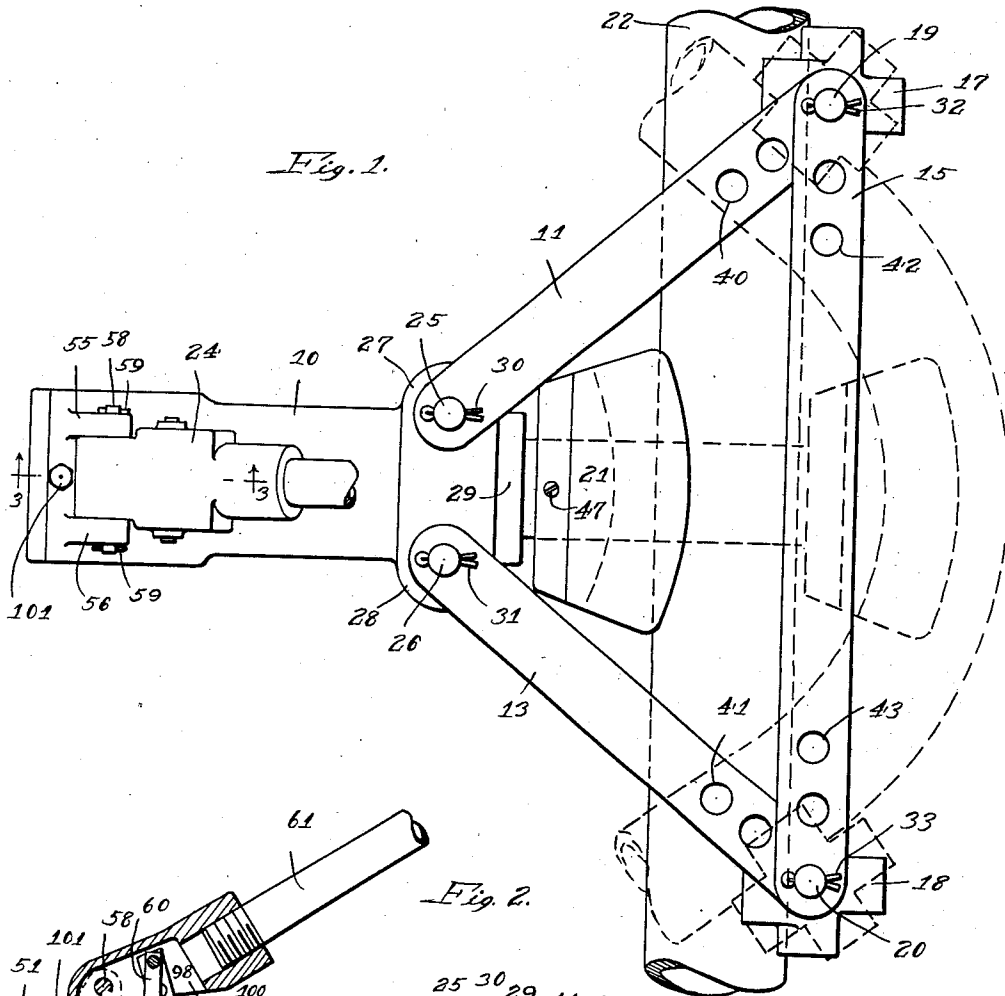
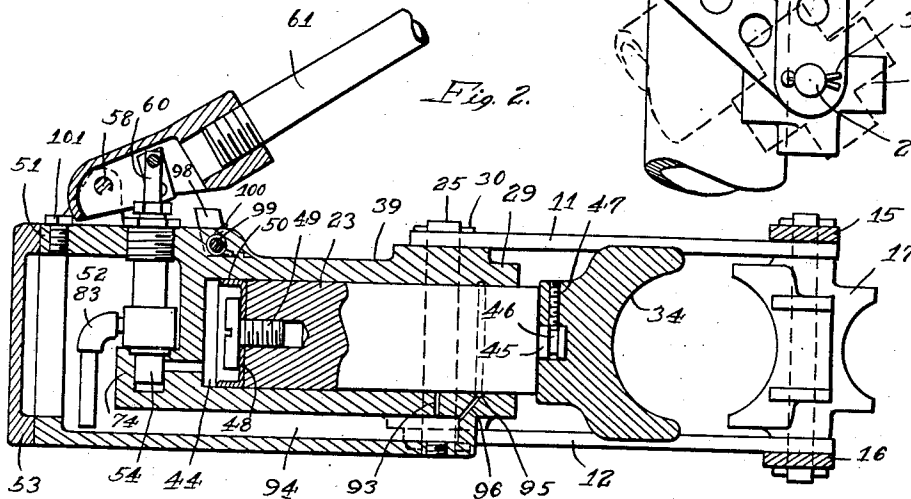


Fig. 2.



