

No. 673,991.

Patented May 14, 1901.

G. I. ALDEN.

STRAIGHTENING AND BENDING MACHINE.

(Application filed June 11, 1900.)

(No Model.)

2 Sheets—Sheet 1.

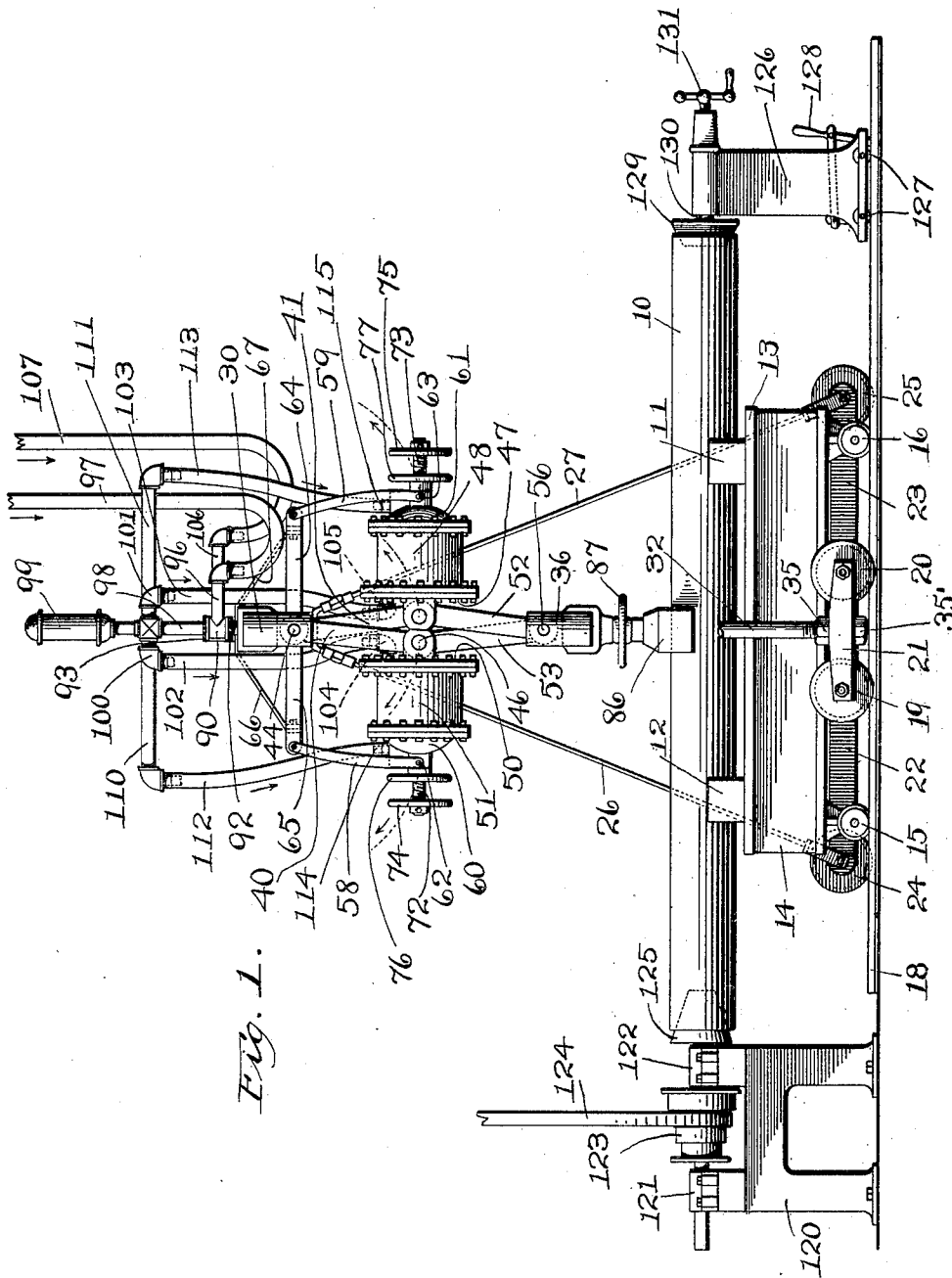


Fig. 1.

