

Dec. 5, 1939.

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2,181,965

SELF-LOCKING ADJUSTABLE TAPPET

Original Filed Oct. 19, 1934 2 Sheets-Sheet 1

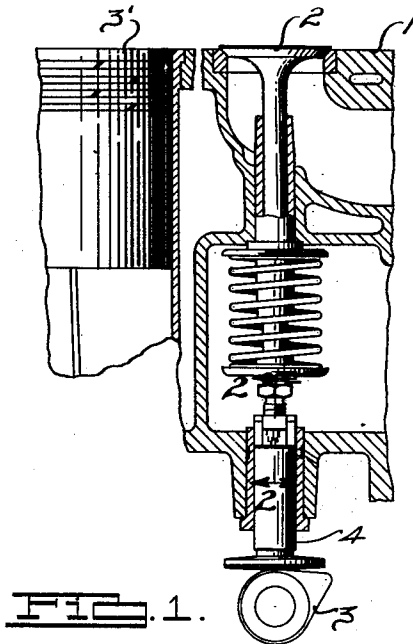


FIG. 1.

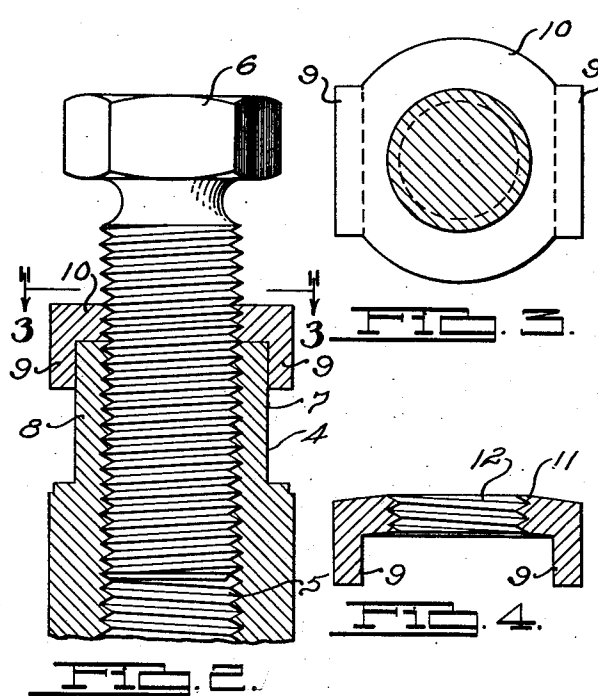


FIG. 2.

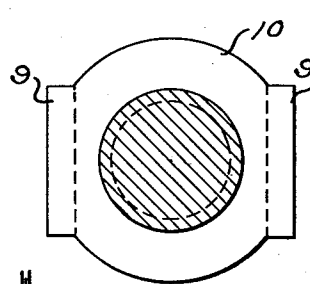


FIG. 3.

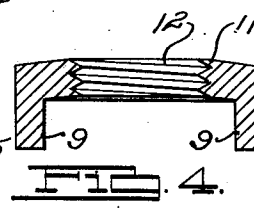


FIG. 4.

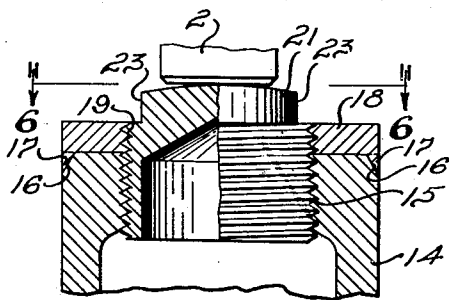


FIG. 5.

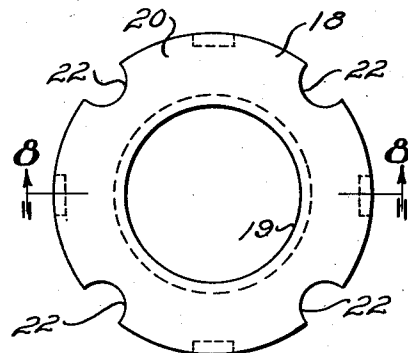


FIG. 7.

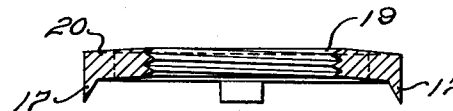


FIG. 8.

