L. H. BRINKMAN.

TUBE FINISHING MACHINE.

APPLICATION FILED SEPT. 12, 1912.

1,095,265.

Patented May 5, 1914.

2 SHEETS—SHEET 1.

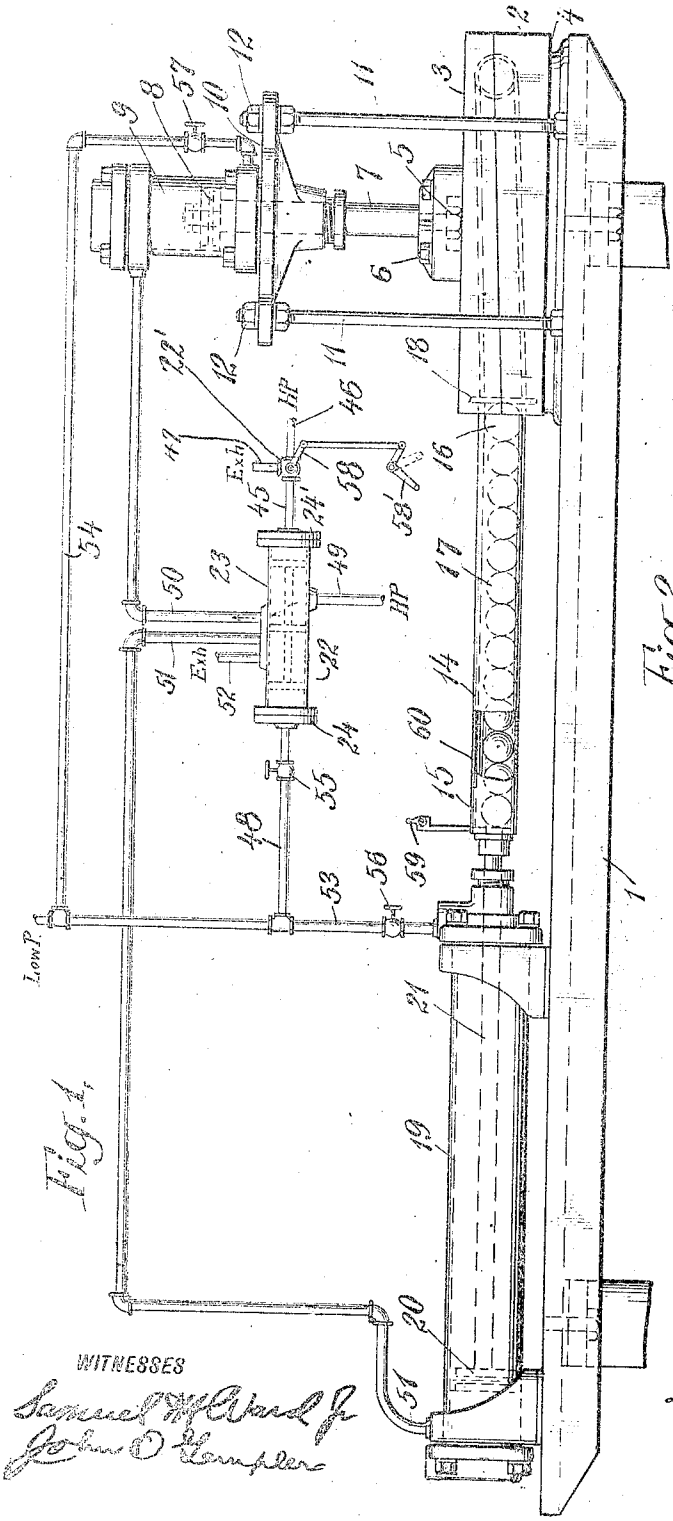


Fig. 1.

