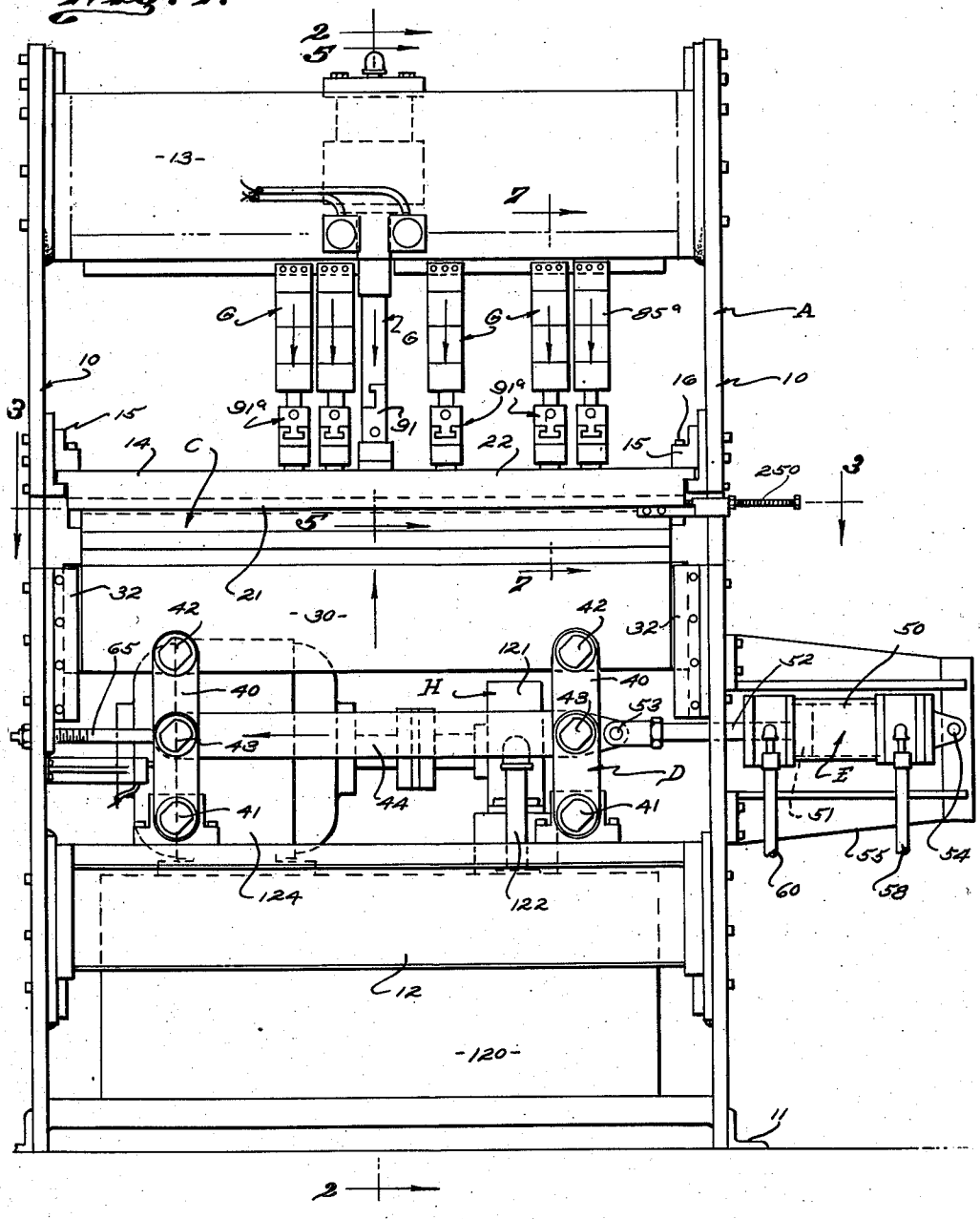
March 24, 1953 S. J. HAMILTON 2,632,511

METHOD AND APPARATUS FOR MAKING APERTURED MANIFOLDS FOR GAS STOVES

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Fig. 1.



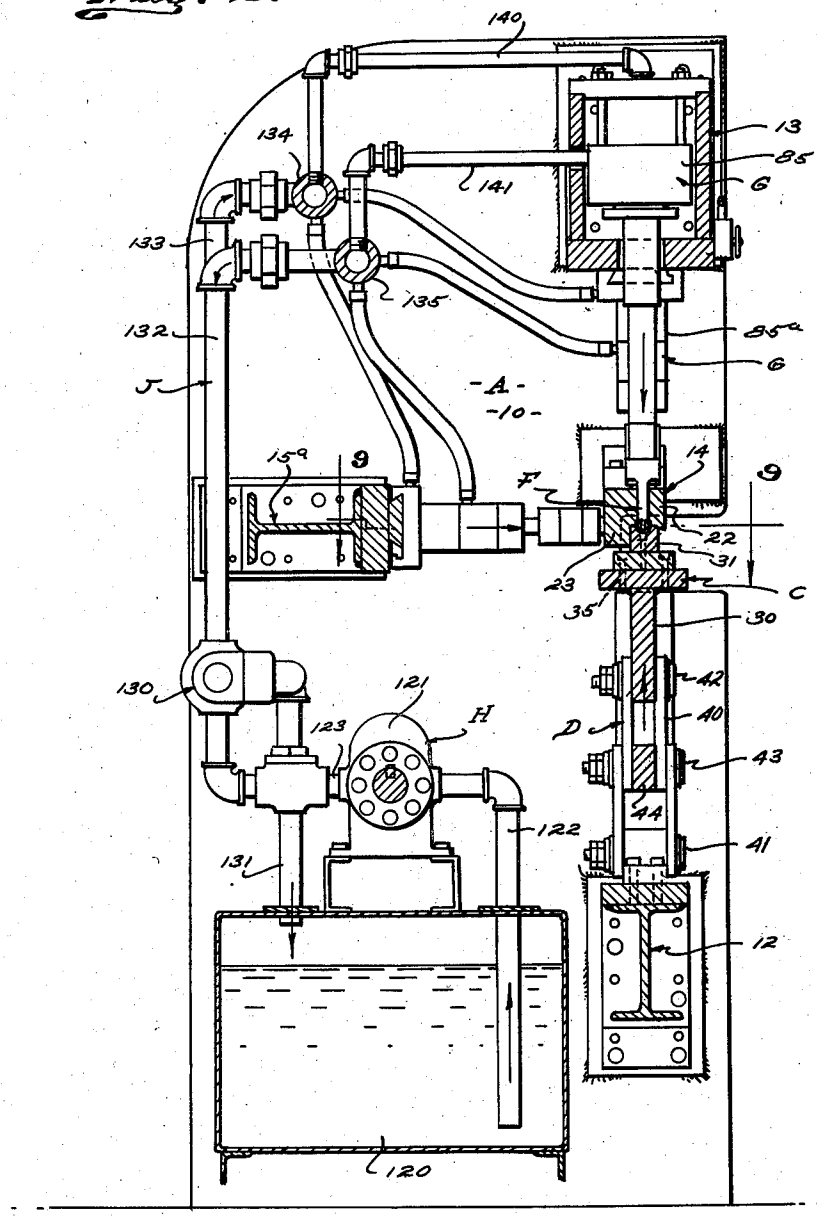
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METHOD AND APPARATUS FOR MAKING APERTURED MANIFOLDS FOR GAS STOVES

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Fig. 2.



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Fig. 3.

