Feb. 15, 1966 G. D. LINE 3,234,815

TAPPET STRUCTURE

Filed May 29, 1962

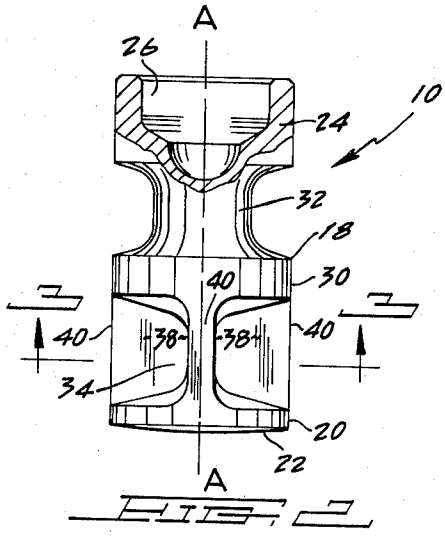


FIG. 2

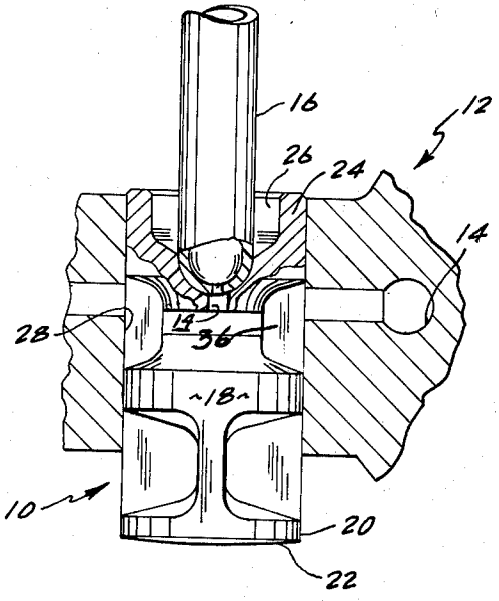


FIG. 1

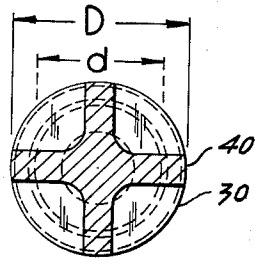


FIG. 3

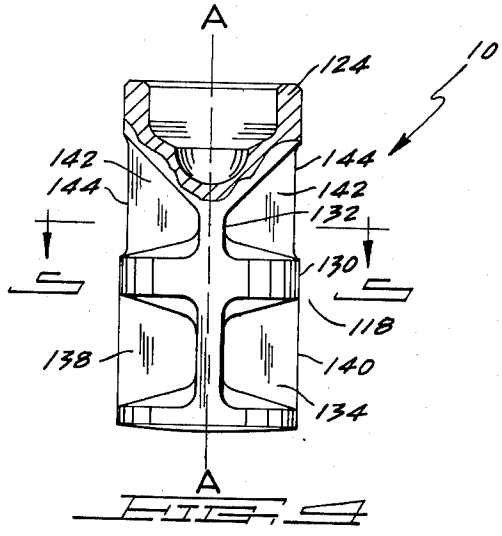


FIG. 4

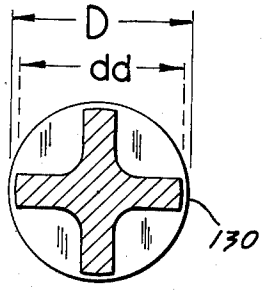


FIG. 5

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United States Patent Office 3,234,815 Patented Feb. 15, 1966

3,234,815
TAPPET STRUCTURE

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Filed May 29, 1962, Ser. No. 198,593
15 Claims. (Cl. 74—569)

This invention relates to tappets and more particularly to substantially solid, integral, unitary tappet structure which has been cast from a suitable material wherein the tappet structure is of lightweight construction but possesses sufficient strength to accomplish the desired results.

