Nov. 10, 1942. A. V. D. WILLGOOS 2,301,235

CYLINDER BARREL CONSTRUCTION

Filed Dec. 10, 1940 2 Sheets-Sheet 1

Fig. 4

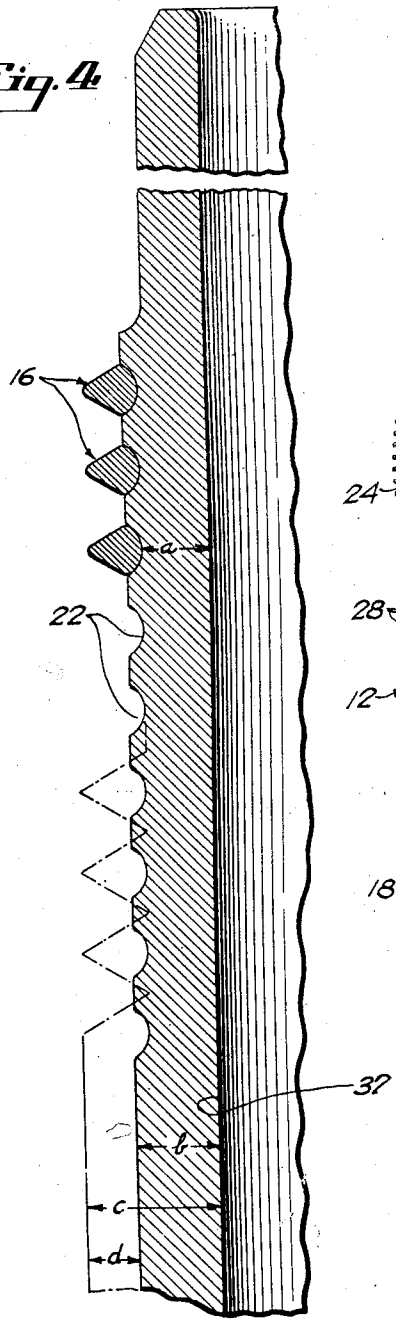
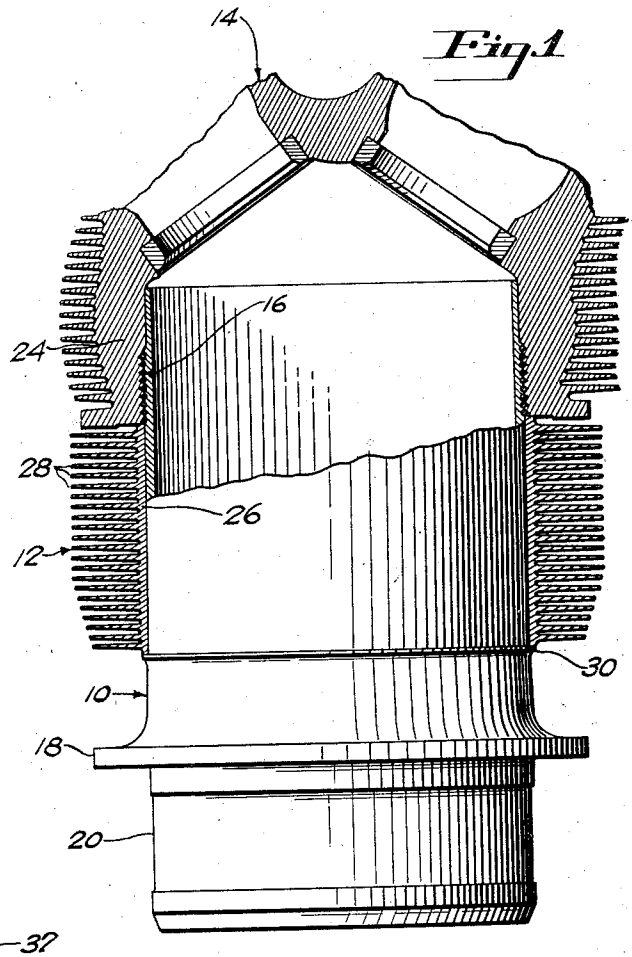


Fig. 1



INVENTOR

Andrew V. D. Willgoos

BY Harris & Luther

ATTORNEY

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Filed Dec. 10, 1940 2 Sheets-Sheet 2

