

Jan. 26, 1954

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2,667,136

HYDRAULIC MACHINE

Filed Aug. 11, 1950

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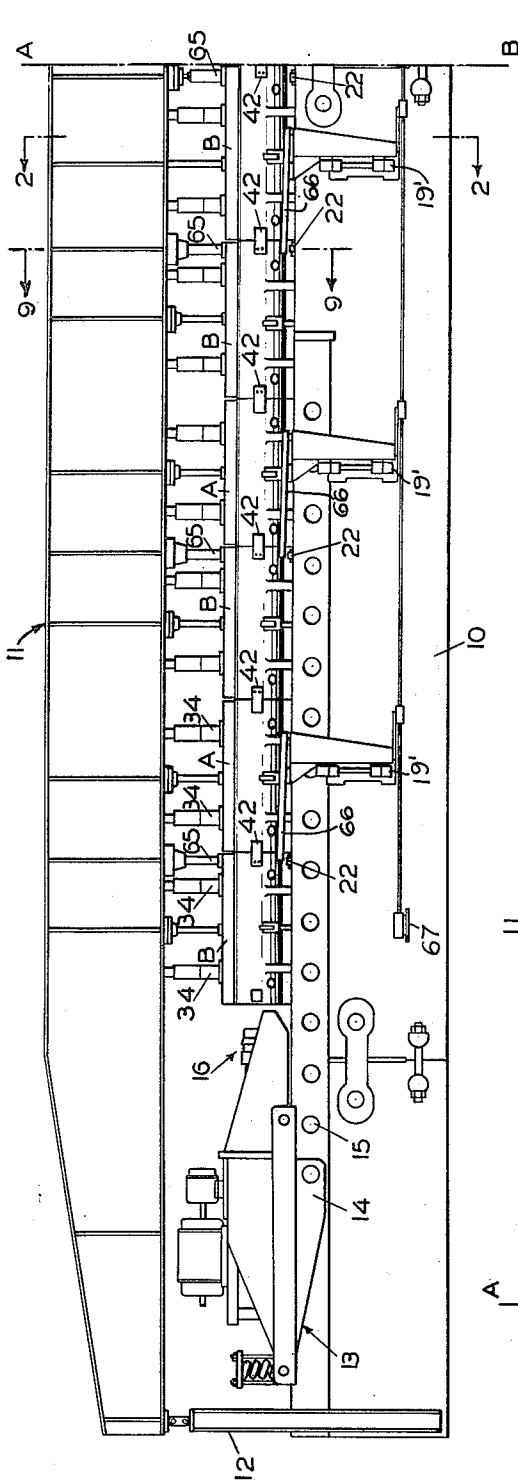