It has long been desired to have unitary, substantially solid, integrally formed tappet structure which may be cast from any suitable material wherein the tappet structure is of lightweight construction but of sufficient strength to perform the desired and necessary functions and which enables and satisfies different requirements for circulating lubricating oil to the tappet structure as well as any push rod and cam arrangement which may be associated therewith.

Accordingly, it is the principal object of this invention to provide substantially solid, unitary, integrally formed tappet structure which is of lightweight construction and which possesses sufficient strength to perform the desired and necessary functions.

It is also an object of this invention to provide improved tappet structure which is of lightweight construction possessing sufficient strength to perform the desired and necessary functions wherein the improved tappet structure has an elongate body portion provided with a plurality of enlarged parts each of which have substantially equal cross-sectional areas wherein the enlarged parts are spaced apart and define therebetween portions which are reduced in cross-sectional area relative to the cross-sectional areas of the enlarged parts.

A further object of this invention is to provide improved tappet structure of lightweight construction which possesses sufficient strength to perform the desired and necessary functions wherein the improved tappet structure has an elongated body portion provided with a plurality of spaced apart enlarged parts each of which have substantially common or equal diameters wherein at least one portion of the body member which is disposed between and defined by adjacent ones of the enlarged parts has a diameter which is less than the common or given diameters of the enlarged parts.

Another object of this invention is to provide improved tappet structure of lightweight construction which possesses sufficient strength to perform the desired and necessary functions wherein the improved tappet structure is provided with an elongate body portion having a plurality of enlarged parts which are disposed in longitudinally spaced relationship relative to each other and define therebetween reduced portions at least one of which is provided with generally longitudinally extending laterally spaced reinforcing web-like elements that project generally outwardly from the body portion and terminate in surface areas which extend substantially continuously between the adjacent ones of the enlarged parts.

Still another object of this invention is to provide tappet structure which is of lightweight construction but which possesses sufficient strength to perform the necessary required functions in order to decrease the required bias of a valve spring arrangement employed in the environment in which the tappet structure is being used which further enables the operation of such environment to possess greater efficiency at higher speeds.

An additional object of this invention is to provide substantially solid, unitary, integrally formed tappet structure which may be cast from any suitable material.

Another additional object of this invention is to provide substantially solid, unitary tappet structure having enlarged end parts for engaging cam and push rod arrangements with the enlarged end parts integrally formed with an intermediate part by reduced portions one of which is recessed, grooved or channeled in a manner to define a passageway which enables the circulation of lubricating oil to be effective to the tappet structure and the cam and push rod arrangements even though the circulation of such lubricating oil may have different requirements depending upon the environment in which the tappet structure is employed.

Still yet another additional object of this invention is to provide tappet structure with sealing means for effectively preventing the flow of a lubricating fluid from the confines of the tappet structure which will normally decrease the pressure of the lubricating fluid and thus enable a substantially constant lubricating fluid pressure to be maintained so that all such tappet structures of a given series or line may be lubricated as required.

Accordingly, in order to acquire and accomplish the desired advantages and objects as stated above, tappet structure according to the instant inventive concept is provided with an elongate body member having, adjacent one end portion thereof, an enlarged part for engaging a push rod arrangement and, adjacent the other end portion, an enlarged part for engaging a cam arrangement. The enlarged end parts of the body member of the tappet structure project generally radially outwardly therefrom and terminate in peripheral surfaces each of which is of substantially constant and equal diameters, generally cylindrical in configuration and which define substantially smooth circumferentially extending surface areas. Intermediate the enlarged end parts of the elongate body member of the tappet structure there is provided a generally radially outwardly or laterally projecting enlarged flange-like part which also is of substantially cylindrical configuration having a constant given diameter which is substantially equal to the diameters of the enlarged end parts and which also defines a substantially circumferentially extending surface area with the enlarged flange-like part being longitudinally spaced from each of the enlarged end parts and defining therewith reduced portions therebetween each of which have a cross-sectional area that is substantially less than a corresponding or like cross-sectional area of the enlarged ends and flange-like parts of the tappet structure. At least one of the reduced portions of the body member of the tappet structure may be recessed, channeled or grooved in order to provide a circumferentially extending substantially unobstructed passageway for a lubricating fluid with the recess, channel or groove of the one reduced portion having a diameter which is substantially less than the diameters of the enlarged parts of the tappet structure. Exending generally longitudinally between the enlarged intermediate or flange-like part and at least one of the enlarged end parts of the body member and disposed within the confines of the other reduced portion which is defined therebetween there is provided a plurality of circumferentially spaced web-like reinforcing elements which give the other reduced portion of the body member of the tappet structure a cruciform configuration in cross-section.