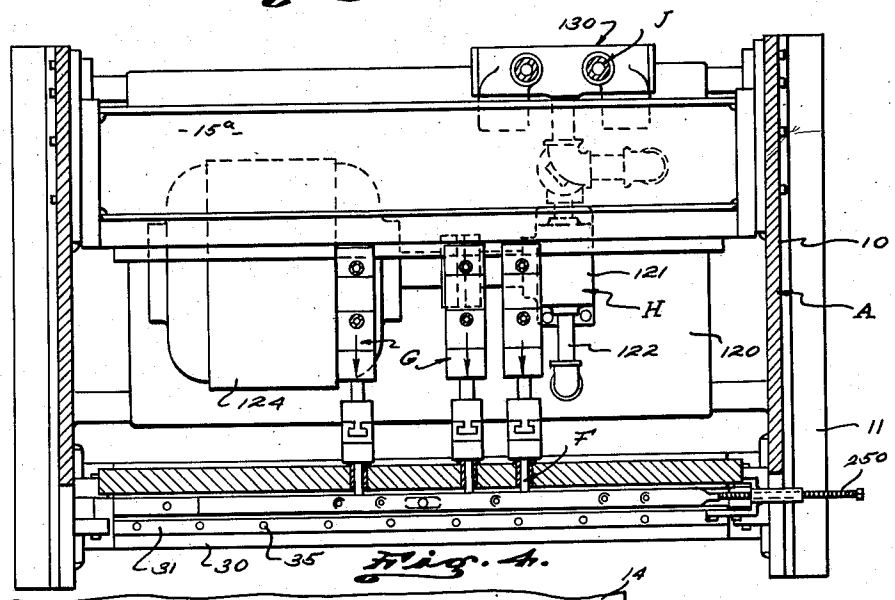
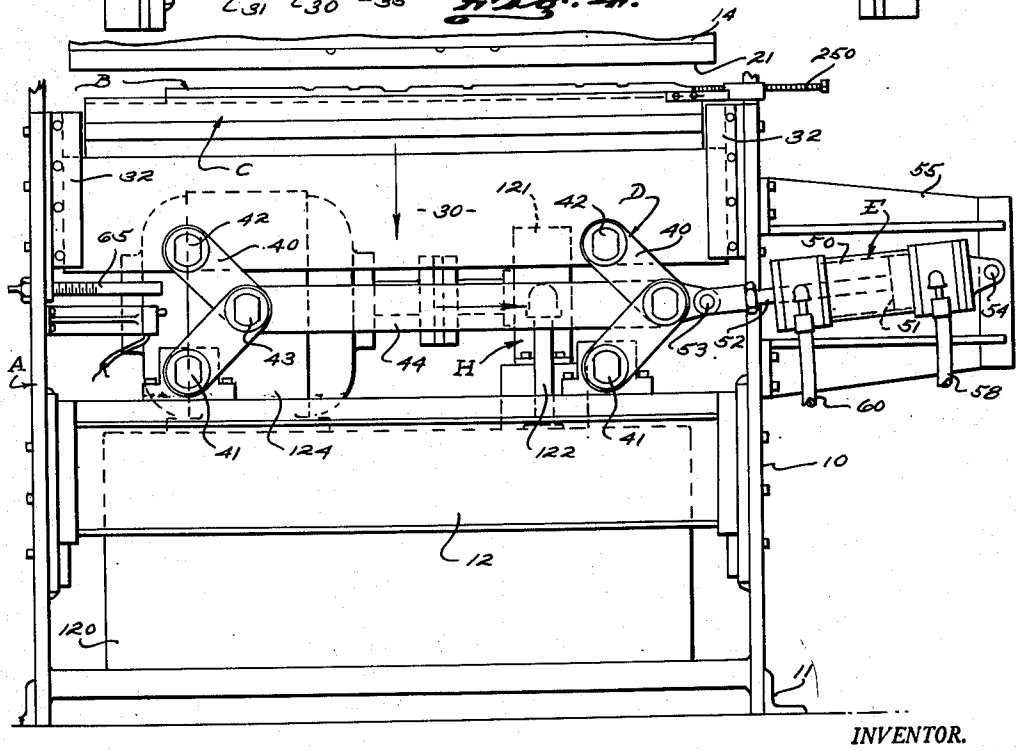


Fig. 4.



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Fig. 5.

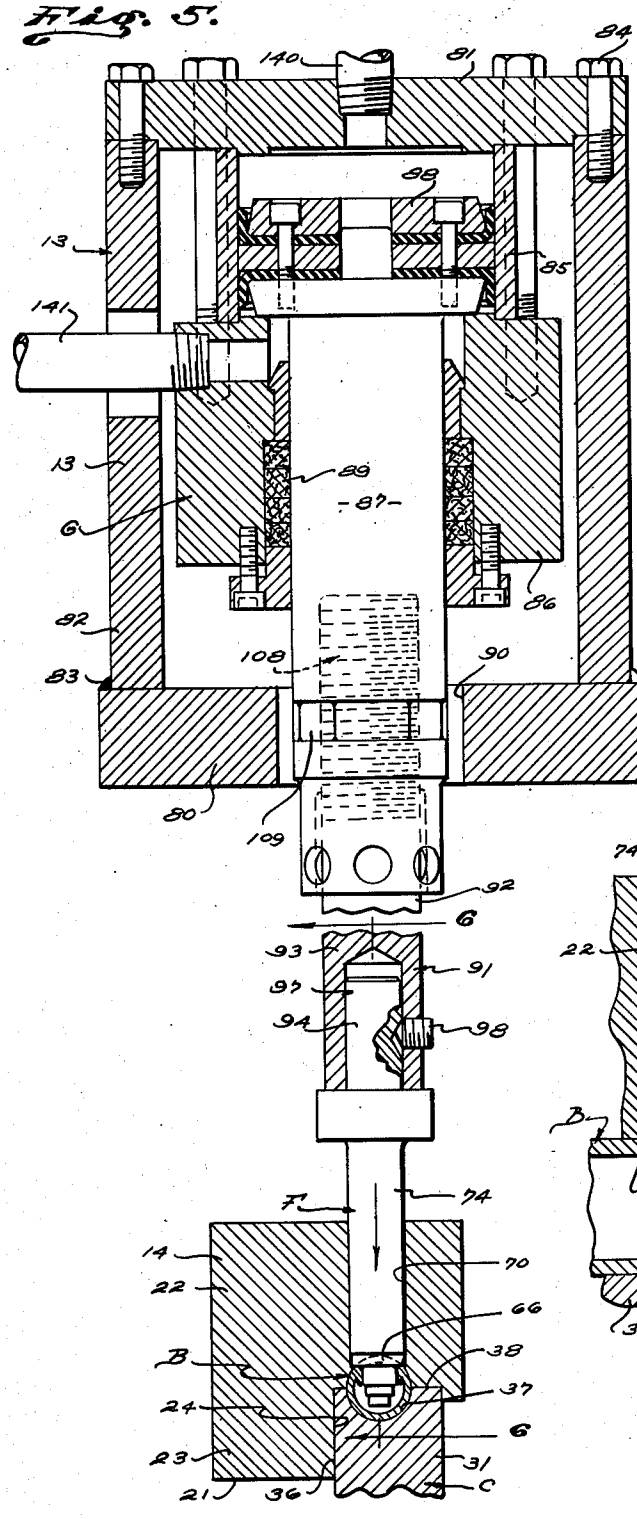
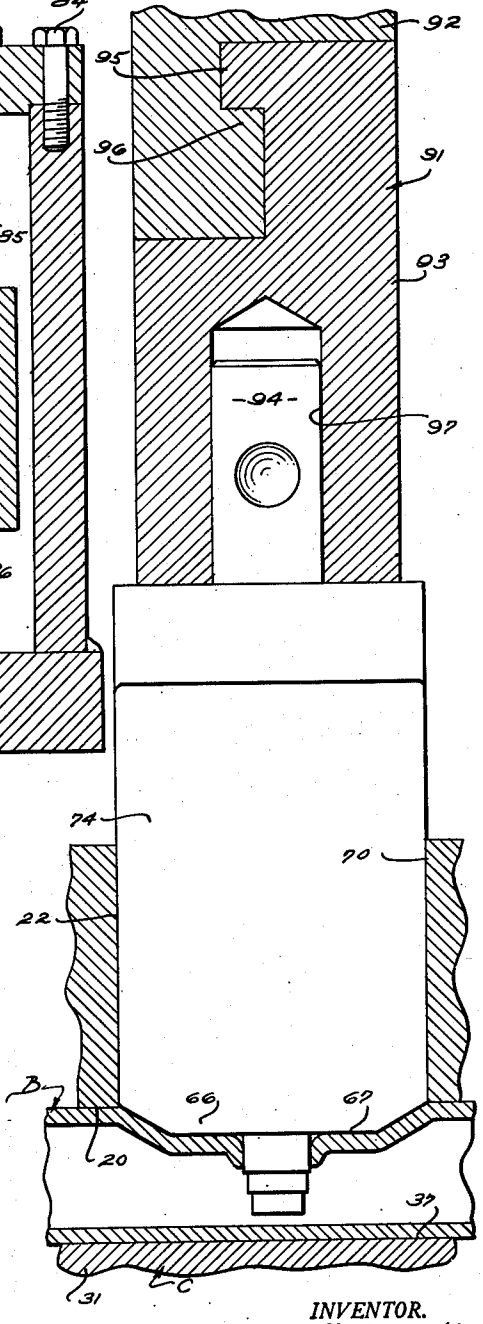


Fig. 6.