Witnesses.

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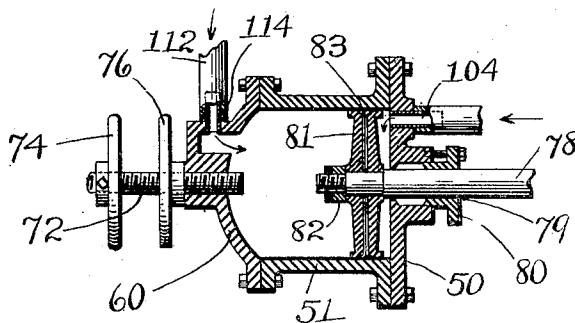
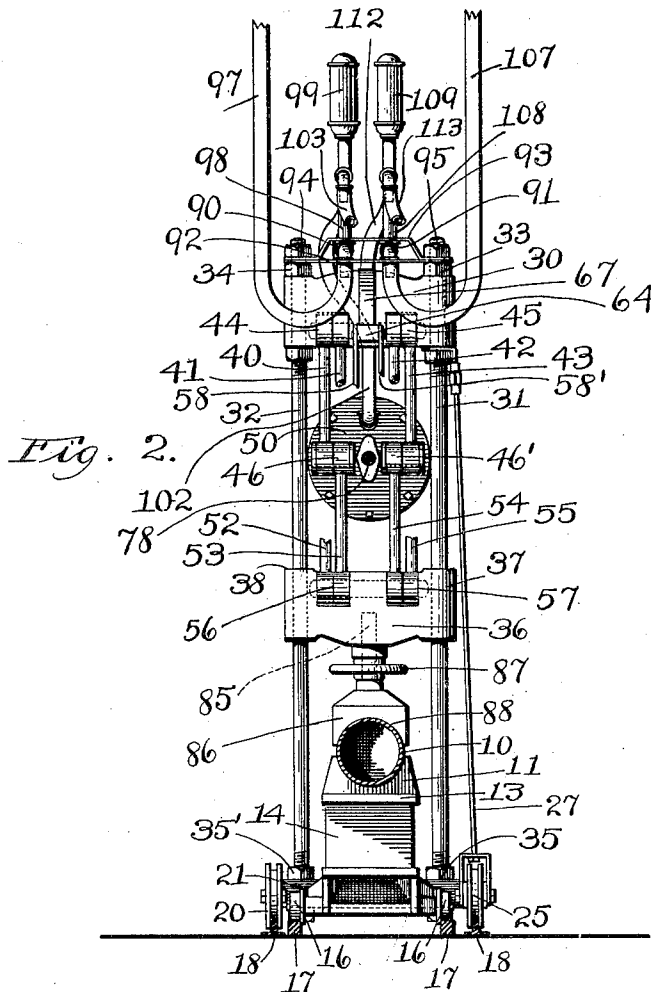
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(No Model.)

2 Sheets—Sheet 2.



Witnesses:

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Fig. 3

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UNITED STATES PATENT OFFICE.

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STRAIGHTENING AND BENDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 673,991, dated May 14, 1901.

Application filed June 11, 1900. Serial No. 19,837. (No model.)

To all whom it may concern:

Be it known that I, GEORGE I. ALDEN, a citizen of the United States of America, and a resident of the city and county of Worcester, Commonwealth of Massachusetts, have invented certain new and useful Improvements in Straightening and Bending Machines, of which the following is a specification.

My invention relates to a hydraulic press mechanism which in the particular use to which I have adapted it in the mechanism hereinafter described has for its object the straightening or bending of lengths of pipe, rods of iron and steel, or work of like character.