Fig. 2

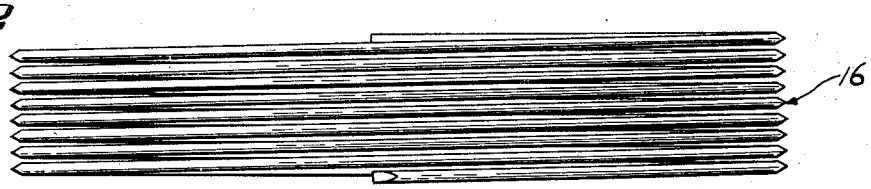
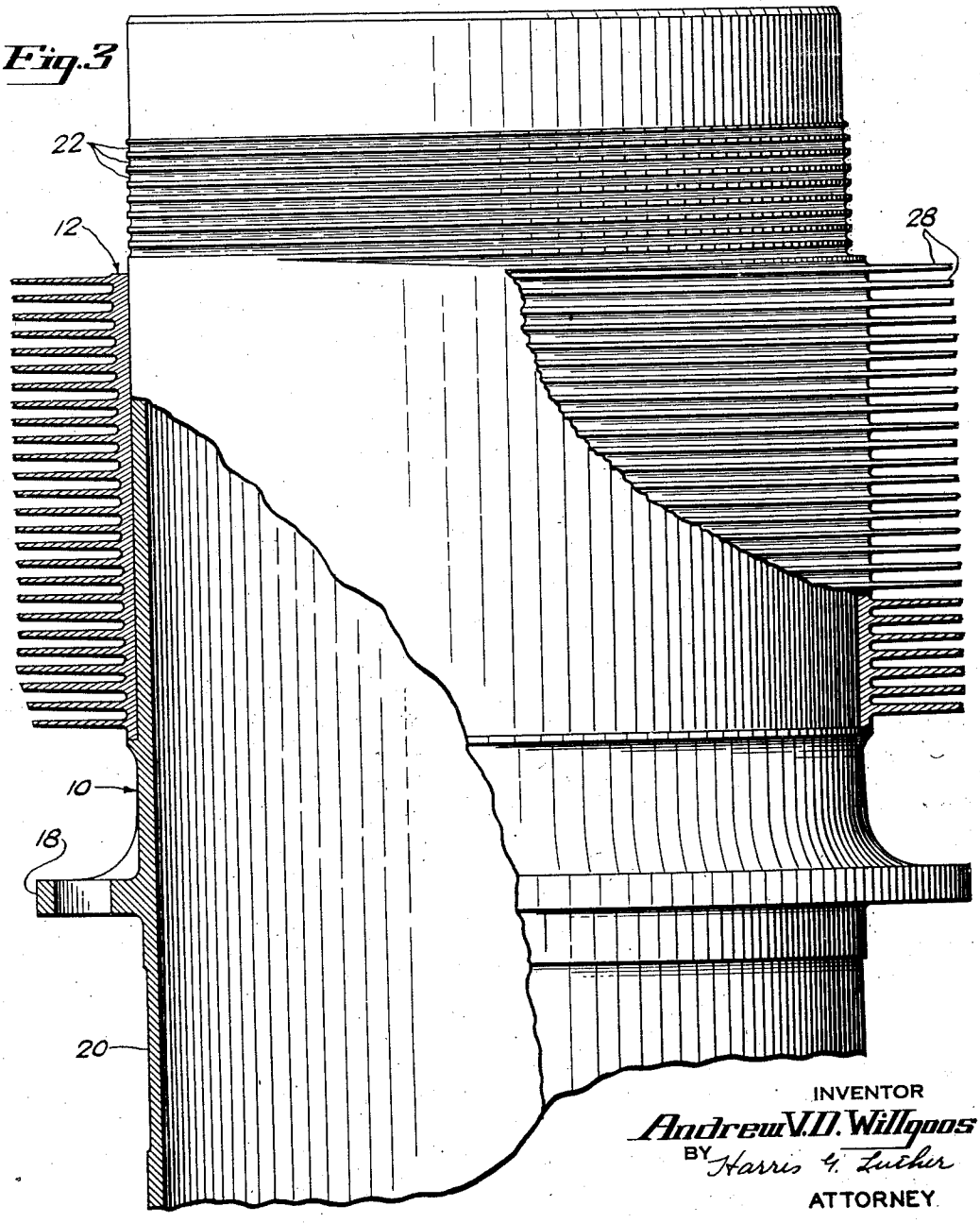


Fig. 3



INVENTOR
Andrew V. D. Willgoos
BY Harris G. Luther
ATTORNEY

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UNITED STATES PATENT OFFICE

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CYLINDER BARREL CONSTRUCTION

Andrew V. D. Willgoos, West Hartford, Conn., assignor to United Aircraft Corporation, East Hartford, Conn., a corporation of Delaware

Application December 10, 1940, Serial No. 369,458

8 Claims. (Cl. 123—171)

This invention relates to improvements in engine cylinders and has particular reference to an improved engine cylinder having separate cylinder barrel, head, and barrel fin portions.

An object of the invention resides in the provision of an engine cylinder of the character indicated having an improved attachment means between the cylinder head and the cylinder barrel.

A further object resides in the provision of an improved engine cylinder of the character indicated having an improved head attaching means arranged to facilitate the assembly of the barrel fin portion on the barrel and obviate the necessity of a thickened barrel portion within the finned area.