Other objects and important features of the invention will be apparent from a study of the specification following taken with the drawing, which together show, illustrate, describe and disclose certain preferred embodiments or modifications of the invention and what is now considered to be the best mode of practicing the principles thereof. Other embodiments or modifications may be suggested to those having the benefit of the teachings

herein, and such other embodiments or modifications are intended to be reserved especially as they fall within the scope and spirit of the subjoined claims.

In the drawing:

FIGURE 1 is a partial sectional view of an environment having tappet structure provided with the improvements according to the present invention embodied therein;

FIGURE 2 is an enlarged longitudinal view partly in section of another embodiment or modification of the tappet structure illustrated in FIGURE 1 of the drawing;

FIGURE 3 is a cross-sectional view illustrating an end portion of the tappet structure illustrated in FIGURE 2 of the drawing taken along the line 3—3 looking in the direction of the arrows;

FIGURE 4 is a longitudinal view, partly in section, similar to FIGURE 2 of the drawing but illustrating a further embodiment or modification of the tappet structure; and

FIGURE 5 is a cross-sectional view illustrating an end portion of the tappet structure illustrated in FIGURE 4 of the drawing taken along the line 5—5 looking in the direction of the arrows.

Attention is now directed to FIGURE 1 of the drawing wherein there is illustrated tappet structure **10** which is operably disposed in an environment **12**, such as an internal combustion engine or the like, which in accordance with conventional practice is provided with a lubricating system **14** for circulating a lubricating fluid to the tappet structure **10**, a push rod arrangement **16** and a cam arrangement, not illustrated.

The tappet structure **10** comprises an elongate body member **18** and, in each of the embodiments or modifications of the invention as illustrated in more detail in FIGURES 1, 2 and 3 of the drawing, the body member **18** of the tappet structure **10** is provided adjacent one end part **20** thereof with means **22** in the form of a dwell for engagement with a cam arrangement, not illustrated, with the other end part **24** of the body member **18** being provided with means **26**, which may be in the form of a longitudinally inwardly projecting recess, into which there may extend the push rod **16** during the operation of the tappet structure **10** in performing the desired functions in accordance with the requirements of and in association with the selected type of environment **12**.

The end arts **20** and **24**, as illustrated, are enlarged and longitudinally spaced from each other relative to a longitudinal axis A—A of the elongate body member **18** with each of the end parts **20** and **24** projecting generally radially or laterally outwardly relative to the longitudinal axis A—A and terminating in substantially cylindrical generally smooth circumferentially extending substantially continuous surface areas which slidably engage a bore **28** of the environment **12** in a manner and for a purpose which will hereinafter be explained, described and disclosed in more detail. The substantially continuously smooth peripheral surface areas of the cylindrical-like enlarged end parts **20** and **24** of the body member **18** are each defined by a given common diameter D and in each instance the diameters D for the respective enlarged end parts **20** and **24** are substantially equal relative to each other with the lateral cross-sectional areas of the end parts **20** and **24** also being substantially equal to each other.

Located intermediate the enlarged end parts **20** and **24** and also extending generally radially or laterally outwardly relative to the longitudinal axis A—A of the body member **18** of the tappet structure **10** is an intermediate flange-like enlarged part **30** which is longitudinally spaced from each of the enlarged end parts **20** and **24** and located intermediate thereof to define therewith longitudinally spaced apart reduced portions **32** and **34** on the body member **18**.

The intermediate flange-like enlarged part **30** of the body member **18** of the tappet structure **10** has a diameter that is substantially equal to the common or given diameters D of the enlarged end parts **20** and **24** with the lateral cross-sectional area of the intermediate flange-like enlarged part **30** also being substantially equal to the like or corresponding cross-sectional areas of the enlarged end parts **20** and **24**.