Fig. 1A

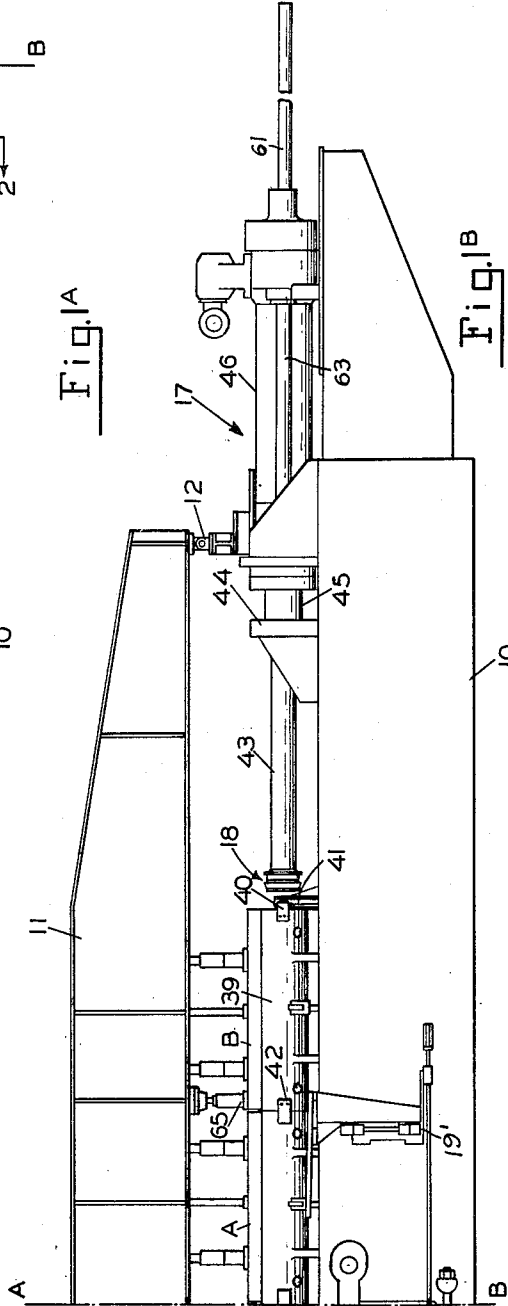


Fig. 1B

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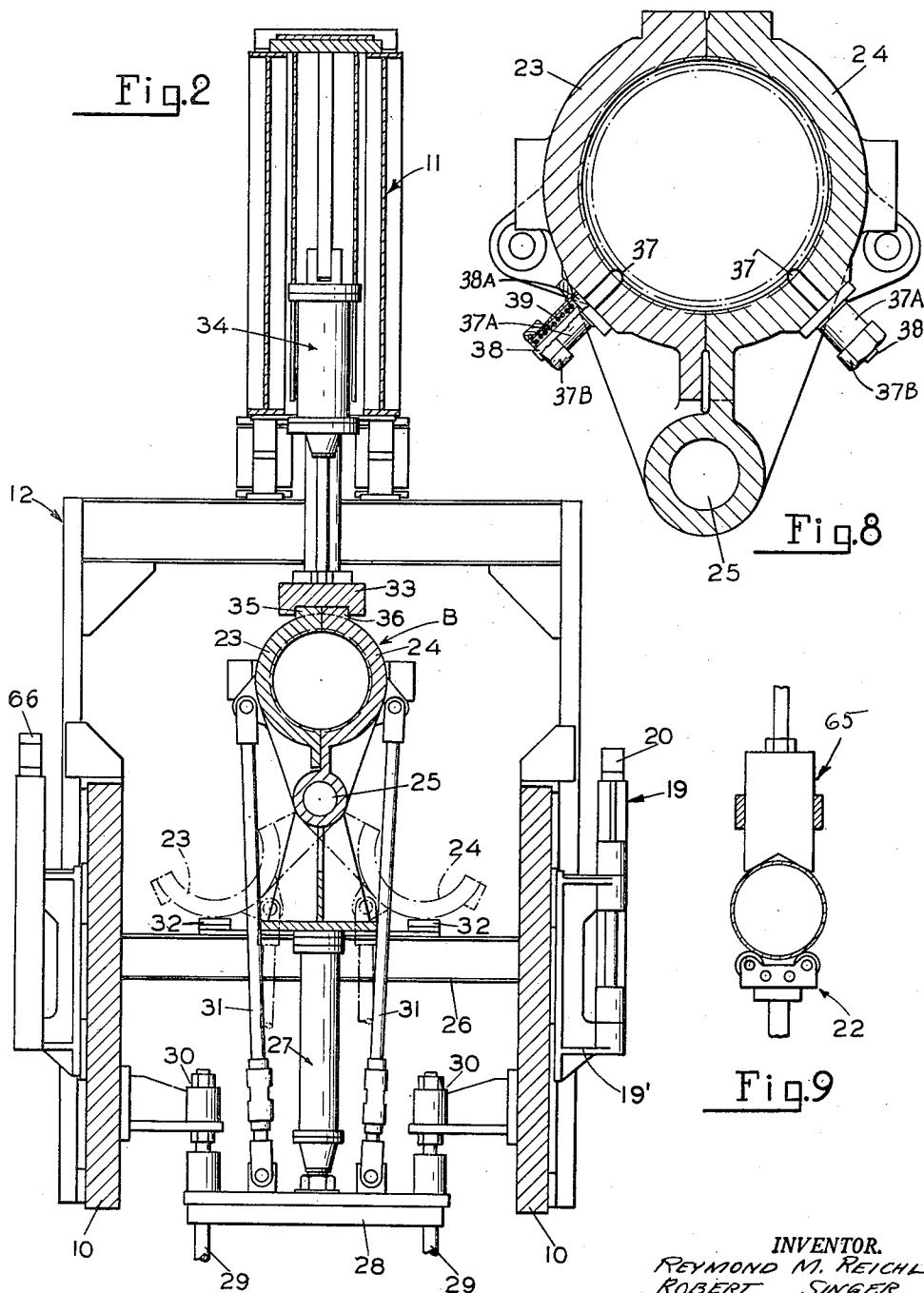
