Feb. 7, 1928. 1,658,553

F. O. CLEMENTS

METHOD OF MAKING ENGINE CYLINDERS

Original Filed Nov. 9, 1922 2 Sheets-Sheet 1

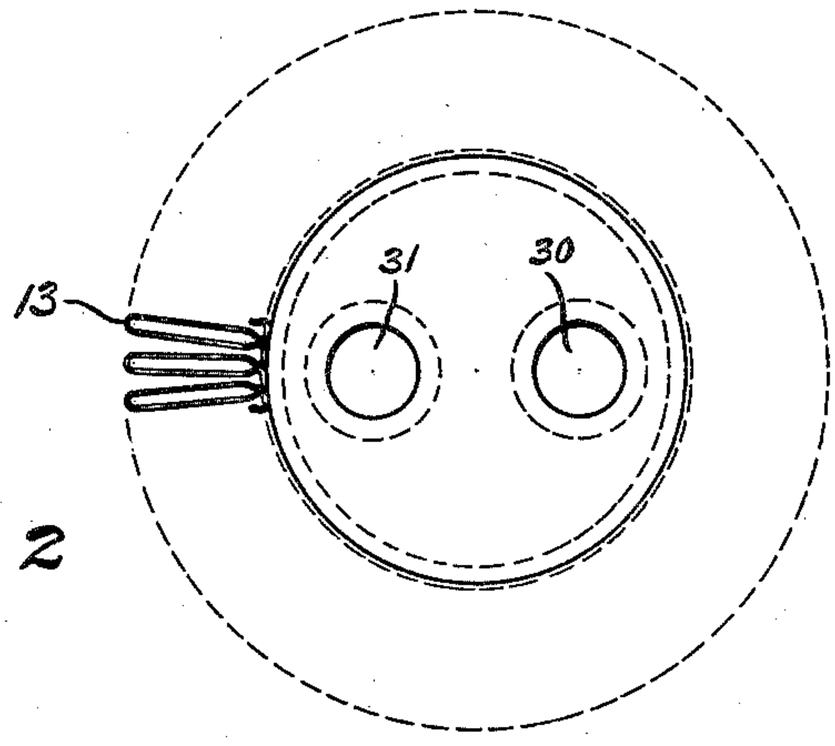

Fig. 2