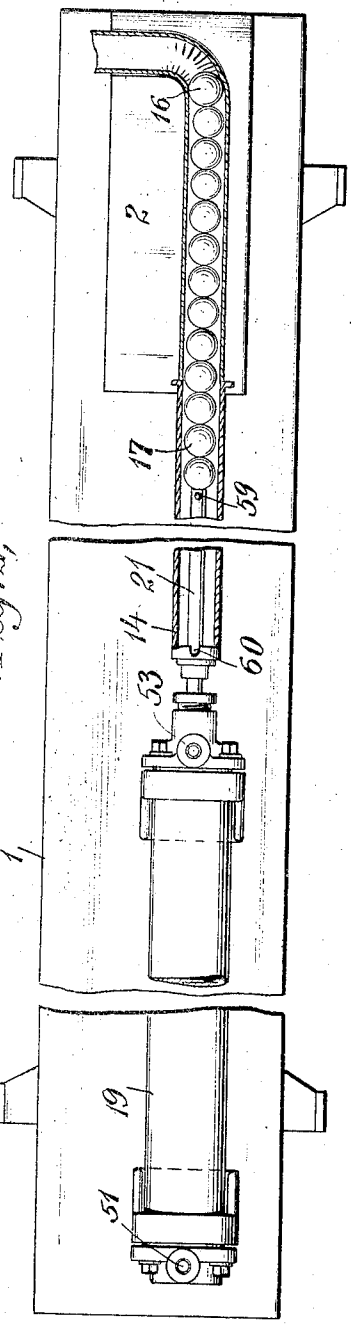


Fig. 2.

WITNESSES

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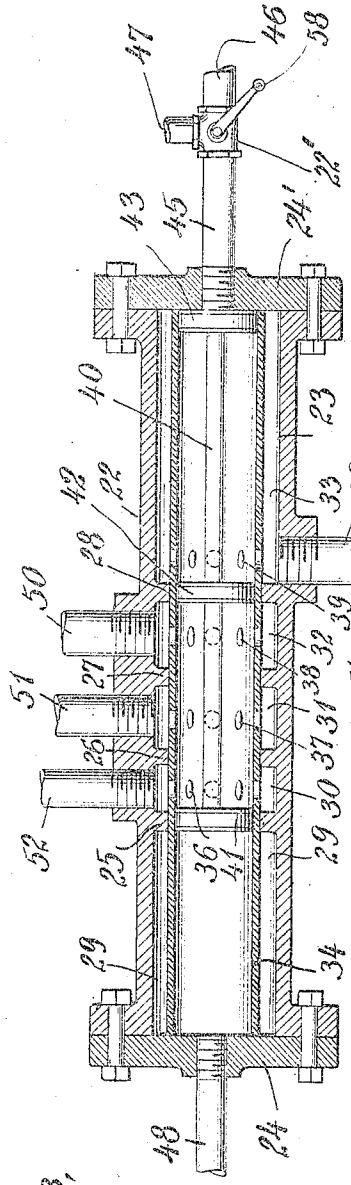


Fig. 3.

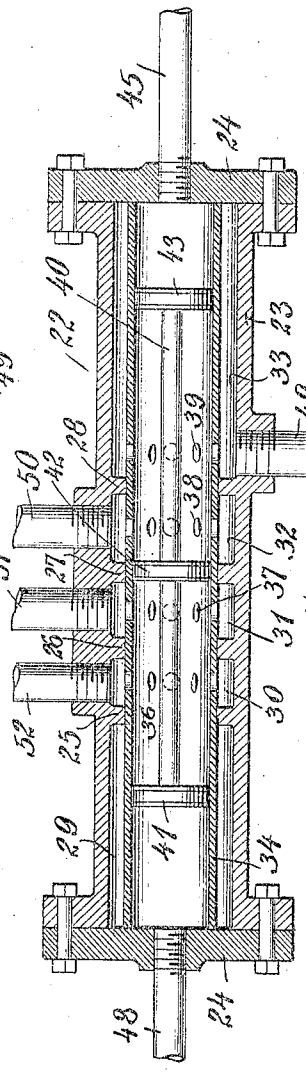


Fig. 4.

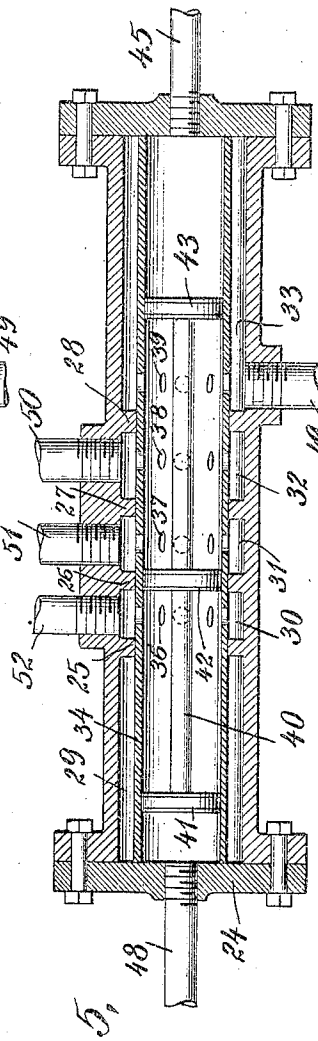


Fig. 5.

