

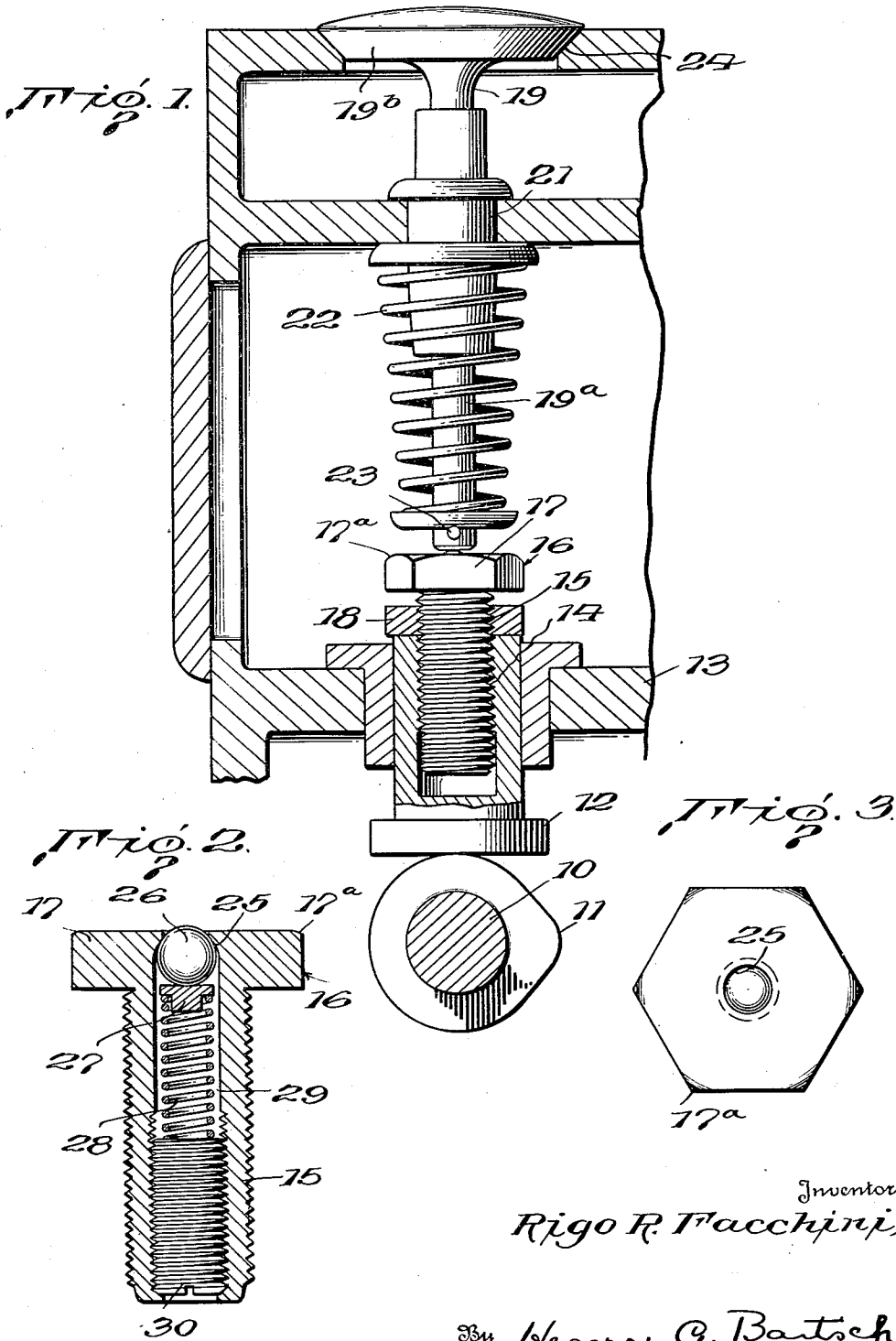
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R. R. FACCHINI

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TAPPET

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TAPPET

Rigo Ralph Facchini, Kingston, Mass.

