May 31, 1949. R. HILBERT 2,471,746

GAUGE TOOL FOR TIMING DIESEL ENGINES

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FIG. 2.

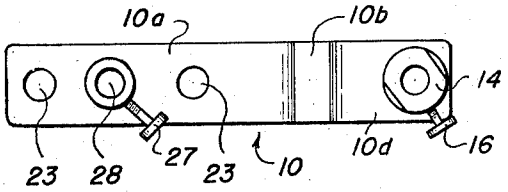


FIG. 1.

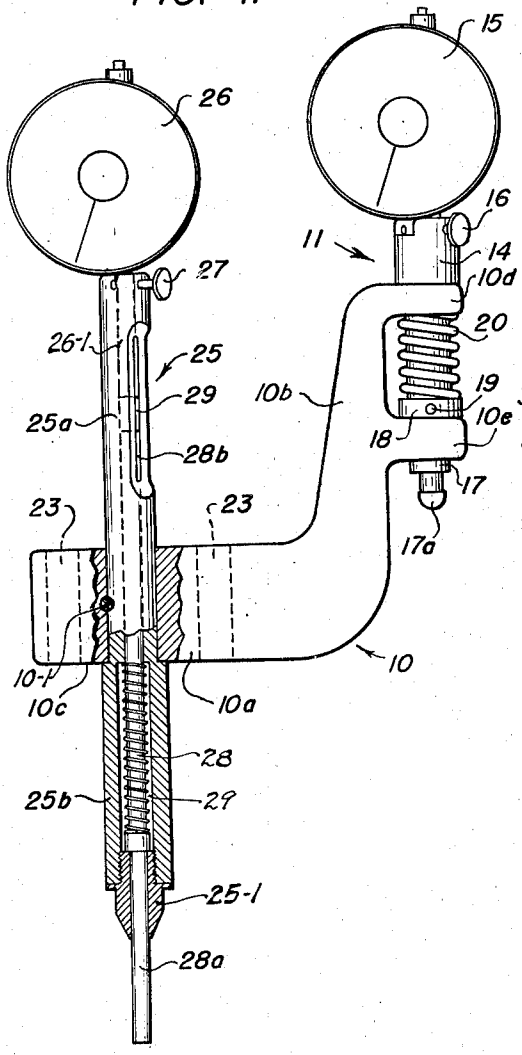
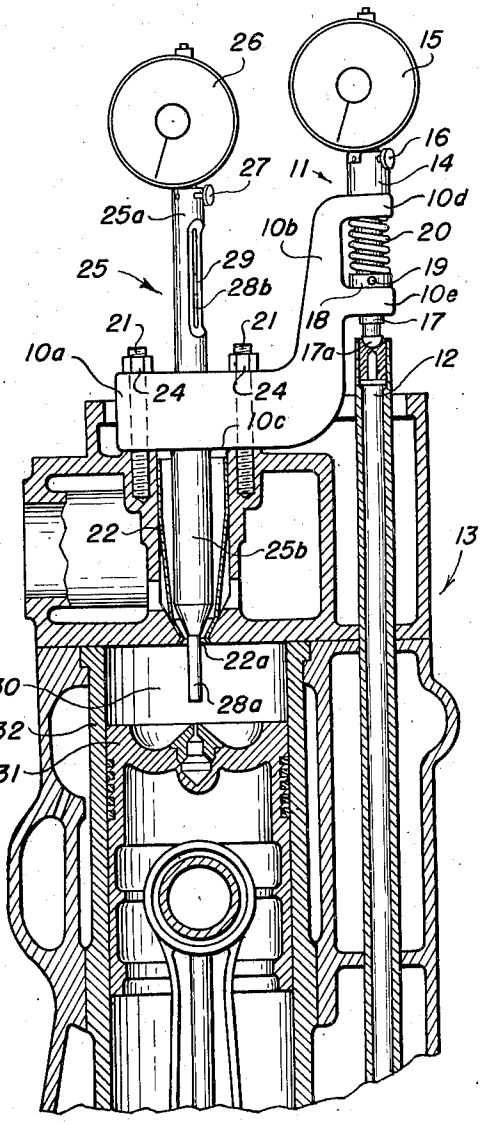


FIG. 3



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GAUGE TOOL FOR TIMING DIESEL ENGINES

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4 Claims. (Cl. 33—181)

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This invention relates to tools for use in accurately timing Diesel engines.

