Nov. 16, 1926. 1,606,787

H. S. HOLMES

CYLINDER AND MANUFACTURE OF THE SAME

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Fig. 1.

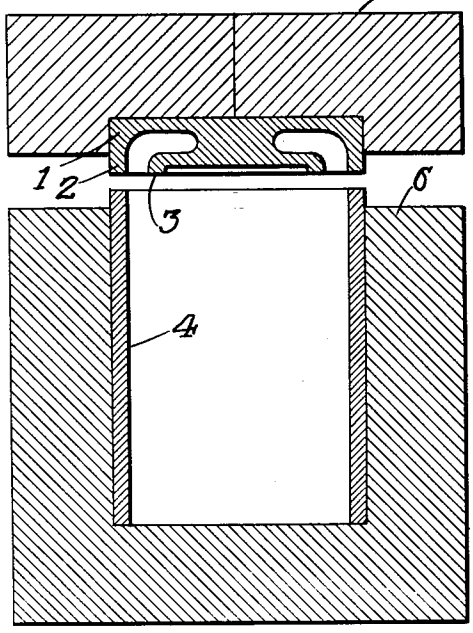


Fig. 2.

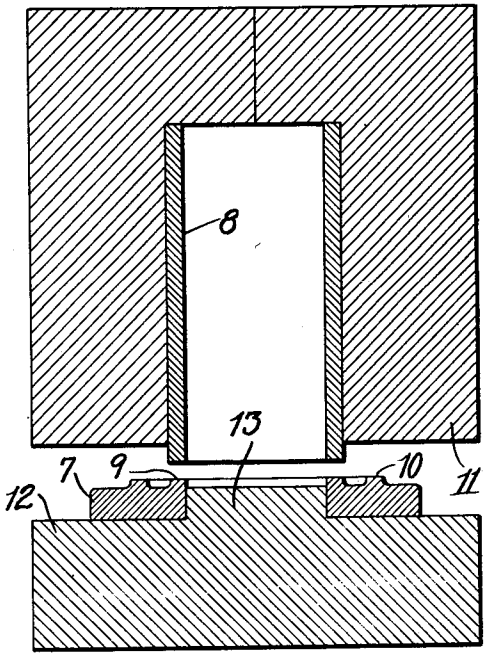


Fig. 3.

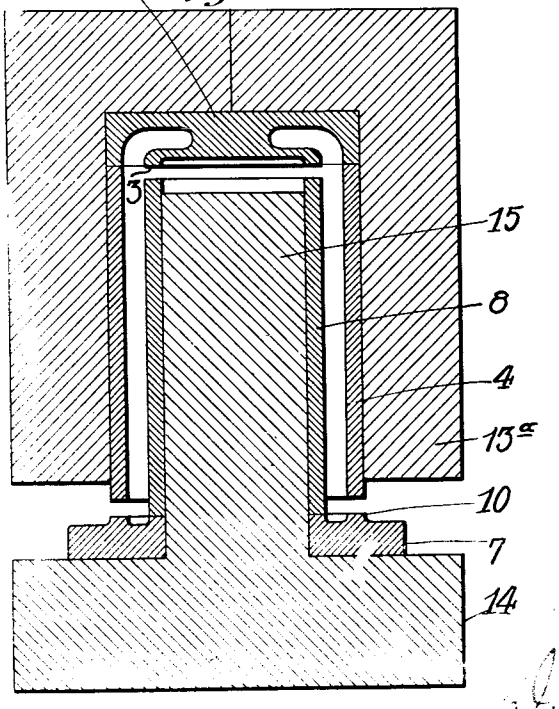
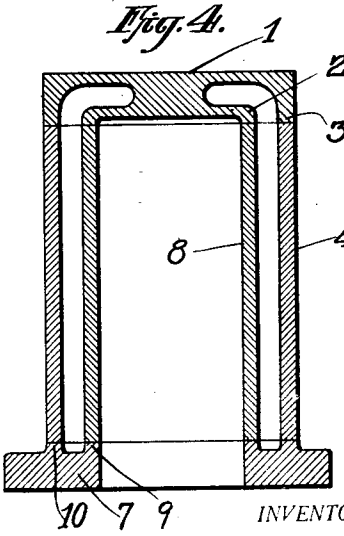


Fig. 4.



