April 23, 1929. G. D. ANGLE ET AL 1,710,136

COMPOSITE ALUMINUM TO STEEL CYLINDER CONSTRUCTION

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FIG. 1.

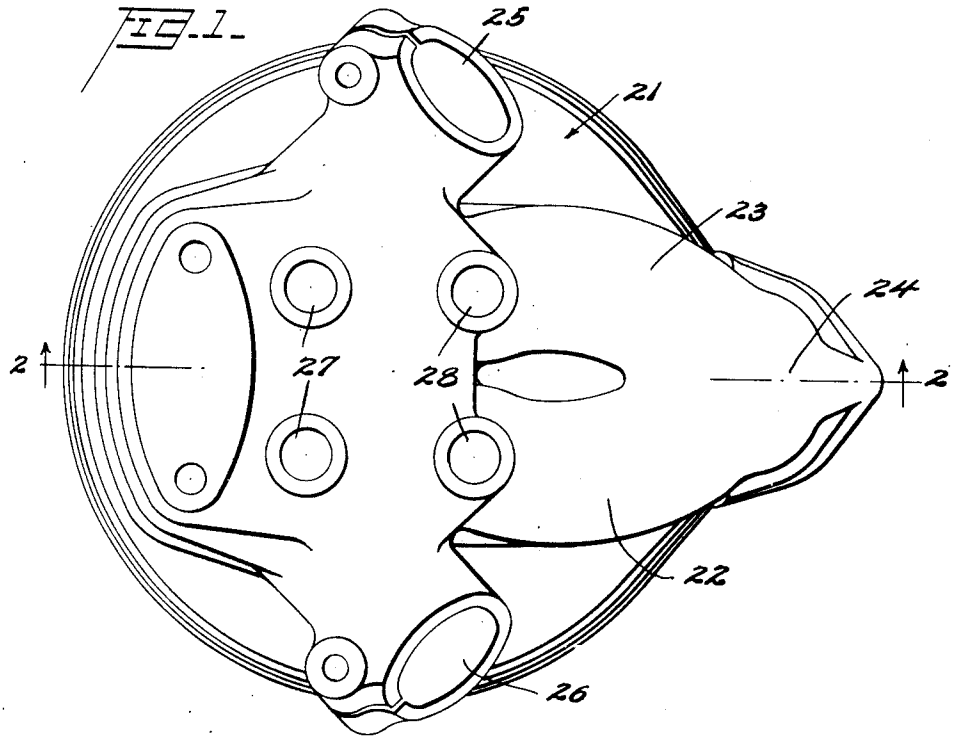
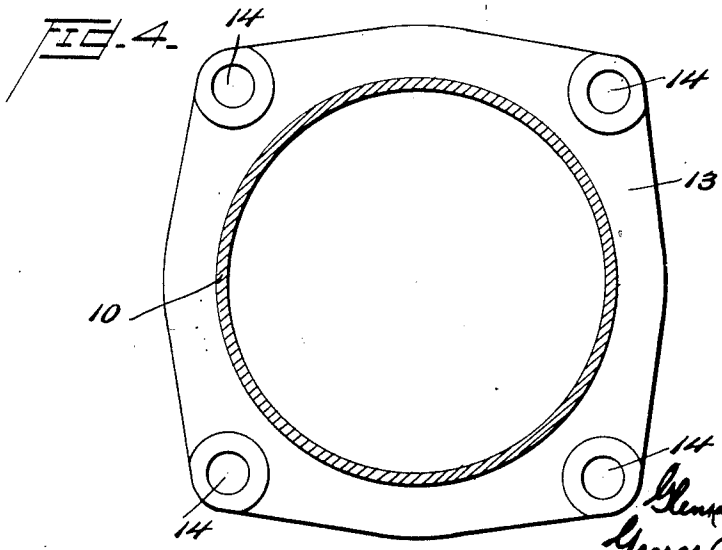


FIG. 4.