Satisfactory performance of a Diesel engine requires properly timed fuel injection, neither too early nor too late with respect to the stages of maximum compression within the respective piston-cylinder combustion chambers of the engine. This means that the fuel injection mechanism must be precisely set relative to piston position.

The tool of the invention has particular applicability to certain types of Diesel engines being currently manufactured by the Cummins Engine Company, Inc. of Columbus, Indiana, under the trade designation "Models H & NH Series." These engines are widely used as prime movers in the transport truck industry, and, due to their almost constant use in long cross-country runs, require frequent overhaul.

The best practice heretofore employed in the so-called timing of these engines, or in checking to see whether the timing is correct, involves the simultaneous use of two fixtures or tools, one being arranged for positioning relative to the combustion chamber at the place in the cylinder head normally occupied by the fuel injector, and the other for anchorage to a corner housing stud of the cylinder head so as to extend into predetermined engaging relationship with the injector push rod of the particular cylinder to be timed. Each fixture is equipped with an indicating gauge, which, in the case of the fixture associated with the combustion chamber, has its indicator moved by the piston as it travels through its compression stroke, and, in the case of the fixture associated with the injector push rod, has its indicator moved by the corresponding travel of such injector push rod. A prescribed procedure is followed in the actual checking of the timing by these fixtures in their stated operative positions, such procedure being fully set forth in the publication "Operator's Instruction Manual," Bulletin No. 6304, put out by the Cummins Engine Company, Inc.

I have found that these fixtures or tools do not give the accurate results intended, and that engine timing set by their use is not precise, as it must be for best engine performance.

Accordingly, a primary object of the invention is to provide a fixture or tool construction which will insure precise results in the timing of the specified, or a similar, type of Diesel engine.

I attribute the major difficulty in the stated prior tools to the fact that the corner housing stud to which the one tool is anchored in cantilever fashion is insufficiently strong to remain perfectly rigid under the great pressure exerted by the injector push rod during the timing procedure. Even slight flexure of this stud will mean significant inaccuracy in the final result.

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A feature of my construction pursuant to the present invention, whereby this inaccuracy is eliminated, is the making of the structural frame or body which carries the gauge mechanism associated with the injector push rod, such that it straddles one of the recesses in the cylinder head normally occupied by a fuel injector, and anchors securely to the pair of studs flanking such opening.

In that portion of the said frame or body which bridges the opening, I mount the second gauge mechanism operative by a piston of the engine. Thus I not only achieve accuracy which is as nearly perfect as possible, due to the rigidity of the mounting, but I also incorporate the two necessary gauge mechanisms in a single tool, which accomplishes a marked saving in the time ordinarily expended for the timing operation, plus other advantages, such as lessening of manufacturing cost, and reducing likelihood of damage to or loss of the individual gauge mechanisms.

Further objects and features of the invention will be apparent from the following detailed description of the presently preferred specific embodiment illustrated in the accompanying drawing.

In the drawing:

Fig. 1 represents a front elevation of the tool;

Fig. 2, a top plan, the gauges having been removed; and,

Fig. 3, a front elevation, drawn to a reduced scale, of the tool in operative position with respect to an appropriate type of Diesel engine, the latter being illustrated fragmentarily in vertical section taken centrally through the piston-cylinder combustion chamber.

Referring now to the drawing: in the illustrated preferred construction, the tool of the invention embodies a rigid, structural body member **10** arranged as a bracket support for a gauge mechanism **11** adapted to be positioned over and to engage the top of the injector push rod **12**, Fig. 3, of an appropriate type of Diesel engine **13**.

The structural body **10** comprises, in this instance, an elongate base portion **10a**, which is horizontally disposed in the operative position of the tool, and an elongate bracket arm portion **10b**, which is substantially vertically disposed in the operative position of the tool. For best results in practice, the entire body **10** is of heavy and absolutely rigid construction, being preferably

formed of cast iron or steel suitably machined to provide a smooth working face at 10c which fits flush against the cylinder head of the engine, as shown in Fig. 3.

While I prefer to utilize the heavy cast iron or steel construction shown, for the body 10, and machined, tool steel parts for the gauge mechanisms, as will hereinafter appear, in order to insure absolute rigidity and absolute precision in operation over long periods of use, the tool may be made of lighter and cheaper construction at the sacrifice of continued preciseness over periods of long continued usage under ordinary conditions of care in handling.