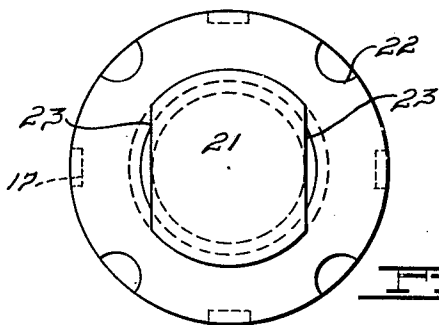


FIG. 6.

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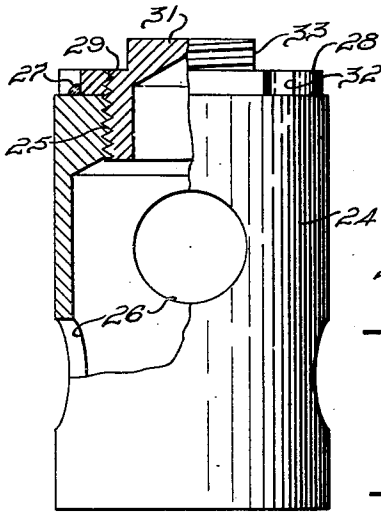


FIG. 9.

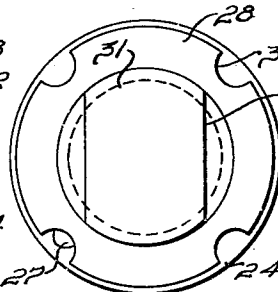


FIG. 10.



FIG. 11.

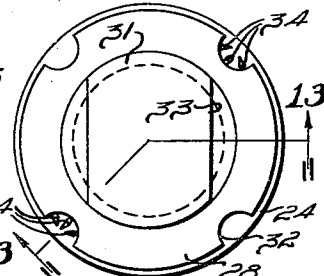


FIG. 12.

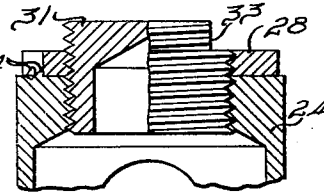


FIG. 13.

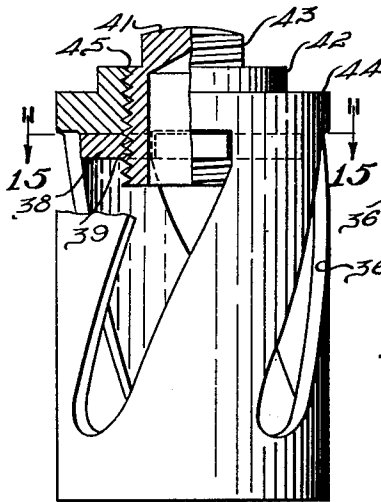


FIG. 14.

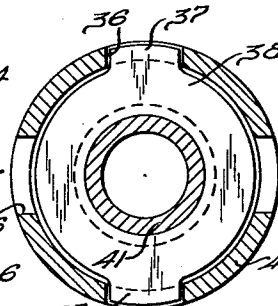


FIG. 15.



FIG. 16.

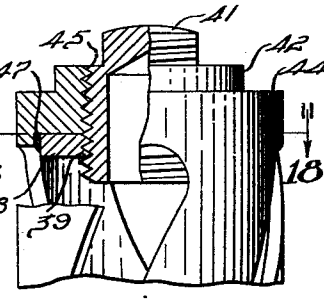


FIG. 17.

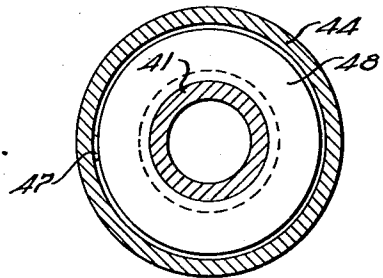


FIG. 18.

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2,181,965

SELF-LOCKING ADJUSTABLE TAPPET

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Application October 19, 1934, Serial No. 749,008
Renewed April 22, 1938

5 Claims. (Cl. 151-15)

My invention relates to valve tappets used in internal combustion engines for transmitting the thrust of the cams to the intake and exhaust valves. The invention is particularly directed to a novel and useful construction for securing the adjusting screws or studs in the end of the tappet which contacts the valve stem. Such adjusting screws are utilized, it is well known, for adjusting the clearance between the end of the valve stem and the tappet.