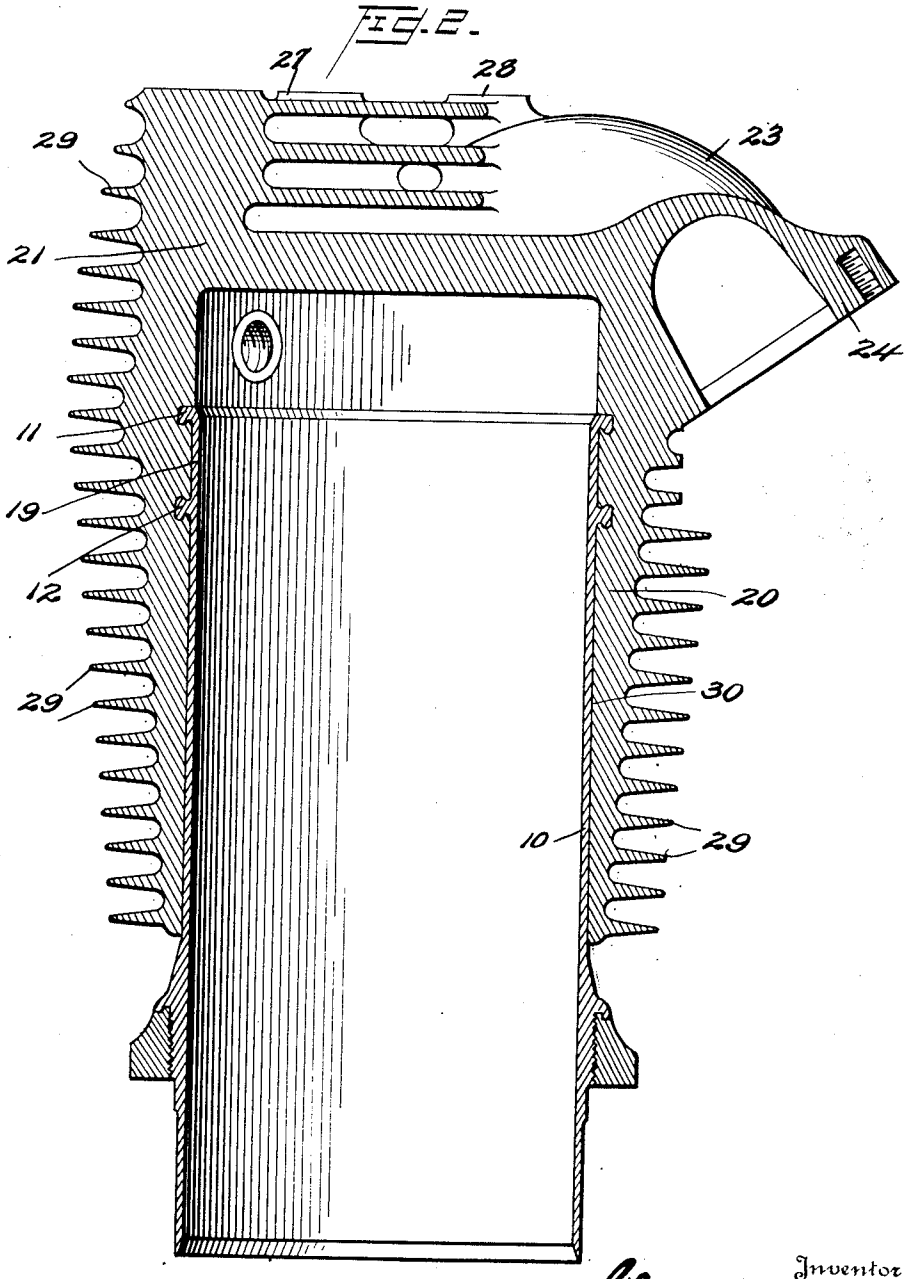
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COMPOSITE ALUMINUM TO STEEL CYLINDER CONSTRUCTION

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FIG. 2.