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My invention relates to tappets broadly, and has to do, more particularly, with the provision of a tappet structure for the silent actuation of the valves of internal combustion engines.

5 The characteristic sound set up by the valve tappets of internal combustion engines, when fitted with generous clearances, is a familiar one to every mechanic, and various expedients have been suggested as a means for reducing such 10 clicking noises without the necessity of so closely adjusting the clearance between the valve stem and tappet as to impair the efficiency of the engine or cause the "burning" or "warping" of the valves by reason of their failure to seat properly 15 when the valve stems have been lengthened by heating. One of the most common of these expedients consists in the formation of the tappet head or face of a material which is relatively soft and non-resonant, for example, very hard fiber. 20 Such a structure suffers from excessive wear in use and has not proven sufficiently successful to be generally employed.

Another structure which has been suggested for the purpose consists of a tappet of telescoping character, the valve-operating section of 25 which is urged outwardly to bridge the "clearance" by a light spring or yieldable body of oil, but initially depresses a slight distance to a positive stop when the push rod is actuated to effect unseating of the associated valve. One such 30 telescoping tappet employs a valve-operating section consisting of a large ball provided with a flat, valve-stem abutting face. The ball socket of this tappet structure is provided with a yieldable spring and a ball seat or stop which 35 engages the ball to unseat the valve after the tappet has been lifted a few thousandths of an inch. Such telescoping tappet structures suffer from rapid wear due to the fact that the entire strain 40 of valve-lifting is borne by the telescoping section and its stop. Moreover, it is difficult, if not impossible, to accurately determine "valve-clearance" by a "feeler" gauge when such structures are employed. Consequently, even though 45 relative silence be obtained, the effective lift of the valve may be far less than intended and necessary for efficiency and smooth operation of the engine.

50 Still another structure has been suggested, which structure consists in the provision of the tappet with a bore in which is received a fine, pin-like clearance-bridging element backed up by a light spring. In this structure, the strain of valve-lifting is borne by the rigid tappet head 55 itself and, for a while, at least, highly satisfactory

results are obtained. However, experience teaches that, as the face of the tappet head wears, a pining over of the bore may occur, particularly when the hard, superficial surface of the tappet head has worn away under the hammering action of the valve end. The pin element then tends to stick and the spring, which backs it, is no longer able to effect its projection into clearance-bridging relation with the end of the valve stem. Such a structure also is exceedingly 10 difficult to adjust for clearance because of the difficulty of depressing the pin to permit insertion of the feeler gauge between the tappet head and the end of the valve stem.

With the disadvantages and problems of such 15 prior art structures in mind, my invention has several well-defined objects. It is a primary object of my invention to provide a tappet construction for internal combustion engines and the like which will provide silent operation without the development of excessive wear of either tappet or 20 valve stem.

It is another object of my invention to provide a silent tappet structure for internal combustion engines or the like in which there is no interference with, or difficulty in, the introduction of a feeler gauge for the purpose of determining and 25 adjusting for proper tappet clearance.

It is an object of my invention, also, to provide a tappet structure for internal combustion engines or the like in which a stick-proof clearance-bridging member is interposed between the tappet proper and the end of the valve stem, which 30 clearance-bridging member bears substantially none of the strain incident to the lifting of the valve, the strain being borne entirely upon the tappet proper. 35

It is an object of my invention to provide a silent tappet structure for internal combustion engines or the like in which tappet there is employed a depressible clearance-bridging element, the depression-resistance of which element is readily adjustable to provide a maximum of 40 silence with a minimum of opposition to the closing of the valve and also to permit re-adjustment to compensate for wear or the "tiring" of the spring employed for the clearance-bridging element. 45

It is an object of my invention to provide a silent tappet structure for internal combustion engines or the like in which the clearance-bridging element is free and encouraged to move about during operation, thus distributing such wear, as may take place, over its entire surface. 50

It is an object of my invention to provide a 55

silent tappet structure for internal combustion engines or the like which includes a spring-urged clearance-bridging element which is self-cleaning and has no tendency to "sludge up".