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Fig. 5.

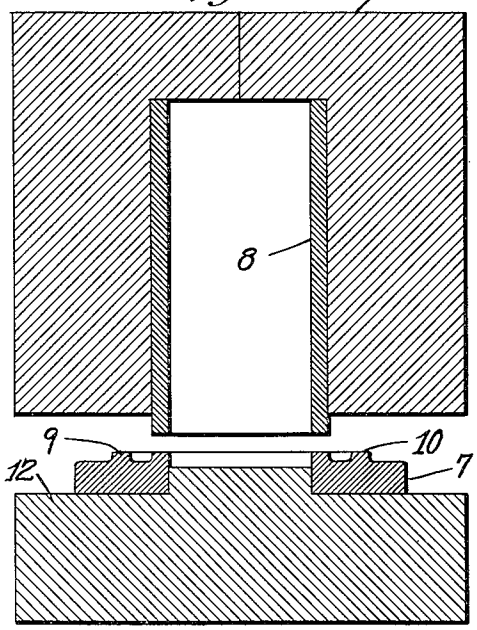


Fig. 6.

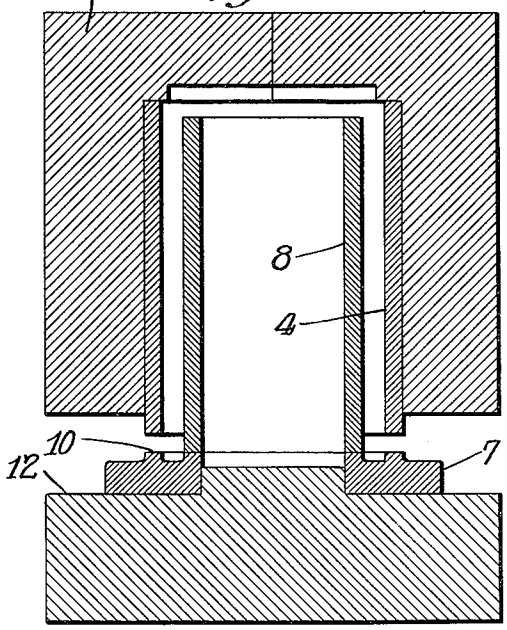


Fig. 7.

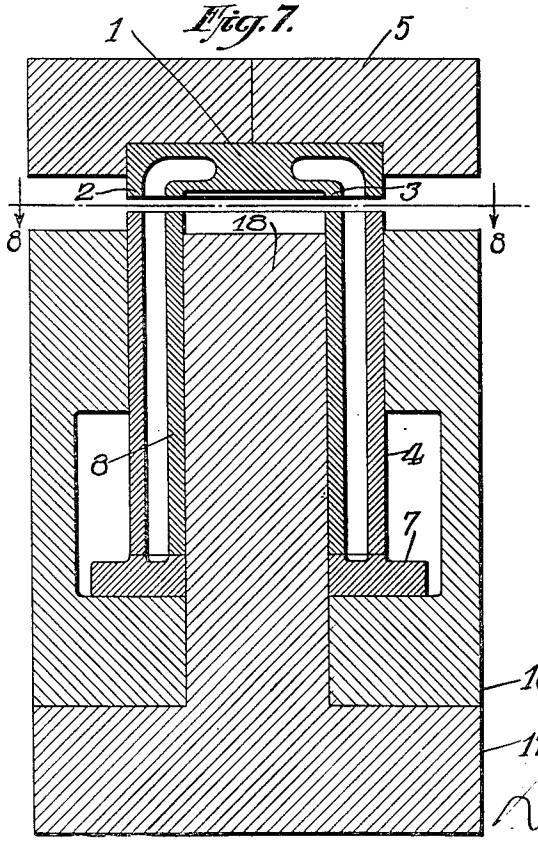
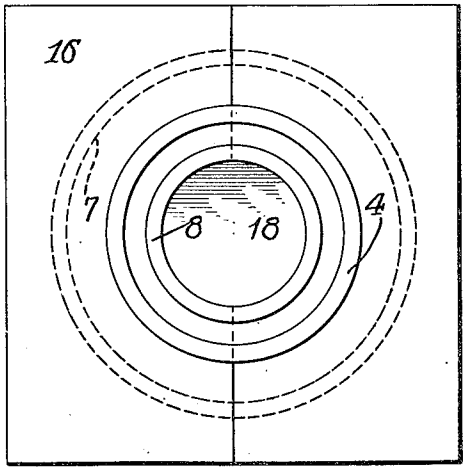


Fig. 8.