One object of my invention is to provide a novel construction and a means whereby the adjusting screw or stud may be locked against rotation relative to the tappet to maintain its adjustment during operation.

Another object is to provide a construction wherein the usual and conventional jamb nuts normally used for the purpose of locking the screws of the tappets are dispensed with.

Another object is to provide a novel method of locking the adjusting screw relative to the tappet whereby the adjusting screw may be more easily adjusted than in conventional constructions wherein one or more jamb nuts are utilized for locking purposes.

Another object is to provide an adjustable tappet construction having essentially the same overall length and bearing area as a non-adjustable tappet of a similar size, i. e., no material reduction is made in the bearing area of the tappet in order to make it adjustable in length.

Another object is to provide a construction wherein the adjustment may be effected by simply applying one wrench to the tappet body or to the locking member and applying a second wrench to the adjusting screw to adjust the tappet, thereby eliminating the additional operation now necessary in conventional constructions of employing a third wrench in backing off and tightening jamb nuts for releasing and locking the adjusting screw relative to the tappet.

With the foregoing and other objects in mind, my invention consists in the construction and combination of parts hereinafter described and claimed and shown in the accompanying drawings, in which:

Fig. 1 is a fragmentary view, partly in section, of a portion of an internal combustion engine showing the mounting and assembly of the valve, tappet and cam.

Fig. 2 is an enlarged detail view, partly in section, of the upper portion of the tappet showing the assembly of means for locking the adjustment screw of the tappet in desired position, the view being taken on the line 2-2 of Fig. 1.

Fig. 3 is a view, partly in section and partly in plan, taken on the line 3-3 of Fig. 2.

Fig. 4 is a cross-sectional view of the locking member embodied in my new invention.

Fig. 5 is an enlarged fragmentary view, partly in section and partly in elevation, showing a modified form of tappet construction embodied in my invention.

Fig. 6 is a plan view taken on the line 6-6 of Fig. 5.

Fig. 7 is a plan view of the locking member embodied in the modified form of my new construction shown in Fig. 5.

Fig. 8 is a cross-sectional view of the locking member shown in Fig. 7, and taken on the line 8-8 of Fig. 7.

Fig. 9 is an elevation, parts being broken away and in section, of a further modified form of tappet according to this invention.

Fig. 10 is a top plan of the construction shown in Fig. 9.

Fig. 11 is an elevation, partly in section, of the locking member shown in Figs. 9 and 10.

Fig. 12 is a top plan, similar to Fig. 10 but illustrating another method of fixing the locking member against rotation relative to the tappet body.

Fig. 13 is a section taken substantially on the line 13-13 of Fig. 12.

Fig. 14 is a side elevation of still another form of my tappet construction, parts being broken away and in section.

Fig. 15 is a section taken on the line 15-15 of Fig. 14.

Fig. 16 is a side elevation, partly in section, of the locking member shown in Figs. 14 and 15.

Fig. 17 is a fragmentary side elevation, parts being broken away and in section, of a tappet construction similar to that shown in Figs. 14, 15 and 16 except for the form of the locking member and the means employed in fixing the locking member against rotation relative to the tappet body.

Fig. 18 is a section taken on the line 18-18 of Fig. 17.

Referring to the drawings, the numeral 1 indicates the engine block in which the valve 2 and piston 3' are mounted. The numeral 3 indicates the cam for operating the valve 2, and the numeral 4 indicates the tappet for transmitting the thrust of the cam 3 to the valve 2.

Referring now to Fig. 2, the tappet 4 is of the usual mushroom type. It is provided at its upper end with a threaded bore 5 adapted to receive the threaded shank of the adjusting screw or stud

6 which may be adjusted axially of the tappet 4 for the purpose of regulating the clearance between the tappet 4 and the end of the stem of the valve 2. For the purpose of locking the adjusting screw 6 against rotation relative to the tappet 4, the upper end of the tappet is provided with oppositely disposed flats 7 and 8 on its exterior surface. These flats are adapted to receive depending flanges 9 provided upon opposite edges of a locking member 10 which, as shown in Figs. 2 to 4, inclusive, comprises a body portion 11 in which is provided a threaded opening 12 adapted to receive the threaded shank of the adjusting screw and to register with the threaded bore 5 of the tappet 4 when applied to the end of the tappet body, as shown in Fig. 2. The depending flanges 9 bear against the flats 7 and 8 on the tappet body to prevent the locking member 10 from rotating relative to the tappet body 4.

