Jan. 26, 1965 J. B. SCANNELL 3,166,832

METHOD OF FORMING A PISTON AND LIKE COMPONENTS

Filed Nov. 2, 1960

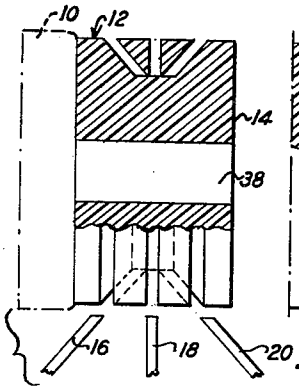

Fig. 1

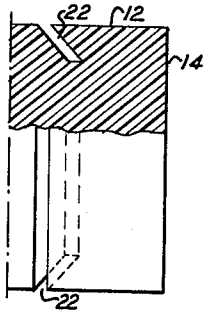

Fig. 2

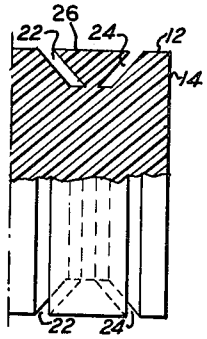

Fig. 3

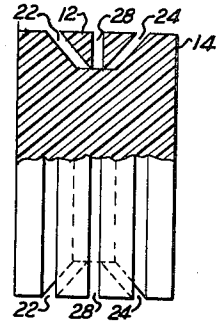

Fig. 4

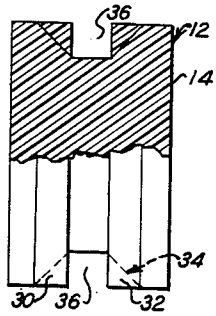

Fig. 5

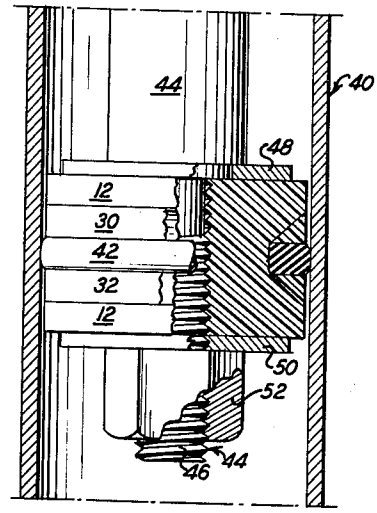

Fig. 6

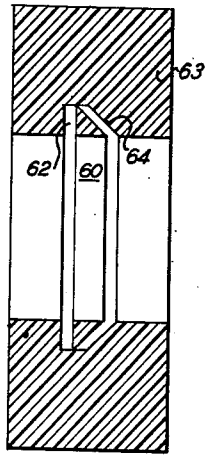

Fig. 7

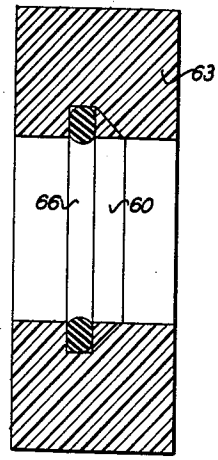

Fig. 8

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METHOD OF FORMING A PISTON AND LIKE COMPONENTS

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14 Claims. (Cl. 29—156.62)

This invention relates to methods of forming pistons and like components.

In the practice of Pat. No. 2,420,104 and methods leading to like articles of manufacture, one basic problem is encountered which is quite significant.

To understand this problem, it is first necessary to consider the structure which it is desired be prepared; to wit: a substantially rigid body having a surface groove in which are positioned a resilient ring and at least one substantially rigid backup ring which functions to maintain the position of the resilient ring and to prevent extrusion thereof.

Snapping the resilient ring into position in the groove is a relatively simple operation and presents no great problem. However, positioning the relatively rigid ring is difficult since it will generally not have the elastic properties necessary. It is therefore necessary to split the rigid ring in order that this ring can be slipped over the piston into the groove. Unfortunately, the position at which the rigid ring is split constitutes the weak and probable failure point of the seal.

It is an object of the invention to avoid this problem and in contemplation thereof, the invention considers cutting the rigid ring directly out of the body of the piston, in situ, so that on its formation the ring is already in proper position.