WITNESSES

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UNITED STATES PATENT OFFICE.

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TUBE-FINISHING MACHINE.

1,095,265. Specification of Letters Patent. Patented May 5, 1914.

Application filed September 12, 1912. Serial No. 719,946.

To all whom it may concern:

Be it known that I, LOUIS H. BRINKMAN, a citizen of the United States, and a resident of Glen Ridge, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Tube-Finishing Machines, of which the following is a specification.

My invention relates to tube finishing machines, and more particularly to machines for smoothing out any irregularities or unevenness in the shell of a tube which has previously been bent to approximately the shape desired, in order to give the tube a smooth, uniform bore and to conform it exactly to the shape desired.

One object of the invention is to provide a simple and durable machine of the above type by means of which tubes may be rapidly finished.

Another object of the invention is to provide such a machine which may be readily controlled and operated with little effort on the part of the attendant; and still another object of the invention is to provide a fluid pressure-operated machine of the above type having a single control valve by means of which the machine may be readily controlled and rapidly operated by a single attendant.

The invention will be more readily understood and other objects of the invention will more fully appear from the following description taken in connection with the accompanying drawings, in which—

Figure 1 shows a side elevation of the preferred embodiment of my invention. Fig. 2 is a broken plan view of the same with certain parts omitted and others in cross section; and Figs. 3, 4, and 5 are vertical longitudinal sections of the preferred form of a motive power operated control valve shown in different operative positions.

Referring to the drawings (Figs. 1 and 2), 1 is a suitable platform on one end of which is mounted a suitable split die 2 of the size and shape to which the tube is to be finished, the die comprising upper and lower members 3 and 4. The lower or floor member 4 is rigidly secured to the platform 1 by any suitable means, and the top or movable member 3 is secured by means of bolts 5 and 6 to a rod 7 on the other end of which is mounted a piston 8 fitting in a cylinder 9 the head of which is provided with a flange portion 10 secured to the upper ends of rods 11 by means of nuts 12, the lower ends of the rods being secured to the platform 1.

Adjacent one end of the die I provide a suitable guide 14 having an opening 15 through which suitable balls 16 and 17 are inserted. The guide may be of any desired structure for holding the balls and guiding them into the adjacent opening of the die, but I prefer to have the guide in the form of a cylindrical tube, as shown, and to provide the same at one end with a flange 18 fitting into the die, by means of which the guide may be steadied and held in position. At the rear of the guide I provide a cylinder 19 having a piston 20 to which is secured a plunger 21 the forward end of which projects through the adjacent end of the guide 15 so as to engage the balls and force them into the tube in the die when the piston is moved forward. The diameter of the foremost ball 16 is equal to the desired bore of the finished tube, and the following balls are of less diameter so that when the foremost ball has been forced through the tube, the remaining balls may roll back into the guide; and in order that these balls may return by gravity to the guide when the plunger is retracted, I incline the die downward toward the guide, as shown in Fig. 1.

Referring to Figs. 1 and 2, it will be seen that the number of balls and the length of the guide and the plunger are such that the foremost ball, or as many of the balls as are to be of the larger diameter, will be forced through the pipe in the die by a single forward stroke of the plunger. This feature enables the tubes to be finished much more rapidly than if the guide and plunger were of such proportions that only one or a few of the balls could be forced into the tube at a single stroke of the plunger. In order to insure a more ready control and rapid operation of such machines than has heretofore been possible, and to obtain perfect control, with smoothness of operation, and to greatly diminish the manual assistance in the operation of such machines, I drive the pistons 8 and 20 by fluid pressure and connect the corresponding cylinders 9 and 19 by suitable piping to a suitable motive power operated valve 22 controlling the flow of motive fluid to and from the cylinders, and, in the preferred form of my invention, I

control the operation of this valve by a master control device preferably in the form of a valve 22'.