The invention consists in the device hereinafter described, and particularly pointed out in the claims.

In the accompanying two sheets of drawings, in which like characters denote like parts, Figure 1 is a side elevation of the machine. Fig. 2 is a side elevation with the toggle-arms of one cylinder broken off and the cylinder removed, and Fig. 3 is a section taken through one of the cylinders.

The rod or pipe 10 to be operated upon by bending or straightening is placed on the supporting-blocks 11 and 12, which in the instance shown are curved to conform with the surface of the pipe. These blocks are mounted on the supporting-table 13, which comprises the body portion 14, supported on two pairs of two-wheeled trucks 15 16. These trucks are adapted to fit and run along the rails 17, laid on the floor. Outside of the rails 17 and parallel therewith are laid rails 18, which are provided for the double truck or press carriage 21, having two wheels, as 19 and 20, on each truck. The carriage 21 is extended, as at 22 23, on one side of the car 13 and provided with wheels 24 25, and to the ends of the extensions to the journals of the wheels are connected the stays 26 27 to the fixed cross-head of the press mechanism. This carriage 21 barely clears the under side of the body 14 of the car 13, allowing movement of each car independently of the other along the track, but preventing vertical movement toward each other, so that both may be held rigidly together when pressure is exerted by the operation of the machine.

The hydraulic press mechanism is supported from the fixed cross-head 30. This cross-head is mounted rigidly on the rods 31 32, which pass through the ends of the same, and is held thereon by the nuts 33 34, threaded on said rods. These rods are fixed vertically in the carriage 21 at their lower ends and rigidly held by threaded nuts 35 35'. Between the fixed cross-head 30 and the car 13 the movable cross-head 36 is mounted slidably on the rods 31 32, through the ends of which, at 37 38, the said rods loosely pass. Four toggle-joint arms 40 41 42 43 are journaled at 44 45 in said fixed cross-head, adapted to swing and operate below the same. At their lower ends the two outside or separated arms 40 43 are journaled at 46 46' to the cylinder-head 50 of the cylinder 51, and the two inside or adjacent arms 41 42 are similarly journaled to the cylinder-head 47 of the cylinder 48. To the lower movable cross-head four toggle-joint arms 52 53 54 55, similar to those already described, are journaled at 56 57 to and adapted to operate above the movable cross-head 36. The inside or adjacent lower arms 53 54 are journaled at 46 46' to the head of the cylinder 51, and the outside or separated arms 52 55 are journaled similarly to the head of the cylinder 48.

The cylinders 48 and 51 are supported at their inner and adjacent heads 47 50 by the toggle-arms journaled to the fixed cross-head and at their outer ends by the links 58 59, journaled, respectively, to the outer heads 60 61 of the cylinders 51 and 48 at 62 63, respectively. These links are made double, as shown as 58 58' in Fig. 2, and are supported by the arms 64 65, to which they are journaled. The said arms are fastened to the fixed cross-head and braced by the stays 66 67. The cylinders are provided with the outer curved cylinder-heads 60 61, through the center of which the stop-rods 72 73 are threaded. These rods are each provided with a hand-wheel 74 75 and with set-nut wheels 76 77, respectively, to hold them in position when adjusted. A continuous piston-rod 78 enters each cylinder and is provided on each end with a piston fitting its respective cylinder. A section of the cylinder 51 is shown in Fig. 3, and the cylinder 48 being similar

thereto said figure will serve to illustrate the interior construction of both. The piston-rod 78 enters the cylinder-head 50 at 79 and is provided with suitable piston-rod packing 5 held by the packing-ring 80. The piston 81 is fastened by means of the nuts 82 to the piston-rod and is furnished with suitable piston-packing, as 83.

The stop-rod 72 is threaded in the cylinder-head 60 and provided with the hand-wheel 74 and the set-wheel 76.

