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FLUE EXPANDER

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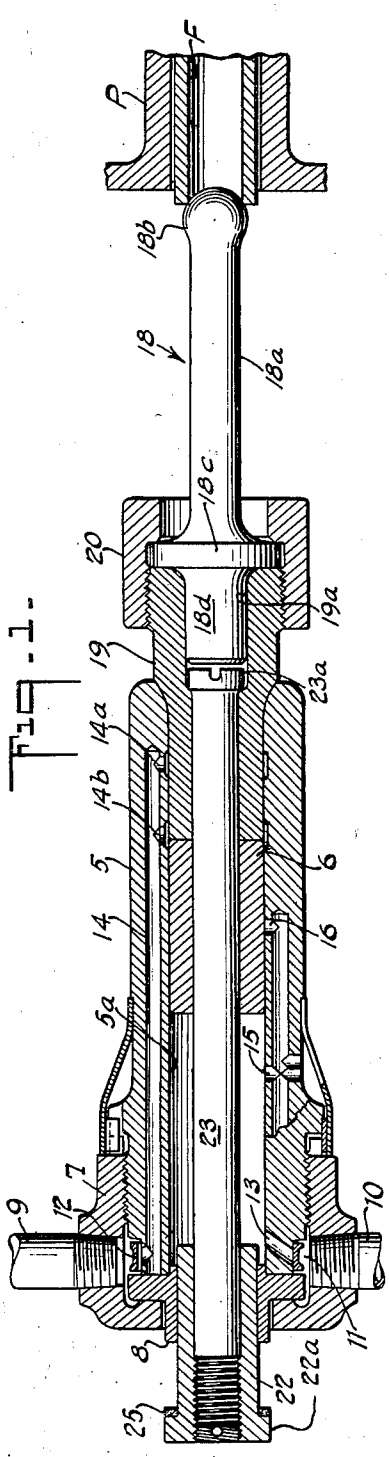

Fig. 1.

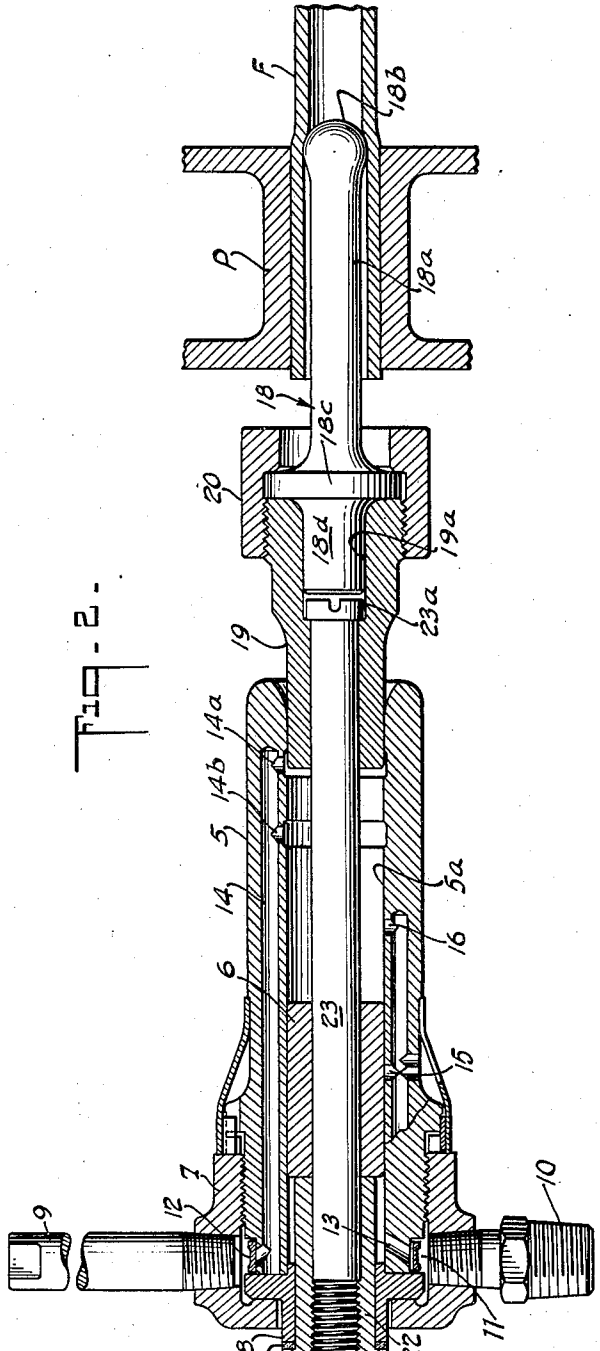

Fig. 2.