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METHOD AND APPARATUS FOR MAKING APERTURED MANIFOLDS FOR GAS STOVES

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Fig. 7.

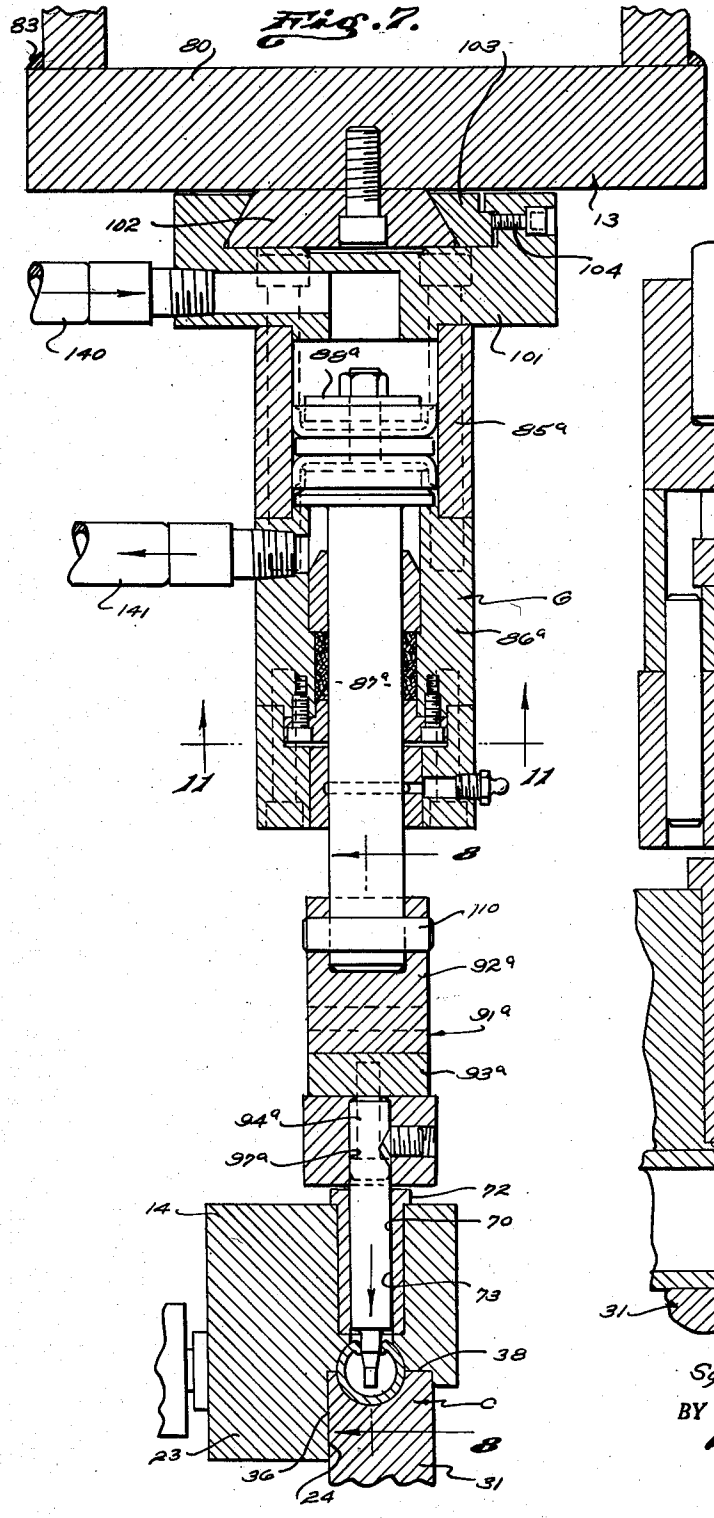
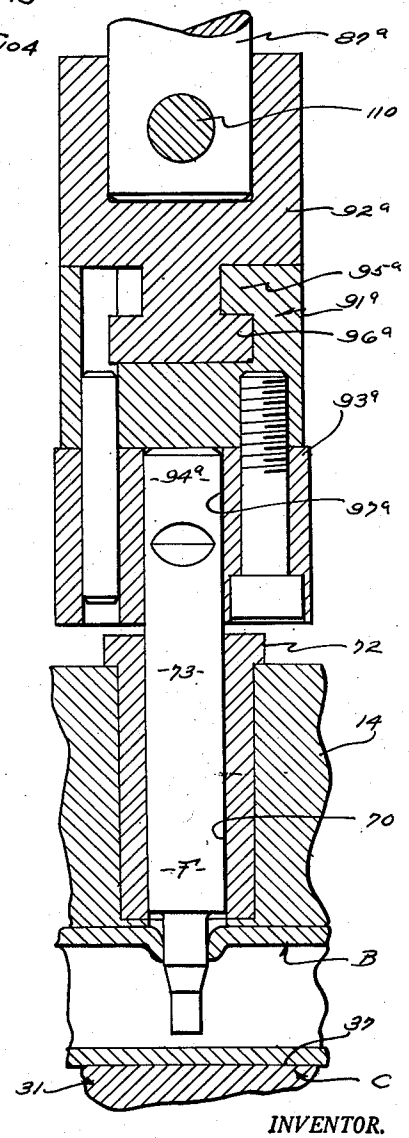


Fig. 8.

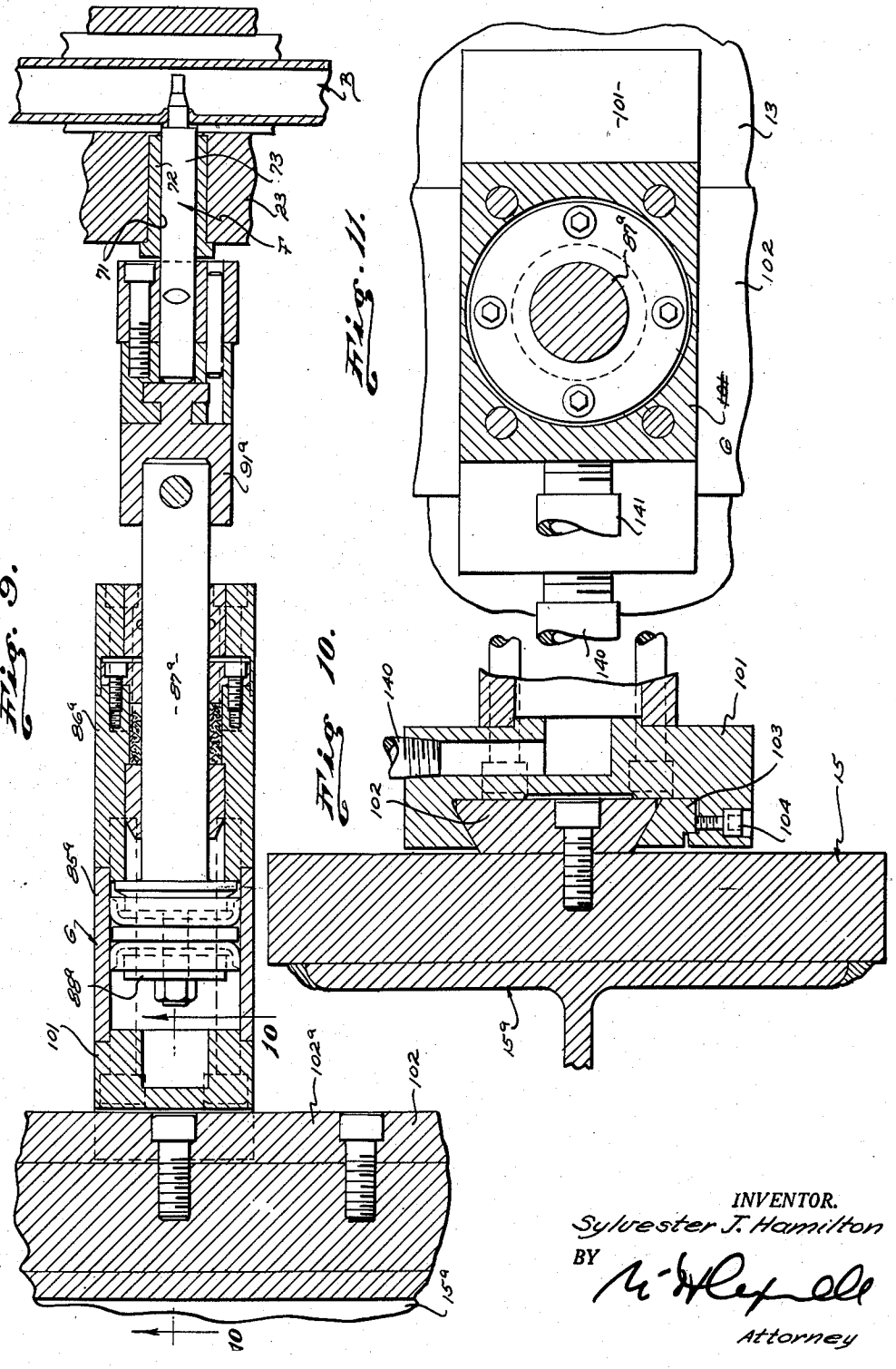


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Fig. 12.