It will be noted, as shown in Fig. 4, that the body portion 11 of the locking member 10 is sprung outwardly. When originally formed this portion 11 of the locking member is perfectly flat and is then tapped to provide the opening 12, after which the portion 11 is sprung outwardly by the application of sufficient force to give the portion 11 a permanent set in non-flat form. The locking member 10 is then fitted upon the end of the tappet 4 with the depending lugs or flanges engaging the same flats 7 and 8 as when the threads were tapped. The portion 11 is then forced, by the application of a force well below the elastic limit of the material of which the portion 11 is composed, inwardly substantially flat against the upper end of the tappet body 4 and the adjusting screw 6 is inserted and turned through the threaded opening 12 and into the threaded opening 5 of the tappet body. When the pressure by which the portion 11 of the locking member is clamped substantially flat against the upper end of the tappet body is released, the portion 11 will tend to spring outwardly or upwardly at the central portion thereof and thus provide a frictional bearing between the lower surfaces of the threads of the adjusting screw 6 and the upper surfaces of the threads of the locking member 10 and will also cause the upper surfaces of the threads of the adjusting screw 6 engaging the threads in the opening 5 in the tappet body to frictionally engage tightly against the upper sides of such threads, all with sufficient force to prevent the adjusting screw 6 from turning relative to the tappet body during operation of the tappet by the cam and valve. The locking member 10 is deformed to non-flat condition only sufficiently to provide the desired resistance to rotation of the adjusting screw 6 relative to the tappet body 4.

When it is desirable to manipulate the adjusting screw 6 for the purpose of regulating the clearance between the tappet and the end of the valve stem, a wrench is engaged against the outer surface of the depending lugs 9 to retain the tappet body from rotation, and another wrench is applied to the head of the adjusting screw and manipulated to turn the adjusting screw relative to the tappet body. When the desired adjustment is attained, the wrenches are removed and the tension of the outwardly sprung portion 11 of the locking member 10 will cause the threads of the adjusting screw to engage the threads in the tappet body and in the locking member with sufficient friction to prevent rotation of the adjusting screw during operation,

thus locking the adjusting screw relative to the tappet body.

In the modified form shown in Fig. 5, the upper end of the tappet body 14 is provided with a threaded opening 15, and the outer edge of the upper end of the tappet body is provided with spaced notches 16 which are adapted to receive depending lugs 17 provided upon the locking member 18 and to retain the locking member 18 from rotation relative to the tappet body. The locking member 18 is also provided with the threaded opening 19 adapted to register with the threaded opening 15 in the tappet body 14, the threads in the member 19 and of the tappet body being of the same pitch as is also the case in the form shown in Figs. 2 to 4, inclusive.

The locking member 18 is made in the same manner as the locking member 10 shown in Figs. 2 to 4, inclusive, that is, it is originally made so that the body portion 20 is flat and will lie flat against the upper end of the tappet 4. It is then tapped to provide the threaded opening 19 with threads corresponding to the threads in the tappet body. The portion 20 of the locking member is then sprung outwardly by the application of a sufficient force to give the body portion 20 a permanent set so that it will assume the form shown in Fig. 8 and the locking member 18 is then applied to the upper end of the tappet body with the lugs 17 engaging the same notches 16 in the tappet body as they engaged when the locking member and tappet body were threaded, and the portion 20 of the locking member is pressed substantially flat against the upper end of the tappet body without exceeding the elastic limit of body portion and the adjusting screw or stud 21 turned into the threaded openings 19 and 15 so that its threads engage both the threads in the locking member 18 and in the tappet body 4. When the pressure for clamping the locking member 18 substantially flat against the upper end of the tappet body is released, the central portion 20 of the locking member will spring outwardly thus causing the upper sides of the threads of the adjusting screw 21 to bear frictionally against the lower sides of the engaged threads of the tappet body and the lower sides of the threads of the adjusting screw to bear frictionally against the upper sides of the threads of the locking member 18 sufficiently to prevent rotation of the adjusting screw relative to the tappet body during operation of the tappet. The locking member 18 is deformed to non-flat form only enough to exert the proper force on the screw 21 so as to require the desired application of force to rotate the screw 21 relative to the tappet body 14.