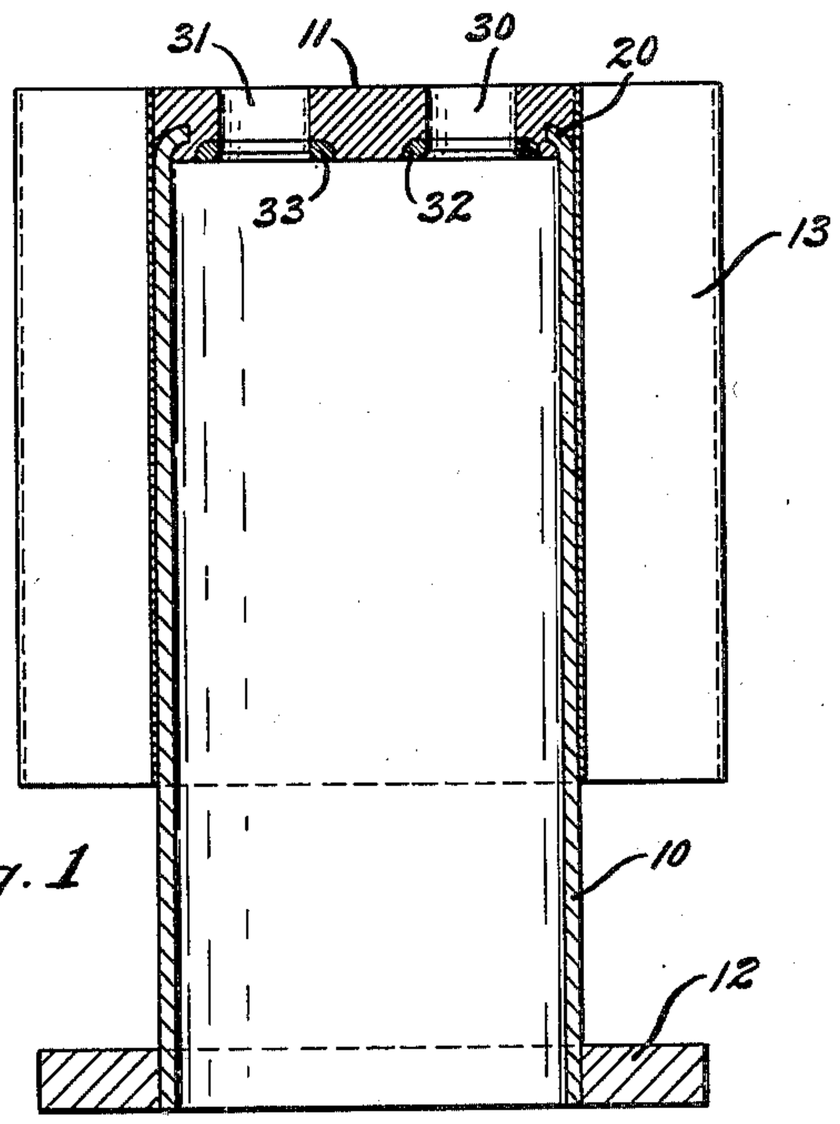

Fig. 1

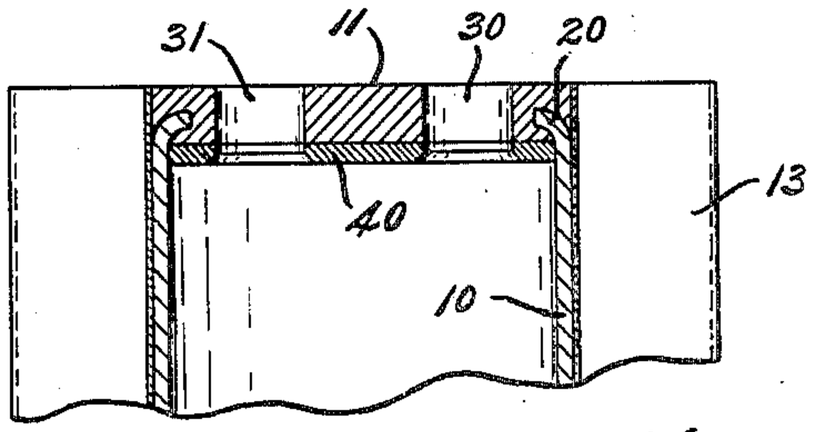

Fig. 3

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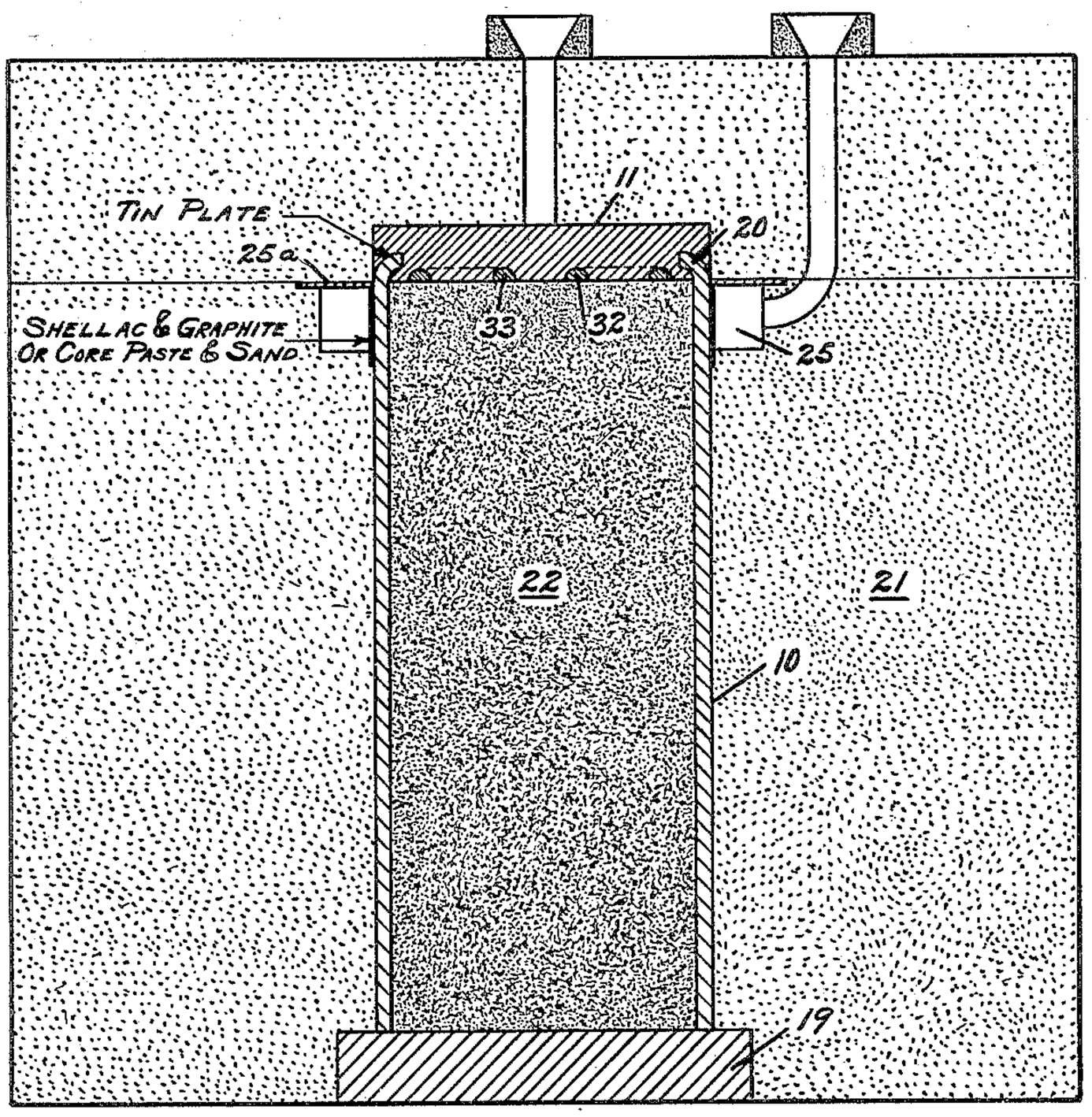