Other objects and advantages will be more particularly pointed out hereinafter or will become apparent as the description proceeds.

In the accompanying drawings, in which like reference numerals are used to designate similar parts throughout, there is illustrated by way of example a suitable construction arrangement for the purpose of disclosing the invention. The drawings, however, are for the purpose of illustration only and are not to be taken as limiting or restricting the invention since it will be apparent to those skilled in the art that various changes in the illustrated construction may be resorted to without in any way exceeding the scope of the invention.

In the drawings,

Fig. 1 is a longitudinal sectional view of an engine cylinder constructed according to the invention.

Fig. 2 is an elevational view on an enlarged scale of a spring thread forming a part of the cylinder head attaching means.

Fig. 3 is an enlarged sectional view of a cylinder barrel and a barrel fin muff assembled therewith, and

Fig. 4 is a sectional view on an enlarged scale of a fragmentary portion of the cylinder barrel shown in Figs. 1 and 3 showing the application thereto of the spring thread illustrated in Fig. 2.

Referring to the drawings in detail, the numeral 10 generally indicates a cylinder barrel preferably formed of steel or some similar strong and resilient material. The numeral 12 generally indicates a barrel fin muff which may be formed of aluminum, or some similar material of good heat conducting characteristics, surrounding the intermediate portion of the cylinder barrel 10 to conduct excess heat away from the barrel and transfer it to the engine cooling air. The numeral 14 generally indicates a cylinder head made separately from the barrel and preferably of some light weight material of good heat conducting properties, such as an aluminum alloy. This head is assembled with the outer end of the barrel 10 by means of a screw thread construction including the spring thread, generally indicated at 16.

In the construction illustrated, the cylinder barrel is provided with an integral annular attaching flange 18 below which is a skirt portion 20 adapted to extend within a crankcase (not illustrated) to which the cylinder is attached. The cylinder barrel extends above the flange 18 to provide a combustion chamber and a working space for an engine piston (not illustrated). A spiral groove 22 having a generally partly circular cross-sectional shape is formed in the exterior surface of the barrel 10 somewhat spaced from the upper or outer end of the barrel and the spring thread 16 is threaded into this groove to provide a screw thread for the attachment of the head 14. As is clearly illustrated in Fig. 4, this spring thread has a cross-sectional shape such that the inner portion thereof is partly circular to fit the groove 22 and the outer portion is wedge shaped to provide a tapered screw thread fitting the internal screw threads provided in the annular portion 24 of the head 14.

This thread arrangement per se is in commercial use for such elements as bolts, spark plugs, etc., and one such commercial product is known to the aircraft engine industry as the "Aero" thread.

The fin muff comprises a continuous cylindrical inner portion 26 the inner surface of which is shaped to fit closely about the outer surface of the barrel 10 between the groove 22 and the flange 18 and carries a plurality of integral annular fins 28.

If desired, the muff 12 may be shrunk onto the portion of the cylinder barrel which it overlies and if desired or considered necessary a bond of some suitable soldering or brazing material may be incorporated between the inner surface of the cylindrical portion 26 and the external surface of the cylinder barrels to provide a heat transfer bond between the barrel and the muff. As it is usually not desirable to have the barrel fins continue down to the flange 18 the barrel may be provided with an external annular shoulder 30 spaced above the flange 18 and forming an abutment for the lower end of the muff 12 and the head 14 may be screwed down on the barrel until its open end is brought into contact with the

upper end of the muff 12 to clamp the muff in position between the head and the shoulder 30.

It is obvious that in the construction illustrated, the only way in which the muff 12 can be brought to its assembled position with respect to the barrel 10 is by inserting the upper or outer end of the barrel through the muff and moving the muff relative to the barrel until it reaches its final position against the abutment 30. If the muff has a shrink fit on the barrel it will be heat expanded before assembly so that relative movement between the muff and the barrel may take place. A predetermined thickness of the cylinder barrel wall between the bottom of the groove 22 and the inner surface of the barrel is required to provide the necessary structural strength to maintain the head 14 in place on the barrel. This thickness, as indicated by the dimension *a* on Fig. 4, has a certain limiting value regardless of whether the head retaining threads are integral with the barrel or whether a separate spring thread is used. Furthermore, the inner surface of the barrel must be kept straight as indicated by the line 32 in Fig. 4. This means that if the head retaining threads were normal V threads and were made integral with the barrel the thickness of the muff receiving portion of the cylinder wall would have to be increased over the thickness indicated, by the dimension *b* in Fig. 4, to the thickness indicated by the dimension *c* in that figure or by the amount that the threads protruded beyond the straight wall thickness *d*. The additional thickness, as indicated by the dimension *d* in Fig. 4 is not necessary for cylinder barrel strength at the location of the fin muff and would add materially to the weight of the cylinder barrel besides obstructing the free flow of heat from the interior surface of the barrel to the fin muff. By utilizing the spring thread 16 and the spiral groove 22 it is possible to limit the thickness of the muff receiving portion of the barrel to the maximum thickness of the groove receiving portions of the barrel and omit from the muff receiving portion the barrel thickness indicated by the dimension *d*. With this illustrated arrangement the muff may be assembled with the barrel before the spring thread 16 is assembled. After the muff has been brought to its operative position against the abutment 30 the spring thread 16 may be threaded into the spiral grooves 22 to provide an external thread for the head 14. After the spring thread is in place the head 14 may be heat expanded and threaded upon the spring thread 16 to its operative position against the upper or outer end of the fin muff 12.