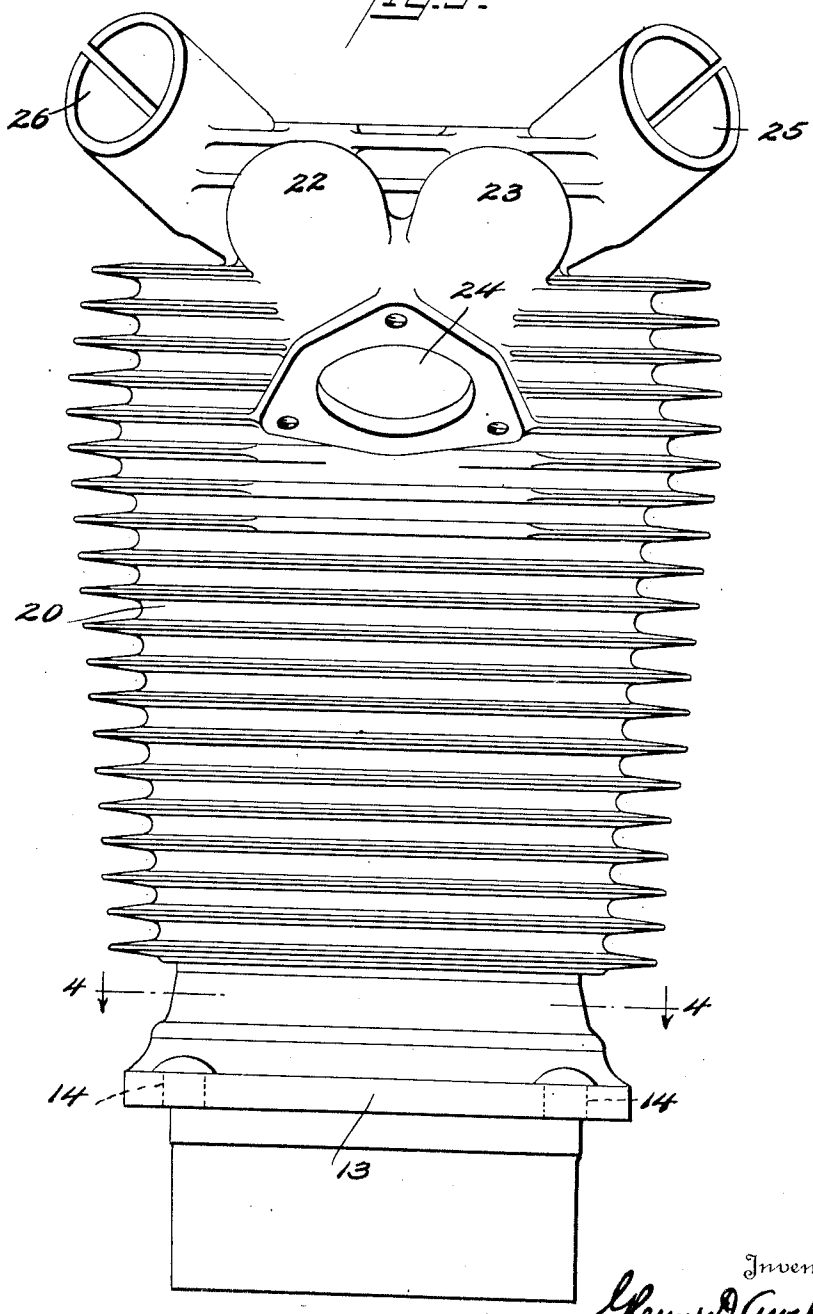
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COMPOSITE ALUMINUM TO STEEL CYLINDER CONSTRUCTION

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FIG. 3.



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COMPOSITE ALUMINUM TO STEEL CYLINDER CONSTRUCTION

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FIG. 5.

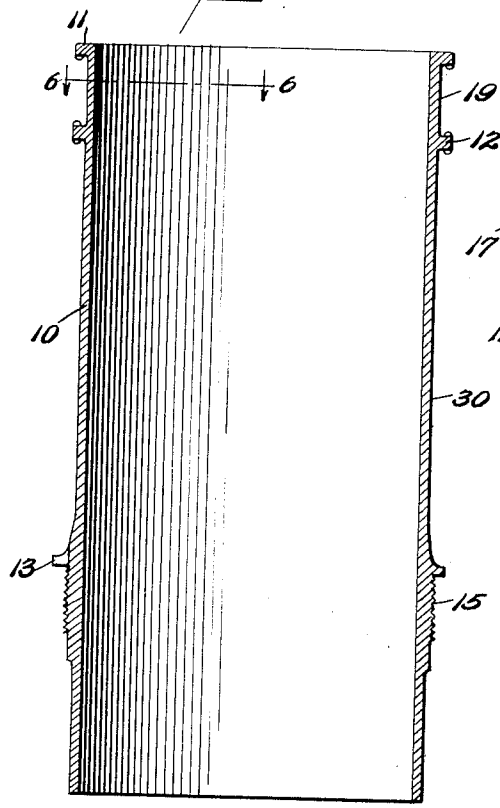


FIG. 6.