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FLUE EXPANDER

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6 Claims. (Cl. 153—80.5)

This invention relates to apparatus for expanding the end of a tube, such as a boiler flue, into tight contact with a surrounding plate.

An object of the invention is to reduce the time consumed in expanding flues thereby putting the operation on a production basis.

Another object is the provision of a device adapted to operate in close quarters where repairs or replacements of tubes must be carried out.

A further object is to extract the expanding tool quickly from the tube after the latter has been expanded.

A still further object is the provision of a tube expanding tool of small size and weight adapted to apply maximum expanding pressure with a high efficiency.

In accordance with the present invention, an expanding mandrel is driven into the end of the flue by a power operated hammer. After the flue has been expanded, the hammer may be arranged to impact the mandrel in the opposite direction.

A feature of the invention resides in the construction of the hammer, which comprises a cylinder, a reciprocating piston therein, and an anvil at each end of the cylinder, both anvils being connected to the working tool or mandrel and movable with respect to the cylinder. By adjusting the position of the cylinder with respect to the working tool and anvils, the piston may be caused to deliver either forward or rearward impacts to the tool.

Other objects and features will appear more clearly from the following description taken in connection with the accompanying drawing and appended claims.

In the accompanying drawing,

Fig. 1 is a longitudinal cross section of a tube expander in operative relation to the work at the start of its operation; and

Fig. 2 is a view, similar to Fig. 1 showing the tube expanded and the hammer arranged to extract the mandrel from the tube.

In the illustrative embodiment of the invention, the hammer is of the fluid pressure type and comprises a cylinder 5 providing a piston chamber 5a in which a piston 6 reciprocates. A back head 7 has a threaded connection with the cylinder 5 and serves to clamp a bushing 8 against the rear end of the cylinder. A handle 9 is screwed to the back head 7. Live pressure fluid, such as compressed air, is admitted through a suitable connection 10 to an annular chamber 11 between the cylinder and back head.

Any suitable means may be provided for distributing the live pressure fluid from the annular chamber 11 to the ends of the piston chamber 5a. In the form shown, a ring valve 12 surrounds the end of the cylinder 5 and is arranged for radial movement to cover alternately a port 13 leading to the rear end of the piston chamber and a passage 14 leading to the front end. For a more complete description of the structure and operation of a ring valve, as shown, reference is made to applicant's prior Patent Number 1,931,042, granted October 17, 1933. Exhaust ports 15 and 16 are provided intermediate the admission ports 13 and 14a.

The expanding tool or mandrel 18 comprises an elongated cylindrical portion 18a having a spherical head 18b at its front end, a collar 18c toward the rear end and a projection 18d extending rearwardly from the collar. The collar seats against the front end of an anvil block 19 which has a recess 19a to receive the projection 18d on the mandrel. A flanged sleeve 20, threaded onto the anvil block 19 provides means for removably securing the mandrel 18 to the anvil block.

The anvil block assembly comprises the front block 19, previously referred to, a rear anvil block 22 and a connecting rod 23. The front end of the connecting rod has a head 23a in the bottom of recess 19a so arranged as to prevent any appreciable axial movement of the connecting rod with respect to block 19. The rear anvil block 22 has a threaded connection with a connecting rod 23 and is slidably mounted in bushing 8. Rod 23 is surrounded by the hammer piston 6 with a close sliding fit. The distance between the inner faces of the front and rear anvil blocks is somewhat greater than the normal travel of the piston 6.

