March 13, 1945. O. J. E. OLSSON 2,371,464

MACHINE FOR BENDING ARTICLES

Filed Sept. 15, 1941 4 Sheets-Sheet 1

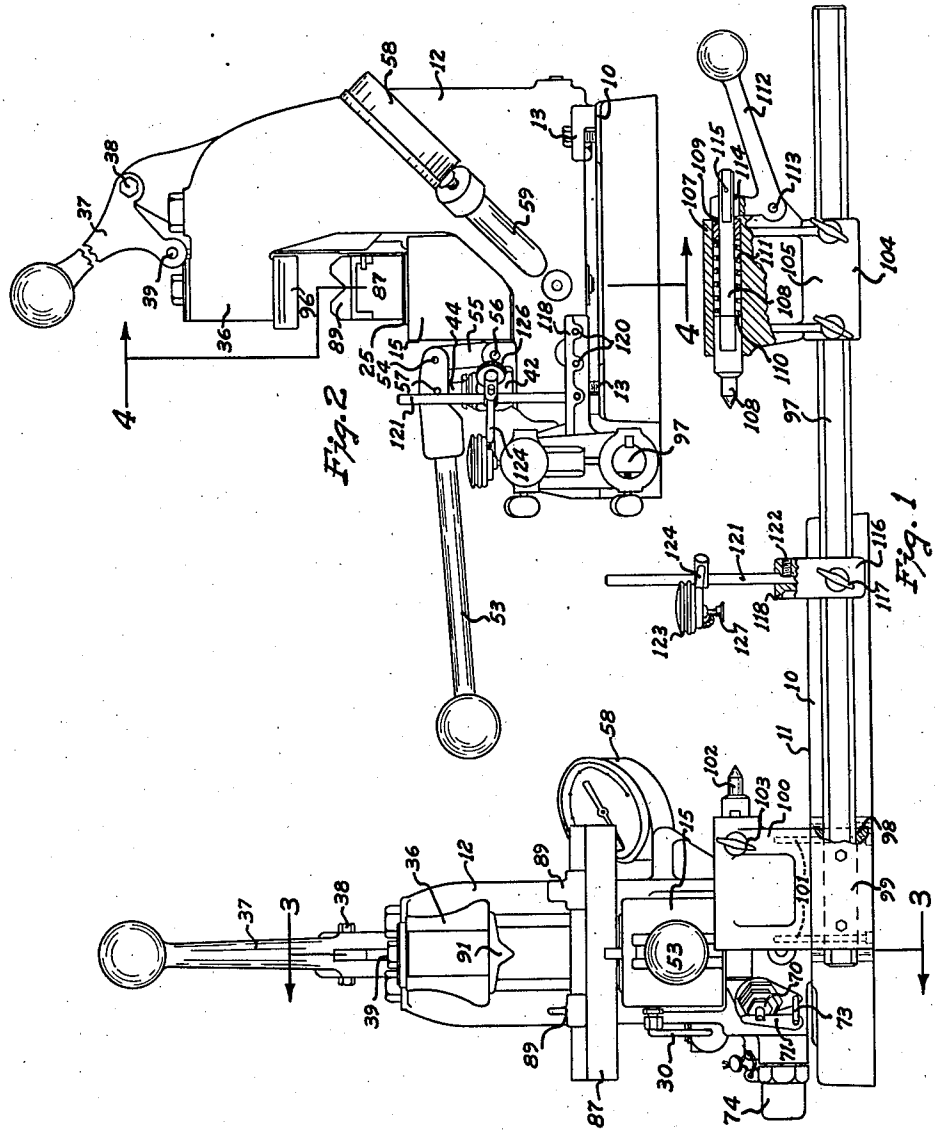


Fig. 2

Fig. 1

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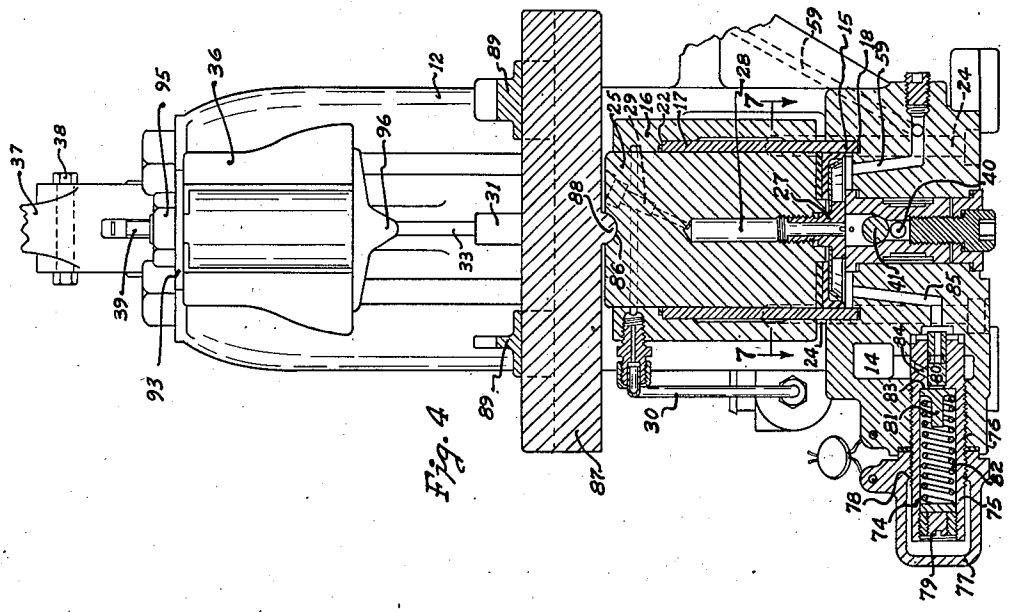