Other objects, as well as features and advantages of the invention, will be found in the following detailed description of a preferred embodiment illustrated in the accompanying drawing in which:

FIGURE 1 diagrammatically illustrates the processing of a work piece according to the invention to form the finished article of manufacture of the invention;

FIGURE 2 diagrammatically illustrates a first step of the method of the invention;

FIGURE 3 diagrammatically illustrates a second step of the method of the invention;

FIGURE 4 diagrammatically illustrates the next sequential step contemplated by the invention;

FIGURE 5 illustrates a sub-assembly, the structure of which is formed according to the steps illustrated in FIGS. 2–4;

FIGURE 6 illustrates a completed assembly prepared according to the method of the invention;

FIGURE 7 illustrates a further application of the invention wherein the backup ring is given a different relative position; and

FIGURE 8 illustrates the structure of FIG. 7 with the resilient ring in place.

To facilitate an explanation of the method of the invention, it will be first assumed that it is desired to prepare a piston of cylindrical form having therein an annular peripheral groove of substantially trapezoidal cross-section, wherein are located two backup rings of substantially triangular cross-section and adapted to sandwich therebetween a resilient ring of O or D cross-section. It will be understood, however, that variations of these shapes and elements are possible within the scope of the invention, as will become apparent hereinafter.

In FIGURE 1 is indicated a workpiece **10** at the end of which is indicated a cylindrical portion **12** which is ultimately severed from the main body of the workpiece. The workpiece may be, for example, of plastic material, such as nylon or polytetrafluoroethylene, or the

like. Generally the workpiece will be selected to have a diameter slightly greater than that of the final piston diameter desired. The workpiece is then in the vicinity of end portion **12**, finished to the desired diameter and provided with a flat end face **14**.

Three tool cuts are then made with three tools or with the same tool moved to different positions, the tools being generally indicated at **16**, **18** and **20**. Tool **16** is fed into the end portion **12** at the desired angle, to generate cut **22** (see FIG. 2).

Cut **22** is an annular cut which is formed either by rotating the workpiece **10** or by holding the workpiece **10** steady in position while rotating the tool **16** thereabout. The thickness of tool **16** and the resulting width of the groove **22** is selected in accordance with aspects of the invention which will be discussed hereinunder.

Secondly, a second groove **24** (see FIG. 3) is cut into the end portion **12** in a manner similar to that employed for groove **22**. The width of tool **20** and the resulting width of groove **24** is also important, as will be discussed hereinunder.

It is important to note that grooves **22** and **24** are in intersecting relationship with one another, or are, in other words, inclined with respect to each other. These grooves thus form an annular body or rib **26** of substantially trapezoidal cross-section which remains affixed to the end portion **12**.

Following the formation of grooves **22** and **24**, a further cut **28** (see FIG. 4) is made in the rib **26**, so as to sever the same from the portion **12** and form two separate rings **30** and **32**. These rings are annular rings, each being of substantially triangular cross-section, inasmuch as the width of tool **18**, and thus of cut **28**, is selected so as to remove the central portion of the trapezoidal cross-section of the rib **26**.

It is to be noted that the accumulated widths of tools **16**, **18** and **20** are selected so as to provide a suitable distance between the inner-faces of the resulting annular ring-confining cavity **34**, which in its final form is of substantially trapezoidal cross-section. It will also be noted that rings **30** and **32** can be moved away from each other by amounts corresponding to the widths of grooves **22** and **24** so as to provide therebetween a space **36** which is adapted to accommodate a resilient sealing ring.

It will be appreciated that rings **30** and **32** are fabricated from the very same material as is the piston **12** itself and that these rings are substantially locked in position, due to the rigidity of the material from which they are fabricated.

FIGURE 1 further illustrates the formation of a hole or bore **38**, which is formed in the piston **12**, so as to accommodate the insertion of a piston rod. The final form of the article of manufacture contemplated by the invention is illustrated in FIGURE 6.

In FIGURE 6 is indicated in axial section a cylinder **40**, wherein is slideably accommodated the piston **12**. Rings **30** and **32** are shown positioned in the cavity **34** and a resilient O ring **42** is shown accommodated between rings **30** and **32** within the space **36**.

A piston rod **44** is provided with a threaded end **46**, which is inserted through the bore **38**, there being provided on opposite faces of the piston **12** washers **48** and **50**. Finally, a nut, or like member **52**, threadably engages the threaded portion **46** of the piston rod **44**, to lock the piston in position on the piston rod.