The constructron and arrangements of the valves and the manner of connecting and operating them in the preferred form of my invention, is as follows: The motive-power operated valve 22 consists of a cylindrical shell 23, the ends of which are closed by heads 24, 24', the inside of the valve casing being divided transversely by four annular flanges 25, 26, 27 and 28, into compartments 29, 30, 31, 32 and 33, and within the outer shell of the valve there is provided a cylinder or tube 34 extending the entire length of the valve and fitting tightly against the annular flanges 25, 26, 27 and 28. This tube is provided with a series of perforations 36 opening into the chamber 30, and with a series of perforations 37, 38 and 39 opening respectively into the chambers 31, 32 and 33. The inner cylinder 34 is provided with a rod 40 carrying three piston rings or heads 41, 42 and 43 fitting within the cylinder 34 so as to slide back and forth therein. To one end of the inner cylinder 34 there is connected a pipe 45 in which is placed the master-controlled valve 22' having a port connected to a pipe 46 leading to a suitable source of high pressure fluid, not shown, with a second port connected with an exhaust pipe 47, while the other end of the cylinder is connected to a pipe 48 leading to a suitable source of low pressure fluid such, for example, a city water supply. The chamber 33 of the valve is connected by pipe 49 to the high pressure source above-mentioned, while the valve chamber 32 is connected through pipe 50 to the upper end of the cylinder 9, the valve chamber 31 being connected by pipe 51 to the rear end of cylinder 20 and valve chamber 30 being connected to an exhaust pipe 52. The front end of cylinder 19 and the lower end of cylinder 9 are respectively connected by pipes 53 and 54 to the above-mentioned source of low pressure fluid, and the pipes 48, 53 and 54 are provided with suitable valves 55, 56 and 57 for cutting off the low pressure when desired, but in the normal operation of the machine these valves are open and the low pressure fluid is always acting on the parts of the apparatus to which these pipes are connected.

The master-control valve 22' is provided with a suitable handle or lever 58 which, in the preferred form of my invention is connected to a bell-crank lever 58' extending into a path of travel of a suitable projection 59 mounted on the upper side of the plunger 21 so as to move therewith through a suitable slot 60 along the cylindrical ball guide 14. The arrangement is such that when the plunger has moved forward to such an extent as to force the leading ball 16 through the tube, the projection 59 will engage the crank 58' and throw it into a position to cut off the high pressure from pipe 45 and connect the pipe with the exhaust pipe 47.

The operation of the apparatus as described is as follows: Assuming that the plunger 21 is retracted in the position shown in Fig. 1, the balls being in position, the die being open with the upper half of the die 3 elevated and the lever 58' of the master-control valve being in the dotted line position shown in Fig. 1, with low pressure fluid holding the piston 8 raised and the piston 20 in its rear position, and the piston of the motive-power operated valve in the position shown in Fig. 3; to start the machine, the operator throws lever 58' of the master-control valve into the full line position shown in Fig. 1, whereupon high pressure is admitted through pipes 46 and 45 against the end piston head 43 of the motive power operated valve, moving the same to the left. As the rod 40 carrying the three piston heads 41, 42 and 43 moves to the left, the ports or openings 38 are first uncovered as shown in Fig. 4, admitting the high pressure fluid from pipe 49 through ports or openings 39 and 38, into valve chamber 32 and from thence through pipe 50 to the upper end of cylinder 9 to force the piston downward to close the die. As this piston is descending the rod 40 continues in its movement to the left until it reaches the position shown in Fig. 5, whereupon high pressure fluid is also admitted through the ports 37 into valve chamber 31, thence through pipe 51 to the rear end of the cylinder 19, causing the plunger 21 to move forward, forcing the balls through the tube. When the plunger 21 is moved forward sufficiently to force ball 16 through the tube, the projection 59 carried on the plunger engages the operating lever 58' of the master-control valve, forcing it into position to cut off the high pressure from pipe 45 and connecting said pipe to the exhaust pipe 47, whereupon the low pressure (preferably connected to the city mains) acting through pipe 48 on the other end of piston head 41 of the motive-power operated valve, forces the rod 40 with its piston heads to the right, first uncovering ports 36 and 37 to connect pipe 51, leading from the rear end of cylinder 19, to exhaust pipe 52 and subsequently uncovering ports 38 to connect pipe 50 leading from the upper end of cylinder 9 to exhaust pipe 52, thus permitting the city pressure acting on the opposite ends of these cylinders to move them so as to return plunger 21 to its retracted position and elevate the upper half of the die.

