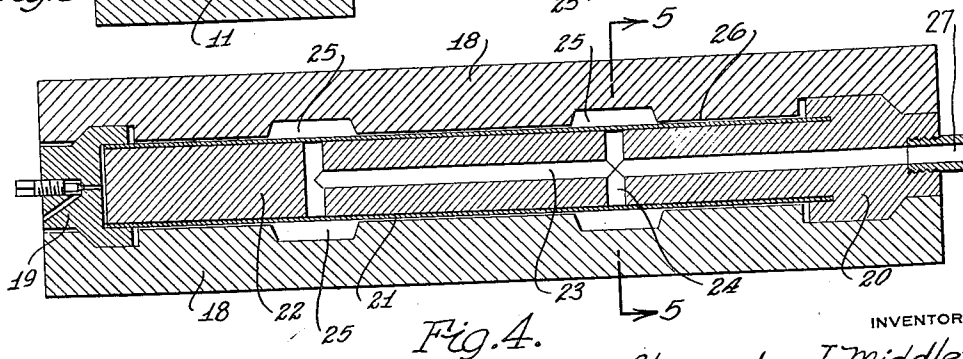
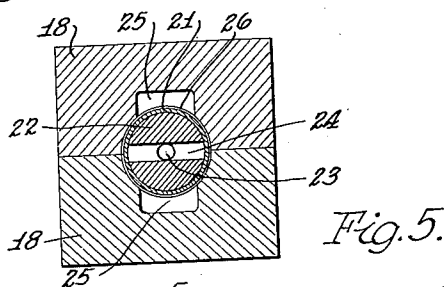
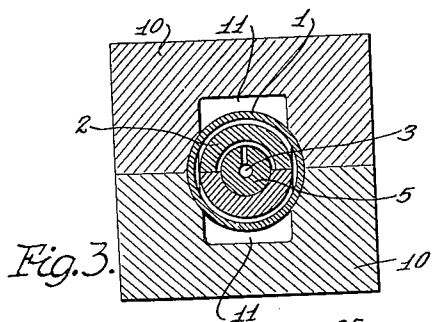
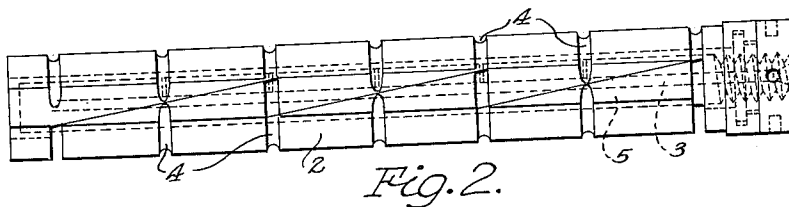
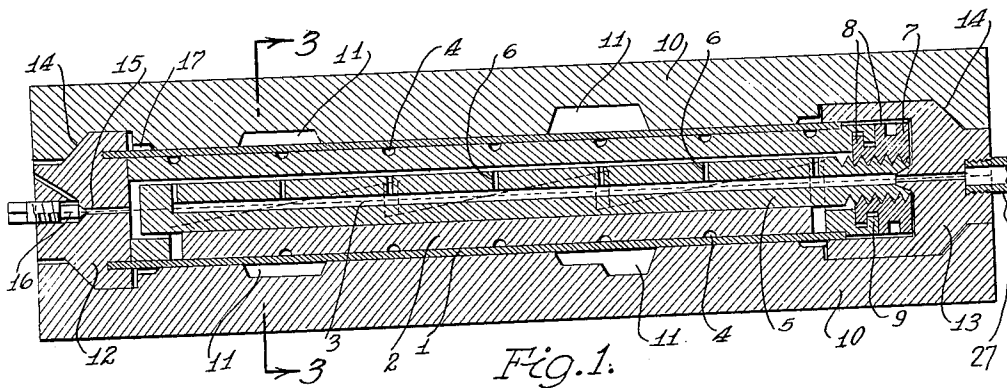


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METAL BLOWING PROCESS
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METAL BLOWING PROCESS

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8 Claims. (Cl. 113—44)

This invention relates to metal working and more particularly to the blowing of metal by high fluid pressures.

More specifically it is the object to provide a process for subjecting metal, such as metal tubes, hollow billets or forgings, or sheet metal, to the expansive force of steam, an exploding powder charge or other form of high pressure fluid pressures while confined in an enclosing die in order that the metal may be expanded against the die walls.

Another object is to provide a process such that a cold enclosing die may be employed, it being readily appreciated that a hot die cannot be expected to have sufficiently long life to be commercially feasible nor will a hot die give sharp formations at corners or other bends.