The screw 85 is threaded in the movable cross-head 36 and is journaled in the press-block 86. The said screw is provided with the hand-wheel 87. This provides a means of vertical adjustment of the press-block which is adapted to receive the pressure exerted by the hydraulic press mechanism. Said block is made with a curved contact-surface 88 to conform with the curve of the pipe.

The pipe connections to the cylinders are made as follows: The iron-pipe elbows 90 91 are held above the fixed cross-head 30, between the pipe-supporting pieces 92 93, supported on the extensions of the rods 32 31 and held rigidly by the nuts 94 95. From the elbow 90 the horizontal extension 96 is connected with the flexible pipe 97, through which the water controlled by a valve (not shown) is admitted and discharged. The vertical extension 98 from the elbow 90 is provided with the air-chamber 99, which by the compression of the air therein prevents any undue pressure consequent on a sudden starting or stopping of the flow of water from being exerted on the flexible pipe and which might otherwise burst it. From this vertical extension 98 the branches 100 and 101 extend, and the flexible pipes 102 103 are connected thereto and to the elbows 104 105, communicating with the cylinders 51 48, respectively, through their inside heads 50 47. The elbow 91 is likewise provided with extension 106, connected with flexible supply-pipe 107, and with the vertical extension 108, having the air-chamber 109. The two branches 110 and 111, connected with the flexible pipes 112 113, communicate with the connections 114 115 in the outside heads 60 61, respectively, of the cylinders 51 48. A valve (not shown) is provided between the flexible pipes 97 107 and the supply and discharge, which must admit of opening the pipe 97 to the supply while opening the pipe 107 to the discharge and also opening the pipe 107 to the supply while the pipe 97 is open to the discharge. A four-way valve may be used for this purpose, or an ordinary three-way valve may be attached to each pipe and so connected that the operation of one to open the discharge in one pipe will open the supply in the other pipe, and vice versa, and in middle position both pipes will be closed to both discharge and supply.

For the purpose of supporting the pipe 10, so that the carriage may be moved along beneath it, and for revolving the same, so that its bends may be indicated by holding a piece

of chalk against it, a lathe apparatus is provided, the headpiece of which comprises the standard 120, fastened to the floor and having the journal-bearings 121 122, carrying the cone-pulley 123, run from a counter-shaft (not shown) by the belt 124, and also the center cone 125, which fits into the pipe and centers the same. At the opposite end the foot-piece comprises the standard 126, mounted on wheels 127 to run along the track 17 and to be held fixed by the holding-lever 128, working in connection with a holding-strip on the floor. (Not shown.) A center cone 129 is journaled on the spindle 130, and the cone is adapted to be adjusted in and out by the handle 131 in the usual manner.

The operation of the device in straightening a piece of pipe, for example, is as follows: The pipe is placed in the lathe apparatus between the centers and revolved, and the deflections or bends in the same are indicated by holding a crayon against it. When the bends have been thus indicated, the pipe is rested upon the blocks on the car 13, which is run under the pipe until the center of the car is approximately under the point of greatest deflection in the pipe. The centers are then withdrawn and the pipe allowed to rest on the blocks 12 13, with the point of greatest deflection uppermost. The press mechanism is then pushed along until the block 86 is above the point of greatest deflection. The block 86 having been adjusted by the screw 85 and the stop-rods 72 73 having been set to limit the range of motion, the valve (not shown) is operated, permitting water to enter through the pipe 97 and into the cylinders through their inner heads 47 50 and to discharge water contained in the cylinder on the opposite side of the piston through the outer heads 61 60 by the pipes leading to pipe 107. This draws the cylinders together, and the toggle-arms connected to them and to the fixed and movable cross-heads operate on their journals, and the lower cross-head is forced down and the block 86 is pressed against the pipe, straightening it. The stop-rods limit the movement of the press-block. When the valve is operated in the opposite direction, water is admitted in the other ends of the piston and they are forced apart and the press-block raised.

The device may be used for bending rods or for exerting pressure for any purpose similar to that described.