In the embodiment or modification of the tappet structure **10**, as illustrated in FIGURES 1, 2 and 3 of the drawing, at least one of the reduced portions **32** of the body member **18** is provided with an annular recess, groove or channel that extends substantially continuously circumferentially about the body member **18** to define a substantially unobstructed open passageway **36** with the bore **28** in the environment **12** through which the lubricating fluid of the system **14** may pass during the circulation thereof in lubricating the tappet structure **10**, the push rod arrangement **16**, cam arrangement, not illustrated, as well as any other portions of the environment **12** as required or desired. In the embodiment of the invention as illustrated in FIGURE 1, lubrication of the push rod arrangement **16** will occur through a cross-over passageway of the system **14** through the bore **28** with the cross-over passageway being in communication with a centrally located passageway through the means **26** which feeds to the push rod arrangement **16**. The annular recess, groove or channel has a diameter *d* that is substantially less than the given diameter D that is common to the enlarged ends **20** and **24** and enlarged intermediate flange-like parts **30** of the body member **18** of the tappet structure **10**.

The other reduced portion **34** of the body member **18** is provided with a plurality of longitudinally extending radially spaced apart web-like reinforcing elements **38** each of which terminates in longitudinally extending surface areas **40**. The web-like reinforcing elements **38** are disposed in a manner which creates a cruciform configuration to the other reduced portion **34** when viewed in longitudinal cross-section as illustrated in FIGURE 3 of the drawing.

The reduced portions **32** and **34** each has a lateral cross-sectional area which is less than the like, corresponding or similar cross-sectional areas of the enlarged end **20** and **24** and the enlarged intermediate flange-like **30** parts which are substantially equal. At least one of the reduced portions **32** or **34** of the body member **18** has a diameter *d* which is substantially less than the given diameter D that is common to the enlarged end **20** and **24** and the enlarged intermediate **30** parts which have substantially equal diameters with the other reduced portion **32** or **34** of the body member **18** having the longitudinally extending surfaces **40** of the web-like reinforcing elements **38** disposed with diameters D that are substantially equal to the given diameter *d* that is common to the enlarged end **20** and **24** and the enlarged intermediate flange-like **30** parts of the body member **18** of the tappet structure **10**.

FIGURE 4 of the drawing illustrates another modification or embodiment of tappet structure **110** which differs from the tappet structure **10** illustrated in FIGURES 1–3 of the drawing in that one reduced portion **132** is provided with generally longitudinally extending web-like reinforcing elements **142** which project generally radially or laterally outwardly relative to the longitudinal axis A—A of the body member **118** in circumferentially spaced relationship relative to each other and terminate in longitudinally extending surface areas **144** with the web-like reinforcing elements **142** being provided with a diameter *d* which is substantially less than the given or common diameter D of adjacent enlarged end **120** and enlarged intermediate **130** parts of body portion **118** in a manner which will define a passageway that functions as the passageway **36**, previously described and disclosed.

In this embodiment or modification of the tappet structure **110**, the other reduced portion **134** is substantially like the corresponding or similar reduced portion **34** of the embodiment or modification or the tappet structure **10**, as illustrated in FIGURES 1–3 of the drawing.

It would also be obvious from the showing in FIGURE 4 that the web-like reinforcing elements **142** may be of the same size as the reinforcing elements **138** when no surrounding lubricant by-pass is required.

Still other embodiments or modifications of the invention are believed to be within the descriptive portion of this disclosure wherein tappet structure may be provided with various combinations of the reduced portions and enlarged parts of the body member which have been shown, illustrated, described and disclosed herein.

In each of the embodiments or modifications of the tappet structure **10** and **110**, as shown, illustrated, described and disclosed herein, the web-like reinforcing elements **38**, **138** and **142** each extend from the respective enlarged end parts **20**, **120** or **24**, **124** to the enlarged intermediate flange-like part **30**, **130** so that the longitudinally extending surfaces **40**, **140** or **144** extend substantially continuously therebetween.