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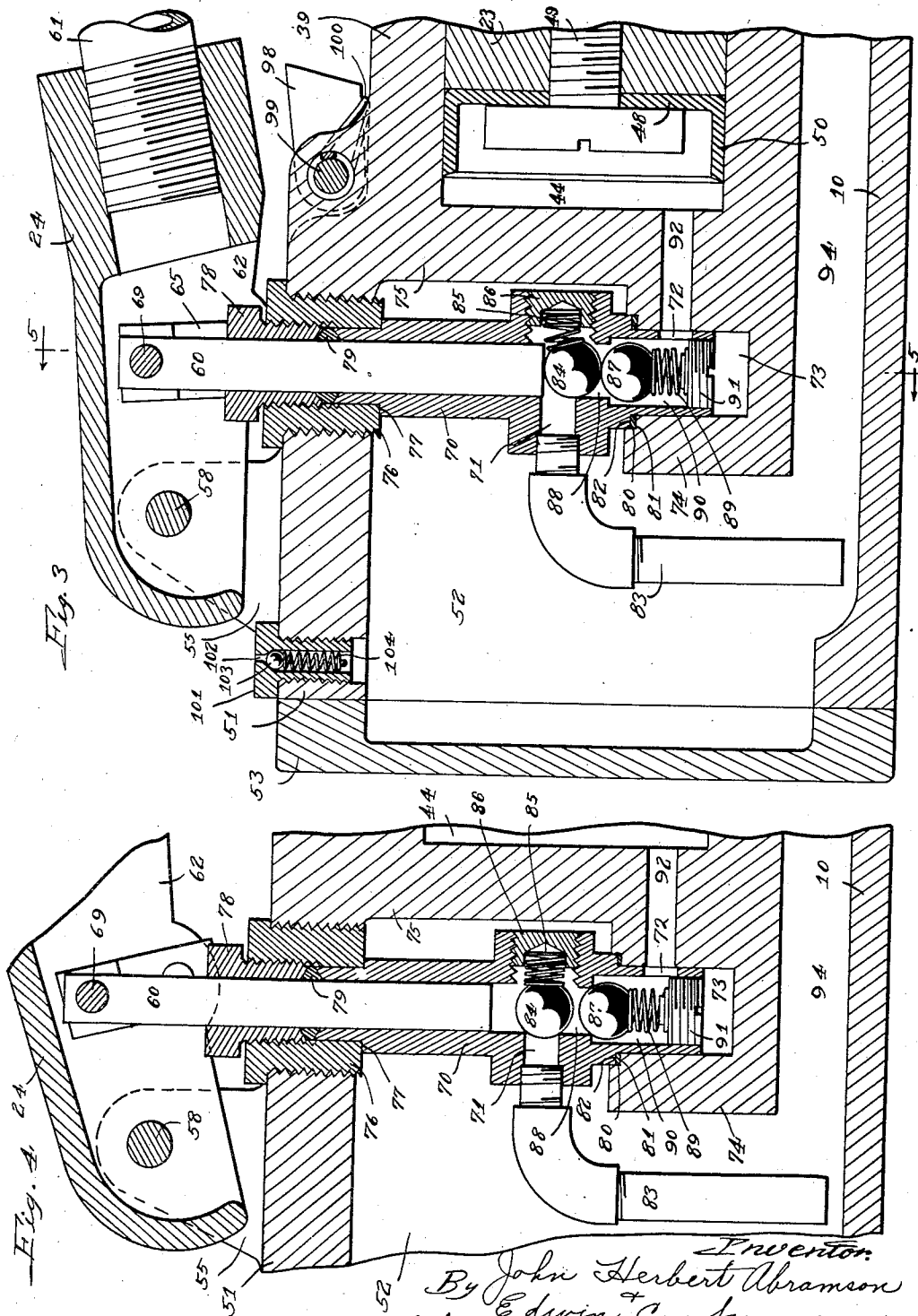
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 5