Another object is to provide a process such that the metal to be blown may be retained at the high temperature imparted thereto by preheating for a sufficiently long time after placement in the enclosing die to permit completion of the blowing operation. In order to accomplish this a core is provided of such construction that it may be inserted into or against the interior walls of the metal to be blown and expanded thereagainst so that when this core is given a high preheat it may impart heat to the said metal by conduction. The core, being expansible, is also contractible for withdrawal subsequent to removal of the metal from the die. This is a highly important feature, (1) since it is really the point that makes it possible to preserve the life of the die, (2) it ensures clearly defined formations as desired from the die shape, (3) it provides for rapid assembly in carrying out the steps in the process, and (4) it provides for rapid disassembly of the core and metal without binding or "freezing" as would otherwise result.

Another object is to teach the attainment of the above results by the slightly different method of expanding the blown metal away from the core instead of by contracting the core. This is applicable for the blowing of light tubes of steel or aluminum but is not recommended for heavy work.

Another object is to provide for the sealing of the interior or pressure region of the metal to be blown by relieving the die near the ends of the said metal in order that an expansion may be had. This may be almost imperceptible in the finished product as it need be, say, only about ten thousandths of an inch, but I have found it to be highly effective as a packing means.

In order to obtain the blowing pressure, the

core is hollow and provided with lateral passages or vents leading to the interior of the tube or billet to be blown. While the core and tube are in place in the die in a highly preheated condition I then introduce high fluid pressure, or I may explode a charge of powder into the core, or, preferably, I may inject a small quantity of water into the center of the core which is converted into steam by the high heat of the core thereby building up pressure of sufficient magnitude to give the desired results. A suitable pressure relief means as for instance a needle valve for opening a vent may be provided to permit reduction of pressure after the blowing has been completed in order that the die may be opened with safety.

A better understanding of the invention will be had with reference to the accompanying drawing wherein the invention is illustrated by way of example and in which,

Figure 1 illustrates a tube in an enclosing die ready to be blown in accord with my invention;

Fig. 2 is an elevation of the core;

Fig. 3 is a transverse section taken along the line 3—3 of Fig. 1;

Fig. 4 is a view similar to Fig. 1 showing a modified form of apparatus;

Fig. 5 is a transverse section taken along the line 5—5 of Fig. 4.

More particularly 1 indicates a tube or billet into which is inserted a core 2 having a central passage 3 and peripheral grooves 4. The core is split and provided with inclined opposing faces so that longitudinal movement of one part with respect to the other in one direction expands the core against the walls of the tube or billet. Relative longitudinal movement of the parts of the core in the other direction contracts the core. The central passage 3 is preferably formed in a tube 5 which is then welded into one centrally grooved part of the core, the other part being also grooved to form a complete peripheral housing for the core. The tube 5 has a plurality of radial openings 6 so that when fluid under pressure is introduced into the passage 3, through the openings 6, thence outwardly between the steps or inclined surface faces to the grooves 4 for expanding action on the tube or billet 1.

In order to obtain the relative sliding of the core parts one end of the tube 5 may be threaded to receive a nut 7 having a double shoulder 8. That part of the core free to move with respect to this tube 5 is given a shoulder formation 9 for residence between the double shoulders 8 so that rotation of the nut 7 in one direction relatively slides the core parts into expanding rela-

tion and relative rotation in opposite direction contracts the core.

In carrying out my process I first give the core 2 and the tube or billet 1 a high pre-heat, either individually or together. The core is expanded 5 against the billet 1 and they are then placed in a cold enclosing die 10 having recesses and formations 11 of the shape to be imparted to the billet 1. The die is usually constructed as two main 10 members having end enclosing plugs 12, 13 each of which plugs envelopes the end of the work 1, and each of which is preferably provided with inclined pressure sealing shoulders 14.

The plug 12 has a vent 15 guarded by a needle 15 valve 16 for relieving pressure within the tube when the blowing has been completed as will be explained. The plug 13 has a vent therethrough with a connection 27 in communication with the interior of the tube. The member 27 diagram- 20 matically illustrates what may be a breach block for a powder charge to be exploded into the passage 3 in order to give high pressure against the work, or a connection to a source of very high fluid pressures, or as a connection to a water in- 25 jection device so that a quantity of water may be introduced into the passage 3 for conversion into steam by the high preheat of the core and work. The latter manner of obtaining high pressure in the core is preferable. It will be readily seen that 30 when the heated work comes into contact with the cold die 10 cooling by conduction takes place rapidly. It is for this reason that, in most work, it is essential to impart heat to the work 1 while it is in the die to prevent undue cooling before 35 the high pressure can be applied. This is the reason for employing an expanding core as heat may be thus imparted to the work by conduction. It may be noted in this connection that the die cannot be preheated, first because the die would 40 wear so rapidly that the cost would be prohibitive and secondly, because a hot die will not give the sharp edges and bends desired. If the core be not contractible it will be impossible to withdraw it from the tube unless the tube is expanded 45 therefrom along its entire length, which cannot be done except on light work.