Fig. 4

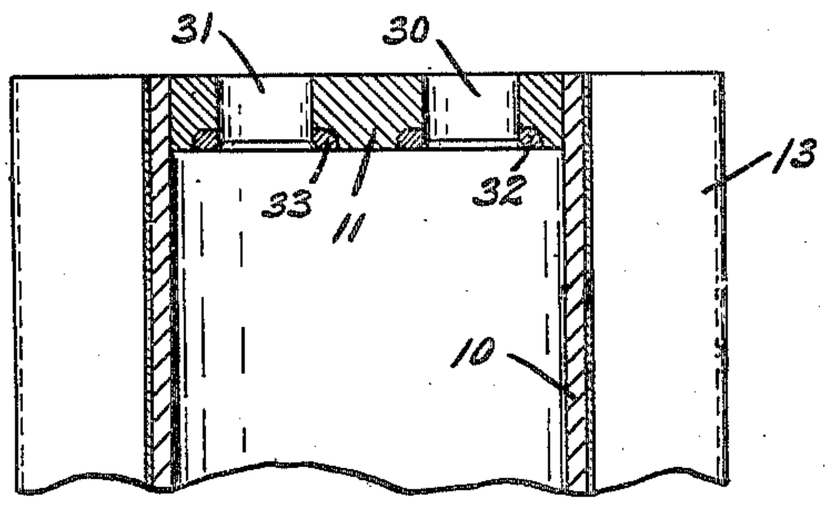

Fig. 5

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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING ENGINE CYLINDERS.