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Fig. 9.

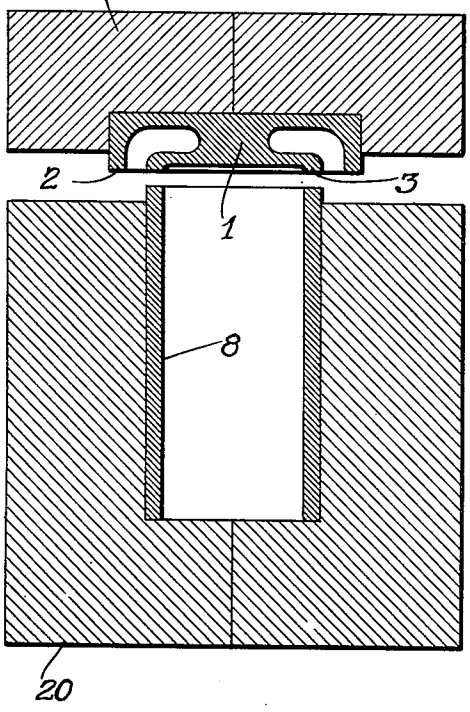


Fig. 10.

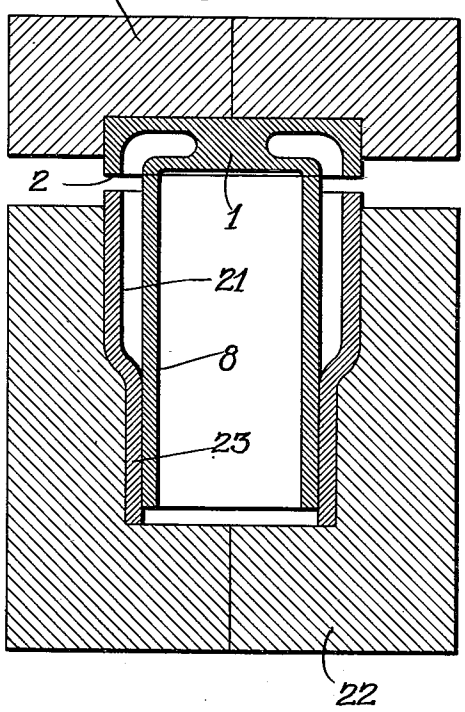
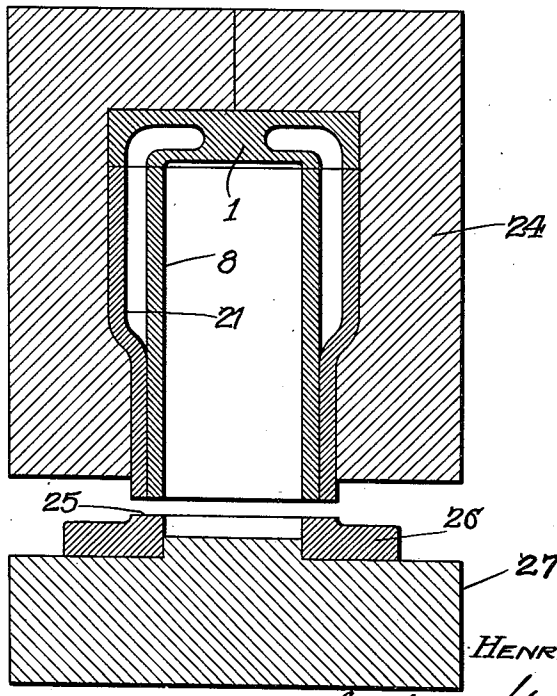


Fig. 11.