The use of the spring thread 16 for retaining the head on the barrel has an additional advantage in that the groove 22 can be given a very shallow rounded cross-sectional shape obviating any relatively sharp edged cut in the exterior surface of the barrel which would lead to a concentration of stresses when the compression and explosion forces within the cylinder tends to separate the head from the barrel. Because of this arrangement either the factor of safety of the head attachment can be increased, or the wall thickness of the entire barrel can be somewhat decreased to provide a light weight barrel of ample strength.

While an assembly method has been mentioned which suggests the threading of the spring thread onto the barrel and a subsequent threading of the cylinder head onto the threaded barrel, this does not mean that other methods might not be employed such as first threading the spring thread into the head and subsequently threading the head onto the barrel around the groove 22.

While a suitable mechanical arrangement for the purpose of disclosing the invention has been illustrated in the accompanying drawing and hereinabove described, it is to be understood that the invention is not limited to the particular arrangement so illustrated and described, but that such changes in the size, shape and arrangement of the various parts may be resorted to as come within the scope of the sub-joined claims.

Having now described the invention so that others skilled in the art may clearly understand the same, what it is desired to secure by Letters Patent is as follows:

1. An engine cylinder comprising, a barrel, a fin muff overlying a portion of said barrel, a head having a portion overlying a different portion of said barrel, and a spiral thread member operatively included between the overlapping portions of said head and said barrel, said barrel having a substantially uniform wall thickness throughout the portions included in said fin muff and said head portion, and a thread groove of generally rounded cross section in the head included portion thereof.

2. The combination of an engine cylinder barrel, a separate fin muff shrunk onto the intermediate portion of said barrel, a cylinder head shrunk onto one end portion of said barrel, and a separate spiral member engaging in spiral grooves in the overlapping portions of said barrel and said head for securing said head on said barrel.

3. An engine cylinder barrel having an enlarged portion at one end thereof, a heat radiating muff surrounding and in close heat conducting relation with the intermediate portion of said cylinder barrel, and grooves in the other end of said barrel having a depth less than a normal V thread for receiving a spiral thread forming member.

4. In a cylinder barrel adapted to have a head screw threaded onto an end thereof and whose external diameter is determined by the internal diameter of a muff that is assembled with the barrel by passing it over the threaded portion of said barrel, a spiral groove located at said end and having a depth less than a normal V thread, for receiving a spiral, head-retaining, thread-forming member.

5. In combination, a steel cylinder barrel having an enlargement at one end, an aluminum heat radiating muff shrunk onto an intermediate portion of said barrel and an aluminum head shrunk and screw threaded onto the opposite end of said barrel, said screw threads comprising a loose spiral member received in grooves in said head and received in grooves in said barrel, the grooves in said barrel being of less depth than said head grooves, the grooved and muff-receiving portions of said cylinder having substantially the same outside diameter.

6. In combination, a steel cylinder barrel having an enlargement at one end, a separate heat radiating muff of light material having high heat transfer properties, and shrunk onto an intermediate portion of said barrel, and an aluminum head shrunk and screw threaded onto said barrel, said screw thread comprising a separate spiral member received in grooves in said head and said barrel, the intermediate portion of said barrel which receives the muff being of smaller

diameter than the outside diameter of the said separate thread when in place on the barrel.

7. In an engine cylinder having a flanged portion and a head receiving threaded portion the thread depth of which is normally determined by the threads in the head, a one piece heat radiating muff located between said portions, and whose internal diameter is determined by the external diameter of the threaded portion of the cylinder and in turn determines the external diameter of the muff-receiving portion of the cylinder, means for reducing the normal external diameter of the threaded portion of the barrel by reducing the thread depth, comprising an insert located between the head and barrel and providing threads of the required thread depth in the head and threads of a shallower thread depth in the barrel.

8. An engine cylinder barrel having an enlarged portion at one end thereof, a heat radiating muff surrounding and in close heat conducting relation with the intermediate portion of said cylinder barrel, and grooves in the other end of said barrel having a rounded cross section and a depth less than the depth of a normal V thread for receiving a spiral thread.

ANDREW V. D. WILLGOOS.