The anvil block assembly 19, 23, 22 is movable axially as a unit with respect to the cylinder 5. When the assembly is shifted to its rearmost position, shown in Fig. 1, the front anvil block 19 seats against the front end of the cylinder and projects inwardly into the path of the hammer piston 6. The rear anvil block 22, in this position is out of striking distance with respect to the hammer piston. When the anvil block assembly is shifted forwardly, as shown in Fig. 2, the front anvil block 19 is moved out of the path, and the rear block 22 into the path of the hammer piston. Forward movement of the assembly is limited by a flange 22a on the rear anvil block 22 upon which is seated packing material 25 engageable with the rear end of bushing 8.

It will be noted that the front anvil block uncovers the port 14a at the extreme front end of

admission passage 14 when in the Fig. 2 position but covers port 14a in the Fig. 1 position. In order to provide for admission and exhaust at the front end of the piston chamber 5a at all times, a supplementary port 14b is provided.

In operation, the front end of the mandrel 18 is placed against the end of a tube, such as flue F, which is to be expanded into contact with the surrounding plate P. The cylinder 5 is pushed forward to the Fig. 1 position with the front anvil block 19 extending far into the cylinder. Live air, admitted through connection 10 to the annular chamber 11, is distributed alternately to the ends of the piston chamber under control of the ring valve 12. Assuming that the piston 6 is at the beginning of its rearward stroke, live air passes around the edges of the valve and underneath the same to passage 14 and port 14b tending to force the piston 6 rearwardly. The pressure on the periphery of valve 12 being balanced, the valve is held in the Fig. 1 position by the difference in pressures between passage 14 and port 13, the latter being in communication with exhaust port 15 through the rear end of the piston chamber 5a. As soon as the piston covers exhaust port 15, it begins compressing air in the rear end of the piston chamber, which is in communication with the port 13. Approximately at the same time, the piston uncovers exhaust port 16 to vent the front end of the piston chamber. The increase in pressure at the rear end and the reduction in pressure at the front end of the piston chamber trip the ring valve 12 to a position in which it covers passage 14 and uncovers port 13 to admit live air to the rear end of the piston chamber. The rear anvil block 22 is spaced a sufficient distance from the exhaust ports 15 and 16 so that the momentum of the piston on its rearward stroke is spent in compressing air in the piston chamber without the piston striking the anvil 22.

After the ring valve 12 has been tripped, the piston is driven forward by live air admitted through port 13, the air in front of the piston being exhausted through port 16. The covering of port 16 and uncovering of port 15 cause the valve to be tripped back to the Fig. 1 position, the operation being similar to that on the rearward stroke, excepting that the piston moves a relatively shorter distance in compressing air in front of exhaust port 16, and hence the piston strikes the front anvil block 19 with a hard blow.

The repetition of impacts delivered by the piston 6 to the front anvil block drive the expanding mandrel 18 progressively through the tube or flue F expanding it into tight contact with the plate P as shown in Fig. 2.

To withdraw the mandrel 18 from the flue F, the operator pulls back on the handle 9 until the parts assume the position shown in Fig. 2 in which the front anvil block 19 is spaced a greater distance from the exhaust ports 15 and 16 than the rear anvil block 22. Continued operation of the piston 6 causes its forward motion to be checked by compression in the front end of the piston chamber 5a and its rearward stroke to result in an impact against the rear anvil block 22. The successive rearward impacts extract the mandrel 18 from the flue F.

To vary the force of impact of the piston 6 against the anvil block 19 or 22, the cylinder may be moved to a position intermediate Fig. 1 and Fig. 2.

While the invention has been particularly described with reference to a single illustrative embodiment, it will be apparent that many changes and adaptations may be made within the spirit of the invention and within the scope of the appended claims.

What is claimed is:

1. A fluid actuated hammer for expanding flues and the like comprising a one-piece cylinder, an anvil block fitting the front end of the cylinder, an anvil block at the rear end of the cylinder, a rod connecting said front and rear anvil blocks and surrounded thereby, a percussive piston reciprocable in said cylinder, said cylinder having inlet and exhaust ports for effecting reciprocation of the piston, said blocks being spaced apart a greater distance than the length of stroke of the piston, said piston being arranged for selectively striking either anvil block by longitudinal movement of the cylinder relative to the blocks, the front anvil block having an abutment contacting exteriorly of the front end of the cylinder to limit forward movement of the cylinder relative to the anvil blocks and the rear anvil block having an abutment contacting exteriorly of the rear end of the cylinder to limit rearward relative movement of the cylinder.