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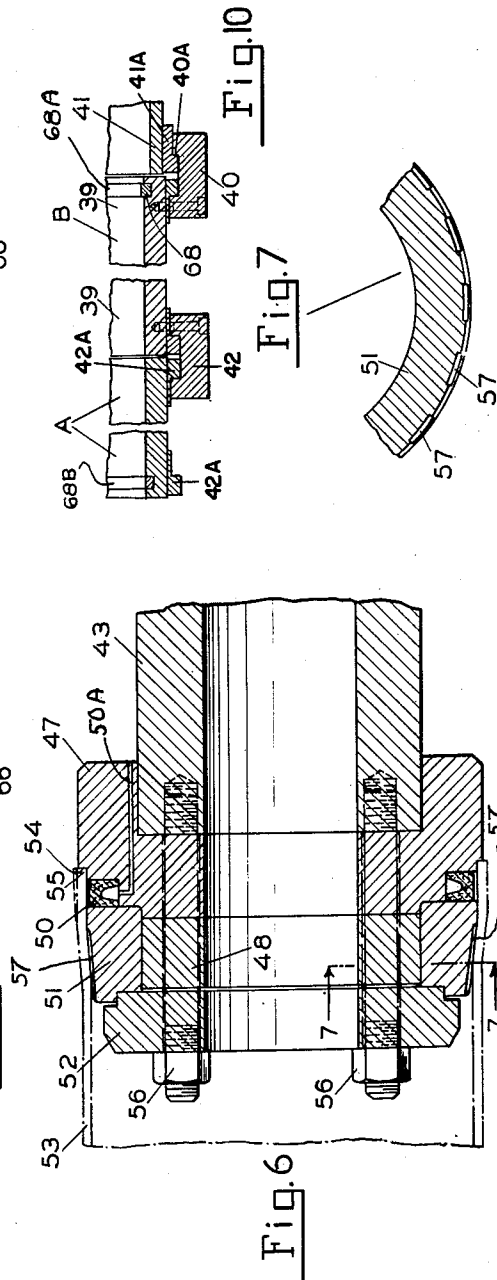
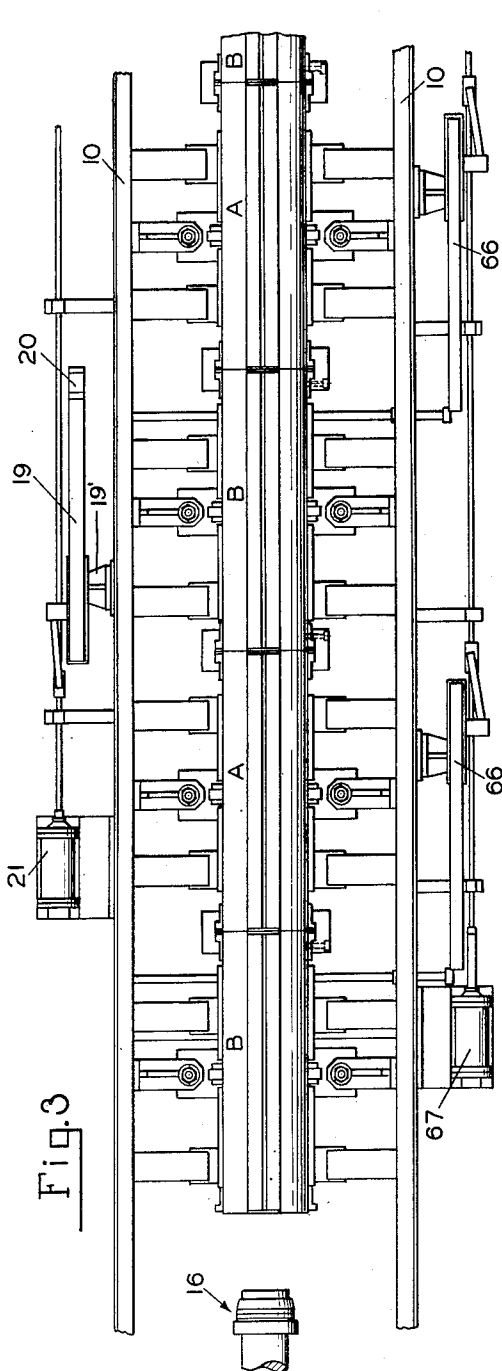
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