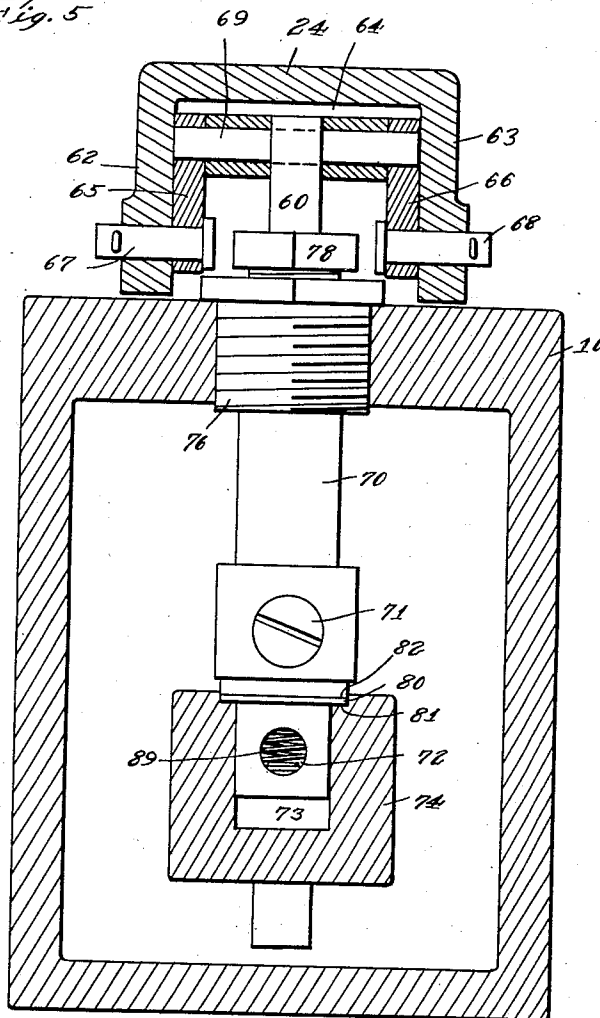


Fig. 6.

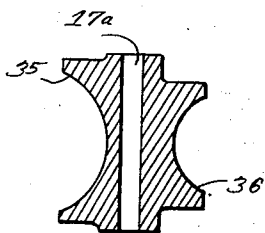
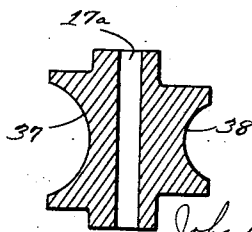


Fig. 7



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UNITED STATES PATENT OFFICE

1,964,550

BENDER

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Application July 7, 1930, Serial No. 466,094

14 Claims. (Cl. 153—38)

Our invention relates to benders for bending pipes, rods, bars and the like, and has special reference to a portable hydraulic bending device more particularly for the bending of metal conduits employed in electric wiring activities.

In the past it has been possible to bend metal conduits only with the greatest difficulty when the operator desires to do so at the point of use. Where bending is desired it may, of course, be accomplished at the factory by the usual hot bending methods, or through the customary large cold bending machines, but during the installation of this conduit it is many times desirable for the workman to bend the metal. Because of the usual thin wall of this pipe it has a marked tendency to flatten out when bent by improper methods.

We have, therefore, aimed to provide an improved pipe bending device which may be carried about by the workman from place to place with relative ease.

Another object of our invention is the provision of a portable pipe bending device which may be operated with a minimum amount of physical effort on the part of the workman.

A further object of the invention is the provision of a portable pipe bender wherein the bending movement takes place parallel to the supporting surface whereby any length of pipe may be bent and wherein means are provided on the top of the bender for actuating the same.

We have also aimed to provide a portable pipe bending device having a hydraulically operated piston and a small fluid pump adapted to be actuated by a workman to provide hydrostatic pressure for operating the piston in its bending stroke.

A further object of the invention is to provide a hydraulic pipe bender having simple and efficient means for relieving the pressure and permitting the flow of liquid from the cylinder chamber.

Another object of the invention is the provision of a pipe bender having an improved injector for transferring the liquid from the well to the cylinder.