2. A fluid actuated hammer comprising a one-piece cylinder having a bore opening at the front end of the cylinder, a front anvil block having a portion projecting into the front end of the cylinder and slidably fitting said bore, said bore providing a piston chamber whose front end is defined by said block, a piston in said chamber, means closing the rear end of said piston chamber, a rear anvil block at the rear end of the piston chamber, a rod connected to both blocks and projecting through the piston, said piston chamber being of uniform diameter between said anvil blocks, means including inlet and exhaust ports for effecting reciprocation of said piston, said anvil blocks being spaced apart a greater distance than the length of stroke of the piston, said cylinder being movable axially relative to said anvil blocks to adapt the piston to deliver impacts selectively in a forward or rearward direction, and means for attaching a working implement to one of the anvil blocks.

3. A tube expander comprising a rear anvil block, a front anvil block spaced therefrom, the front block having a recess open at its forward extremity and having a bore leading from said recess to its rear extremity, a connecting rod having at its front end a head seated in the bottom of said recess, said rod projecting through said bore and being connected at its rear end to the rear anvil block, a mandrel having a collar seated against the forward extremity of the front anvil block and having a projection in said recess positioned to restrict axial movement of the connecting rod with respect to the front anvil block, a sleeve threaded to the front anvil block and having a flange engaging the forward end of the collar to secure the mandrel to the front anvil block, a hammer piston slidably mounted on said connecting rod, and means for actuating said piston for delivering impacts selectively to either anvil block.

4. A fluid actuated hammer comprising a cylinder having a bore opening at the front end of the cylinder, a front anvil block having a portion projecting into the front end of the cylinder and slidably fitting said bore, said bore providing a piston chamber whose front end is defined by said block, a piston in said chamber, means closing the rear end of said piston chamber, a rear anvil block at the rear end of the piston

chamber, a rod connected to both blocks and projecting through the piston, means including inlet and exhaust ports for effecting reciprocation of said piston, said anvil blocks being spaced apart a greater distance than the length of stroke of the piston, said cylinder being movable axially relative to said anvil blocks to adapt the piston to deliver impacts selectively in a forward or rearward direction, and means for attaching a working implement to one of the anvil blocks, one of said inlet ports being positioned to be covered by the front anvil block when the cylinder is shifted forwardly relative to the anvil blocks and to be uncovered when the cylinder is in the opposite position.

5. A fluid actuated hammer comprising a cylinder having a bore opening at the front end of the cylinder, a front anvil block having a portion projecting into the front end of the cylinder and slidably fitting said bore, said bore providing a piston chamber whose front end is defined by said block, a piston in said chamber, means closing the rear end of said piston chamber, a rear anvil block at the rear end of the piston chamber, a rod connected to both blocks and projecting through the piston, means including inlet and exhaust ports for effecting reciprocation of said piston, said anvil blocks being spaced apart a greater distance than the length of stroke of the piston, said cylinder being movable axially relative to said anvil blocks to adapt the piston to deliver impacts selectively in a forward or rearward direction, and means for attaching a working implement to one of the anvil blocks, the connection between the rod and rear anvil block being detachable, the rod, piston and front block being removable through the front end of the cylinder upon the disestablishment of said connection.

6. A percussive tool for expanding tubes and the like, comprising a one-piece cylinder providing a piston chamber, a back-head attached to the rear end of the cylinder, a front anvil block, a connecting rod secured to said block, a rear anvil block threadably secured to said rod, said rod being coaxial with the piston chamber, a percussive piston in said cylinder adapted to reciprocate on said rod, said blocks being spaced apart a greater distance than the range of movement of the piston, said piston being arranged for selectively striking either anvil block by movement of the cylinder relative to the anvil blocks, the front anvil block being of the same diameter as the piston and fitting the bore of the cylinder, thereby providing a movable end wall for the piston chamber, said front anvil block having an abutment contacting the front extremity of the cylinder to limit forward movement of the cylinder relative to the anvil blocks, the rear anvil block having an abutment in back of the cylinder and backhead to limit relative rearward movement of the cylinder, said rear anvil block having an exposed portion in back of the backhead, by means of which the block may be rotated to connect or disconnect the latter with respect to said rod.

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