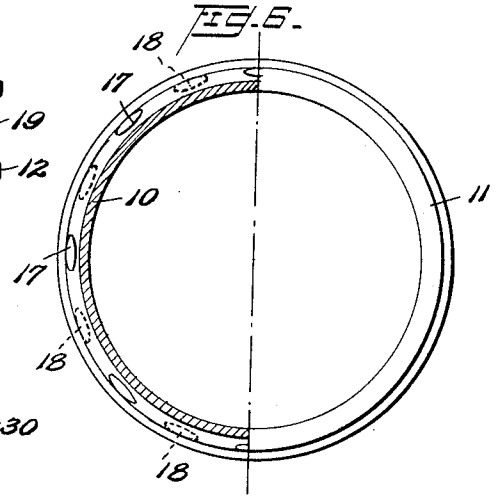
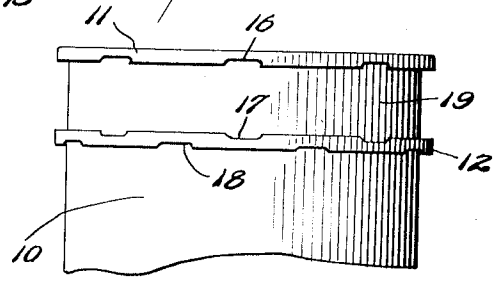


FIG. 7.



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UNITED STATES PATENT OFFICE.

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COMPOSITE ALUMINUM TO STEEL CYLINDER CONSTRUCTION.

Application filed October 30, 1925. Serial No. 66,175.

This invention relates to a composite air-cooled cylinder construction for internal combustion engines, and more particularly to a cylinder construction of this general type employing steel and aluminum.

It has been found with cylinders having cast aluminum locked over the entire outer portion of a steel cylinder barrel, that the overall expansion affects the valve tappet clearance to such a degree that it is very difficult to determine a cold valve timing which gives the proper valve opening and closing points during operation. This, of course, applies more especially to valve mechanisms using push rods and rocker arms, particularly those in radial engine construction. Furthermore, due to the greater expansion of aluminum, under working conditions, the stresses produced in the steel barrel from this cause are often very great.

The primary object of this invention is to provide a composite cylinder construction of steel and aluminum which will minimize the stress in the steel barrel and eliminate excessive overall expansion. To accomplish these purposes the aluminum and steel are placed in such relation as to permit as much freedom of expansion and contraction under heat conditions as is structurally possible.

With these and other objects, consisting of new and useful features of construction and arrangements of parts, in view, the invention will be hereinafter more fully described in connection with the accompanying drawings.

In the drawings Fig. 1 is a plan view of the cylinder head of a cylinder constructed according to my invention.

Fig. 2 is a central vertical section taken on the line 2—2 of Figure 1 and looking in the direction of the arrows.

Fig. 3 is a side elevation of the cylinder.

Fig. 4 is a sectional view on the line 4—4 of Fig. 3 looking in the direction of the arrows.

Fig. 5 is a central vertical section of the cylinder barrel.

Fig. 6 is a sectional view on the line 6—6 of Fig. 5 looking in the direction of the arrows, and

Fig. 7 is a side elevation of the upper part of the cylinder barrel.

Like numerals of reference refer to corresponding parts in all the figures of the drawings.

The numeral 10 designates a steel cylinder barrel having at its upper part two annular flanges or rings 11 and 12, and a flange 13 near its lower end which is provided with a plurality of apertures 14 for the purpose of receiving suitable bolts or studs for securing the cylinder barrel directly to the crank case of the engine. Adjacent the bottom flange 13, the cylinder barrel is provided with screw threads 15 which are adapted to engage corresponding threads on the crank case (not shown) and thereby act as a further means for holding the crankcase and cylinder barrel together. The annular flanges 11 and 12 are provided on their lower and upper faces respectively, with a plurality of spaced notches 16 and 17, and the lower face of flange 12 is formed with similar notches 18 for a purpose which will hereinafter appear. The cylinder barrel is preferably tumbled in a receptacle containing powdered zinc and heated, and the sherardizing thus accomplished is subsequently removed by finishing machining operations from all surfaces of the cylinder except the surface 19 located between the spaced flanges 11 and 12.