Further, the enlarged parts **20**, **120**, **24**, **124**, **30**, **130** and the web-like reinforcing elements **38**, **138** or **142** are all integrally formed one with the other to define the tappet structure **10**, **110** respectively, which is a solid, integral, unitary structure and the tappet structure **10**, **110**, as the case may be, may be formed by casting from any suitable material in accordance with conventional processes or practices.

From the above disclosure and description, it is believed that the tappet structure **10**, **110** will be relatively lightweight in construction but will possess sufficient strength to enable the tappet structure **10**, **110** to perform the desired functions as required by the selected environment **12**. Further, the lightweight construction of the tappet structure **10**, **110** will enable a relatively smaller bias to be required from a valve spring arrangement and hence result in a more efficient operation at higher speeds of the environment **12**.

As best illustrated in FIGURE 1 of the drawing, the surface areas defined by the parts **20**, **120** in cooperation with the surfaces defined by the parts **30**, **130** respectively, when in engagement with the bore **28** in the environment **12** will effectively seal the lubricating system **14** so that on passage of a lubricating fluid through the system **14** and the passageway **36**, leakage will be prevented from the passageway **36** so that the pressure of a lubricating fluid passing through the system **14** will be maintained substantially constant and will not require a pressure buildup in the system **14** in order to lubricate other tappet structures which may be operated in series or line in the environment **12**.

While the invention has been described, disclosed, illustrated and shown in terms of certain preferred embodiments or modifications which it has assumed in practice, the scope of the invention should not be deemed to be limited by the precise certain embodiments or modifications herein shown, described, illustrated and disclosed, such other embodiments or modifications being intended to be reserved especially as they fall within the scope of the claims herein appended.

I claim as my invention:

1. Elongate tappet structure having

at least three longitudinally spaced apart generally laterally outwardly projecting substantially cylindrical parts of each of which terminate in substantially smooth circumferentially continuously extending surfaces,

said parts of the tappet structure each having a common given diameter with the diameters of each part being substantially equal,

one of said parts of the tappet structure being disposed intermediate the other parts thereof and defining therewith portions therebetween each of which is reduced in longitudinal cross-sectional area relative to the longitudinal cross-sectional area of the parts of the tappet structure,

at least one of the reduced portions of the tappet structure having a diameter substantially less than the common given diameters of the parts of the tappet structure, and

a plurality of longitudinally extending generally laterally outwardly projecting circumferentially spaced apart web-like elements disposed within the confines of the other reduced portion of the tappet structure with the web-like elements each extending between the respective adjacent parts of the tappet structure.

2. Tappet structure as set forth in claim **1**, wherein said one reduced portion of the tappet structure is defined by an annular circumferentially extending substantially unobstructed recess.

3. Tappet structure as set forth in claim **1**, wherein the web-like elements disposed within the confines of the other reduced portion of the tappet structure terminate in generally longitudinally extending surface areas, and

said other reduced portion of the tappet structure is of cruciform configuration in cross-section.

4. Tappet structure as set forth in claim **3**, wherein said generally longitudinally extending surface areas of the web-like elements of the other reduced portions are disposed along a diameter which is substantially equal to the common given diameter of the parts of the tappet structure.

5. Tappet structure as set forth in claim **1**, wherein the parts of said tappet structures are disposed with the one of the parts being intermediate the end portions of the tappet structure and the other parts thereof being disposed adjacent the opposed end portions of the tappet structure.

6. Tappet structure as set forth in claim **5**, wherein one of the other parts of the tappet structure which is disposed adjacent the end portions thereof is provided with a generally longitudinally inwardly projecting recess for receiving a push rod of an environment in which said tappet structure may be functioning.

7. Tappet structure as set forth in claim **5**, wherein one of the other parts of the tappet structure which is disposed adjacent the end portions thereof is provided with a dwell for engaging a cam arrangement of an environment in which the tappet structure may be functioning.