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Fig. 13.

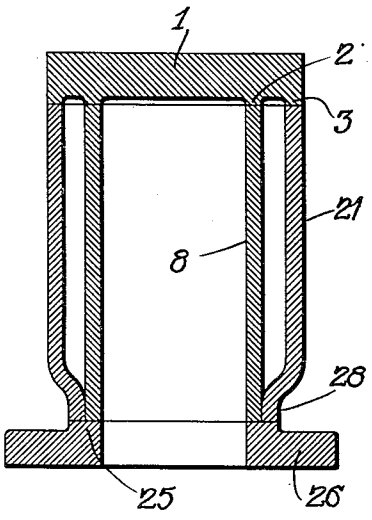


Fig. 12.

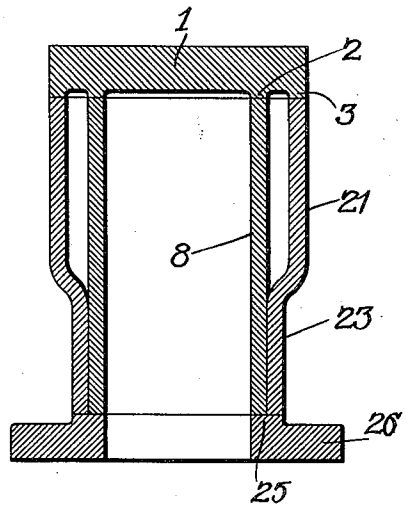


Fig. 14.

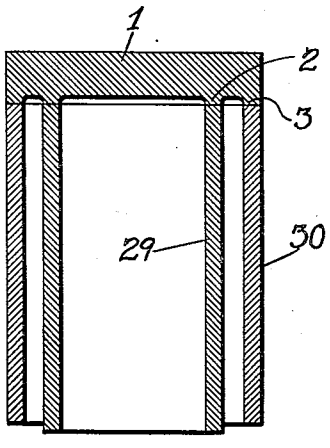
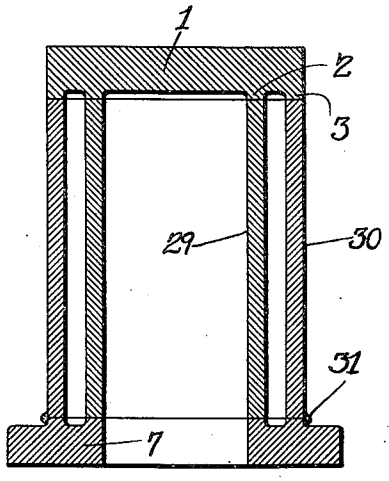


Fig. 15.



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Patented Nov. 16, 1926. 1,606,787

UNITED STATES PATENT OFFICE.

HENRY S. HOLMES, OF NEW YORK, N. Y., ASSIGNOR TO THOMAS E. MURRAY, OF BROOKLYN, NEW YORK.

CYLINDER AND MANUFACTURE OF THE SAME.

Application filed September 30, 1922. Serial No. 591,446.

My invention aims to provide a cheap and efficient method of making cylinders for various uses and particularly for internal combustion engines of the usual single acting type.

The accompanying drawings illustrate embodiments of the invention.

Figs. 1, 2 and 3 are diametral sections illustrating successive steps in the operation; Fig. 4 is a similar section of the finished product;

Figs. 5, 6 and 7 are sections of alternative methods; Fig. 8 is a plan or horizontal section on the line 8—8 of Fig. 7;

Figs. 9, 10, and 11 are sections of a third process and Fig. 12 a section of the product thereof;

Fig. 13 is a section of a slightly different product; and

Figs. 14 and 15 illustrate successive stages in another method embodying the invention.

Referring to the embodiments of the invention illustrated, a cylinder head 1 is cast or otherwise shaped to provide on one face a projecting annular edge 2 and a second projecting annular edge 3 concentric with the first and at or near the outside edge of the head. The head may be of copper or other metal of comparatively high heat conductivity so as to carry off rapidly the heat of the combustion chamber, or it may be of the iron or steel generally used for such cylinders, or of other suitable metal.