A still further object of the invention is the provision of a combined injector and pressure releasing mechanism.

We have still further aimed to provide a pipe bender having improved means for holding the pipe at the points between which the bend is to be made.

A still further object of the invention is the provision of improved means for actuating the piston of the fluid injector.

Other objects and attendant advantages will become apparent to those skilled in the art from the following description and the accompanying drawings, in which—

Figure 1 is a top view of our improved pipe bender showing a section of pipe in a position to be bent and in dotted lines the relative position of the parts after bending has occurred.

Fig. 2 is a vertical section through our improved bender showing the piston in its retracted position.

Fig. 3 is a section on the line 3—3 of Fig. 1 showing the injector in section in a position to discharge fluid from the cylinder chamber to the well.

Fig. 4 is a section on the line 3—3 of Fig. 1 showing the injector in its pumping position.

Fig. 5 is a section on the line 5—5 of Fig. 3.

Fig. 6 is a section through one of the holding blocks; and

Fig. 7 is a section through a holding block at right angles to that shown in Fig. 6.

The invention consists, in a general way, of a body 10 having two pair of links designated by 11 and 12 and by 13 and 14, the link 14 not appearing on the drawings but occupying the same relation to link 13 as link 12 occupies with respect to link 11, the two pair being connected at their outer ends by a pair of cross bars 15 and 16. Holding blocks designated generally by 17 and 18, are pivotally supported upon bolts 19 and 20, which also serve to connect the links of each pair at their outer end and receive opposite ends of the cross bars 15 and 16. The holding blocks 17 and 18 are adapted to cooperate with a shoe 21 to receive a pipe 22 therebetween which is arranged to be bent through a desired curvature.

The shoe 21 is supported on the outer end of a piston 23 adapted to be projected from the end of the body 10 by operation of an injector lever, designated generally by the numeral 24, positioned upon the body 10. Thus a pipe or bar to be bent, as for example the pipe 22, is positioned between the holding blocks 17 and 18 and the shoe 21 with the links 11 and 13 on one side of the pipe and the links 12 and 14 on the other side thereof. Operation of the injector lever 24 causes the piston 23 to move outward forcing the shoe 21 against the pipe whereby it is bent through an angle between the blocks 17 and 18, the blocks rotating through an angle during this bending movement, all as shown in dotted lines in Fig. 1. When the piston 23 is retracted into the body 10 the pipe 22 in its bent condition may be moved from between the links.

Special attention is directed to the fact that the parts are so arranged that the bending operation occurs in a plane parallel to the support and in close proximity thereto.

We will now proceed to describe the invention more in detail, like numerals being employed to designate like parts throughout the drawings.

The inner ends of the links 11, 12, 13 and 14 are pivotally secured to the body 10 through pins 25 and 26 passing through the body 10, the body being somewhat enlarged at 27 and 28 near the piston end 29 to lend the structure sufficient strength to withstand the stress imposed on the pins 25 and 26. The end of the link 11 is provided with an opening to pivotally receive the pin 25 and is positioned on the pin at the upper side of the body 10 through a cotter pin 30, while the link 12 is positioned in like manner on the lower side of the body 10. Similarly links 13 and 14 are positioned on opposite ends of the pin 26 at opposite sides of the body 10 by means of cotter pins 31. Thus the links 11 and 12 and the links 13 and 14 project outward from the body 10, the links of each pair lying substantially parallel and in spaced relation. The outer ends of the links 11 and 12 are connected by the pin 19 and have the holding block 17 interposed therebetween. In like manner the outer ends of the links 13 and 14 are connected by the pin 20 and have the holding block 18 interposed therebetween on pin 20. Cotter pins 32 and 33 serve to maintain the links on the pins. Cross bars 15 and 16 are supported on the pins 19 and 20 at each end and are positioned on opposite sides of the holding blocks 17 and 18. The blocks 17 and 18 being rotatably positioned upon the pins 19 and 20 are free to rotate about the pins as the shoe 21 moves the center point of the pipe 22 inward.