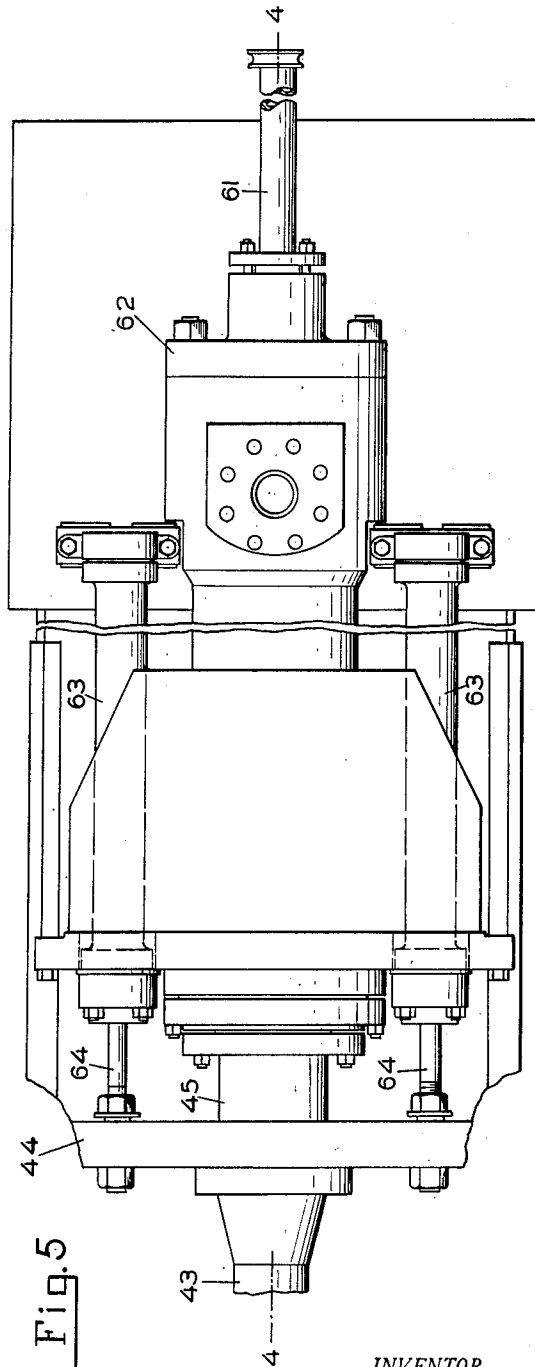
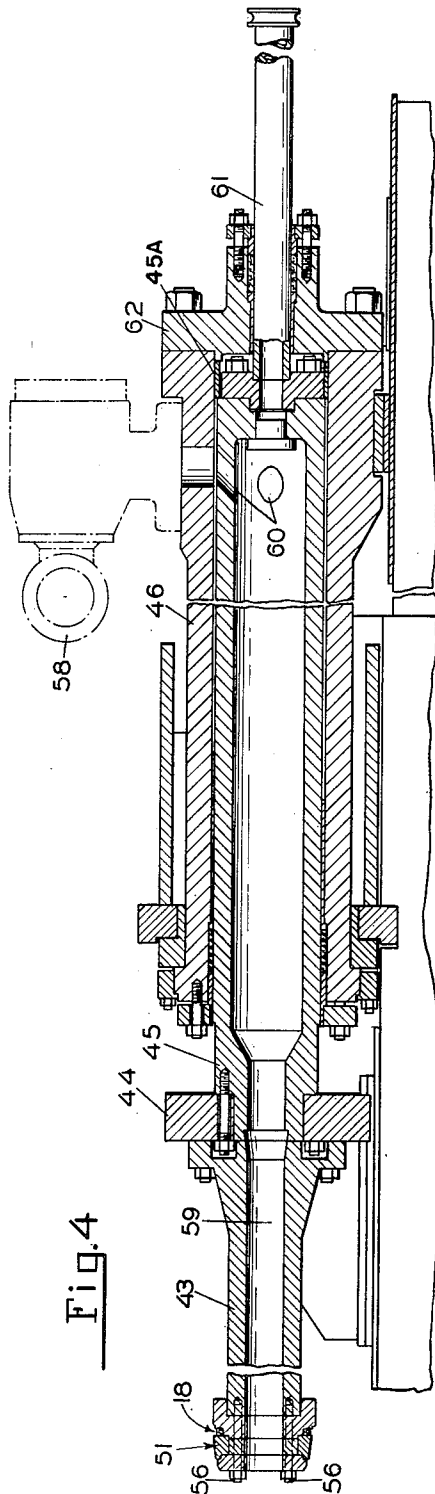
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2,667,136