The locking member 18 is also provided with notches 22 adapted to receive the lugs of a spanner wrench, and the adjusting screw 21 is provided with flats 23, as shown in Figs. 5 and 6, disposed upon opposite sides thereof provided for engagement of a wrench therewith.

When it is desired to adjust the screw 21 to regulate the clearance between the valve stem and the tappet, a spanner wrench is engaged with the notches 22 in the locking member 18 and another wrench is engaged with the flats 23 on the adjusting screw. The adjusting screw may be turned relative to the tappet 4 and the desired adjustment made.

The inherent resiliency of the metal of the locking member 18 will maintain the locking member in an outwardly sprung condition, causing sufficient frictional engagement of the

threads of the screw and the threads of the tappet body and the locking member to prevent rotation of the adjusting screw during operation of the tappet.

Reference may now be had to Figs. 9, 10 and 11 in which a further modified form of tappet is disclosed in which the tappet body 24 is provided with a threaded opening 25 at the upper end thereof, but notches, corresponding to notches 16 of the previously described embodiment, are not provided. A locking member 28, provided with the threaded opening 29 adapted to register with the threaded opening 25 of the tappet body 24 is threaded on the adjusting screw 31. The locking member 28 is made in the same manner as the locking member 18 of the previously described embodiment except that the depending lugs 17 are omitted. The tappet body 24 may be provided with openings 26 in order to lighten the construction. Spanner wrench notches 32 on the locking member 28 and wrench flats 33 on the adjusting screw 31 are provided in much the same manner as in the previous embodiment.

In assembling this tappet construction, the adjusting screw 31 is threaded through the locking member 28, permanently deformed to non-flat condition, and into the top of the tappet body 24 and then the locking member 28 is rotated on the screw 31 and against the tappet body 24 until it is sufficiently flexed to afford the desired amount of friction between the threads thereon and the threads 25 and 29 so that the desired amount of force must be applied to rotate the adjusting screw relative to the tappet body. The locking member 28 is preferably threaded against the tappet body 24 until it is flexed so that a force of approximately twenty foot pounds, for example, is required to rotate the adjusting screw 31 relative to the tappet body. The locking member is then secured against rotation relative to the tappet body. This may be accomplished by spot welding the locking member to the top of the tappet body 24 at a point within one of the spanner wrench notches 32 as indicated at 27 in Figs. 9 and 10. This interlocks the locking member 28 and the tappet body 24 against relative rotation so that the desired amount of force must be applied to effect rotation between the adjusting screw 31 and the tappet body 24. Since the locking member 28, in its flexed condition, is subjected to a small force as compared with the elastic limit of the material of which the locking member is composed, the desired amount of friction between the threads of the thread adjusting screw and the threads 25 and 29 of the locking member and tappet body will remain substantially constant throughout the life of the tappet.

Reference may now be had to the embodiment shown in Figs. 12 and 13 which is of substantially the same construction as that disclosed in Figs. 9 to 11, inclusive, except that in securing the locking member 28 against rotation relative to the tappet body 24, prick punched portions 34 are raised on the top of the tappet body 24 and within one or more of the spanner wrench openings 32. This tappet construction is assembled in the same manner as that disclosed in Figs. 9 to 11, inclusive, except that the locking member 28 and the tappet body 24 are interlocked against relative rotation by prick punching instead of welding.