In order to prevent any substantial amount of flattening of the pipe 22 we have found it advisable to provide a plurality of shoes 21 having different curvatures on the working face 34 thereof to correspond with different sized pipes. In like manner the holding blocks 17 and 18 are each provided with a plurality of working faces 35, 36, 37 and 38, as clearly shown in Figs. 6 and 7. The holding blocks being rotatable upon the pins, any one of the working faces thereof may be brought into operative relation with the pipe. The working faces are each positioned at such a distance from the central openings 17a that the center of the pipe to be bent will be a fixed distance from the opening regardless of the size of the pipe. In the particular instance shown the working face 35 is made for use with three inch pipe, the working face 36 with two and one-half inch pipe, the face 37 with two inch pipe and the face 38 with one and one-half inch pipe. We have found through experiment that in most cases the working face 38, designed particularly for one and one-half inch pipe, may be satisfactorily used in bending pipe substantially smaller, as, for example, three-fourth inch pipe, since the wall thickness of these smaller pipes is relatively great with respect to the diameter. It will be seen that working faces such as shown may be provided for cooperation with any desired size of pipe and we do not intend to limit ourselves to the particular sizes mentioned. In this particular instance four shoes 21 are provided to cooperate with the working faces on the holding blocks in bending four different sized pipes.

A series of holes 40 in the links 11 and 12 and holes 41 in links 13 and 14 are provided near the outer ends thereof to receive the pins 19 and 20

when pipes of smaller diameter are being bent. A series of holes 42 at one end and 43 at the other end of the cross bars 15 and 16 are provided to be used in conjunction with the holes 40 and 41 to receive the pins 19 and 20 whereby the radius of the arc to be bent in the tube between the holding blocks 17 and 18 may be altered. This is desirable in that it permits a shorter stroke of the shoe 21 than would otherwise be possible, since if the blocks were employed in the position shown in Fig. 1 for bending small pipe it would be necessary to project the shoe 21 outward considerably further than shown in order to bend a 90° angle therein.

The portion of the body 10 adjacent to the end 29 is arranged to form a cylinder wall 39 to provide a cylinder chamber 44 in which the piston 23 is adapted to reciprocate and to closely fit the inner walls thereof. The forward end of the piston is provided with a projection 45 having a groove 46 therein adapted to receive a set screw 47 for the purpose of maintaining the shoe 21 securely on the end of the piston 23. The rear end of the piston 23 is provided with a leather cup 48 secured thereto by means of a large headed metal screw 49, the upturned edges 50 of the cup being adapted to closely fit the inner surface of the wall 39 of the cylinder chamber 44 to substantially prevent the passage of fluid along the interface between the piston 23 and the cylinder wall 39.

The rear end 51 of the body 10 is provided with a well 52 adapted to hold a quantity of fluid for the operation of the piston 23. A removable plate 53 is provided to enclose the end of the body 10 and to permit access to an injector designated generally by 54 presently to be more fully described. A pair of ears 55 and 56 are formed integrally on the top of the body 10 near the end 51 thereof and have an injector lever 24 pivotally secured therebetween on a pin 58. Cotter pins 59 in each end of the pin 58 serve to secure the latter in proper position between the ears. An injector plunger 60 is adapted to be operated by oscillation of the lever 24 about the pin 58, a rod 61 being threaded into the injector lever 24 to permit easy movement thereof by the operator.

The injector lever 24 is provided at its lower end with downwardly projecting side walls 62 and 63 adapted to form a recess 64 therebetween. Arms 65 and 66 are pivotally secured against the inner surface of the side walls 62 and 63 through pins 67 and 68 rotatably secured therein. The upper ends of the arms 65 and 66 are provided with suitable openings to support a shaft 69 passing through the injector plunger 60. By this arrangement the plunger 60 is attached to the lever 24 at a relatively high point and the pivotal pin 58 is located relatively close to the body 10 whereby the lever 24 may be positioned close to the body and yet provide a comparatively long stroke for the plunger 60.

Referring now to Figs. 3 and 4 the injector 54 includes an injector tube 70 having an inlet opening 71 and an outlet opening 72. The lower end of the injector tube 70 is positioned in a cylindrical socket 73 formed on the upper side of a projection 74 from a wall 75 separating the cylinder chamber 44 from the well 52. The upper end of the tube 70 is secured in the walls of the body 10 by a bushing 76 threaded to the body 10 and arranged to bear against a shoulder 77 on the outer surface of the injector tube 70. A stuffing box is formed by the sleeve 78 closely fitting the plunger 60 and threaded into the bushing 76 whereby to compress a packing material 79 positioned be-

tween the lower end of the sleeve 78 and the upper end of the injector tube 70. This stuffing box prevents the escape of fluid from the injector along the plunger 60. A leather or other packing ring 80 is positioned within a recess 81 and is adapted to be pressed downward by a shoulder 82 on the outer surface of the injector tube 70 to prevent the passage of fluid therethrough.