Fig. 4

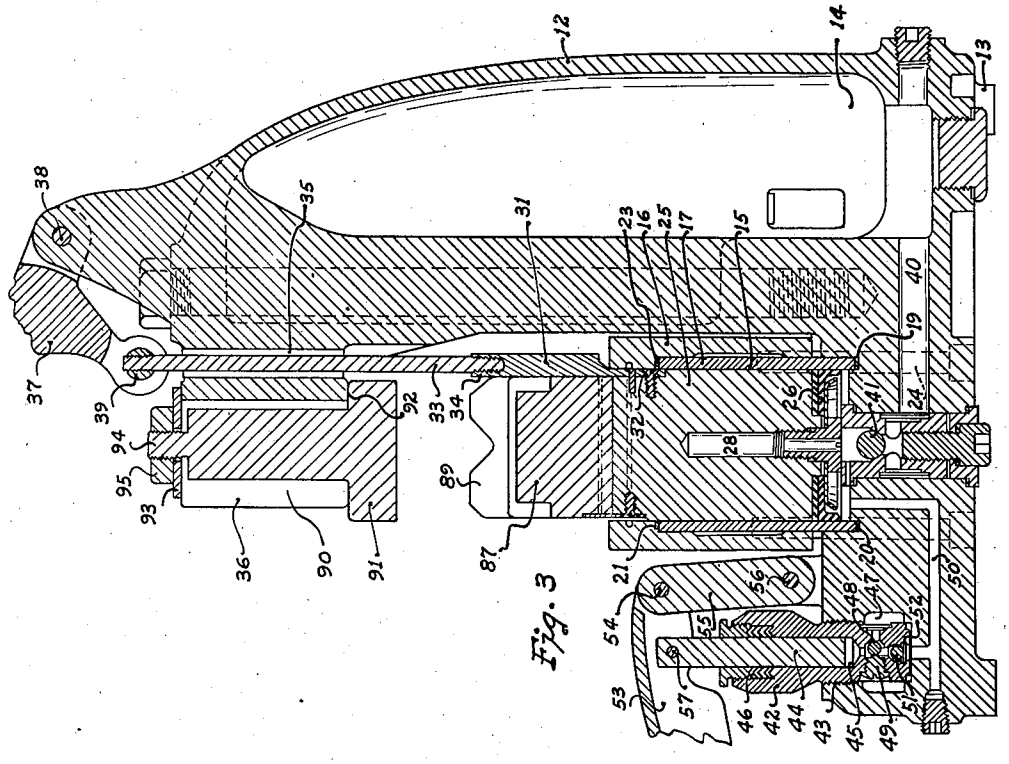


Fig. 3

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MACHINE FOR BENDING ARTICLES

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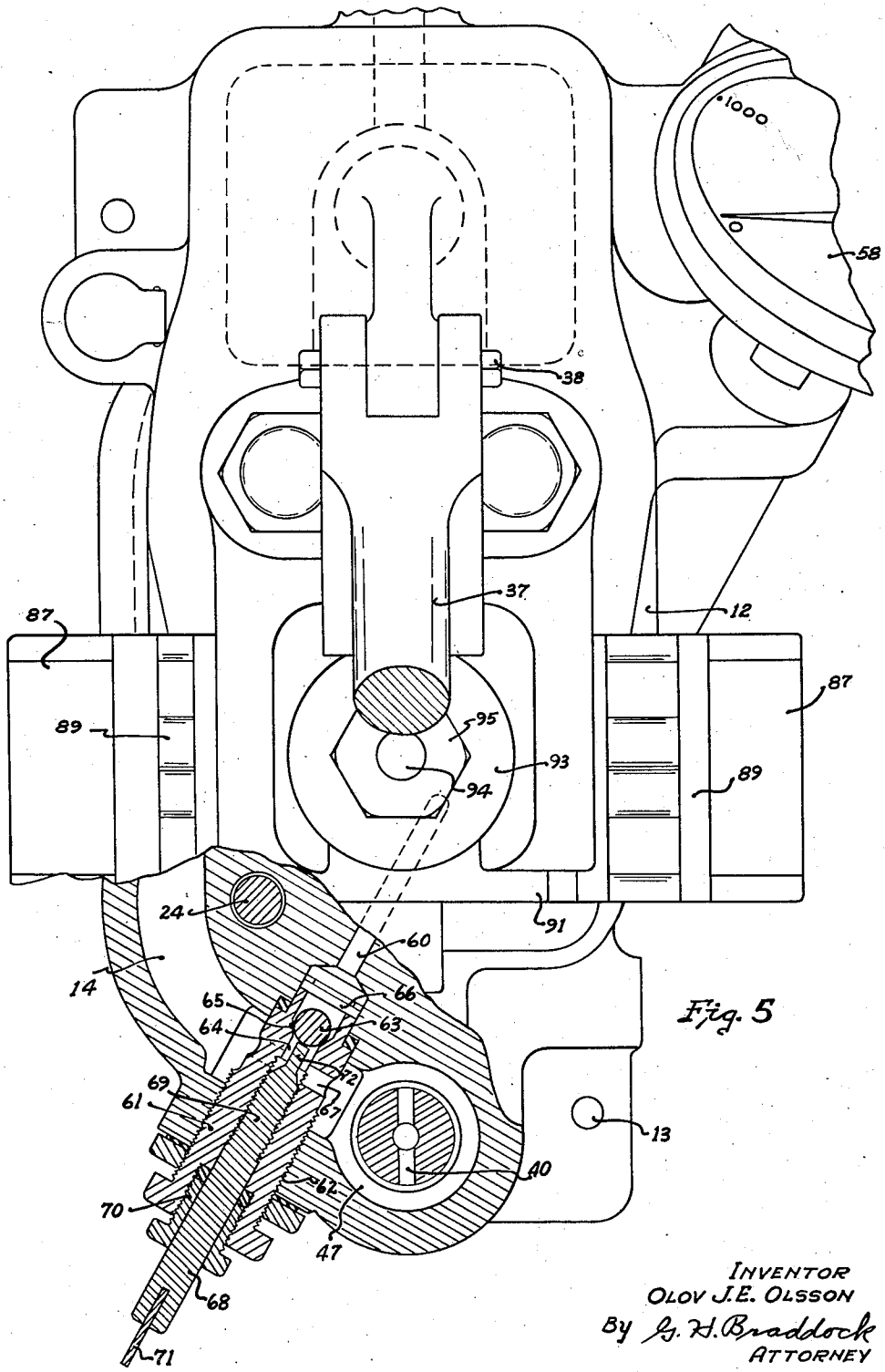