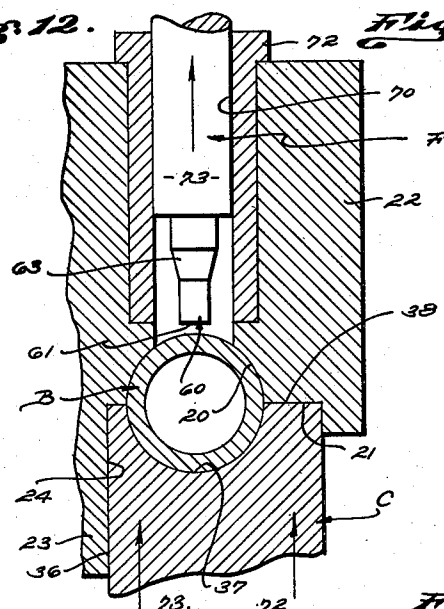


Fig. 13.

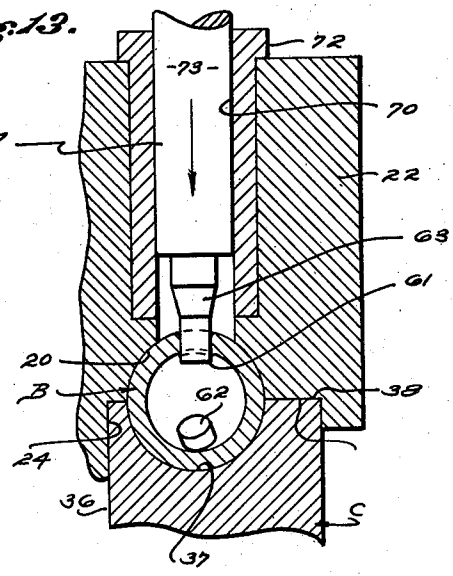


Fig. 14.

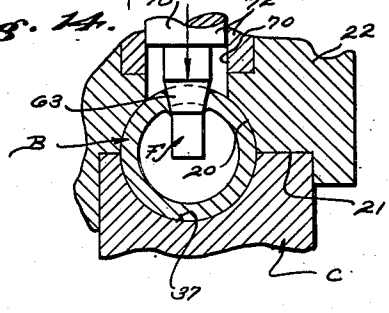


Fig. 15.

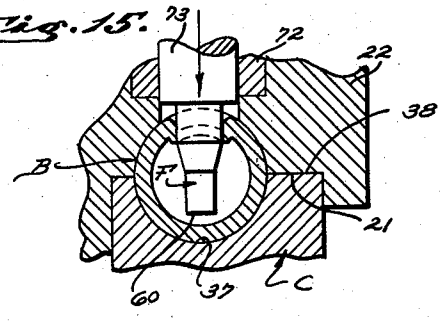


Fig. 16.

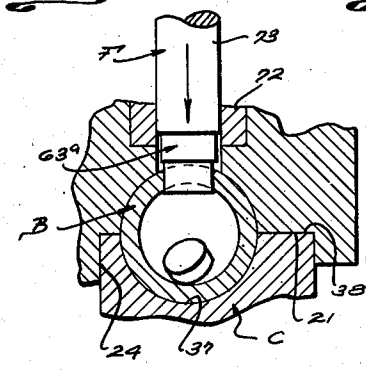


Fig. 17.

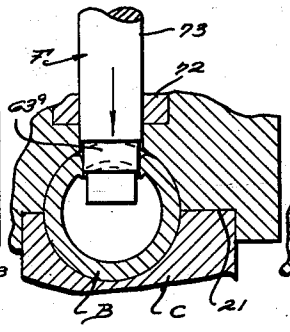
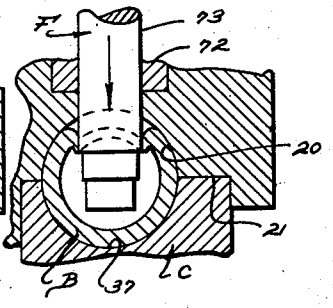


Fig. 18.



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Fig. 19. Fig. 20. Fig. 21.

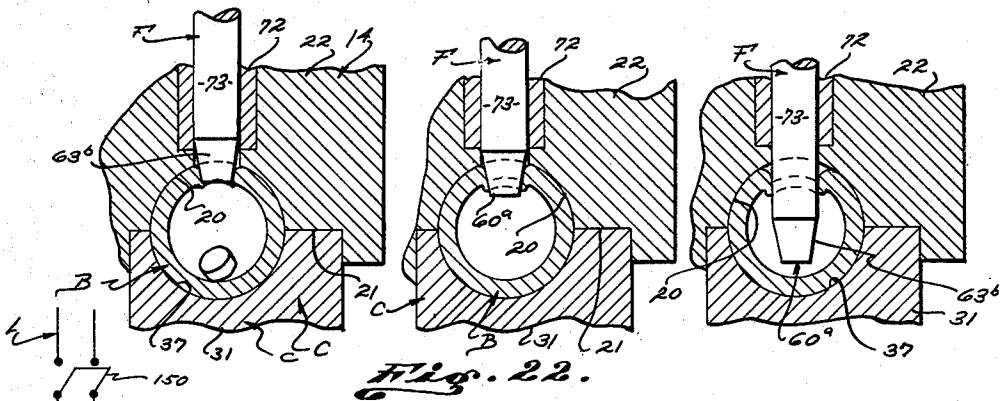
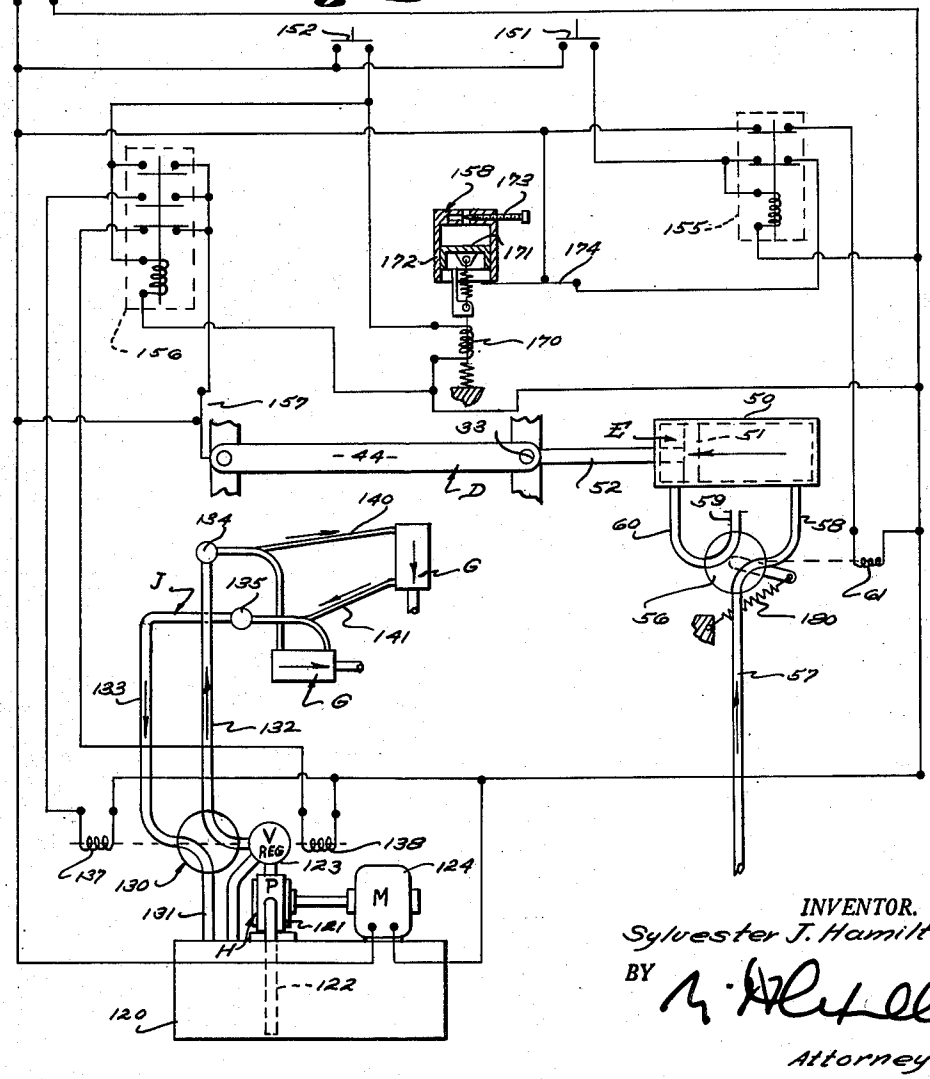