8. Elongate tappet structure having

a plurality of generally laterally outwardly projecting substantially cylindrical parts each of which have substantially equal diameters,

said parts being longitudinally spaced apart to define therebetween portions each of which is reduced in cross-sectional area relative to the cross-sectional areas of the parts, and

at least one of said portions having a diameter that is substantially equal to the diameter of the parts of the tappet structure.

9. Tappet structure as set forth in claim **8**, wherein

a plurality of longitudinally extending generally laterally outwardly projecting circumferentially spaced apart web-like elements are disposed within the confines of the one portion of the tappet structure with the web-like elements each extending between the respective adjacent parts of the tappet structure.

10. Elongate tappet structure having

a plurality of generally laterally outwardly projecting substantially cylindrical parts,

said parts being longitudinally spaced along the tappet structure to define therebetween portions thereon each of which have a cross-sectional area sub-

stantially less than the cross-sectional areas of the parts of the tappet structure,

a plurality of longitudinally extending generally laterally outwardly projecting circumferentially spaced apart web-like elements disposed within the confines of at least one of the portions of the tappet structure with the web-like members each extending between the respective adjacent parts of the tappet structure, and

said one portion of the tappet structure is of cruciform configuration in cross-section.

11. Elongate tappet structure having

one end portion thereof enlarged for engaging a push rod and the other end portion thereof enlarged for engaging a cam arrangement,

an intermediate part of said tappet structure being enlarged and disposed in spaced relationship to the enlarged end parts thereof and defining therewith reduced portions therebetween,

said parts of the tappet structure having substantially equal diameters and cross-sectional areas with the reduced portions having cross-sectional areas substantially smaller than the cross-sectional areas of the parts,

one of said reduced portions having an annular peripherally extending recess for defining a passageway having a diameter substantially less than the diameters of the parts, and

the other of said reduced portions having a plurality of longitudinally extending laterally spaced apart generally outwardly projecting web-like elements having a diameter substantially equal to the diameters of the parts.

12. Elongate tappet structure having

one end portion thereof enlarged for engaging a push rod and the other end portion thereof enlarged for engaging a cam arrangement,

an intermediate part of said tappet structure being enlarged and disposed in spaced relationship to the enlarged end parts thereof and defining therewith reduced portions therebetween,

said parts of the tappet structure having substantially equal diameters and cross-sectional areas with the reduced portions having cross-sectional areas substantially smaller than the cross-sectional areas of the parts,

one of said reduced portions having an annular peripherally extending recess for defining a passageway having a diameter substantially less than the diameters of the parts.

13. Elongate tappet structure having

one end portion thereof enlarged for engaging a push rod and the other end portion thereof enlarged for engaging a cam arrangement,

an intermediate part of said tappet structure being enlarged and disposed in spaced relationship to the enlarged end parts thereof and defining therewith reduced portions therebetween,

said parts of the tappet structure having substantially equal diameters and cross-sectional areas with the reduced portions having cross-sectional areas substantially smaller than the cross-sectional areas of the parts,

one of said reduced portions having a plurality of longitudinally extending laterally spaced apart generally outwardly projecting web-like elements terminating in surface areas having diameters substantially equal to the diameters of the parts.

14. Tappet structure having

enlarged end parts and an intermediate part disposed in spaced relationship relative to the enlarged end parts and defining therewith reduced portions therebetween,

said enlarged end and said intermediate parts having substantially equal diameters,

one of said reduced portions having an annular substantially peripherally continuously extending recess, and

the other of said reduced portions having a plurality of spaced apart generally outwardly projecting web-like elements extending substantially continuously between the respective parts of the tappet structure.

15. Tappet structure having

enlarged end parts and an intermediate part disposed in spaced relationship relative to the enlarged end parts and defining therewith reduced portions therebetween,

said enlarged end and said intermediate parts having substantially equal diameters,

one of said reduced portions having a plurality of spaced apart generally outwardly projecting web-like elements each of which extend substantially continuously between the respective parts of the tappet structure.

References Cited by the Examiner

UNITED STATES PATENTS

2,324,006	7/1943	Lenz et al.	123—90
2,426,083	8/1947	Corlett	123—90
3,089,473	5/1963	Kueny	74—569 X

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