Fig. 5

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MACHINE FOR BENDING ARTICLES

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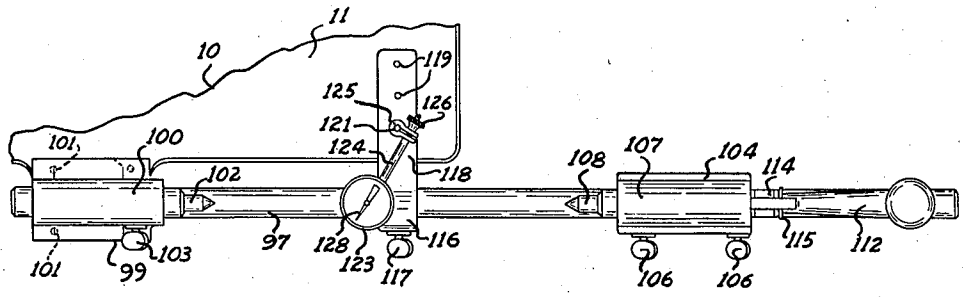


Fig. 6

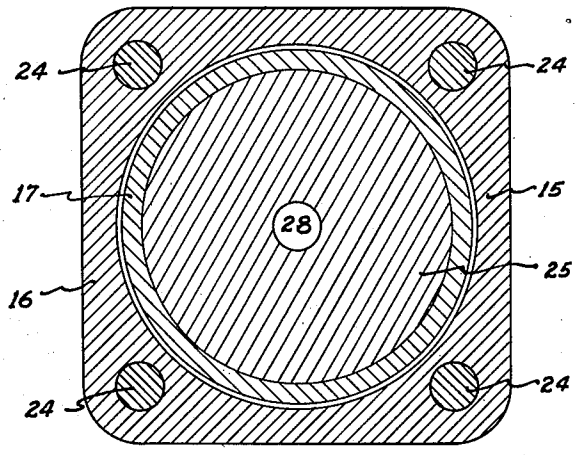


Fig. 7

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UNITED STATES PATENT OFFICE

2,371,464

MACHINE FOR BENDING ARTICLES

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Application September 15, 1941, Serial No. 410,906

5 Claims. (Cl. 153—48)

This invention has relation to a machine for bending articles, such, for example, as the connecting rods of the engines of automotive vehicles. The machine of the application is adapted for operation upon articles of a great many different varieties. The invention herein presents a machine including mechanism adapted to be operative upon articles to cause them to be straightened, or otherwise shaped, thus to be accurate for their intended purposes. The word "bending" as above and hereinafter used is intended in a broad sense, as including twisting, straightening, etc.

An object of the invention is to provide a machine for bending articles which will be of novel and improved construction.

A further object is to provide a machine of the present character which will be an improvement generally over more or less similar machines and wherein will be incorporated various improved features and characteristics of construction novel both as individual entities of the machine and in combination with each other.

And a further object is to provide a machine for bending articles of construction as hereinafter explicitly set forth.

With the above objects in view, as well as others which will appear as the specification proceeds, the invention comprises the construction, arrangement and combination of parts as now to be fully described and as hereinafter to be specifically claimed, it being understood that the disclosure herein is merely illustrative and intended in no way in a limiting sense, changes in details of construction and arrangement of parts being permissible so long as within the spirit of the invention and the scope of the claims which follow.

In the accompanying drawings forming a part of this specification,

Fig. 1 is a front elevational view, partially in section, of a machine for bending and testing articles made according to the invention;

Fig. 2 is an end elevational view of the machine as it would appear from the right side of Fig. 1;

Fig. 3 is an enlarged vertical sectional view, taken substantially on line 3—3 in Fig. 1, detailing features of the machine and omitting the base plate;

Fig. 4 is an enlarged vertical sectional view, taken substantially on line 4—4 in Fig. 2, at right angles to the disclosure of Fig. 3, omitting the base plate of the machine;

Fig. 5 is an enlarged fragmentary plan view, partially in section, of the machine, omitting its base plate;

Fig. 6 is a reduced fragmentary plan view of the base plate of the machine and entities assembled and/or associated with said base plate; and

Fig. 7 is an enlarged horizontal sectional view, taken substantially as on line 7—7 in Fig. 4.