The injector is adapted to pump fluid from the well 52 through a pipe 83 and the inlet 71 by operation of the plunger 60. When the plunger 60 is drawn upward the fluid will be drawn into the injector tube 70 through the inlet 71 against the pressure of a ball 84. When the plunger 60 starts its downward movement the ball 84 is pressed firmly over the opening 71 by action of a coil spring 85 bearing against a plug 86, thus preventing egress of the liquid through the inlet 71. Pressure on the fluid in the tube 71 will cause a ball 87, held in position across an opening 88 by a spring 89, to be unseated permitting the fluid to flow through the opening 88 into a lower chamber 90 within which the ball 87 and the spring 89 are secured by means of a threaded plug 91 screwed into the lower end of the injector tube 70. From the chamber 90 the oil moves through the outlet 72 into a passageway 92 connecting the chamber 90 with the cylinder chamber 44. It will be seen that continued operation of the injector will remove fluid from the well 52 and pass it into the cylinder chamber 44. The pressure of the fluid against the end of the piston 23 will cause the piston to move outward along the cylinder. With continued operation of the injector the piston will eventually reach a point at which the fluid in the cylinder chamber may pass from the cylinder chamber, through an opening 93 in the walls thereof and a passageway 94, back to the well 52, thereby releasing the pressure against the end of the piston 23. The outward movement of the piston will be automatically stopped at this point because of this release in pressure. This arrangement prevents accidental displacement of the piston from the end 29 of the body or the accidental breakage of any parts arranged to prevent excessive movement thereof.

A circular depression 95 extends completely around the inner surface of the cylinder wall and serves to collect any of the fluid which may have been forced by the cup 50 along the interface between the cylinder wall and the piston 23. A passageway 96 permits this oil to be returned to the passageway 94 and conducted back to the system.

The passageway 94 extends along the bottom side of the body 10, between the openings 93 and 96 and the well 52, and, since the device is employed in a horizontal position, will normally be filled with fluid and will be the lowest point in the well. For this reason the lower end of the pipe 83 is arranged to extend into this passageway as shown in Figures 2, 3, and 4, so that a major portion of the fluid may be removed from the well by action of the injector.

In order to relieve the pressure in the cylinder chamber 44 with the piston at any point short of the opening 93 and to permit the fluid to be returned from the cylinder chamber to the well 52 we have arranged to permit the plunger 60 to be moved downward beyond its normal stroke whereby the lower end thereof strikes the ball 84 causing it to be moved away from the inlet 71 against the upper end of the ball 87 and to move the ball 87 downward slightly thereby opening the passageway 88. In this manner the fluid in

the cylinder chamber 44 may move through the passageway 92, the chamber 90, the opening 88 and out through the inlet 71. This movement of fluid may be caused by manually grasping the shoe 21 and pushing the piston 23 inward, the movement being accomplished with but a small amount of effort. When the ball 84 is forced downward by the lower end of the plunger 80 the spring 85 will be slightly distorted and the parts will occupy substantially the position shown in Fig. 3, the normal positions of the parts being shown in Fig. 4. In order to limit the normal downward movement of the plunger 60 during the operation of the injector we have provided a stop 98 pivotally secured to the top of the body 10 through a pin 99 and arranged to be held in the position shown in Fig. 2 during the normal pumping operation by a spring 100. When fluid is desired to be released from the cylinder the stop 98 is moved against the spring to the position shown in Fig. 3 whereby the injector lever 24 may be moved downward beyond its normal stroke, thereby moving the plunger 60 against the ball 84.

A plug 101 is inserted through the wall of the body 10 into the well 52 and is provided with a small opening 102 against which a ball 103 is securely held by a spring 104. The arrangement is such as to permit air to enter the well 52 when fluid is being pumped therefrom into the cylinder chamber 44 but to prevent the passage of fluid out through the opening 102. The arrangement thus permits the relief of any decrease or increase in pressure which may be formed in the well 52 by the movement of fluid.