A tubular member 4 of the same diameter as the projecting edge 2 of the head is brought into engagement with said edge and welded thereto. This tube 4, forming as it does the outer jacket of the final product, may also be made of copper or other metal of comparatively high conductivity so as to carry away the heat rapidly. Or it may be made of steel or other metals.

According to the preferred method of welding, for this and the succeeding stages I use an electrical resistance welding operation; such, for example, as the Murray method of butt-welding in which the edges of the parts are forced together and subjected to a current of extremely high amperage or density per unit of area, say 90,000 or more amperes per square inch, and for a very brief interval of time, say a fraction of a second. In applying this process to the operation shown in Fig. 1, the head of the cylinder is clamped in a split electrode 5 of copper or other good conducting material and the tube 4 is held in a recess in a solid electrode 6. The edges of the parts project slightly beyond the electrodes and are brought together and welded with a slight take-up or extrusion of metal forming a fin which can readily be removed afterwards.

In Fig. 2 a base in the form of a ring 7 is welded to an inner tube 8. The latter is preferably of steel or iron to form a durable guide for the piston, and the base ring 7 may also be of steel or iron. This ring has an inner projecting edge 9 and an outer projecting edge 10. The tube 8 is carried in a split electrode 11 and the ring 7 is carried on a solid electrode 12 having a central projection 13 fitting within the ring. The edge 9 is pressed against the edge of the tube and the current passed to weld these parts together as described in connection with Fig. 1.

The next step is to take the two parts formed in the manner described in connection with Figs. 1 and 2 and unite them to each other. This is done as shown in Fig. 3. The part comprising the head 1 and outer tube 4 is clamped in a split electrode 13^a. The part comprising the ring base 7 and the inner tube 8 is mounted on an electrode 14 with a projection 15 extending up into the inner tube 8. The upper edge of the tube 8 is then forced against the inner edge 3 of the head, and the edge 10 of the base against the lower edge of the outer tube 4 and the current passed as before, thus making two welds at one operation and producing the completed cylinder illustrated in Fig. 4.

By this method of uniting the parts, the electrodes are arranged to engage the work at points close to the edges which are to be welded. For example in Fig. 1 the electrodes embrace the pieces 1 and 4 and the current has to pass through only a short projecting length of each of these pieces. In Figs. 2 and 3 the upper electrodes similarly embrace their work pieces, and the lower electrodes project into their work pieces to a point near the edge of the latter. This has advantages in reducing losses of heat by radiation. Figs. 1 to 3 illustrate a very convenient way of achieving this desired result, that is, by separately uniting one of the end

pieces to the outer tube and the other to the inner tube and then uniting the two pieces thus formed.

According to Figs. 5, 6 and 7 the end piece is united to first one tube and then the other and then the unit thus formed is united to the end of the other piece. According to Fig. 5 the inner tube 8 is united to the base by means of electrodes 11 and 12; and the next operation is to weld the outer tube 4 to the edge 10 of the base by means of a similar split electrode 15 while the base is still carried by the same electrode 12 or a similar one. The unit thus formed is then mounted on an electrode of the style shown in Fig. 7 consisting of a split ring 16 and a base plate 17 with a projection 18 extending up within the tube 8 nearly to the upper edge of the latter. In this way the current is conveyed by the electrode nearly to the edge of both the tubes 4 and 8. The head 1 is then clamped in a split electrode 5 similar to that of Fig. 1 and the edges 2 and 3 are pressed against the upper edges of the tubes 4 and 8 and the current passed to form welds at these two contact edges. The product here is the same as shown in Fig. 4.

Figs. 9 to 12 illustrate a slightly different construction, in which the tubes are brought together at their lower ends to close the space between them which serves for circulating fluid such as air or water.

Fig. 9 shows the head 1 united in this case first to the inner tube 8. For this purpose the parts are clamped between split electrodes 19 and 20 respectively. In the next stage, Fig. 10, the unit formed of the head 1 and the inner tube 8, still clamped in the electrode 19 or a similar one, is welded to the outer tube 21, the latter being carried in a split electrode 22 which fits it and extends nearly to its upper edge. In this case the lower portion 23 of the outer tube closely embraces the lower portion of the inner tube 8. The product is, therefore, a unit such as is shown in Fig. 11, of the head 1, inner tube 8 and outer tube 21, with the edges of the latter in close contact. This unit is then clamped in a split electrode 24 and its lower edge pressed against the comparatively wide edge 25 of a base ring 26 which is carried on an electrode 27 with a projection at the center extending nearly to the edge 25. The projecting edges are welded as before described.