HYDRAULIC MACHINE

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Application August 11, 1950, Serial No. 178,812

6 Claims. (Cl. 113—44)

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This invention relates to a machine for operating on tubes and particularly to an arrangement for belling, expanding and testing tubes.

In previous devices, it has been necessary to provide separate machines for belling, expanding and testing. It is known to expand tubes against an outer shell or mantle by hydraulic pressure. In such a process, the tubes will be sized accurately and will have their strength increased due to the cold working. The belling operation usually has been carried out by separate mechanical means in a separate machine because of the difficulty of subjecting the extreme ends of the tubes to hydraulic pressure. In such prior practice, the ends are brought to the desired diameter before the tube is inserted in the hydraulic expanding machine.

One of the objects of the invention is to provide a combined belling or preliminary end enlarging, expanding and testing machine.

In one aspect of the invention, the machine can have a stationary housing at one end and a movable housing at the other end, each housing carrying a combination belling and sealing head or tool, said tool being reciprocable relative to a tube supported and clamped in the machine. A plurality of groups of openable mantles can be used to surround the tube. The tube can be moved to the center of the machine and then raised upwardly by tube raising mechanism to a position in alignment with the tools.

One group of mantles is arranged to accommodate the tube raising mechanism. The other group is closed on an axially aligned tube, the tube raising means withdrawn, and then the other group of mantles closed so as to envelop the tube. A mantle can have two halves movable together to surround the tube, the interior bore of the closed mantle being the outside diameter to which the tube is to be expanded. Locking means can be provided to hold the mantles in closed position and a means can be used to prevent axial movement of the closed mantles. Preferably, after the tube is in the closed mantles, the tools are moved toward each other and they enter and bell out the ends of the tube.

Thereafter, hydraulic pressure is exerted interiorly of the tube so as to expand it outwardly to substantially fill the interior bore of the closed mantles, the tools having sealing means thereon and may have means to permit pressure to act properly on the belled ends.

Following this, the mantles can be opened sequentially in groups and the tube held in the

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machine by the raising mechanism and clamps during a testing operation, the tools remaining in the ends of the tube.

A follow-up mechanism preferably is used in conjunction with the tool moving mechanism for at least one of the housings so as to compensate for changes in length of the tube during expansion.

These and other advantages, features and objects of the invention will become apparent from the following description and drawings:

In the drawings:

Figure 1A is an elevation of the left-hand end or adjustable housing end of the machine.

Figure 1B is an elevation of the right-hand end or stationary housing end of the machine, Figure 1B being an extension to the right from line A—B of Figure 1A.

Figure 2 is an enlarged section taken along the line 2—2 of Figure 1A.

Figure 3 is a plan view of a central portion of the machine.

Figure 4 is an enlarged broken sectional view of the stationary housing ram and tool.

Figure 5 is a broken plan view of Figure 4.

Figure 6 is a fragmentary enlarged section of one form of belling tool.

Figure 7 is a fragmentary section taken along the line 7—7 of Figure 6.

Figure 8 is an enlarged section showing the mantles in closed position.

Figure 9 is a fragmentary section taken along the line 9—9 of Figure 1A.

Figure 10 is a broken enlarged fragmentary view showing the locks for the mantles.