Fig. 22.



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UNITED STATES PATENT OFFICE

2,632,511

METHOD AND APPARATUS FOR MAKING APERTURED MANIFOLDS FOR GAS STOVES

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Application March 6, 1950, Serial No. 147,871

6 Claims. (Cl. 164—108)

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This invention has to do with a method and apparatus for the making of apertured manifolds for gas stoves and it is a general object of the invention to provide a simple, practical, economical method of manufacture and apparatus for carrying out such method which is simple, practical and dependable.

The usual gas stove or cooking range provided for domestic use has a gas distributing manifold which is in the form of a pipe of substantial length, and this manifold has apertures in it at various points along its length to carry, or for the reception of, various connections or fittings desired in the finished stove. Since the devices or fittings which are applied to a manifold must have tight connection therewith it is common to provide the manifold with openings which are threaded or tapped so that such fittings can be threaded into the manifold. Manifolds made in accordance with methods heretofore available and with apparatus in general use have been of substantial wall thickness to provide for necessary threads or have required rather slow complicated swedging operations to establish the desired openings for the reception of fittings.

It is an object of this invention to provide a method of making an apertured manifold for a gas stove whereby, with minimum handling of the manifold and with few simple, easily executed operations, a manifold of nominal or light wall thickness is provided with a multiplicity of apertures at varying positions along and/or around the manifold, the wall thickness of the manifold being increased where the apertures occur to afford ample stock for adequate threads suitable for the reception of various attachments or fittings.

It is another object of this invention to provide apparatus for converting a simple elongate tube, such as a pipe, into a multiple apertured manifold, which apparatus confines the pipe or blank, as the apertures are formed, so that the manifold is maintained in substantially round condition while the apertures are initially formed by punching and are thereafter enlarged by swedging.

It is another object of this invention to provide apparatus of the general character referred to wherein a plurality of tools is provided to act upon the manifold, which tools are provided with individual actuating mechanisms which are so supplied with actuating pressure that they may operate simultaneously or in rapid succession so that a multiplicity of apertures are formed in a manifold in a single operation or substantially simultaneously.

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It is a further object of the invention to provide apparatus of the general character referred to in which there is a frame of unique construction and arrangement carrying the various essential parts of the apparatus so that they are readily accessible and operate efficiently and effectively.

It is a further object of the invention to provide apparatus of the general character referred to in which a clamp is provided to hold the blank in place to be apertured, which clamp cooperates with a stationary part so that the blank is completely embraced or confined and is operated by a toggle mechanism so that an actuating device of limited size and capacity serves to effectively maintain the clamp in blank holding position as heavy pressures are applied to the blank in the course of establishing the apertures therein.

It is a further object of the invention to provide apparatus of the character described with a series of tools that act upon the blank while it is held in the apparatus, which tools are shiftable relative to each other to various positions to establish apertures at various points along the manifold and are provided with individual actuating mechanisms each in the form of a fluid pressure actuated mechanism to which the tool is releasably coupled.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a front elevation of the machine or apparatus provided by this invention showing a typical setting of the tools of the vertical series and showing the mechanism set so a blank is confined or held ready to be acted upon by the tools. Fig. 2 is a vertical transverse sectional view of the machine as shown in Fig. 1, being a view taken substantially as indicated by line 2—2 on Fig. 1. Fig. 3 is a plan section taken as indicated by line 3—3 on Fig. 1. Fig. 4 is a view of a portion of the mechanism shown in Fig. 1 showing it in a released position with a manifold that has been formed by operation of the tools thereon. Fig. 5 is an enlarged vertical sectional view of a portion of the machine, being a view taken as indicated by line 5—5 on Fig. 1. Fig. 6 is an enlarged detailed sectional view taken substantially as indicated by line 6—6 on Fig. 5. Fig. 7 is an enlarged vertical sectional view taken as indicated by line 7—7 on Fig. 1. Fig. 8 is an enlarged detailed sectional view taken as indicated by line 8—8 on Fig. 7. Fig. 9 is a plan section of a part of the machine taken as indicated

by line 9—9 on Fig. 2. Fig. 10 is an enlarged detailed sectional view taken as indicated by line 10—10 on Fig. 9. Fig. 11 is an enlarged detailed sectional view taken as indicated by line 11—11 on Fig. 7. Fig. 12 is an enlarged detailed sectional view showing a blank held in the machine with a typical tool in position ready to be operated into engagement with the blank. Fig. 13 is a view similar to Fig. 12 showing the tool operated far enough to perforate or pierce the blank. Fig. 14 is a view similar to Fig. 13 showing the tool further advanced and in process of enlarging the opening initially pierced in the blank. Fig. 15 is a view similar to Fig. 14 showing the tool fully operated and the opening fully enlarged by the swedging operation. Fig. 16 is a view similar to Fig. 13 showing a somewhat different form of tool. Fig. 17 is a view similar to Fig. 14 showing the tool illustrated in Fig. 16. Fig. 18 is a view similar to Fig. 15 showing the tool illustrated in Figs. 16 and 17. Figs. 19, 20 and 21 are views similar to Figs. 16, 17 and 18, respectively, showing another form of tool that may be employed and Fig. 22 is a diagrammatic view illustrating the control system employed in the machine.

The apparatus or machine provided by this invention involves, generally, a frame A which forms a carrier or support for the blank B which is to be acted upon by the machine to form the desired apertured manifold and to form a mounting or carrier for the various essential elements of the machine as will be hereinafter described. The machine further involves a clamp C which serves to hold or maintain the blank B in position to be acted upon and which cooperates with an element of the frame A so that the blank is confined or embraced in such manner as to be maintained in its initial form as pressures are applied to the blank in order to form the desired apertures therein. The machine further involves an actuating means D for operating the clamp C and power means E. The machine further includes a plurality of tools F carried by the frame to act upon the blank and an actuating mechanism G for each tool F. Fluid pressure generating means H is provided to supply fluid under pressure to operate the several actuating means G and a fluid distributing system J handles the actuating fluid between the means H and the several actuating means G. The machine further involves a control system illustrated diagrammatically in Fig. 22 of the drawings by which the operating parts of the machine are controlled and properly synchronized, to the end that the desired operations occur in proper sequence.

The frame A, as provided by the invention, is a simple rigid unit or structure characterized by spaced vertical end plates 10 that may be anchored to a suitable support by feet or brackets 11, and a plurality of beams arranged parallel with each other and preferably extending between the end plates 10 so that they are horizontally disposed and preferably having their ends fixed or anchored to the end plates 10. In the preferred arrangement there is a bottom beam 12, a top beam 13, a center beam 14 and a side beam 15a. The beams 12, 13 and 14 are preferably arranged so that they are in vertical alignment, as shown in Fig. 2, and each of these beams extends horizontally between the end plates 10 and has its ends fixed to the end plates. In the preferred form of the invention the ends of the center beam 14 are releasably secured or fixed to the plates 10 by means of suitable brackets 15 and screw fasteners 16 so that this beam can be released and removed from the other parts of the frame when desired. The side beam 15a is located in the same horizontal plane as the center beam 14 and is laterally spaced from one side of the beam 14, preferably from what may be termed the inner or rear side of the beam 14, as shown in Fig. 2 of the drawings.