Reference may now be had to the embodiment shown in Figs. 14, 15 and 16 in which the locking member of the tappet is disposed within the tap-

pet body rather than exteriorly as in the previously described embodiments. In this construction, a tappet body 44 is provided with a threaded opening 45 at the upper end thereof and is further provided with angularly disposed slots 36. The slots 36 are provided to lighten the tappet construction, to permit the locking member 38 to be disposed within the interior of the tappet body, to permit insertion of support or anvil means into the interior of the tappet body for flexing the locking member during assembly, and to cooperate with lugs 37 provided on the locking member 38 for the purpose of interlocking the locking member 38 and the tappet body 44 against relative rotation. The locking member 38 is interiorly threaded as indicated at 39 with threads corresponding to the threads 45 provided at the top of the tappet body 44 for the reception of an adjusting screw 41. Wrench flats 42 and 43 are provided at the top of the tappet body 44 and on the adjusting screw 41.

In the construction and assembly of the tappet illustrated in Fig. 14, the body portion 44 and adjusting screw 41 are fabricated in the form illustrated in this figure. The locking member 38, in flat condition and provided with the lugs 37, is inserted through an opening 36 and the lugs 37 disposed within diametrically opposite slots 36. With a locking member contacting the bottom surface of the head portion of the tappet body 44 the openings 35 and 39 are threaded and the locking member 38 removed from the interior of the tappet body. The locking member 38 is then permanently deformed to a non-flat form, the distortion of the locking member being only sufficient so that upon being flexed to substantially flat condition, the desired friction will be afforded between the threads of the adjusting screw and the threads of the end portion of the tappet and the locking member so that the desired resistance to turning of the adjusting screw relative to the tappet body will be obtained. The locking member 38 is then reinserted within the interior of the tappet body through one of the slots 36 so that the lugs 37 project through the same opening 36 in which they were disposed during the threading of the openings 45 and 39. Suitable support or anvil means is projecting inwardly through the slots 36 to support the lower surface of the locking member 38 and pressure is applied to the upper surface of the end of the body portion 44 to flex the locking member 38 to substantially flat condition. The adjusting screw 41 is then threaded through the openings in the head portion of the tappet and through the central opening in the locking member 38 and the pressure upon the upper surface tappet body released. Wrenches may be applied to the flats 42 and 43 for effecting adjustment of the tappet. The lugs 37 disposed within diametrically opposed slots 36 in the tappet body 44 prevent relative rotation between the locking member 38 and the tappet body. Otherwise, the operation of the tappet is essentially the same as that of the constructions illustrated in the previously described embodiment.

Reference may now be had to the construction illustrated in Figs. 17 and 18 in which the same form of tappet body 44 and adjusting screw 41 are employed as in the construction illustrated in Figs. 14 to 16, inclusive. In this construction, however, the locking member 48 is not provided with lugs, corresponding to the lugs 37 of the previously described embodiment, but is interlocked with respect to the tappet body to prevent

relative rotation between these elements in the completed tappet construction by spot welding, as indicated at 47. In assembling this tappet the locking member 48, in flat form, is inserted within the interior of the tappet body and flat against under surface of the head portion thereof. The openings 45 in the head portion of the tappet body and opening 39 in the central portion of the locking member are then threaded. The locking member 48 is then removed from the interior of the tappet body and deformed permanently to non-flat form. The tappet may be assembled either by applying pressure to the head portions of the tappet body and to the bottom surface of the locking member 48 with these elements in the position shown in Fig. 17 and then threading the adjusting screw 41 through the aligned openings in these elements, in much the same manner as described relative to the embodiment shown in Figs. 14 to 16, inclusive, or the locking member 38 may be threaded along the adjusting screw 41 already threaded to the opening 45 in the head portion of the tappet body until the locking member has been flexed sufficiently to afford the desired friction between the threads of the locking member 41 and the threads 45 and 39 of the head portion tappet body and of the locking member 48. The latter method of assemblage is substantially the same as that described with reference to the embodiment illustrated in Figs. 9 to 13, inclusive. Where the locking member is assembled by applying pressure to the bottom surface thereof and to the head portion of the tappet, the precaution must be taken to deform the locking member 48 only sufficiently so that when flexed to substantially flat form the desired friction will be afforded between the threads of the adjusting screw 41 and the threads 45 and 39 of the tappet body and locking member. Where the locking member is assembled by threading the same along the adjusting screw 41 until the desired friction is obtained between the cooperating threads of the adjusting screw and of the tappet body and locking member, the deformation from flat form of the locking member 48 may be greater. In the latter case, the locking member does not have to be flexed back to substantially flat form in order to thread the adjusting screw 41 through the threaded openings 25 and 39.