With respect to the drawings and the numerals of reference thereon, 10 represents a base plate of the machine adapted to rest upon a support, such as a table or bench, so that a continuous, flat upper surface 11 of said base plate is desirably disposed in a horizontal plane.

A main frame 12 of the machine is supported upon and secured to an end portion of the upper surface 11 of the base plate 10, as denoted generally at 13, and said main frame 12 extends upwardly from said base plate.

The main frame 12 includes a well 14 therein and supports a hollow cylinder, designated generally at 15. The well 14 is adapted to contain a liquid, such, for example, as oil, and the liquid is adapted to pass between said well and the hollow cylinder 15 through suitable openings, in a manner to be set forth.

Said hollow cylinder 15 is constituted as an outer shell 16 and an inner shell 17 snugly fitted into said outer shell. The lower end 18 of the inner shell 17 is disposed in an annular groove 19, provided in a surface of the main frame 12 opposite the base plate 10, against an annular gasket 20 seated at the bottom of said annular groove 19. The outer shell 16 includes an internal annular shoulder 21 at its upper portion, and the upper end 22 of said inner shell 17 is disposed against an annular gasket 23 seated between said upper end 22 and the internal annular shoulder 21. The construction and arrangement are such that the internal surface of the portion of the outer shell 16 above its internal annular shoulder 21 and the inner surface of the inner shell 17 are in a single, continuous circumference which defines the internal side wall of the hollow cylinder 15 and that a surface of the main frame 12, surrounded by the inner shell 17, defines the base of said hollow cylinder. The construction and arrangement are also such that the lower end of the outer shell 16 is in spaced relation to an adjacent surface of the main frame 12 directly beneath said outer shell and surrounding the lower end of the inner shell, as will be clear from Figs. 3 and 4. Screw bolts 24, spaced at ninety degrees apart about the outer shell 16 and embedded in and passing upwardly through a lower portion of the main frame 12, are adapted to be turned home in the lower end portion of said outer shell to cause the outer shell to be forced down toward

the base of the main frame 12, thus to cause the lower and upper ends of the inner shell 17 to be seated against the gaskets 20 and 23, respectively, and said gaskets to be seated between said lower and upper ends of said inner shell and the bottom of the annular groove 19 and the internal annular shoulder 21, respectively. See Figs. 3, 4 and 7.

A ram 25 is snugly and slidably fitted to the hollow cylinder 15, and said ram includes a packing entity 26, of leather or other suitable material, for precluding the passage of liquid or oil past the ram. The packing entity 26 is held in fixed position by a hollow pin 27 screwed into an opening 28 disposed centrally in the lower end of the ram, and a controlled bleeder outlet 29 from the opening 28 is for removal of air which might possibly become entrapped in the system of the machine. A flow back line 30, extending between an upper portion of the hollow cylinder 15 and the well 14, is for conveying liquid or oil from said hollow cylinder back to said well should any liquid or oil at some time or other pass upwardly along the side wall of the ram 25.

Said ram 25 is adapted to be raised or actuated by a mechanical lift for rapid movement of the ram to work to be performed, and the ram is also adapted to be raised or actuated in response to the pumping of fluid or oil into the hollow cylinder 15 beneath the ram.

The mechanical lift for said ram 25 includes an upright post 31 secured, as at 32, to an upper portion of the ram, and a vertical rod 33 removably screwed, as at 34, into the upper end of said post 31. An upper portion of the vertical rod 33 passes freely through a vertical guideway 35 for said vertical rod disposed in an overhanging support 36 upon the main frame of the machine. An actuator 37 for the ram is constituted as a substantially L-shape lever having one of its arms pivoted, as at 38, upon a portion of the main frame 12 at a side of and above the overhanging support 36 and the other of its arms pivoted, as at 39, to the upper end of the vertical rod 33. Evidently, the ram 25 will be elevated in response to upward swinging movement of the actuator 37. A fluid passageway 40 between the well 14 and the hollow cylinder 15 is controlled by a gravity actuated check valve 41, within a concavity below and contiguous with said hollow cylinder, adapted to permit flow of fluid or oil from said well into the hollow cylinder but to preclude flow from said hollow cylinder back into said well.

A pump cylinder 42 of the machine, which is screw threaded, as at 43, into an end portion of the main frame 12, extends upwardy from said main frame at a side of the hollow cylinder 15, and an upright pump plunger 44 is slidably fitted to said pump cylinder. A pump chamber within the pump cylinder beneath the pump plunger 44 is denoted 45, and a packing gland within the pump cylinder and about said pump plunger is designated 46. A fluid passageway 47 between the well 14 and the pump chamber 45 is controlled by a horizontally movable check valve 48 held in operative relation to its seat by a threaded plug 49, and a fluid passageway 50 between the hollow cylinder 15 and said pump chamber 45 is controlled by a gravity actuated check valve 51 within a concavity beneath the pump chamber and rested upon a cross member 52. The check valve 48 is adapted to permit flow of fluid or oil from the well 14 into the pump chamber 45 and to preclude flow from said pump chamber back to said well, and the check valve 51 is adapted to permit flow of fluid or oil from the pump chamber to the hollow cylinder 15 but to preclude flow from said hollow cylinder back to said pump chamber.

Upon elevation of the ram 25 by upward swinging of the actuator 37, fluid or oil will be drawn from the well 14 through the passageway 40 past the check valve 41 into the hollow cylinder 15, and upon release of said actuator said ram will be prevented from returning to a depressed conditon because the fluid or oil which has entered said hollow cylinder will be precluded from flowing out of the hollow cylinder by the check valves 41 and 51.