Thus in one form the method of the invention consists of forming a piston by cutting out of a cylindrical piston body and in situ at least one annular ring, or, alternatively, of cutting into a cylindrical body at least two grooves in intersecting relationship which form in situ an annular ring.

More specifically, the invention contemplates forming

a piston body and cutting into the same first and second peripheral grooves inclined towards each other, to form in this body an annular rib of trapezoidal cross-section, which is connected to the body. Then there is contemplated, according to the method of the invention the cutting of said rib into two separate parts and severing the same from the body to form two rings adapted to constitute backup rings.

As noted above, the body may preferably be of a plastic material, such as nylon or polytetrafluoroethylene, and between the backup rings is accommodated a resilient sealing ring of known type.

Preferably, the rings are first formed as a single rib of trapezoidal cross-section, connected to the associated body, this connected body being severed such that the middle portion of the trapezoid is removed to form two backup rings of triangular cross-section.

It will be noted that the backup rings have substantially the same mean diameter as the mean diameter of the groove in which they are accommodated, so that the backup rings are secured or locked in position as they are formed.

In FIGS. 7 and 8, the backup ring is provided internally, a backup ring **60** being cut out in situ. In connection with this embodiment, one cut **62** is made radially into member **63** and a second cut **64** is made in intersecting relation with the first cut. The ring **60** is moved to the extreme position of FIG. 8 and a resilient ring **66** is placed in the resulting annular groove.

There will now be obvious to those skilled in the art many modifications and variations of the method and article of manufacture set forth above. These modifications and variations will not, however, depart from the scope of the invention if defined by the following claims.

What is claimed is:

1. In method of manufacturing a piston adapted for accommodating a piston ring, the steps comprising forming a piston body, cutting into the surface of said body first and second peripheral annular grooves inclined towards each other to form in said body an annular rib of trapezoidal cross-section connected to the body, and cutting said rib into two separate parts and severing the same from said body to form two rings each of which are completely disconnected from said body and are adapted to constitute backup rings for the piston ring.

2. A method as claimed in claim 1 comprising forming said body of a plastic.

3. A method as claimed in claim 2 wherein the plastic is nylon.

4. A method as claimed in claim 2 wherein the plastic is polytetrafluoroethylene.

5. A method as claimed in claim 1, further comprising snapping a resilient piston ring into position between the backup rings.

6. A method as claimed in claim 1 comprising removing a central portion of the rib of trapezoidal cross-section by cutting said annular rib so that the thus formed backup rings have a triangular cross-section.

7. A method as claimed in claim 1 comprising boring a hole through said body to accommodate a piston rod.

8. A method as claimed in claim 7 comprising inserting a threaded piston rod into said hole and sandwiching said body with washers and a nut to lock said body to said rod.

9. A method as claimed in claim 1 comprising cutting said peripheral grooves with a width adapted to provide, with the cutting of said annular rib, an annular ring-confining cavity of predetermined dimensions in said piston.

10. A method as claimed in claim 1 wherein said body is cylindrical.

11. A method as claimed in claim 1 wherein said body is part of a larger piece from which it is severed when the backup rings are formed.

12. A method of forming a piston comprising providing a piston body and forming two intersecting peripheral annular grooves in the surface of the body one being substantially normal to the axis of the body to form a completely severed annular ring capable of free movement in an annular ring-confining cavity which is defined by the surfaces of the body bounding the grooves whereby the ring is adapted to constitute a backup support for a resilient annular element inserted into said ring-confining cavity.

13. A method of forming a piston comprising forming a piston body, cutting into the surface of said body, first and second annular peripheral grooves inclined towards each other to form in said body an annular rib connected to said body in an annular ring-confining cavity defined by the surfaces of the piston body bounding said grooves, completely severing said rib from said body to form rings which have limited movement in the cavity and snapping an annular resilient element into position in the cavity of said body to engage said annular rings formed therein and be held in position thereby.

14. A method of forming a piston comprising forming a cylindrical piston body, cutting into the surface said body, first and second peripheral annular grooves inclined towards each other to form in said body an annular rib of trapezoidal cross section connected to the body in an annular ring-confining cavity defined by the surfaces of the piston body bounding said grooves, cutting said rib into two separate parts and completely severing each part from the body to form two annular rings which are freely slidable in said cavity, and snapping an annular resilient element between the two said rings such that said rings engage the resilient element on either side thereof and hold the same immovably in position in said cavity.

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