Fig. 13 illustrates a similar construction, the outer tube or jacket 21 being bent inward at a point near the bottom of its length to form the portion 28 immediately surrounding the inner tube 8 and thus forming a circulating space which surrounds practically the full length of the cylinder.

According to Fig. 14, the head 1 is formed as before with projecting concentric edges 2 and 3 to which are butt-welded the ends of two concentric tubes. In this case, however, the inner tube 29 is longer than the outer tube 30. In the butt-welding operation described there is a certain take-up of the metal which shortens one or both of the parts to be welded. The extra length of the tube 29 is to provide for this take-up. The ring 7, Fig. 15, is butt-welded to the tube 29, taking up enough metal in the operation to bring the ring 7 against the outer tube 30. A joint is then made between the tube 30 and the corresponding part of the ring 7 by an arc welding method, depositing an excess of metal as indicated at 31 around the joint, or by other known methods.

The cylinders produced by the above method can be made very accurate and at the same time very economically. When the head and the outer wall are of copper or similar metal of high conductivity they can be cooled more rapidly than the ordinary iron and steel cylinders. No attempt has been made to show the details, the invention being applicable without respect to the design of the cylinder and connected parts in detail. The outer and inner tubes need not have the same thickness. It is probable that the inner tube which has to stand the bearing strain directly, will be of heavier metal. In referring to tubular portions and to cylinders it is to be understood that the parts are not necessarily all circular in cross-section, though the inside face of the inner tube will naturally be circular.

Though I have described with great particularity of detail certain embodiments of my invention, yet it is not to be understood therefrom that the invention is restricted to the embodiments disclosed. Various modifications thereof may be made by those skilled in the art without departing from the invention as defined in the following claims.

What I claim is:

1. The method of making cylinders which consists in butt-welding a one-piece head onto the edges of two concentric tubular members with a space between them by an electric resistance welding operation.

2. The method of making cylinders, which consists in butt-welding a head by an electric resistance welding operation on to the edges of two concentric tubular members with a space between them.

3. The method of making cylinders which consists in forming a head with a pair of projecting concentric edges on one face and butt-welding said projecting edges onto the edges of two concentric tubular members.

4. The method of making cylinders which consists in butt-welding a one-piece head onto the edges of two concentric tubular members with a space between them by an electric resistance welding operation and welding the opposite edges of said tubular members to a one-piece ring.

5. The method of making cylinders which consists in butt-welding a one-piece head onto the edge of an inner tubular member and then onto the edge of an outer tubular member by an electric resistance welding operation and uniting the opposite edges of said tubular members.

6. The method of making cylinders which consists in butt-welding a one-piece head onto the edge of an inner tubular member and then onto the edge of an outer tubular member by an electric resistance welding operation and welding a one-piece ring to the opposite edges of said tubular members.

7. The method of making cylinders with two concentric tubular portions and with opposite end pieces which consists in forming two units each comprising one of said tubular members and one of said end pieces, and then welding said units together.

8. A cylinder for internal combustion engines having a head in one piece with a pair of projecting concentric edges and two concentric tubular portions butt-welded at their ends to said edges.

9. A cylinder for internal combustion engines having a head and two concentric tubular portions welded at their ends to said head and formed of different metals, one of higher conductivity than the other.

10. A cylinder for internal combustion engines having a head in one piece and two concentric tubular portions welded at their ends to said head, the head and outer tubular wall being of metal of higher conductivity than the inner tubular wall.

11. A cylinder for internal combustion engines having a head in one piece with a pair of projecting concentric edges and two concentric tubular portions butt-welded at their ends to said edges and a ring welded to the opposite ends of said tubular parts.

In witness whereof, I have hereunto signed my name.

HENRY S. HOLMES.