The center beam 14 of the frame A carries or is provided with a seat for the reception of the blank B which is to be acted upon by the mechanism. In the form of the invention illustrated the blank is in the nature of a simple length of tubing or pipe with one end pinched closed and being ordinary pipe the blank is round in cross section. In this case the seat provided at the center beam of the frame is in the form of a groove or channel 20 provided in the beam. In the particular case illustrated the seat forming channel is provided in the lower or bottom side 21 of the beam 14 and since the blank is a simple straight pipe the seat forming groove is a simple straight groove of uniform size and shape throughout its length. It is preferred that the seat forming groove 20 be semi-circular in contour or extent so that it receives the upper half of the blank B in the manner shown throughout the drawings.

In the form of the invention illustrated the beam 14 provided with the seat forming groove or channel 20 has a main or body portion 22 in which the seat is formed and it has a depending side flange 23 preferably located at its inner side and depending a substantial distance below the bottom 21 of the body 22. With this arrangement the flange 23 is at the side of the beam 14 which faces or which opposes the side beam 15a, as clearly shown in Fig. 2 of the drawings. The flange 23 has a flat vertical side 24 at or on which the clamp C operates.

The clamp C is located immediately beneath the center beam 14 and preferably involves a body 30 in the form of a vertically disposed plate and a jaw 31 on the top of the plate and opposing the bottom 21 of the beam 14. The body 30 extends between the ends 10 of the frame A and has its ends carried in vertical guides 32 provided on the inner sides of the plates 10. The jaw 31 of clamp C is secured to the upper edge portion of body 30 by suitable releasable fastening means 35. One side 36 of the jaw 31 slidably engages the side 24 of flange 23. The jaw 31 may be substantially coextensive with the beam 14 and, as shown in the drawings, it is related to the beam to reciprocate vertically relative thereto. The jaw 31 is provided with a blank holding or receiving seat and in the case illustrated the desired seat is formed by a longitudinal groove or channel 37 provided in the top 38 of the jaw. The channel 37 is located immediately beneath the channel 20 provided in beam 14 and like the channel 20 it is semi-circular in contour or cross section so that it cooperates with channel 20 in defining a blank receiving opening that is round in cross section and which receives the blank so the blank is completely held or confined throughout its length or at least throughout that portion of its length which is to be acted upon by the tools of the machine.

The actuating means D serves to operate the clamp C vertically relative to beam 14 between a working or engaged position where the jaw of the clamp cooperates with the beam in confining the

blank B and a down or released position where the jaw is away from beam 14 so the blank can be arranged in or removed from the machine. The down position is illustrated in Fig. 4 of the drawings. The actuating means D as illustrated in the drawings is a mechanical means and is preferably a toggle mechanism. The particular toggle mechanism illustrated involves two sets or pairs of toggle links 40 each of said pairs of links including a lower link pivoted to the bottom beam 12 by a pivot pin 41 and an upper link pivoted to the body of the clamp by a pivot pin 42. The upper and lower links are joined by a pivot pin 43. A connecting rod 44 connects the two pairs of toggle links and is joined thereto by the pivot pins 43. When the toggle links are contracted or folded as shown in Fig. 4 the clamp is down and spaced a substantial distance from the beam 14, whereas when the links are actuated to be in line or to be substantially in line, as shown in Fig. 1, the clamp is up and cooperatively engaged with the beam 14.

The power means E serves to actuate means D and in the form of the invention illustrated it involves a pneumatically operated cylinder and piston mechanism and a suitable control valve. The said cylinder and piston mechanism as shown in the drawings includes a cylinder 50 carrying a piston 51 which operates a piston rod 52 that projects from the cylinder and is connected to the rod 44 by a pivot pin 53. The cylinder 50 is anchored or held by a pivot pin 54 carried by a bracket 55 on the frame A. Through this construction the cylinder and piston mechanism may rock or swing as the toggle mechanism operates between the two positions above described. The valve 56, which controls the cylinder and piston mechanism of means E may be a simple or conventional reversing valve which receives fluid such as air under pressure from a supply line 57, and when in one position it connects the supply line 57 with one end of cylinder 50 through a connection 58 while the other end of the cylinder 50 is connected with an exhaust duct 59 through a connection 60. When the valve is in the other position the supply line 57 is connected with the connection 60 while the exhaust 59 is connected with connection 58. It will thus be seen that through the valve 56 the piston 51 can be operated in either direction in the cylinder 50. As indicated in the diagram, Fig. 22, the valve 56 is an electrically operated valve and is under control of a suitable solenoid or winding 61.

The structure preferably includes a suitable stop limiting the action of the toggle mechanism and it is preferred that the stop be adjustable so that the action of the mechanism may be varied as circumstances require. In the case illustrated a stop pin 65 is threaded to the frame A and may be adjusted or set to form a positive stop limiting movement of the toggle mechanism in the direction indicated by the arrow in Fig. 1.

In accordance with the invention the machine may include one or more tools for acting upon the blank as it is held through the structure above described. In the case of the usual manifold for a gas stove it is desired that the manifold have a plurality of openings or apertures for the reception of various devices or fittings and therefore it is preferred that the machine of the present invention be provided with a plurality of tools and in the preferred arrangement these tools are guided by the center beam 14 to act upon the blank B at the desired points along the blank and/or around the blank, as required. In the

particular case illustrated I illustrate a plurality of tools acting upon the blank and I show these tools divided, generally, into two groups or series, namely a vertically disposed series of tools and a horizontally disposed series of tools. Each of these series of tools extends longitudinally of the blank to provide openings or apertures in the blank at spaced intervals lengthwise thereof, and as the tools of the two series operate on the blank they form openings or apertures therein in two rows which are spaced 90° apart from each other around the central axis of the blank. It will be apparent that the number of series of tools may be varied, that each series may include various numbers of tools and that when two or more series of tools are employed they may be angularly related in various manners, as circumstances require. In view of this circumstance it is to be understood that when I refer to but two series of tools and when I refer to these as being vertical and horizontal such reference is merely for purpose of example.

In accordance with the present invention each tool F provided in the machine serves to first establish an opening in the blank by cutting out a slug or section of the blank, and it then acts to enlarge or expand the opening initially formed so that the wall thickness of the blank at the opening is increased a substantial amount and the final opening is established so that it is of such size as to be ready for tapping or otherwise receiving finishing operations or fittings as circumstances require. The specific details or formations of the tools may vary and for purpose of example I have illustrated several different tools which may be considered typical of those that can be used to advantage. In Figs. 1 to 15, inclusive, of the drawings I illustrate two forms of tools employed simultaneously in the machine, whereas in Figs. 16 to 21, inclusive, I illustrate two other forms of tools which may be used if desired. The particular tool illustrated in Figs. 12 to 15, inclusive, involves a piercing nose 60 which is round and which has a sharp or piercing edge 61 that cuts the blank to form a round opening from which a slug 62 is removed. The particular nose 60 here illustrated is of substantial length so that it enters a substantial distance into the blank through the opening as it is initially formed. A hole swedging or enlarging portion 63 adjoins the piercing nose 60 and in this case is a tapered or gradually enlarging part which, when forced or introduced into the opening initially formed in the blank acts to spread the material around the hole until the hole reaches the final size or form. In the form of tool illustrated in Figs. 16 to 18, inclusive, the spreading or swedging portion 63^a instead of being conical or tapered is stepped and operates in the manner shown in these figures of the drawings to enlarge the hole initially formed. In the tool shown in Figs. 19 to 21 the piercing nose 60^a is confined to the tip end of the tool and the swedging or hole enlarging portion 63^b is tapered as is the corresponding part shown in Figs. 12 to 15, and it immediately adjoins the end of the tool so that the hole is enlarged as it is formed.

The tool illustrated in Figs. 5 and 6 of the drawings pierces the blank and enlarges the hole formed by piercing with a construction such as is shown in Figs. 16 to 18 of the drawings. However, this particular tool is further provided with a base portion 66 which is moved into engagement with the blank in the vicinity of the hole being formed in the blank so that the exterior

of the blank in the immediate vicinity of the hole is shaped in a predetermined manner, as for instance so that it has a flat portion or land 67.