It will be seen from the above described operation that I have provided a machine

of the character described, which in the preferred embodiment of my invention is practically automatic in its operation and only requires little attention aside from placing the balls in the guide and throwing the lever 58′ to start the operation, the parts being automatically returned in position for a second operation without thought on the part of the operator. Such a machine may be operated with considerable less skill on the part of the attendant than is required in tube finishing machines heretofore known, and without effort on the part of the operator. It will also be observed that the machine operates with great efficiency in the motive power necessary to operate it, since the low pressure fluid is not exhausted but simply acts as a buffer against the high pressure fluid to automatically return the parts when the tube in the die has been "finished." It will be obvious to those skilled in the art that in so far as certain features of my invention are concerned, various changes in the arrangement, construction and operation of the machine may be made without departing from the scope and spirit of the invention, such for instance as the substitution of some other arrangement and connection for the fluid pressure for returning the cylinders to their normal position in place of the normally applied low pressure acting to automatically return these parts, or the substitution of differently constructed valves or other parts of the machine, and I do not wish to be understood as limiting myself other than is indicated in the accompanying claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, power-operated means including a piston actuating the movable part of the die and a plunger for forcing the balls into the tube in the die, and a control device governing said power-operated means to close the die and to force the balls into the tube.

2. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide holding a plurality of balls registering with one end of the die, said balls, power-operated means including a piston for actuating the movable part of the die and a plunger for forcing the balls into the tube in the die, said balls being sufficient in number and the plunger and guide being of such length that the foremost ball will be forced through the tube by a single stroke of the plunger, and means controlling said power-operated means to close the die and force the balls into the tube.

3. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes leading to said cylinders, and valve mechanism connected with the pipes and controlling the pistons to close the die and then force the balls into the tube.

4. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, the floor member of the die sloping downward to the adjacent end of the guide so as to permit the return of the balls thereto by gravity, said balls, power-operated means including a piston actuating the movable part of the die and a plunger for forcing the balls into the tube in the die, and a control device governing said power-operated means to close the die and to force the balls into the tube.

5. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide holding a plurality of balls registering with one end of the die, the floor member of the die sloping downward to the adjacent end of the guide so as to permit the return of the balls thereto by gravity, said balls, power-operated means including a piston for actuating the movable part of the die and a plunger for forcing the balls into the tube in the die, said balls being sufficient in number and the plunger and guide being of such length that the foremost ball will be forced through the tube by a single stroke of the plunger, and means controlling said power-operated means to close the die and force the balls into the tube.

6. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one

end of the die, the floor member of the die sloping downward to the adjacent end of the guide so as to permit the return of the balls thereto by gravity, said balls, means including a cylinder, and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth through the guide to engage and force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes leading to said cylinders, and valve mechanism connected with the pipes and controlling the pistons to close the die and then force the balls into the tube.

7. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide holding a plurality of balls registering with one end of the die, said balls, power-operated means including a piston for actuating the movable part of the die and a plunger for forcing the balls into the tube in the die, said balls being sufficient in number and the plunger and guide being of such length that the foremost ball will be forced through the tube by a single stroke of the plunger, and a control device connected with said power-operated means for governing the same to open and close the die and to force the balls into the tube.

8. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, fluid pressure pipes leading to each side of the pistons, and a control valve governing the admission and outlet of said fluid through the pipes to move the pistons so as to close the die, move the plunger forward and then retract the plunger and open the die.

9. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, power-operated means including a piston actuating the movable part of the die and a plunger for forcing the balls into the tube in the die, and means including a single manually operated control valve for supplying and controlling power to said piston and plunger to operate the same.

10. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, fluid pressure conveying pipes leading to each end of said cylinders, and a single valve mechanism connected to said pipes for controlling the admission of fluid pressure to each end of the cylinders for operating the piston and plunger.

11. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, fluid pressure conveying pipes leading to each end of the cylinders, and a single valve mechanism connected with said pipes for controlling the admission and exhaust of fluid pressure to and from each end of the cylinders.

12. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, fluid pressure conveying pipes connected to said cylinders, a motive power-operated valve connected with said pipes to control the admission of fluid pressure to the cylinders to close the die and then force the balls into the tube, and means for applying motive power to said valve.

13. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the

die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, fluid pressure conveying pipes leading to each end of the cylinders, a motive power-operated valve connected with said pipes to control the admission and exhaust of fluid pressure to and from each end of the cylinders, said valve being biased in operation to the position for exhausting the fluid pressure from one end of the cylinders to return the piston and plunger to their normal position, and means for applying power to the valve to move it so as to admit fluid pressure to the cylinders to close the die and move the plunger forward.

14. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes for leading high pressure fluid to one end of said cylinders, a valve connected to said pipes for controlling the admission and exhaust of fluid to and from the cylinders, and pipes for leading relatively low pressure fluid to the other end of the cylinders to automatically return the piston and plunger to their normal position when high pressure is cut off from said cylinders.

15. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes for leading high pressure fluid to one end of said cylinders, a valve connected to said pipes for controlling the admission and exhaust of fluid to and from the cylinders, and pipes for leading relatively low pressure fluid to the other end of the cylinders to automatically return the piston and plunger to their normal position when high pressure is cut off from said cylinders, said valve being biased in operation to the position for exhausting the high pressure fluid from the cylinders so that the low pressure fluid may automatically return the piston and plunger to their normal positions.

16. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes for leading high pressure fluid to one end of said cylinders, a valve connected to said pipes for controlling the admission and exhaust of fluid to and from the cylinders, pipes for leading relatively low pressure fluid to the other end of the cylinders to automatically return the piston and plunger to their normal position when high pressure is cut off from said cylinders, said valve being biased in operation to the position for exhausting the high pressure fluid from the cylinders so that the low pressure fluid may automatically return the piston and plunger to their normal positions, and means including a master control device for controlling the movement of said valve to admit high pressure fluid to the cylinders to close the die and move the plunger forward.

17. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes for leading high pressure fluid to one end of said cylinders, a valve connected to said pipes for controlling the admission and exhaust of fluid to and from the cylinders, pipes for leading relatively low pressure fluid to the other end of the cylinders to automatically return the piston and plunger to their normal position when high pressure is cut off from said cylinders, said valve being biased in operation to the position for exhausting the high pressure fluid from the cylinders so that the low pressure fluid may automatically re-

turn the piston and plunger to their normal positions, and means for controlling said valve comprising a part connected with the plunger to move therewith and operatively related to the valve to cause the same when the plunger has been moved forward, to be moved into a position for exhausting the high pressure from the cylinders to permit the return of the piston and plunger.

18. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the ball into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes leading high pressure fluid to one end of said cylinders, pipes for leading a relatively low pressure fluid to the other end of the cylinders to automatically return the piston and plunger to their normal positions when the high pressure to the cylinders is cut off, a valve connected with the high pressure pipes for controlling the admission and exhaust of fluid to and from the cylinders, means for normally applying power to the valve to move it into the position for exhausting the high pressure fluid from the cylinders, and means including a master control device, for applying power to the valve to move it into position to admit high pressure to the cylinders.

19. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes for leading high pressure fluid to one end of the cylinders, pipes for leading relatively low pressure fluid to the other end of the cylinders for automatically returning the piston and plunger to their normal position when the high pressure is cut off from the cylinders, valve mechanism comprising a sliding piston and with ports connected to the high pressure pipes leading to the cylinders and an exhaust port, a pipe connected with said valve mechanism on one side of the piston for normally applying relatively low pressure fluid thereto for moving the piston into position to exhaust the high pressure from the cylinders, a pipe connected with the valve mechanism on the other side of the piston for conducting fluid pressure thereto to move it against the low pressure, and a valve controlling the fluid pressure to the valve through said last pipe.

20. In a tube finishing machine, the combination of a split die for holding the tube and confining its shell to the desired shape and size, one member of the die being movable to permit the placing of the tube in the die, a guide for balls registering with one end of the die, said balls, means including a cylinder and hydraulically-operated piston connected with the movable part of the die for actuating the same, a plunger movable back and forth to force the balls into the tube, means including a cylinder and hydraulically-operated piston actuating said plunger, pipes for leading high pressure fluid to one end of the cylinders, pipes for leading relatively low pressure fluid to the other end of the cylinders for automatically returning the piston and plunger to their normal position when the high pressure is cut off from the cylinders, valve mechanism comprising a sliding piston and with ports connected to the high pressure pipes leading to the cylinders and an exhaust port, a pipe connected with said valve mechanism on one side of the piston for normally applying relatively low pressure fluid thereto for moving the piston into position to exhaust the high pressure from the cylinders, a pipe connected with the valve mechanism on the other side of the piston for conducting fluid pressure thereto to move it against the low pressure, a valve controlling the fluid pressure to the valve mechanism through said last pipe, and means including a projection from said controlling valve and a projection from the plunger adapted to engage therewith when the plunger has been moved forward to cut off the high pressure fluid from the valve mechanism and permit the piston and plunger to be automatically returned to their normal positions.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

LOUIS H. BRINKMAN.

Witnesses:
SAMUEL M. WARD, JR.,
EDWIN SEGER.