The cylinder barrel has cast upon it an aluminum jacket 20 having an upper portion 21 extending above the upper open end of the cylinder barrel and thus enclosing a combustion chamber. This upper portion 21 of the aluminum alloy jacket is formed with the two branches 22 and 23 of a main inlet conduit 24, and with the two exhaust passages 25 and 26, as the particular cylinder illustrated on the drawing is provided with two inlet and two exhaust valves. Apertured bosses 27 and 28 are also provided on the cylinder head and act as guides for the exhaust and inlet valve stems, respectively. The same casting or jacket 20 also encases the working surfaces of the cylinder barrel and has formed thereon the circumferential cooling fins 29.

During the casting operation the molten aluminum alloy enters the space between the flanges 11 and 12 and contacting with the sherardized surface 19, the molten metal forms a sort of alloy with the zinc coating and as the latter has a mechanical bond with the steel barrel, consisting of particles of zinc located in the pores of the steel, it can be seen that a firm thermal bond is established between the cast alumium and steel along this surface. Since the sherardizing has been removed from the surface 30 of the cylinder barrel, which is located below the flange 12, no bond, other than that due to the natural shrinkage between the aluminum and steel.

exists along this surface. The aluminum engages in the notches 16, 17 and 18 and the jacket is thus locked from lateral movements with relation to the cylinder barrel.

Under heat conditions, the aluminum is allowed to move freely up and down along the surface 30 of the steel barrel 10. Such an arrangement results in an overall change in distance, due to heat, of only the sum of the expansion of the aluminum above the upper flange or ring 11 and that of the steel below this point, being obviously, practically a minimum for constructions of this type.

The heat from the combustion chamber walls is transmitted by the integral aluminum casting distributed throughout its length and readily dissipated by the cooling fins formed thereon.

It will be understood that the particular construction described and shown has been chosen for illustrative purposes merely and that the invention as defined by the claims hereunto appended may be otherwise embodied and supplied without departing from the spirit and scope thereof.

We claim:

1. A composite cylinder for an air-cooled internal combustion engine comprising in combination, a metallic cylinder barrel in which the piston of the engine is adapted to reciprocate, said cylinder barrel having spaced flanges near one end, a casting of different material encasing said barrel and forming a combustion chamber, and means for forming a thermal bond between said casting and the outer surface of the cylinder barrel included between said flanges.

2. A composite cylinder for an air-cooled internal combustion engine, comprising in combination, a metallic cylinder barrel in which the piston of the engine is adapted to reciprocate, said cylinder barrel having spaced annular flanges provided with a plurality of notches, a casting of different material encasing said barrel and engaging said flanges and the notches thereof for preventing longitudinal and lateral movement of the casting in relation to the cylinder barrel, and means for forming a thermal bond between said casting and the outer surface of the cylinder barrel included between said flanges.

3. A composite cylinder of an air-cooled internal combustion engine, comprising a metallic cylinder barrel adapted to be secured to the crankcase of the engine, a casting of different material encasing said barrel and forming a combustion chamber, means forming an intermolecular thermal bond between the barrel and casting in the vicinity of the combustion chamber, and means for locking said casting from lateral movement relative to said cylinder barrel.

4. A composite cylinder for an air-cooled internal combustion engine, comprising in combination, a metallic cylinder barrel in which the piston of the engine is adapted to reciprocate, said cylinder barrel having spaced annular flanges provided with a plurality of notches, a casting of different material encasing said barrel and engaging said flanges and the notches thereof for preventing longitudinal and lateral movement of the casting in relation to the cylinder barrel, and means for forming an intermolecular thermal bond between said casting and the outer surface of the cylinder barrel included between said flanges.

In testimony whereof we affix our signatures.

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GEORGE E. A. HALLETT.