The several tools provided in the machine are preferably carried by the beam 14 of the frame. In the particular case illustrated the tools which are included in the vertical series of tools are carried in guide openings 70 provided in the body of the beam 14, while the tools of the horizontal series are carried in guide openings 71 in the flange 23 of the beam. In the case illustrated certain of the tools are slidably carried in openings formed directly in the stock or material of the beam 14 while others are carried in guide bushings 72. In the particular case illustrated the tools having stems 73 which are round in cross section are carried in bushings while the tool shown in Figs. 5 and 6, which has a stem 74 rectangular in cross section is carried in an opening 70 formed directly in the body of beam 14.

In accordance with the present invention each tool is provided with an individual actuating mechanism G and in the case of the tools forming the vertical series the actuating mechanisms are carried by the top beam 13 whereas in the case of the tools in the horizontal series the actuating mechanisms are carried by the side beam 15a. In accordance with the invention the tools may be spaced in various manners lengthwise of the beam 14, depending upon the location of guide openings in the beam, and the particular beam that is employed may have various guide openings that can be used as desired, or beams 14 with guide openings variously spaced may be employed, as circumstances require. By reason of this feature the actuating mechanisms G are adjustable lengthwise of the beams by which they are carried or to which they are secured so that the actuating mechanisms G can be positioned to be properly aligned with the tools operated thereby. In the case of the actuating mechanisms G for operating the tools of the vertical series one actuating mechanism G, being the one illustrated in detail in Fig. 5 of the drawings, is located in a fixed position lengthwise of beam 13 while the others are adjustable to various positions along beam 13. One of the mechanisms G adjustable along the beam 13 is shown in detail in Fig. 7 of the drawings. In the particular case illustrated the actuating mechanism G which is in fixed position lengthwise of beam 13 is located within the beam 13, while the shiftable mechanisms G are secured to the bottom of beam 13 and depend therefrom.

The beam 13 in the case illustrated in the drawings is a box-shaped structure including a bottom plate 80, a top plate 81 and spaced vertical side plates 82. The side plates 82 are shown integrally joined to the bottom plate 80, as by welding 83 while the top plate 81 is secured to the side plates 82 by releasable fasteners 84.

The particular actuating mechanism fixed lengthwise of the beam 13 and shown in Fig. 5 includes a cylinder 85 arranged at the lower side of the top plate 81 so that the top plate closes the upper end of the cylinder. A head 86 closes the lower end of the cylinder and passes a piston rod 87 which carries a piston 88 that operates in the cylinder 85. Suitable packing means 89 is provided to establish a fluid tight seal around the rod as it issues from the head 86. The rod 87 passes freely through an opening 90 in the bottom plate 80 and depends from the beam 13 to be connected with the tool F by means of a suitable coupling 91. The particular coupling 91 provided in connection with the operating mechanism G shown in Figs. 5 and 6 of the drawings involves an upper section 92 connected with the piston rod 87 to be, in effect, a part or depending continuation thereof and a lower section 93 which receives and holds the shank 94 of the tool. The sections 92 and 93 have engaged or cooperating parts 95 and 96, respectively, which overlie each other or hook together so that they can be engaged and disengaged by shifting of the upper and lower sections horizontally relative to each other. With this construction the beam 14 when released from the side plates of the frame can be shifted horizontally to disengage the coupling 91. In the case illustrated the lower section 93 of the coupling has a socket 97 which receives the shank 94 of the tool and a set screw 98 retains the shank 94 in the socket 97.

The upper section 92 is, in effect, a depending part of the rod 98. In the particular case illustrated it is shown as a separate part joined to the rod 98 by a threaded connection 108 and the connection is set or locked by a suitable lock nut 109.

The upper section 92, is, in effect, a depending part of the rod 98. In the particular case illustrated it is shown as a separate part joined to the rod 98 by a threaded connection 108 and the connection is set or locked by a suitable lock nut 109.

Each of the actuating mechanisms G shiftable along the beam 13 may be essentially the same as the mechanism G above described, that is, it may include, generally, a cylinder 85a closed at its lower end by a head 86a which passes a piston rod 87a carrying a piston 88a that operates in cylinder 85a. In this case, however, the details of which are shown in Fig. 7, a head 101 closes the upper end of cylinder 85a and is engaged with a guide rib 102 provided on the lower side of the bottom plate 80 of beam 13. The guide rib 102 is shown as having upwardly converging sides so that it is, in effect, dovetailed and the head 101 is fitted to the rib to be held thereon and has a section 103 operable or shiftable by means of a screw 104 so that the head can be set on the rib 102 against movement lengthwise of the beam. Through this construction the operating mechanism G can be shifted along the beam to be in vertical alignment with the tool F that is to be operated by it and it is connected with the tool by a suitable releasable coupling 91a. The particular coupling 91a shown in Figs. 7 and 8 of the drawings differs slightly from that shown in Fig. 6. The coupling 91a has an upper section 92a held on the lower end of the rod 87a by a pin 110. The lower section 93a of coupling 91a has a socket 97a holding the shank 94a of the tool and the sections 92a and 93a have engaged parts 95a and 96a which normally connect the sections together and which are subject to being disengaged by relative movement of the sections laterally.

The actuating mechanisms G for the tools of the horizontal series may be substantially identical with the actuating mechanisms that are shiftable along beam 13 and they may be shiftable along beam 15a. One of these mechanisms

is illustrated in Figs. 9 and 10 of the drawings. A comparison of Figs. 7 and 9 will reveal that these mechanisms G of the vertical and horizontal series may be the same and it will be apparent that the mechanisms G of the horizontal series may be carried by beam 15a through a guide rib 102a corresponding to the guide rib 102 hereinabove described. It is to be observed that the head 101 shown in Fig. 11 which may be the head of the mechanism shown in Fig. 9 or that shown in Fig. 7, is rectangular in form and it will be observed from the drawings that these heads of the mechanisms G are arranged on the guide ribs so that they extend transversely of the ribs and occupy minimum amounts of the ribs lengthwise thereof. Through this construction it is possible to arrange actuating mechanisms G close together along the beams and thus operate tools to establish apertures at close intervals along the blank B.

The pressure generating means H as shown in the drawings involves a reservoir 120 carrying a supply of operating fluid such as oil, a suitable pump 121 receiving oil from the reservoir through a suction line 122, and delivering it under pressure to an outlet line 123, and a motor 124 driving the pump.

In the preferred arrangement the reservoir 120 is a box-like structure located in the lower portion of the frame A to one side of the bottom beam 12 so that it is below the side beam 15a, and it extends between the end plates 10.

The fluid distributing system J includes, generally, a reversing valve 130 that receives fluid under pressure from the outlet 123 of the pump, returns fluid to the reservoir 120 through an exhaust line 131, and controls the flow of fluid to and from lines 132 and 133 which connect with manifolds 134 and 135, respectively. The valve 130 is operated electrically as by means of solenoids or windings 137 and 138 and when it is in one position it passes fluid under pressure to connection 132 while fluid exhausts from connection 133. When the valve is in the other position it supplies fluid under pressure to connection 133 while fluid exhausts from connection 132. The manifold 134 is connected to the outer ends of the cylinders of the actuating mechanisms G as by individual cylinder connections 140 while the manifold 135 is connected to the inner ends of the cylinders of mechanisms G by individual cylinder lines 141.

Through the construction and arrangement just described it will be apparent that operating fluid under pressure can be admitted to the outer ends of the cylinders of mechanisms G while it is exhausted from the inner ends thereof, to the end that the mechanisms operate the the tools into pressure engagement with the blank held in the machine, and under this condition the full force of the pressure generated by the means H is delivered to the actuating mechanisms G and forces the tools into engagement with the blank in such manner as to cause the desired piercing and swedging actions to occur. When the valve 130 is reversed the mechanisms G are retracted or operated in the opposite direction causing the tools to be withdrawn or retracted from the blank following which the clamp can be released, freeing the apertured blank so it can be removed from the machine.

It is important to observe that with the mechanism provided by this invention the blank is not pierced nor swedged by impact or by striking the blank with a tool, but rather the several tools are brought into engagement with the blank rapidly but without violently striking the blank and when all of the tools have engaged the blank and are stopped thereby the pressure develops in such manner as to force the tools through the blank usually forcing one somewhat ahead of another as the structure of the blank offers varying resistance to the tools. In practice all or several of the tools may operate simultaneously or the tools may operate in succession, one immediately following the other so that the operation is substantially instantaneous.