Original application filed November 9, 1922, Serial No. 599,933. Divided and this application filed December 12, 1924. Serial No. 755,577.

The present invention relates to internal combustion engine cylinders, and particularly to a process of making cylinders for air cooled engines.

This is a division of my co-pending application, Serial #599,933 filed Nov. 9, 1922.

Among the objects of the invention is a cylinder which is easier and more economical to produce and at the same time more efficient than those heretofore known.

Another object is a cylinder fabricated of parts which are of materials particularly suitable for the functions which they are designed to perform.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of embodiment of the invention is clearly shown.

In the drawings:

Fig. 1 is a vertical section through a completed cylinder embodying the invention.

Fig. 2 is a plan view of the same with parts omitted.

Fig. 3 is a vertical section through the head portion of a modified form.

Fig. 4 shows in vertical section a mold with the tube in place ready for casting and also indicates a method of preheating the tube.

Fig. 5 is a section of a modified form of cylinder.

The drawings show a cylinder formed from a steel tube 10, having a head 11 securely fixed therein, a base 12, and cooling elements or fins 13 secured to the upper portion. Such a cylinder is preferably made by spinning an inturned flange 20 upon a steel tube of the proper length; setting the tube, upon a suitable spacing block 19, in a mold 21 with a suitable core 22, preferably made by ramming in sand filling the tube to within a short distance of the flange 20, and casting the head 11 preferably of copper in the end of the tube in such fashion as to cover both sides of the flange and extend a short distance above and extend laterally sufficiently to be flush with the outer surface of the tube 10.

In carrying out the process, there is preferably formed in the mold, a short distance below the top of the tube 10, a space 25 for casting a ring of iron or other metal for the purpose of preheating tube 10 to a temperature sufficient to insure a good junction between the tube and the metal of the head, and in order to prevent the heating metal from sticking to the tube, the lattter is covered at this portion with a thin layer of shellac, graphite, or core paste and sand. Space 25 may be covered by a flat iron or steel ring 25^a fitting closely around the cylinder.

Further, it is quite advantageous, in order to assist the bonding of the head metal to the barrel metal, to tin that portion of the latter, namely, flange 20, which projects into the head mold.

After the mold has been thus prepared with the tube in place, the heating ring is poured in space 25 and then, after an interval of a few seconds, the head metal.

Such a procedure, insures a good bond between the metals and therefore an easy passage of heat from the one to the other in the operation of the finished cylinder.

After the head casting has set the cylinder it taken from the mold and the base 12 and fins 13 secured thereto.

In securing the fins 13 to the cylinder use is made of the process described and claimed in application of Charles F. Kettering, Serial No. 671,490, filed October 29, 1923, now owned by the assignee of this application.

Briefly, the process described in that application is as follows: After a rough finishing operation on the outside of the cylinder, a thin coat of flux is applied and a sheet of brazing brass wrapped around the fluxed cylinder. About the sheet of brass is wrapped a set of fins formed by suitably crimping or folding a strip of sheet copper and to the inner surfaces of which has been applied a second thin coat of flux. When the brass and finning material have been placed about the cylinder the assembly is wired together and the whole coated with a thick layer of flux. After drying, the assembly is heated under proper conditions to cause the brass to unite the copper finning material to the ferrous metal cylinder.

After the operation of finning just described has been completed and while the assembly is still close to the brazing temperature it may be put into a suitable quenching

medium, such as oil, so as to give a very hard wearing surface on the interior of the cylinder barrel.

Before, after, or simultaneously with the finning operation the base 12 which may be a casting or forging, may be secured to the cylinder by brazing. Or a suitable base may be welded in place by some form of autogenous welding. It is also contemplated to cast a base on the tube either before or after the head casting or substantially simultaneously therewith.