To those skilled in the art to which this invention is related changes will be apparent which I have not attempted to describe, but which are within the scope of my invention.

Therefore, without being limited to the precise construction shown, what I claim, and desire to secure by Letters Patent, is—

1. The combination with fixed and movable cross-heads mounted over, and adapted to be moved horizontally over, an operating-table, of a pair of hydraulic cylinders, each cylinder having a piston, a piston-rod connect-

ing said pistons rigidly together, toggle-joint arms connected to said cylinders and to the fixed and movable cross-heads respectively, means for supplying hydraulic pressure to said cylinder and means for holding said fixed cross-head rigid to said table when pressure is exerted thereon, substantially as described.

2. The combination with a movable carriage, of supporting-rods mounted thereon, a fixed cross-head mounted rigidly on said rods, a movable cross-head slidable on said rods, a double toggle-joint connecting said cross-heads, hydraulic cylinders respectively attached to each toggle-joint, pistons fitted respectively to each cylinder, a piston-rod connecting said pistons rigidly together, and means for supplying hydraulic pressure to said cylinders, substantially as described.

3. The combination with the horizontally-moving operating-table, of the independently-movable carriage, supporting-rods mounted on the said carriage, a fixed cross-head mounted rigidly on said rods, a movable cross-head slidable on said rods, a double toggle-joint connecting said cross-heads, hydraulic cylinders respectively attached to each toggle-joint, pistons fitted respectively to each cylinder, a piston-rod connecting said pistons rigidly together, and means for supplying hydraulic pressure to said cylinder, substantially as described.

4. The combination with horizontally-movable operating-table, of the independently horizontally movable carriage, a fixed cross-head carried by said carriage, of a movable cross-head, a double toggle-joint connecting said cross-heads, a press-block carried by said movable cross-head, and hydraulic mechanism connected with said toggle-joint to operate the same, substantially as described.

5. The combination with the horizontally-movable operating-table, of an independently horizontal, movable support extended under said table and adapted to be brought into rigid engagement therewith, of a fixed cross-head mounted on said movable support over said table, a movable cross-head mounted to reciprocate between said fixed cross-head and said operating-table, and operating

mechanism for exerting pressure between said fixed and movable cross-heads, substantially as described.

6. The combination with fixed and movable cross-heads, of double toggle-joints connecting said cross-heads, of the hydraulic cylinders connected to said toggle-joints, pistons fitted respectively to each cylinder, a piston-rod rigidly connected to said pistons, stop-rods threaded in the heads of said cylinders to limit the movement of said pistons, and means for supplying hydraulic pressure to said cylinders, substantially as described.

7. The combination with operating-table, of supporting-blocks mounted on said operating-table, of the independently horizontally movable carriage, having means to engage said table when said carriage is vertically raised, a fixed cross-head carried by said carriage over said operating-table, a movable cross-head having a press-block operating above said operating-table, double-toggle-joint connections between said cross-heads, hydraulic cylinders engaging with said toggle-joint connections, connected pistons operating within said cylinders, whereby force is applied to operate said toggle-joint and press-block, substantially as described.

8. In a pipe-straightening machine, the combination with the lathe mechanism of the supporting-car 13 having the blocks 11, 12, on which the pipe rests, the press-supporting carriage 21, independently, horizontally movable and extending beneath said car 13, supporting-rods 31, 32, the fixed cross-head 30 mounted thereon, the movable cross-head 36 slidable on said rods, the double toggle-joints connecting said cross-heads, the hydraulic cylinders 48, 51 connected with said double toggle-joint, the piston-rod 78, pistons mounted rigidly to said cylinders respectively, and flexible hydraulic connections with said cylinders, substantially as described.

Signed by me at Worcester, Massachusetts, this 6th day of June, 1900.

GEORGE I. ALDEN.

Witnesses:

MILTON P. HIGGINS,
ALDUS C. HIGGINS.