The control provided by the present invention and which is illustrated diagrammatically in Fig. 22 of the drawings coordinates the action of the working parts and particularly the valves 56 and 130 and puts the mechanism effectively under control of three switches, namely a main or master switch 150, a starter switch 151 and a retracting switch 152. The control involves an electrical system in which the winding 61 operating valve 56 is connected and in which the windings 137 and 138 operating valve 130 are connected. The system also involves suitable mechanical and electrical features including a normally open relay 155 under direct control of the starter switch 151, a normally closed relay 156 under control of the retracting switch 152, a switch 157 controlling the windings that operate the valve 130 and a time delay mechanism 158.

The switch 150 connects the electrical system with a power line L so that the system is suitably supplied with electrical energy. The starter switch is connected in the circuit or system so that when it is closed, as by manual operation, it acts through the normally closed relay 155 which may be a self-energizing or sustaining relay to energize winding 61 so that the valve 56 is operated to a position which causes the toggle mechanism to be actuated through the means E. Assuming a blank to have been placed on the jaw 31 of clamp C operation of the toggle mechanism from the position shown in Fig. 4 to that shown in Fig. 1 sets the blank in the machine ready to be operated upon and when the toggle mechanism reaches the fully actuated position, as shown in Fig. 1, the switch 157, which may be a snap switch, closes. The switch 157 is connected with winding 137 so that when this switch is closed it acts through the normally closed relay so that valve 130 is operated to a position causing fluid under pressure to be admitted to the outer ends of the cylinders of the mechanisms G. The control system remains in this condition as the mechanisms G operate until all of the tools have completed their operations on the blank B.

To retract the tools and release the clamp so that the apertured blank can be removed from the machine the switch 152 is closed, preferably by manual operation. The switch 152 acting through the relay 156 energizes winding 138 causing the valve 130 to be reversed so that fluid under pressure is admitted to the inner ends of the cylinders of mechanisms G and at the same time the control winding 170 of the time delay mechanism 158 is energized and tends to move plunger 171 outward in cylinder 172, which operation is controlled by a needle valve 173 which regulates the admission of air into the cylinder 172 behind the piston 171. After a predetermined time delay resulting from the mechanism just described a switch 174 is opened and acts through the re-

lay 155 so that the winding 61 is deenergized, whereupon valve 56 returns to its unactuated position through the action of a spring 180, causing the means E to be retracted or reversed in such manner as to release the toggle mechanism to the position shown in Fig. 4. When the toggle mechanism has been released the mechanism has completed its cycle and the apertured blank can be removed and another blank placed in the machine ready to be acted upon.

From the foregoing description it will be apparent that the present invention provides for rapidly operating upon a pipe or blank to provide a plurality of apertures or openings therein, which openings may be provided at various places along the blank and in various positions around the blank. The apertures or openings are initially formed smaller than is finally desired and the material of the pipe is swedged or spread so that the wall thickness at the openings is increased, providing ample material in which to form threads or other features suitable for receiving fittings or the like. It will be apparent that the operation of the machine is such that it requires no great skill. An operator may easily and quickly place a blank on the jaw of the clamp against a suitable stop 250, thus locating the blank in a predetermined position in the machine. When the starter switch 151 is actuated the operation of the machine is started causing the clamp to be set, which operation is immediately followed by actuation of the tools and as soon as they have completed their action on the blank the operator can return the mechanism to the unactuated position by actuating switch 152. Through the action of the time delay mechanism 158 the return of the toggle mechanism and thus retraction of the clamp is delayed long enough to insure complete disengagement of all of the tools from the blank. By confining the blank in the machine in the manner clearly illustrated throughout the drawings the desired operations may be performed on the blank by pressure as distinguished from impact, spinning, or other like actions, and yet the pipe or blank is not deformed or pressed out of round but rather is maintained in its original shape or form, except as it is acted upon by the tools. Further, by reason of forming the blank through pressure applied at such rate that the tools and the blank are not heated appreciably, there is no tempering or surface hardening of the metal of the blank to retard or interfere with further machining, finishing, or cutting of the blank, as circumstances may require.

Having described only a typical preferred form of apparatus and manner of carrying out the method of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A machine for establishing openings in a tubular blank including, a rigid frame having spaced vertical end plates and a plurality of horizontal beams fixed between the plates including a center beam having a blank receiving seat therein and vertical and horizontal tool openings communicating with the seat, two beams vertically removed from the center beam one above it and the other below it, and a side beam spaced horizontally from the center beam, a clamp movable vertically and cooperating with the center beam to confine and hold an elongate tubular blank, operating means for the clamp acting between the clamp and one of said two beams, tools operating in the tool openings to act on the blank from different directions laterally thereof, operating means carried by the other of said two beams and operating the tools in vertical tool openings, and operating means carried by the side beam and operating the tools in the horizontal tool openings.

2. A machine for establishing openings in a tubular blank including, a rigid frame having spaced vertical end plates and a plurality of horizontal beams fixed between the plates including a center beam having a blank receiving seat therein and vertical and horizontal tool openings communicating with the seat, two beams vertically removed from the center beam one above it and the other below it, and a side beam spaced horizontally from the center beam, a clamp movable vertically and cooperating with the center beam to confine and hold an elongate tubular blank, operating means for the clamp acting between the clamp and one of said two beams, tools operating in the tool openings to act on the blank laterally thereof, fluid pressure actuated operating means carried by the other of said two beams and operating the tools in vertical tool openings, and fluid pressure actuated operating means carried by the side beam and operating the tools in the horizontal tool openings.

3. A machine for establishing openings in a tubular blank including, a frame having spaced vertical end plates and a plurality of horizontal beams fixed between the plates including a center beam having a blank receiving seat therein and vertical and horizontal tool openings communicating with the seat, two beams vertically removed from the center beam one above it and the other below it, and a side beam spaced horizontally from the center beam, a clamp movable vertically and cooperating with the center beam to confine and hold an elongate tubular blank, a fluid pressure actuated toggle mechanism for operating the clamp and acting between the clamp and one of said two beams, tools operating in the tool openings to act on the blank, operating means carried by the other of said two beams and operating the tools in vertical tool openings, and operating means carried by the side beam and operating the tools in the horizontal tool openings, each of the tools having a cutting end engaging the blank to cut a section therefrom and having an enlarged swedge portion entering and enlarging the opening made by the cutting end by swedging action that thickens the wall of the blank.

4. A machine for establishing openings in a tubular blank including, a frame having spaced vertical end plates and a plurality of horizontal beams fixed between the plates including a center beam having a blank receiving seat therein and vertical and horizontal tool openings communicating with the seat, two beams vertically removed from the center beam one above it and the other below it, and a side beam spaced horizontally from the center beam, a clamp movable vertically and cooperating with the center beam to confine and hold an elongate tubular blank, operating means for the clamp acting between the clamp and one of said two beams, tools operating in the tool openings to act on the blank, operating means carried by the other of said two beams and operating the tools in vertical tool openings, operating means carried by the side beam and

operating the tools in the horizontal tool openings, and a single means supplying operating fluid to the tool operating means for substantially simultaneous operation thereof.

5. A machine for establishing openings in a tubular blank including, a frame having spaced vertical end plates and a plurality of horizontal beams fixed between the plates including a center beam having a blank receiving seat therein and vertical and horizontal tool openings communicating with the seat, two beams vertically removed from the center beam one above it and the other below it, and a side beam spaced horizontally from the center beam, a clamp movable vertically and cooperating with the center beam to confine and hold an elongate blank, a toggle mechanism actuating the clamp and acting under compression between the clamp and one of said two beams, pneumatic actuating means for the toggle mechanism, tools operating in the tool openings to act on the blank transversely thereof, operating means carried by the other of said two beams and operating the tools in vertical tool openings, operating means carried by the side beam and operating the tools in the horizontal tool openings, and a single means supplying operating fluid to the tool operating means for substantially simultaneous operation thereof.

6. A machine for establishing openings in a tubular blank including, a frame having spaced vertical end plates and a plurality of horizontal beams fixed between the plates including a center beam having a blank receiving seat in the lower side thereof and vertical tool openings from its upper side to the seat, a bottom beam below the center beam, and a top beam above the center beam, the center beam being detachable from the plates, a clamp cooperating with the center beam to embrace and hold a tubular blank, an actuating mechanism for the clamp acting between the clamp and the bottom beam, tools in the openings, tool operating mechanisms carried by the top beam, and releasable couplings connecting the tools and said tool operating mechanisms, the couplings being engaged and released by shifting of the center beam laterally of the tools.

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