The ram 25 is adapted to be elevated by manipulation of the actuator 37 to cause tools of the machine to engage against work to be performed, and after said ram has been mechanically elevated, the pump plunger 44 is adapted to be actuated to cause fluid or oil from the well 14 to be forced under pressure into the hollow cylinder 15 beneath said ram 25.

Mechanism for actuating said pump plunger 44 is constituted as a pump handle 53 having one of its ends pivoted, as at 54, upon a link 55 itself pivoted, as at 56, upon the main frame 12. An intermediate portion of the pump handle 53 is pivoted, as at 57, upon the upper end portion of the pump plunger. The pump plunger 44 is elevated upon upward swinging movement of the pump handle 53 and is depressed upon downward swinging movement of said pump handle. On its upward, suction stroke said pump plunger 44 draws fluid or oil past the check valve 48, the fluid or oil travelling from the well 14 through the passageway 47 into the pump chamber 45. On its downward, pressure stroke, the pump plunger forces fluid or oil from said pump chamber 45 through the passageway 50 past the check valve 51 into the hollow cylinder 15, thus to create a lifting pressure beneath the ram 25. The check valve 48 is in seated position throughout the downward, pressure stroke of the pump plunger 44, and the check valve 51 is in seated position throughout the upward, suction stroke of said pump plunger. Pumping of fluid or oil into the hollow cylinder 15 beneath the ram 25 is accomplished by oscillation of the pump handle 53 which causes the pump plunger 44 to be reciprocated vertically.

The portion of the hollow cylinder 15 beneath the ram 25 is in communication with an ordinary or preferred type of pressure gage 58 by way of a port 59 leading from said hollow cylinder directly to said pressure gage in such manner that pressure in the hollow cylinder will be accurately registered at the pressure gage.

Pressure in the hollow cylinder 15 is adapted to be manually released and the ram 25 is adapted to be allowed to drop after a desired and predetermined pressure has been registered at the pressure gage 58 during practical operation of the machine. A passageway 60 leads from a portion of the hollow cylinder 15 at location below the ram 25 to a valve cage 61 screw threaded, as at 62, into the main frame 12, and a horizontally movable check valve 63 within said cage 61 is adapted to control flow of fluid or oil from said hollow cylinder to the well 14. The cage 61 includes a longitudinal opening 64 defining a valve seat 65 for the check valve 63, and a cross member 66 in said cage is for retaining said check valve 63 in adjacent, operative relation to said valve seat. The passageway 60 is adapted to communicate with the longitudinal opening 64 of the valve cage 61 when the check valve 63 is in unseated relation

to the valve seat 65, and said longitudinal opening 64 is in communication with the well 14 by way of lateral openings 67 in said valve cage at the side of the passageway 60 opposite the check valve 63. An actuator screw 68 is threaded, as at 69, in the longitudinal opening 64 of the cage 61 for adjustable movement longitudinally of said valve cage, and a packing gland 70 in the valve cage and about said actuator screw is for sealing the outer portion of said longitudinal opening 64 closed. The outer portion of the actuator screw 68 is situated to be accessible at a side of the main frame 12, and a finger piece 71 upon said actuator screw is for ready turning manipulation thereof. An inner end portion of the actuator screw 68 is of reduced dimension and is situated within the longitudinal opening 64 at location adjacent the check valve 63, between said check valve and the lateral openings 67. The construction and arrangement are such that the reduced inner end portion 72 of said actuator screw 68 is in spaced relation to the bounding wall of the longitudinal opening 64 thus to offer no hindrance to the flow of fluid or oil from the passageway 60 to said lateral openings 67 when the check valve 63 is in open condition. When the actuator screw 68 is adjusted to outward, receded position, as in Fig. 5, said check valve 63 is held against the valve seat 65 by pressure of fluid or oil within the hollow cylinder 15 thus to preclude passage of fluid or oil from said hollow cylinder to the well 14. To release pressure in the hollow cylinder 15 said actuator screw is turned in direction to be moved inwardly to cause the check valve 63 to be forcibly removed from the valve seat 65, and with movement of said check valve 63 to open condition the ram 25 can become depressed by forcing of the fluid or oil out of the hollow cylinder 15 by way of the passageway 60 and the valve cage 61 into the well 14. A stop 73 upon the main frame 12 adapted to be engaged by the finger piece 71 is for limiting the extent to which the actuator screw 68 can be turned inwardly. Upon adjustment of the actuator screw to outward, receded position after the ram has become depressed, the check valve 63 will be free to return to seated position and will, evidently, become engaged against the valve seat 65 under pressure of fluid or oil in the hollow cylinder 15 immediately upon the passage of fluid or oil into said hollow cylinder during the immediately succeeding elevation of the ram 25 in the manner as hereinbefore set forth.