In assembling the device the injector 54 is positioned by inserting it through the open end of the body 10. After the injector has been suitably secured in its position, as will be obvious from the drawings, the well 52 is completely filled with a suitable fluid, such for example as oil, and the end 53 is secured over the well 52.

The advantages of our improved construction may be readily apparent to those skilled in the art. We have provided a machine adapted to be used in a horizontal position whereby any desired length of pipe may be bent. We have provided holding blocks having a plurality of bearing surfaces thereon of different curvature adapted to be employed in bending pipe of different diameters whereby flattening thereof by the bending operation is substantially prevented. We have provided means whereby bends of different radii may be had.

The design and construction of the injector employed permits the fluid to be injected into the cylinder chamber and released therefrom through the same means, no separate releasing means being required. The means employed for releasing the fluid is exceedingly simple and convenient of operation and may be manufactured at relatively small cost.

We have provided an exceedingly compact and simple device which may be carried about by the operator from place to place.

We have provided a device wherein no stuffing box is needed at the forward end of the cylinder, in other words the piston itself acts as a connecting rod to the shoe 21 whereby maximum strength is had and a stuffing box is eliminated.

Another marked advantage resulting from our improved construction and arrangement is the greater ease with which the pipe may be bent. The pipe is bent in a position close to the floor and in a direction parallel thereto. Because of this

arrangement it is unnecessary to lift the pipe any distance off the floor or to hold it manually while it is being bent. As a matter of fact, when the length of pipe is very great the ends thereof will usually rest upon the floor because of the bending thereof, due to the elasticity of the pipe. It will be seen also that this construction permits any length of pipe to be bent, since the bending occurs in a direction parallel to the floor and the ends of the pipe are merely moved along the floor during the bending operation. Since the device rests directly on the floor and the injector handle is positioned on the top of the body, the operation thereof is easily accomplished by the operator standing in a position over the device.

We claim:

1. The combination in a portable hydraulic device of the character described of a body having a cylinder, means thereon for holding a pipe at spaced points, a piston adapted to bear against said pipe between said points, and means for urging said piston against said pipe in bending movements including means comprising an injector system within said body and a handle outside said body for injecting fluid into said cylinder to project said piston, and means operable to permit fluid to flow out of said cylinder whereby said piston may be retracted.

2. The combination in a hydraulic device of the character described, of means for holding a pipe at spaced points, a shoe adapted to bear against said pipe between said points, and means for urging said shoe against said pipe in bending and return movements including, a body having a hydraulic cylinder, a piston in said cylinder arranged to be projected therefrom, means for automatically relieving the pressure on said piston to limit the outward movement thereof, means for injecting fluid into said cylinder to project said piston, and means operable to permit fluid to flow out of said cylinder whereby said piston may be retracted.

3. The combination in a hydraulic device of the character described, of means for holding a pipe at spaced points, a shoe adapted to bear against said pipe between said points, and means for urging said shoe against said pipe in bending and return movement including, a body having a hydraulic cylinder, a piston in said cylinder arranged to be projected therefrom, means for injecting fluid into said cylinder to project said piston, means arranged to automatically cause the flow of fluid out of said cylinder when said piston is projected to a predetermined point, whereby to relieve the pressure therein and stop the movement of said piston, and means within said body operable to permit fluid to flow out of said cylinder whereby said piston may be retracted.

4. The combination in a portable pipe bender of the character described adapted to bend a pipe horizontally, of means for holding a pipe at spaced points, a shoe adapted to bear against said pipe between said points, and means for urging said shoe against said pipe in horizontal bending and return movements including, a body having a horizontal cylinder, a piston in said cylinder arranged to be projected therefrom, an injector radially positioned within said body for injecting fluid into said cylinder to project said piston, a manually operable lever on the top of said body arranged to be reciprocated vertically to operate said injector, and means operable to permit fluid to flow out of said cylinder whereby said piston may be retracted.