5 It is an object of my invention to provide a silent tappet structure for internal combustion engines or the like which, when incorporated as a part of an L-head engine having a closed valve chamber, will be self-lubricating and will positively direct oil upon the end of the valve stem with which it is associated.

10 It is an object of my invention to provide a silent tappet structure for internal combustion engines or the like which is unitary, and which does not require re-assembly each time the valves of the engine are removed for trueing or grinding.

15 It is an object of my invention to provide a silent tappet unit for internal combustion engines or the like which may be easily and quickly installed as a replacement for conventional tappet structures.

20 Finally, it is an object of my invention to provide a silent tappet structure for internal combustion engine valves or the like which may be manufactured at extremely low cost and marketed in inexpensive sets by accessory houses.

25 Further objects and objects relating to details and economies of construction and use will more definitely appear from the detailed description to follow. In one instance, I accomplish the objects of my invention by the means set forth in the following specification. My invention is clearly defined in the appended claims. A structure constituting a preferred embodiment of my invention is illustrated in the accompanying drawing, in which:—

30 Figure 1 is a transverse sectional view of a conventional internal combustion engine taken through the camshaft and the valve and tappet operated by one of the cams thereof, said tappet specifically constituting a preferred embodiment of my invention;

35 Fig. 2 is a vertical sectional view, on an enlarged scale, of the tappet element forming a part of the structure illustrated in Fig. 1; and

40 Fig. 3 is a top plan view of the head of the tappet element shown in Fig. 2.

45 Throughout the drawing, the same reference numerals refer to the same parts.

50 In a broad sense, my invention is predicated upon an appreciation that the objectionable noise developed by generous clearance in the valve tappets of internal combustion engines results from the departure of the valve-lifting member from riding contact with the cam during the initiation of the cam cycle, and consists in the provision of the tappet head with a very small tapered bore which receives and retains a tiny ball lightly urged to seat against the walls of said tapered bore and extend therethrough beyond the face of the tappet head for a distance sufficient to tangentially contact the butt end of a properly-clearanced valve. A helical spring received within a bore in the tappet stem and subjected to a compression of from 10 to 30 ounces effects projection of said ball to close the valve-clearance and prevent "jumping" of the tappet base or push rod from the cam during initiation of the lift, yet does not adversely affect the seating of the valve.

70 More specifically, and with reference to Fig. 1 of the accompanying drawing in which I have illustrated a preferred embodiment of my invention, there is shown a conventional cam shaft

10 provided with a cam element 11, upon which cam rides a push rod 12, of conventional form, suitably journaled for reciprocation in a guiding web 13 forming a part of the engine block. The push rod 12 is provided with a threaded axial bore 14 within which is adjustably assembled a complementarily threaded stem 15 of the tappet element 16. The tappet element 16 is provided with a head 17 having a slightly crowned tappet face 17a which head is fixable in adjusted extension with respect to the push rod 12 by means of a locking nut 18 threaded upon the stem 15 of the tappet and abutting the end of the push rod. Disposed in alinement with the head 17 of the tappet is a conventional valve 19, the stem 19a of which is snugly received within the guide 21 of the cylinder block. A valve spring 22, through the medium of anchoring means 23, engages the valve stem and urges the valve head 19b to its complementary seat 24. The lower end of the valve stem is, as usual in such structures, slightly spaced from the head 17 of the tappet. Thus far described, the present structure is conventional.

25 Referring now to Figs. 2 and 3 of the drawing, it will be noted that the crowned head 17 of the tappet is provided with a central bore 25 of tapered form complementary to a hardened ball element 26 receivable therewithin and extending slightly therebeyond. The ball 26 and the bore 25 are of such relative size that the said extension of the ball 26 amounts to approximately 1/50 of an inch and, by means of a saddle element 27 and a saddle-supporting, helical spring 28 received within the bore 29 of the tappet stem 15, the ball 26 is yieldably maintained in contacting relation with respect to the seat formed in the head member 17 by the conical bore 25. The bore 29 extends completely through the lower end of the tappet stem 15 and is provided with threads which receive a screw-slotted plug 30, which supports the spring 28 and by which the spring may be readily subjected to the desired degree of compression.