The latter is also true of the embodiment illustrated in Figs. 9 to 13 since the deformation from flat form of the locking member 28 may be greater than in the case of the embodiment illustrated in Figs. 2 to 8 and Figs. 14 to 16, both inclusive, since the locking member 28 does not have to be flexed to substantially flat form against the head portion of the tappet body in order to match the threads of the locking member with those of the head portion of the tappet body in order to insert the adjusting screw. It will also be noted, particularly with respect to the embodiment shown in Figs. 5 to 18, inclusive, that the bearing area of the tappet extends through practically the entire over-all length of the tappet so that no material reduction is made in the bearing area of the tappet in order to make it adjustable in length. In all of the illustrated embodiments the locking member has been given a permanent deformation and then flexed back by a force less than the elastic limit of the material of which the locking member is composed so that the desired friction between the threads of the adjusting screw and the cooperating threads of the head portion of the tappet body will exist and of the

locking member will flex so that the desired friction or resistance to the rotation of the adjusting screw with respect to the tappet body will be maintained throughout the life of the tappet. In all of the embodiments illustrated, the conventional jamb nuts usually employed in adjustable tappet constructions are eliminated and but two wrenches need be employed in making adjustments of the length of the tappet. In the embodiment illustrated in Figs. 14 to 18, inclusive, the threads on the tappet body directly carry the load of the valve spring rather than having the load imposed on the locking member of the tappet during the opening of an engine valve. In the remainder of the embodiments the locking member, having been previously given the proper deformation so that upon being flexed to substantially flat condition against the head portion of the tappet to require the desired resistance to rotation of the adjusting screw with respect to the tappet body, no further flexing of the locking member will be had prior to the time when the threads in the end portion of the tappet body assume the load of the valve spring.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. An adjustable tappet comprising a tappet body provided with an axially directed threaded opening, an adjusting screw threaded into said opening, a resilient locking member in the form of a blank initially flat but deformed to such extent that it receives a permanent set with a portion thereof disposed outside its original plane, said locking member being threaded on said adjusting screw and abutting said tappet body and arranged in slightly compressed condition between said screw and body for preventing undesired relative rotation of the screw and body, said tappet body being provided with a recess adjacent said locking member, and a lug on said locking member projecting into said recess to prevent relative rotation of the locking member and body.

2. An adjustable tappet comprising a tappet body provided with a threaded opening, an adjusting screw threaded into said opening, and a resilient locking member threaded on said adjusting screw and abutting said tappet body to maintain the locking member in compressed condition between said screw and body for preventing undesired relative rotation of said screw and body, said locking member being provided with a spanner wrench notch in the periphery thereof and the tappet body provided with a raised metal portion projecting into said notch to prevent relative rotation between said locking member and said tappet body.

3. An adjustable tappet comprising a tappet body provided with a threaded opening, an adjusting screw threaded into said opening, and a resilient locking member threaded on said adjusting screw and abutting said tappet body to maintain the locking member in compressed condition between said screw and body for preventing undesired relative rotation of said screw and body, said locking member being provided with a spanner wrench notch in the periphery thereof and being spot welded to the tappet body at a point within said notch.

4. An article of manufacture comprising a part having an aperture therein, said part being

threaded in the aperture, a spring metal disc having an aperture in axial alignment with the first said aperture, said disc in its normal state being cup-shaped and having threads so formed
5 in the wall of its aperture that when the disc is in a flat state the threads correspond exactly with the threads in said part, said spring metal disc being in a flat state with its normally concave face against the face of said part, and an externally threaded member extending through the
10 aligned apertures of said part and disc and in intimate threaded contact with both.

5. An article of manufacture comprising a part having a threaded aperture therein, a spring
15 metal nut having a threaded aperture in axial

alignment with said first-named aperture, and an externally threaded member threaded through the aligned apertures of said part and said nut and in intimate threaded contact with both when the nut is in a substantially flat condition, said
5 nut being adapted to abut said part when the body of the nut is flexed within its elastic limit from a condition of permanent set to prevent rotation of said externally threaded member relative to said part, said nut being provided with
10 diametrically opposed lugs and said part being provided with cooperative recesses for receiving such lugs to prevent rotation of said nut relative to said part.

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