The machine is one in which a belling, expanding and testing operation can be accomplished, although it can be used for any one of the operations, or successive combinations thereof. It may have a main frame 10 (Figs. 1A, 1B) and a superstructure generally indicated at 11, said superstructure being carried by supports 12 located at each end of the machine and mounted on frame 10. The superstructure is for the purpose of carrying the mantle locking means and other parts of the machine as will appear hereafter.

The machine includes an adjustable housing 13 movable along the frame 10 and lockable in its adjusted position by means of a locking arrangement 14 cooperable with apertures 15 in frame 10. Adjustable housing 13 carries a belling tool 16 which is movable relative thereto by a hydraulic motor as will be explained hereafter. This movement may be governed by a limit

switch controlling its movement to a predetermined position or it may be moved the full stroke of the hydraulic motor to which it is connected.

At the other end of the machine, there is a stationary housing 17 carrying the reciprocable stationary belling tool 18, said housing having suitable hydraulic means for advancing and retracting tool 18. The tools have suitable internal sealing means associated therewith for engaging the interior of the tube. Of course, external sealing means can be used where testing only is involved.

The frame may carry a plurality of loading arms 19 located along the frame 10 (Figs. 2, 3), said arms being suitably pivoted on bracket 19' and arranged so that the ends 20 thereof can be swung inwardly by a fluid motor, such as a liquid or an air operated arrangement indicated at 21. When the loading arms are swung inwardly, the pipe or tube involved will roll down to a stop adjacent the end of each of the arms so as to be positioned generally at the center of the machine but below the tool axis.

Appropriately spaced pipe raising means or jacks 22 (Figs. 1A, 9) can be raised upwardly by suitable means so as to lift the tube upwardly from the loading arm ends 20 at the center of the machine into aligned position relative to the tools or heads. The stroke of the jacks can be made adjustable so as to accommodate tubes of different sizes.

There are two groups of mantles in the machine for holding and suitably enclosing the tube. The mantles of one group are designated by the letter A, and the mantles of the other group are designated by the letter B. The A mantles do not have provision for accommodation of jacks, whereas the B mantles are arranged to accommodate the jacks, which will be described at a later point.

Each of the mantles comprises a pair of halves 23, 24 (Fig. 2), said halves being pivoted on a common shaft 25 supported on cross members 26 located between the side frame members 10. The B mantles are indicated in Figure 2 in closed position in full lines and in their open position in dot-dash lines.

The mantles can be operated by means of a hydraulic cylinder 27 operating to reciprocate platform 28. Platform 28 is guided by rods 29 held at 30 by frame 10. The platform 28 is connected by means of tie rods 31 with its respective mantle half. In open position, the mantles may rest on blocks 32, carried suitably on the frame of the machine.

After the halves of the A mantles are swung upward and closed to surround the tube, appropriate locking blocks 33 (Fig. 2) are moved downwardly by means of hydraulic or air cylinder arrangements 34 into locking relationship with the lugs or members 35, 36, located on the mantle halves 23, 24, respectively. The locking means hydraulic or air motor mechanism 34 may be housed in the super-structure 11.

All of the mantles are provided with spring loaded pins 37, 37 mounted in housings 37A as shown in Fig. 8 for maintaining the tube substantially in the center of the closed mantles. The pins may include plungers 38 flanged as shown at 38A adjacent the mantle and extending through the outer end wall or cap 37B of housing 37A, said pins are spring pressed inwardly by means of springs 39 surrounding said plungers and abutting flange 38A at one end and said end wall 37B of housing 37A at the other end.

One or more sets of the pins may be located along each of the mantle halves.

After the A mantles have closed, jacks 22 (Figs. 1A, 1B, 9) are moved downwardly and the B mantles closed in appropriate sequence. The lengths of the mantles and the mantle combination used may be chosen according to the tube length involved.

The right-hand mantle 39 (Fig. 1B, 10) of group B may have a mantle retaining or axial locking device 40 thereon, said device having a hook-like configuration 40A which engages the lug 41A located on or attached to the support 41 of the machine so as to lock mantle 39 against axial movement. Each of the B mantles may have a retaining block 42 (Figs. 1A, 1B) carried at each end thereof, or at the appropriate end, depending upon arrangement of the machines, for the purpose of engaging a lug or member 42A on a closed mantle so as to lock and hold all of the mantles against axial movement. This will serve to prevent axial shifting of the mantles during the belling and expanding operation at which time the pipe will shorten and tend to carry the mantles therewith. All of the axial forces are transmitted through the mantle retaining device 40, lug 41A and support 41 to the frame of the machine.