As stated above the base may be secured to the cylinder by a brazing operation at the same time that the finning is accomplished. This is done by assembling the cylinder base, brass and flux, in much the same manner as in the finning, and brazing with the same heat.

The base may also be secured to the cylinder by electrically welding them together and satisfactory cylinders have been produced both ways.

After or before the finning operation the valve ports 30 and 31 may be formed in the cylinder head and it is preferable to provide these with seats 32 and 33 by placing suitable seat material in proper location on core 22 and casting the head about them or such seats may be provided by brazing in suitable rings or other formed pieces, before, after, or during the finning operation.

A modification of the above described cylinder provided in the same fashion, is shown in Fig. 3.

In this latter form a thin iron plate 40 is placed in the upper end of the tube 10 and the head 11 cast as before so as to extend within the flange 20 and unite with both the steel and iron. This plate 40 then furnishes the seats for the valves in ports 30 and 31. The metals preferably chosen for the present purpose are steel for the tube or cylinder barrel, copper for the head proper, cast iron for the inner plate 40, and cast or forged iron or steel for the base, but it should be understood that other metals might be substituted and some of the advantages of the present structure retained.

It is preferable but not necessary to provide the tube with the flange 20. Excellent results have been obtained by using the straight walls of the tube to surround the cast in head and extend to the top thereof as shown in Fig. 5, or to extend not quite to the top thereof allowing the head metal to extend over the upper edge and to the outer periphery of the tube.

Further, it is contemplated to use in the present process for the production of these cylinders, a tube formed from a plate of steel, or other suitable wear resisting metal having a high tensile strength, rolled up to the tube form and welded. It is also possible to use for this purpose a tube made by piercing an ingot and forming therefrom a cylinder having walls of sufficient dimensions and uniformity.

It will thus be seen that, instead of the usual form of cylinder wherein one metal is used to perform the several functions of resisting wear, furnishing strength and rigidity, conducting heat, etc., a cylinder is produced which has in each portion a material particularly suitable for the function of that portion. In the barrel, the properties of high tensile strength and wear resistance are present, in the head, high heat conductivity; in the cooling fins, large area and high heat conductivity; and in the base great rigidity and machineability.

While the processes and articles herein shown and described, constitutes a preferred form of embodiment of the present invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What I claim is as follows:

1. The process of producing internal combustion engine cylinders which comprises forming a tube of material capable of being hardened by quenching and having a high tensile strength; securing to one end thereof by a metallic bond a head of material of high heat conductivity; securing in effective heat conducting relation to the outer periphery thereof cooling fins, by a heat involving operation; and quenching the assembly at the end of the heat operation.

2. The process of producing internal combustion engine cylinders which comprises forming a steel tube; providing the tube at one end with an integral head of material of high heat conductivity; brazing cooling fins to the outer periphery thereof; and quenching the assembly at the end of the brazing operation.

3. The process of producing internal combustion engine cylinders which comprises forming a steel tube; providing the tube at one end with an integral head of copper; brazing cooling fins to the outer periphery thereof; and quenching the assembly at the end of the brazing operation.

4. The process of producing internal combustion engine cylinders which consists in forming a steel tube; providing the tube at one end with an integral head of copper; brazing cooling fins to the outer periphery thereof; quenching the assembly at the end of the brazing operation, and securing to the other end of the tube a suitable base.

5. The process of producing internal combustion engine cylinders which consists in forming a tube of material capable of being hardened by quenching and having a high tensile strength; securing to one end thereof by a metallic bond a head of material of high heat conductivity; securing in effective heat conducting relation to the outer pe-

riphery thereof cooling fins, by a heat involving operation; quenching the assembly at the end of the heat operation; and securing to the other end of the tube a suitable base.

6. The process of producing engine cylinders which comprises setting a steel tube in molding sand with one end of the tube extending into a mold for a head; casting a ring in heating relation to the said end of the tube adjacent said mold; and after a suitable interval casting a head of copper in the mold.

In testimony whereof I hereto affix my signature.

FRANK ORVILLE CLEMENTS.