One of the difficult points in utilizing the very high pressures here contemplated is in sealing the die. I have found that the apparatus described 50 is materially improved by relieving the die at 17 adjacent the plugs 12 and 13 so that the work will be bulged adjacent its ends. This relieved portion may be very shallow, say ten thousandths of an inch, so that the bulge is hardly perceptible in 55 the product.

Figs. 4 and 5 illustrate an enclosing die 18 hav- 60 ing end plugs 19 and 20 and a thin tube 21 in place therein. The core 22 is of one piece construction and has a central passage 23 with lateral passages 24 leading to the interior of the tube 21. The expanding of the tube against the die is accomplished as described previously. The 65 core 22 tightly fits into the tube 21 for heating thereof by conduction. When the blowing pressure is applied the tube is expanded against the recesses and formations 25. A space 26 is provided along the entire length of the tube, before blowing, so that the relative size of the tube is altered thereby permitting withdrawal of the 70 core. As will be understood in the art, the space 26 may be very slight but it is highly essential as otherwise the core will "freeze" to the tube.

Fig. 5 best illustrates that the transverse pas- 75 sages 24 should be horizontal. This prevents

contact of the injected water with the work before evaporation thereof.

What I claim is:—

1. The method of blowing metal which consists in preheating the metal to be blown, in 5 placing the metal in a cold die having recesses and excavations of desired form in the adjacent surfaces thereof, in providing a source of heat by conduction for the metal, in subjecting the metal to fluid pressures of explosive force where- 10 by the metal is pressed into the recesses and excavations of said die, and in removing the metal from the die and the source of conductive heating from said metal.

2. The method of blowing metal which con- 15 sists in preheating the metal to be blown, in tightly sealing the metal in a cold die of desired form, in heating the metal by conduction over substantially one entire surface thereof while in the die, in injecting water into said die for 20 conversion into steam whereby said metal is caused to expand against said die, and in removing the metal from said die.

3. The method of working a metal tube which consists in preheating the tube, in placing said 25 tube in an enclosing die having formations in the inner walls thereof to be imparted to said tube, in imparting heat to said tube by conduction while in said die, in introducing water into said tube for conversion into steam whereby the 30 steam pressure expands said tube against said die, and in removing said tube from said die.

4. The method of working a metal tube which consists in filling the tube with a hollow core 35 having transverse passages leading to the inner surface of the tube, in heating the tube and the core, in then placing the tube with its core into a die having its inner surface formed in counterpart of the shape to be given the tube, in in- 40 troducing high fluid pressures into the hollow interior of said core for expansion of said tube into the die, in altering the relative sizes of said core and said tube whereby said core may be removed, and in removing said tube from said 45 die and said core from said tube.

5. The method of working a tube which con- 50 sists in filling said tube with a hollow heat resisting core having transverse passages whereby said tube is in surface contact with substantially the entire inner surface of said tube, in 55 heating said tube and said core, in introducing the tube with its core into a cold die having recesses and excavations of the shape to be imparted to the tube, in then admitting to the core fluid under high pressure for expansion of the 60 tube into the die, in removing the tube and core from the die and in reducing the diameter of said core whereby it may be removed from said die.

6. The method of working a metal tube which 65 consists in inserting into the tube a heat resistant hollow core having passages from the interior thereof to the interior surface of the tube, in preheating said tube and core, in placing said 70 tube in an enclosing die which clamps and closes the ends of the tube and which is provided with a relieved portion inwardly of each end of the tube, in providing high fluid pressure within said core for expansion of said tube at said relieved 75 portions to seal the fluid against escape and for expansion of said tube against the inner surfaces of said die, in allowing said fluid pressure to escape, and in removing said tube from said die and said core from said tube.

7. The method of working a metal tube which consists in inserting into the tube a preheated heat resistant hollow core having passages leading from the interior thereof to the interior surface of said tube, said core filling said tube for imparting heat thereto by conduction, in then placing said tube in an enclosing die which clamps the ends of said tube and which is provided with a relieved portion inwardly of each end of said tube, in injecting water into said core for conversion into steam whereby said tube is expanded into said relieved portions as a pressure seal and said tube is expanded against said die, in relieving said pressure, and in re-

moving said tube from said die and said core from said tube.

8. The method of working a metal tube which consists in preheating a metallic tube, in inserting an expansible preheated core into said tube for imparting heat to said tube by conduction upon expansion thereof, in expanding said core, in placing said tube with its core in an enclosing die, in subjecting the interior of said tube to high fluid pressure for expansion thereof against said die, in removing said tube from said die, and in contracting and removing said core from said tube.

ALEXANDER J. MIDDLEL.