During the time of the closing of the mantles, the movable housing tool 16 can be advanced forward to its predetermined position and the tool 18 of the stationary housing moved forward. Both tools enter the pipe and perform the belling operation.

The belling or preliminary pipe end expanding tool of the stationary housing will be described, the other tool being similar thereto. The tool 18 can be mounted on ram extension or tool stem 43 (Figs. 4, 5), cross head 44 being connected thereto and moved by the ram 45 operated by hydraulic motor 46 or by two hydraulic cylinders 63 (Figs. 1B, 4, 5). As shown in Fig. 4, spacing ring 45A prevents contact between the rear end of ram 45 and cylinder cover 62 but does not have a fluid tight contact with said ram. Tool 18 of the stationary housing will push the tube forward against the adjustable housing tool and both of the tools will enter the pipe and perform the belling or end expanding operation.

One form of suitable belling tool is illustrated in Figure 6 wherein the tool stem 43 carries a seating ring 47 which in turn has a squeeze ring 48 mounted inside of the belling ring 51. Packing 50 may be employed and pressure exerted at the appropriate time through suitable passage (not shown) in order to complete the hydraulic seal. A passage 50A (Fig. 6) can be provided for appropriately connecting the underside of sealing ring 53 with an external source of pressure for sealing purposes before the main pressure level is reached. Belling ring 51 is maintained in place by means of retaining ring 52, the assembly being held in place by bolts 56.

The tube in belled condition is illustrated in the dot-dash lines 53, the end 54 thereof being positioned in the stepped cut 55 in seating ring 47. Longitudinally extending grooves 57 can be provided on the periphery of belling ring 51 so that hydraulic pressure can be exerted on the tapered walls of the pipe during the expanding operation which will assist in the correct expansion thereof.

After the belling tools have been inserted in the ends of the tube, a water pre-filling valve 58 (Fig. 4) can be opened so as to fill the tube with low

pressure water through ports 60 in the ram 45 and duct 59 in the tool stem 43, air being purged from the interior of the tube by suitable air release valves (not shown). After the tube has been filled with water and said air release valves have been closed, high pressure water can enter the tube through valve 53 for the purpose of completing the expanding operation. Ring 45A does not move with the ram. The spring pressed pins 38 in the various mantles will be pressed outwardly by the expanding pipe and thus keep the pipe substantially centered in the closed mantle assembly during the expanding operation.

Inasmuch as expansion will cause a shortening of the tube, it is necessary to provide a follow-up movement of one or both of the belling tools. In the present device, pressure furnished to the interior of the tube is exerted on the external end or right hand end (Fig. 4) area of the ram to compensate for the length change. The force exerted thereon will tend to move the tool 13 to the left (Fig. 4). In order to avoid too high a follow-up force for smaller sizes of pipes, an extension 61 can be bolted on to the end of the ram so as to decrease its effective follow-up pressure area. It is quite apparent that the extension 61, together with cover 62, can be readily changed and various sizes of extensions and end covers employed for the purpose of providing the requisite follow-up pressure.

In addition to the aforementioned follow-up arrangement, a pair of lateral cylinders 63, 63 can be connected to cross head 44 by means of piston rods 64 (Fig. 5). These can be used for fast advance and pull back purposes and also can be kept under pressure during expansion so as to provide a further control of the follow-up force.

After completion of the expansion, the pressure water can be released until a predetermined testing pressure is reached, or until the pressure drops to zero. At this time, the mantle locks 34 of the B mantles can be lifted, the B mantles opened, and the jacks 22 raised so as to support the tube. In addition to the jacks 22, V-shaped pipe clamps 65 can be lowered so as to grip the tube between the jacks and the clamps (Fig. 9). At this time, hydraulic test pressure can be employed and air hammers used where desired to act along the length of the tube.

Thereafter, the hydraulic pressure can be released and the heads retracted. The unloading arms 66 (Figs. 1A, 3) they can be pivoted inwardly by means of hydraulic or air motor 67 (Fig. 3) so as to receive the tube as the jacks 22 are lowered. The tube then can be rolled out of the machine to a delivery zone. The unloading arms 66 can be swung outwardly and the machine will be in readiness for another operation.