A safety device of the machine for limiting the amount of pressure which can exist in the hollow cylinder 15 beneath the ram 25 is represented generally at 74. The purpose of said safety device 74 is protection of the operative elements or parts of the machine against liability of damage. A tubular element 75 of the safety device is threaded, as at 76, in the main frame 12, and a cap member 77 may desirably enclose the outer end portion of said tubular element. As disclosed, the cap member 77 is threaded at 78 upon the tubular element 75. A thrust element 79 is adjustably disposed within and closes the outer end portion of said tubular element 75, and a valve member 80 is slidably disposed within the inner end portion of the tubular element. The valve member 80 is rigid with a flanged pin 81 which is slidable within said tubular element, and a coil spring 82 seated between said thrust element 79 and said flanged pin 81 normally retains the flanged pin under resilient pressure against an internal annular shoulder 83 of the tubular element. As disclosed, the thrust element 79 is adjustably threaded within the outer end portion of said tubular element 75 so that the force exerted by the coil spring 82 against the flanged pin 81 can be made to have any predetermined value, within limits, which may be selected. The construction and arrangement are such that when the flanged pin 81 is retained against the internal annular shoulder 83 by the coil spring 82 the valve member 80 will be in closing relation to a port, or ports, 84 in the inner end portion of the tubular element 75 leading from the interior of said tubular element to the well 14. See Fig. 4. A passageway 85 leads from a portion of the hollow cylinder 15 beneath the ram 25 to the inner end portion of the interior of the tubular element 75, which has the valve member 80. The coil spring 82 is adapted to withstand a predetermined and intended amount of pressure within the hollow cylinder 15 without collapsing, and to collapse when said predetermined and intended amount of pressure is exceeded. Of course, said coil spring 82 is subjected to the pressure within said hollow cylinder 15 through the instrumentality of the valve member 80 and the flanged pin 81. The construction and arrangement are such that with collapse of the coil spring 82, said valve member 80 will be moved within the tubular element 75 by the fluid or oil under pressure within the hollow cylinder to position uncovering the port, or ports, 84 and affording communication between the passageway 85 and said port, or ports, 84. That is, with collapse of the coil spring 82 the hollow cylinder 15 is caused to become open to the well 14, by way of the pasageway 85 and the tubular element 75, so that fluid or oil will be caused to flow from said hollow cylinder to said well and pressure within the hollow cylinder will become relieved.

A part-circular depression or socket 86, extending across the upper surface of the ram 25, swingably or rotatably supports a rocker member 87. As disclosed, the lower surface of the rocker member 87 includes a part-circular projection 88, desirably at the midlength of said rocker member, which is oscillatably mounted in the depression or socket 86. The rocker member 87 is of general rectilinear configuration and its upper surface adjustably supports a plurality, two as shown, of rocker jaws 89. That is, the rocker jaws 89 supported upon the upper surface of said rocker member 87, are mounted for adjustment in direction away from and toward the location of the part-circular projection 88, thus to be capable of being situated at any positions relatively to an article to be operated upon in the machine which may be selected. The rocker member 87 can support more than two rocker jaws, and the rocker jaws can be of any type suitable to their purposes.

The overhanging support 36 of the main frame 12 is directly above the rocker member 87 and rocker jaws 89 and is provided with a vertical concavity 90 adapted to receive the shank of a tool 91 which is complemental to the rocker jaws 89, 89. The shank of the tool 91 is disposed within the concavity 90 and the head of said tool is fixed up against the flat lower edge 92 of the overhanging support 36 through the instrumentality of a flat plate 93 rested upon the flat upper edge of said overhanging support, a reduced, threaded extension 94 of the tool shank projecting upwardly through said flat plate, and a nut 95 upon the threaded extension 94 and turned down against the flat plate 93. Stated differently, the

tool 91 is rigid with said overhanging support 86. A downwardly extending working rib or element 96 of said tool is disposed parallelly of the rocker jaws 89 and is situated above the rocker member 87, desirably over its midlength.

To the accomplishment of the bending of an article, such as a connecting rod, the article is placed or rested upon the rocker jaws 89, 89 and the ram 25 is elevated to cause said article to be grasped between the working rib or element 96 and said rocker jaws. In practical operation of the machine, assuming the ram to be depressed, said ram is first elevated by upward swinging movement of the actuator 37 to cause the work to be engaged by and between the working rib or element 96, above said work, and the rocker jaws 89, 89, below the work. Then, the pump handle 53 is oscillated to cause lifting pressure to be applied in the hollow cylinder 15 against the lower surface of the ram. When bending of the article is completed, by application of the intended pressure, indicated at the pressure gage 58, the actuator screw 68 is adjusted inwardly of the main frame, by turning movement of said actuator screw, to cause the check valve 63 to become removed from the valve seat 65 so that the ram 25 can return by gravity or by downward swinging of the actuator 37 to a depressed condition. During the accomplishment of a bending operation upon an article, the actuator screw 68 must, naturally, be in receded position, as in Fig. 5, to permit the check valve 63 to engage the valve seat 65.

An auxiliary frame of the machine is constituted as an elongated bar or support 97 having one of its end portions rigidly mounted or supported, as at 98, in a projecting portion 99 of the base plate 10. The projecting portion 99 is in the plane of and at the front of said base plate 10, directly forwardly of the main frame 12, and said projecting portion retains the elongated bar or support 97 so that this extends along and adjacent to the forward edge of the base plate 10 in the plane of said base plate. The end portion of the elongated bar or support 97 which is spaced from the projecting portion 99 of the base plate 10 extends to position, as disclosed, which is considerably beyond the end of said base plate spaced from, or opposite, said main frame 12. Also, said elongated bar or support 97 is as shown disposed at the side of the main frame having the pressure gage 58.

A stationary center holder 100 rests upon the projecting portion 99 of the base plate 10 at location directly above the adjacent end portion of the elongated bar or support 97, and said stationary center holder is fastened down against and made rigid with said projecting portion by screw bolts 101 which are embedded in and pass upwardly through the projecting portion and enter the stationary center holder through its lower surface. A stationary center 102 is suitably and conveniently fixed, as at 103, in the stationary center holder 100 to be parallel with the elongated bar or support 97, and the working or pointed portion of the stationary center projects in direction toward the end of said elongated bar or support which is opposite the projecting portion 99 and the main frame 12.