40 Preferably, the complementary threads of the plug 30 and the stem 15 have a tight fit such that vibration will not disturb the adjustment thereof. In addition, the lower end of the stem 15 is pined inwardly at 15a to insure retention of the plug 30.

50 I have found that, for all practical purposes where a valve clearance of from 5/1000 to 20/1000 of an inch is to be maintained between the end of the valve stem and the abutting face 17a of the tappet, a compression of from 10 to 30 ounces in the spring 22 will afford substantially complete silence in the tappet. This silence, as previously indicated in this specification, is believed to obtain by reason of the fact that the tappet 12 is caused to closely follow the cam nose during the initial lifting movement imparted thereto. Moreover, it should be explained, the resistance of the ball spring 28 to the valve spring 22 is so slight, in comparison, that no appreciable opposition to the normal closing of the valve 19 is experienced.

75 I am aware that my invention is susceptible of embodiment in various forms. For example, other means than the plug 30 may be employed for the adjustable support of the spring 28. Where, for the sake of simplicity and economy of manufacture, it may be desirable to dispense with compression adjustment in the spring 28, the plug 30 or its equivalent may be omitted and the spring 28 supported upon a transverse pin or 75

other instrumentality. Likewise, my tappet structure may be fabricated of materials other than steel. Moreover, while the present invention has especial application to the tappets of internal combustion engines, it is also applicable to other machinery with similar advantage. These and other variants will definitely appear to those skilled in the art upon familiarity with the concepts of my invention. I therefore claim my invention broadly, as indicated by the appended claims.

What I claim is:

1. A tappet for internal combustion engines and the like, comprising: an annular tappet head provided with a substantially flat tappet face, the internal diameter of which head is less at its tappet face than below said face, a body portion integral with said head and by which said head is supported and driven, said body portion being provided with an axial bore of greater diameter than the internal diameter of said annular tappet head, a compressed helical spring supported within the bore of said body portion, and a hard-surfaced ball-bearing having a diameter slightly greater than the internal diameter of said head at its tappet face, said ball-bearing being rotatably journaled within said tappet head and yieldably maintained by said helical spring, in centrally seated, slightly protruding relation with respect to the tappet face of said head.

2. A tappet for internal combustion engines and the like, comprising: an annular tappet head provided with a substantially flat tappet face, the internal diameter of which head is less at its tappet face than below said face, a body portion integral with said head and by which said head is supported and driven, said body

portion being provided with an axial bore of greater diameter than the internal diameter of said annular tappet head, a hard-surfaced ball-bearing rotatably journaled in said tappet head and having a diameter slightly greater than the internal diameter of said head at its tappet face, a helical spring disposed within the bore of said body portion, and manually adjustable means for supporting one end of said helical spring and subjecting the same to any desired degree of compression, said helical spring, when compressed, having its other end bearing upon said ball-element and urging the same into centrally seated, slightly projecting relation with respect to the tappet face of said head.

3. A tappet for internal combustion engines and the like, comprising: an annular tappet head provided with a substantially flat tappet face, the internal diameter of which head is less at its tappet face than below said face, a tubular body portion integral with said head and provided with an internal thread the diameter of which is greater than the internal diameter of said annular tappet head, a hard-surfaced ball-bearing rotatably journaled in said tappet head and having a diameter slightly greater than the internal diameter of said head at its tappet face, a helical spring disposed within the threaded bore of said body portion, and a threaded plug supporting one end of said helical spring and adjustably engaged with the thread of said tubular member to subject said spring to any desired degree of compression and cause the other end thereof to bear upon said ball element and urge the same into centrally seated, slightly projecting relation with respect to the tappet face of said head.

RIGO RALPH FACCHINI.