A special stripper arranged can be provided so as to facilitate stripping of tubes which have been belled, but not expanded due to defects or other reasons, considerable force being required for withdrawing the belling tools under such conditions. In the mantle next to the stationary head, grooves 68 (Fig. 10) can be provided to receive the two halves of stripper ring 68A. In the other mantles, grooves also can be provided at their ends closest to the movable housing and a second stripper ring, similar to ring 68A, placed in the outermost active mantle relative to the adjustable head. The idle grooves in the other active mantles can be provided with flush rings

68B to serve as filler pieces. The belled end of the pipe will abut the stripper ring as the tool is withdrawn, so that the pipe will be stripped therefrom.

It should be apparent that variations may be made in the details of construction without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. In a hydraulic machine for operating on tubes, the combination comprising two groups of mantles closeable to surround a tube, said mantles when closed having a bore the diameter of the finished tube and greater than the initial diameter of the tube to be expanded, means closing one group of mantles, means thereafter closing the other group of mantles, means carried by at least some of said mantles maintaining said tube substantially in the center thereof, and means admitting fluid pressure into the interior of said tube expanding the same into contact with the interior of the mantle means.

2. In a hydraulic machine for operating on tubes, the combination comprising two groups of mantles closeable to surround a tube, said mantles when closed having a bore the diameter of the finished tube and greater than the initial diameter of the tube to be expanded, means closing one group of mantles, means thereafter closing the other group of mantles, means on the last closed group of mantles coacting with holding means on the first group of mantles for retaining the mantles against axial movement, and means admitting fluid pressure into the interior of said tube expanding the same into contact with the interior of the mantle means.

3. In a hydraulic machine for operating on tubes, the combination comprising two groups of mantles closeable to surround a tube, said mantles when closed having a bore the diameter of the finished tube and greater than the initial diameter of the tube to be expanded, means closing one group of mantles, means thereafter closing the other group of mantles, means carried by at least some of said mantles maintaining said tube substantially in the center thereof, means on the last closed group of mantles coacting with holding means on the first group of mantles for retaining the mantles against axial movement, and means admitting fluid pressure into the interior of said tube expanding the same into contact with the interior of the mantle means.

4. In a hydraulic machine for operating on tubes, the combination comprising a plurality of groups of mantle means along the machine closeable to surround and centrally position a tube therein, said mantle means when closed having a bore greater than the initial diameter of the tube, the bore having a diameter substantially that of the finished tube, stripper ring means adapted to be carried adjacent the ends of each of the mantle means, means closing one group of mantles, means thereafter closing the other group of mantles, sealing means advanceable into each end of said tube, means admitting fluid pressure into the interior of said tube expanding the same into contact with the interior of the mantle means, and means withdrawing said sealing means from an expanded tube, the stripper ring means holding the tube during withdrawal of the tube.

5. In a hydraulic machine for operating on tubes, the combination comprising two groups of mantles closeable to surround a tube, said mantles when closed having a bore the diameter

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of the finished tube and greater than the initial diameter of the tube to be expanded, means closing one group of mantles, means thereafter closing the other group of mantles, spring pressed plungers carried by said mantles centrally holding a tube therein, and means admitting fluid pressure into the interior of said tube expanding the same into contact with the interior of the mantle means.

6. In a hydraulic machine for operating on 10 tubes, the combination comprising a frame, a stationary housing at one end of the machine and an adjustable housing spaced from said stationary housing and lockable in any one of a plurality of positions along said frame, the distance between the housings being chosen in accordance with the length of the tube to be operated upon, sealing heads mounted on each of said housings, hydraulic motor means reciprocally carrying the head on the stationary housing, said hydraulic motor means being movable relative to the sealing head on the adjustable housing into and out of sealing relationship with a tube, a plurality of openable mantles closeable to surround a tube and located along the machine between said housings, said mantles when closed having a bore the diameter of the finished tube and greater than the initial diameter of the tube to be expanded, means to close a selected number of mantles, the number closed depending 30

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upon the length of the tube to be encompassed thereby, and means admitting fluid pressure into the interior of said tube expanding the same into contact with the interior bore of the mantle means.

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