An adjustable center holder 104 is mounted upon a portion of the elongated bar or support 97 at location spaced from the stationary center holder 100. Said adjustable center holder is adapted to be slid longitudinally of said elongated bar or support and to be fixed upon the bar or support at selected adjusted position. To the accomplishment of these ends, the adjustable center holder includes a lower portion 105 thereof situated upon the elongated bar or support for sliding movement, and the construction and arrangement are such that said adjustable center holder is fixed against turning or twisting movement relatively to said bar or support. Set screws 106 are for fixing said adjustable center holder 104 at adjusted position upon the elongated bar or support. The adjustable center holder includes an upper hollow portion 107 thereof alined with the stationary center holder 100, and said hollow portion 107 slidably supports a movable center 108 directly alined with the stationary center 102. The working or pointed portion of the movable center 108 projects in direction toward said stationary center.

It is the intention that an article, such, for example, as a connecting rod, after being bent or otherwise operated upon by the working entities of the machine, be removably supported by and between the centers 102 and 108 to be tested in a manner to be made plain. To the end that an article can be removably supported by said centers, the movable center 108 is slidably disposed within the hollow portion 107 of the adjustable holder 104 for movement away from and toward the stationary center 102. Said movable center is manually actuated to receded position when an article to be tested is to be placed between the centers, and is allowed to move to engaging relation against the article after placed between the centers. A limit piece 109 is suitably and conveniently fixed within the end of the hollow portion 107 of the movable center 108 which is opposite the stationary center 102, and the rear end portion of said movable center is slidably disposed in said limit piece. The front end portion of the movable center is enlarged to provide an annular shoulder 110 of said movable center spaced from and facing the limit piece 109, and a coil spring 111 situated within the hollow portion 107 is seated between said limit piece 109 and the annular shoulder 110. The coil spring 111 resiliently urges the movable center 108 in direction toward the stationary center 102, and an L-lever 112 is adapted to be manually actuated to cause said movable center to be slid in the hollow portion 107 in direction away from the stationary center 102. As disclosed, an intermediate portion of the L-lever 112 is pivoted, as at 113, upon the adjustable center holder 104, and a bifurcated arm 114 of said L-lever is engaged about the movable center 108 in front of a cross pin 115 in the adjacent end portion of said movable center. By downward swinging movement of the L-lever 112 the movable center is slid to receded position against the resilient action of the coil spring 111, and upon release of said L-lever said coil spring acts to cause the movable center to be projected toward the position as disclosed in Figs. 1 and 6. When said movable center is projected to the position as in said Figs. 1 and 6, the bifurcated arm 114 is resiliently retained against the adjacent end of the adjustable center holder 104 by the action of the coil spring upon the cross pin 115, and said cross pin, by reason of its engagement against said bifurcated arm, limits the extent to which the movable center can be slid in direction toward the stationary center.

An indicator support 116 is mounted upon a portion of the elongated bar or support 97 at location between the stationary center holder

100 and the adjustable center holder 104. Said indicator support 116 is adapted to be moved longitudinally of said elongated bar or support and to be fixed thereon at selected adjusted position, closer to or farther away from the center holders 100 and 104, respectively. To the end that the indicator support 116 can be movable along the elongated bar or support 97, said indicator support includes a lower portion thereof slidably situated upon said elongated bar or support, and the construction and arrangement are such that said indicator support is fixed against turning or twisting movement relatively to the elongated bar or support. A set screw 117 is for fixing the indicator support at adjusted position upon said elongated bar or support. Said indicator support 116 includes a substantially horizontal extension portion or member 118 at the upper part thereof which as disclosed extends away from the indicator bar or support in direction toward the base plate 10. See Figs. 1, 2 and 6. The horizontal extension member 118 includes a plurality, three as disclosed, of vertical openings, each denoted 119, spaced apart longitudinally of said horizontal extension member, and there is a horizontal opening 120 contiguous with each vertical opening 119. The vertical openings are for the selective reception of an indicator supporting shank 121, and said indicator supporting shank is adapted to be retained in fixed position in any selected one of the vertical openings 119 by a set screw 122 located in the horizontal opening 120 which is contiguous with the vertical opening containing the indicator supporting shank. Said indicator supporting shank extends upwardly from the horizontal extension member 118 and is desirably disposed in a substantially vertical position.

An indicator 123 is rigid with a supporting arm 124 for said indicator, and said supporting arm 124 is mounted upon the indicator supporting shank 121 for movement longitudinally thereof. More explicitly, a clamp 125 fixed to the supporting arm 124 encircles said indicator supporting shank 121, and a knurled finger piece 126 is adapted to be adjusted to selectively secure said clamp in fixed position upon the indicator supporting shank or to cause the clamp to be released so that the supporting arm 124, with the indicator 123 thereon, can be moved upwardly or downwardly, away from or toward an article or piece of work situated between the centers 102 and 108 in position to be tested. A manipulator 127 of the indicator 123 extends downwardly therefrom, and a pointer 128, suitably and conveniently operatively connected with said manipulator to be actuated thereby, is visible from position above said indicator.