5. The combination in a hydraulic device of the character described, of a body, a piston arranged to be retracted or projected from one end of said body, a shoe on the outer end of said piston adapted to fit an object to be bent, holding blocks, links connected to said body and arranged to support said holding blocks in any of a plurality of fixed distances from said body, whereby an object to be bent may be interposed between said shoe and said blocks, links for connecting and spacing said blocks in any of a plurality of fixed distances apart, said links providing means whereby bends of different curvature may be produced, and means for projecting said cylinder whereby said shoe is brought into contact with said object between said blocks to laterally displace said object therebetween and produce an arcuate bend therein.

6. The combination in a portable pipe bender of the character described, adapted to bend pipe horizontally, of means for holding a pipe at spaced points a shoe adapted to bear against said pipe between said points, and means for urging said shoe against said pipe in bending and return movements including, a body having a well and a horizontal cylinder, a piston in said cylinder arranged to be projected therefrom, and an injector fixedly positioned within said well arranged to inject fluid from said well into said cylinder to project said piston and to permit fluid to flow from said cylinder into said well whereby said piston may be retracted.

7. The combination in a hydraulic device of the character described, of means for holding a pipe at spaced points, and means for exerting a bending force against said pipe between said points including a body having a well and a hydraulic cylinder, a piston in said cylinder arranged to be projected in bending movement, an injector within said well arranged to move fluid from said well into said cylinder to project said piston, a handle arranged to operate said injector, and means operable by said handle to provide an opening between said cylinder and said well to permit fluid to flow from the former to the latter whereby said piston may be retracted.

8. A holding block having a centrally disposed opening for pivotally supporting the same and a plurality of faces of different curvature adapted to support cylindrical bodies of different sizes being bent, each of said faces being placed a distance from said opening such that the centers of curvature thereof will be substantially the same distance from said opening.

9. In a pipe bending machine a body, a piston having means for exerting a bending force, and means for operating the same including an injector handle for reciprocating an injector plunger, having downwardly projecting side walls arranged to form a recess therein, means for hingedly supporting said handle on said body, a shaft pivotally secured in the upper end of said plunger transversely of said cavity, and a pair of links pivotally secured at their lower ends to said side walls and at their upper ends to said shaft, arranged to reciprocate said plunger when said handle is moved about its pivotal support.

10. In combination in a portable hydraulic device of the character described, a body having a cylinder lying in a plane parallel to the floor, means thereon for holding a pipe at spaced points in close proximity to the floor, a piston in said cylinder adapted to bear against said pipe between said points, and means for urging said piston against said pipe in bending movements

whereby to bend said pipe in a direction parallel with the floor including an injector positioned within said body to be operated from the upper side of said body for convenient operation by the user in a standing position over the device.

11. The combination in a portable bender of a body having a cylinder, a piston in said cylinder and means for projecting said piston to exert pressure on a pipe, a pair of bearing blocks for holding said pipe, and pairs of vertically spaced links connected at one end to opposite sides of said body, each of said links having openings at its outer end to rotatably support said bearing blocks.

12. The combination in a portable bender of a body having a cylinder, a piston in said cylinder and means for projecting said piston to exert pressure on a pipe, a pair of bearing blocks for holding said pipe, and pairs of vertically spaced links connected at one end to opposite sides of said body, each of said links having openings at its outer end to rotatably support said bearing blocks, and a pair of links connecting the outer ends of said spaced links to maintain said bearing blocks a desired distance apart.

13. The combination in a hydraulic device of the character described, of a horizontal body, a piston arranged to be retracted or projected from said body, injection means including an injector the major portion of which is enclosed within

said body and a handle above said body, a shoe on the outer end of said piston adapted to fit a cylindrical object to be bent, bearing blocks supported on said body on opposite sides of said shoe arranged to hold said object at the points between which it is to be bent, whereby said shoe may be forced against said object intermediate said bearing blocks, by projection of said piston, to laterally displace said object between said blocks and produce an arcuate bend therein.

14. The combination in a portable hydraulic device of the character described of a body, adapted to rest horizontally upon the floor to support said device, a piston arranged to be retracted or projected horizontally from one end of said body, a shoe on the outer end of said piston adapted to fit an object to be bent, spaced blocks, links connected to said body and arranged to support said blocks beyond the end of said body on each side thereof, whereby an object to be bent may be interposed between said shoe and said blocks, means for projecting said piston, and injection means including a handle manually operable above said body whereby said shoe is brought into contact with said object between said blocks to laterally displace said object therebetween and produce an arcuate bend therein.

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