The testing of the accuracy or other condition of an article or piece of work situated between the centers 102 and 108 is accomplished by movement of the indicator 123 along the vertical supporting shank 121 toward the article or piece of work, so that the manipulator 127 of said indicator engages the work, and reading the result at the pointer 128. Stated differently, to the accomplishment of testing, the manipulator 127 is caused to engage the piece to be tested, and the result of the test is readable at the pointer 128. The several different vertical openings 119 in the horizontal extension member 118 of the indicator support 116 are provided to the purpose that parts of articles at variable distances from the line of the centers 102 and 108 can be engaged by the manipulator 127 in the accomplishment of testing. In the disclosure as made, the indicator 123 is directly above the elongated bar or support 97. By shifting of the indicator supporting shank 121 to the next adjacent vertical opening 119, said indicator will become situated at the inner side of said elongated bar or support, and by shifting of said indicator supporting shank to the opening 119 at the free end of the horizontal extension member 118, the indicator will be situated still further inwardly of the elongated bar or support. The horizontal extension member of the indicator support is mounted to be situated above the base plate 10, and the supporting arm 124 for the indicator 123 is adapted to be swung about the indicator supporting shank 121 as an axis, so that an article to be tested, instead of being supported between the centers 102 and 108, can be rested upon the base plate 10 to be engaged by the manipulator 127 of said indicator 123. That is, the indicator 123 is supported to be capable of testing articles while resting upon the base plate 10, as well as when supported by the centers 102 and 108.

The machine as illustrated and described has been found to be practical and efficient in operation. The bending entities of the machine perform their intended services in entirely satisfactory manner, and the pressure gage 58 constitutes a ready instrumentality for indicating that a bending or other operation has been completed. And, too, the indicator 123 constitutes a ready instrumentality for testing the accuracy or other condition of articles. The testing mechanism and the bending mechanism are set up and related to each other and to other instrumentalities of the machine so that successive testing operations upon different articles after operated upon in said machine are capable of being performed with expenditure of but a minimum of time.

What is claimed is:

1. In a machine of the character described, a supporting tool including an element for operating upon an article, a complemental tool including an element for operating upon said article in cooperation with the tool first mentioned, a vertically movable ram carrying said supporting tool, a cylinder in which said ram is movable, a well for fluid, a passageway for fluid between said cylinder and said well, a mechanical lift for causing said ram to be elevated and depressed, said mechanical lift being adapted to be actuated to elevate the ram to bring said tools into cooperative engagement with said article and to draw fluid from said well through said passageway into said cylinder beneath said ram, means for normally precluding the travel of fluid from said cylinder through said passageway to said well, a pump plunger, means for reciprocating said pump plunger, hydraulic means responsive to reciprocations of the pump plunger for elevating said ram to cause the tools to accomplish a working operation upon said article, and means for opening said passageway for fluid to permit said ram to become depressed thus to remove said tools from cooperative engagement with said article.

2. In a machine of the character described, a supporting tool including an element for operating upon an article, a complemental tool including an element for operating upon said article in cooperation with the tool first mentioned, a vertically movable ram carrying said supporting tool, a cylinder in which said ram is movable, a well for fluid, a passageway for fluid between said cylinder and said well, a pivotally supported actuator for causing said ram to be elevated and

depressed, said actuator being adapted to be operated to elevate the ram to bring said tools into cooperative engagement with said article and to draw fluid from said well through said passageway into said cylinder beneath said ram, means for normally precluding the travel of fluid from said cylinder through said passageway to said well, a pump plunger, means for reciprocating said pump plunger, hydraulic means responsive to reciprocations of the pump plunger for elevating said ram to cause the tools to accomplish a working operation upon said article, and means for opening said passageway for fluid to permit said ram to become depressed.

3. In a machine of the character described, a supporting tool including an element for operating upon an article, a complemental tool including an element for operating upon said article in cooperation with the tool first mentioned, a vertically movable ram carrying said supporting tool, a cylinder in which said ram is movable, a well for fluid, a passageway for fluid between said cylinder and said well, a mechanical lift connected directly to said ram for causing said ram to be elevated and depressed, said mechanical lift being adapted to be actuated to elevate the ram to bring said tools into cooperative engagement with said article and to draw fluid from said well through said passageway into said cylinder beneath said ram, means for normally precluding the travel of fluid from said cylinder through said passageway to said well, a pump plunger, means for reciprocating said pump plunger, hydraulic means responsive to reciprocations of the pump plunger for elevating said ram to cause the tools to accomplish a working operation upon said article, and means for opening said passageway for fluid to permit said ram to become depressed thus to remove said tools from cooperative engagement with said article.

4. In a machine of the character described, a supporting tool including an element for operating upon an article, a complemental tool including an element for operating upon said article in cooperation with the tool first mentioned, a vertically movable ram carrying said supporting tool, a cylinder in which said ram is movable, a well for fluid, a passageway for fluid between said cylinder and said well, a pivotally supported actuator connected directly to said ram for causing said ram to be elevated and depressed, said actuator being adapted to be operated to elevate the ram to bring said tools into cooperative engagement with said article and to draw fluid from said well through said passageway into said cylinder beneath said ram, means for normally precluding the travel of fluid from said cylinder through said passageway to said well, a pump plunger, means for reciprocating said pump plunger, hydraulic means responsive to reciprocations of the pump plunger for elevating said ram to cause the tools to accomplish a working operation upon said article, and means for opening said passageway for fluid to permit said ram to become depressed.

5. In a machine of the character described, a tool including an element for operating upon an article, a complemental tool including an element for operating upon said article in cooperation with tool first mentioned, a ram carrying said first mentioned tool, mechanism connected directly to said ram for actuating said ram to bring said tool and complemental tool into engagement with said article and to cause one of said tools to be in spaced relation to the article, manually actuable means for causing said mechanism to be operated, a pivotal support for said manually actuable means, means pivotally connecting said mechanism and said manually actuable means to each other, hydraulic means for actuating said ram to cause said tool and complemental tool to accomplish a working operation upon said article, and means including a manually reciprocable pump plunger for operating said hydraulic means.

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