In the illustrated instance, the several parts of the gauge mechanisms, which are essentially of conventional construction, are carefully and precisely machined prior to being assembled and fixedly mounted in the structural body 10.

The gauge mechanism 11 is mounted at the upper part of the bracket arm portion 10b of the body 10 in and between outwardly extending, spaced lug members 10d and 10e, which are provided with aligned receiving bores for the purpose. Fixed in the receiving bore of the upper lug member 10d, as by means of screw threads, is a socket piece 14 adapted to removably receive therein an indicating gauge 15 of the type utilized in conventional timing practice. A set screw 16 holds the same tightly in place. Slidably mounted in the bore of the lower lug member 10e is a push rod 17, which has its upper end slidably received by a bottom bore of the socket piece 14 so as to extend upwardly into the socket of said piece 14 and engage the movable push member (not shown) of the gauge 15. A collar 18 is secured to the push rod 17, as by means of a pin 19, and a compression spring 20 encircles said push rod for compression between collar 18 and the upper lug member 10d of the body as the push rod is forced upwardly during operation of the tool, such spring 20 exerting a very heavy resistance to compression as is customary.

The lower end of push rod 17 is preferably though not necessarily reduced in diameter and rounded, as shown at 17a, for intimate engagement with the correspondingly socketed upper end of the injector push rod 12 of the engine 13.

The structural body of the tool is so constructed and arranged as to anchor to the engine by means of its base portion engaging a pair of studs, indicated 21, respectively, Fig. 3, flanking, in alignment considered longitudinally of the base portion 10a, a recess 22 which normally receives a fuel injector for a corresponding cylinder of the engine. In this way, such structural body member of the tool not only acquires a rigid and secure anchorage to the cylinder head of the engine, but its base portion is also placed in bridging position relative to the fuel injector recess 22 of the engine.

In the construction illustrated, the base portion 10a of the structural body 10 of the tool is provided with mutually spaced bores or passages, indicated 23, respectively, for receiving the studs 21. The tool is clamped firmly in place by means of the nuts 24.

It should be noted that the described anchorage of the tool to the engine is a very rigid one, sufficiently rigid, I have found, to overcome any tendency for flexing due to the heavy upward push of injector push rod 12 against the bracket arm portion 10b of the structural body 10.

For mounting the second gauge mechanism 25 in proper position relative to the fuel-injector-receiving recess 22 of the engine, that part of the base portion 10a of the structural body 10 which lies between the stud-receiving bores 23 and bridges the recess 22 is, in the illustrated instance, bored and reamed to receive, in a tight-pressed fit, the upper shank portion 25a of such gauge assembly 25. The said upper portion 25a and a lower shank portion 25b, of larger diameter, as shown, make up an elongate gauge member which extends transversely through the base member between the stud-receiving bores 23 thereof. A tapered dowel pin 10—1 is desirably fitted in a receiving bore passing through the body 10 and shank 25a.

The upper end of the upper shank portion 25a is formed as a socket to removably receive a gauge 26 of the same type as the gauge 15, a set screw 27 serving to retain the same in position. A push rod 28, resiliently mounted within an elongate slideway 29 formed longitudinally through the two shank portions, has its lower end projecting downwardly, as at 28a, beyond the tapered lower guide tips 25—1 so as to depend into the piston-cylinder combustion chamber 30 of the engine through the lower opening 22a of the fuel-injector-receiving recess 22 when the tool is in operative position relative to the engine, see Fig. 3, and has its upper end 28b arranged to engage and move upwardly the movable push rod 26—1 of the gauge 26.

Checking of the engine timing is accomplished in the same manner as with the separate fixtures described hereinbefore as being old in the art, the piston 31 engaging the lower end 28a of the push rod 28 during such checking operation and forcing such push rod upwardly throughout its compression stroke within the engine cylinder 32 to accurately indicate on the gauge 26 the exact point of maximum compression, the injector push rod 12 meanwhile moving upwardly to produce a correlated reading on the gauge 15. The exact checking procedure is not detailed here, for it, in itself, is not new with this invention.

It can be readily seen that, because of the advantageous manner of assemblying the two gauge mechanisms into a single timing tool pursuant to the invention, not only is precise engine timing always assured, but both mechanisms are accurately placed in operative position by a single installing operation, the two mechanisms are inseparably maintained at all times so as to be always available for use together, and there is considerably less likelihood of damage to the individual mechanisms because of careless handling.

I have found the illustrated and specifically described form of my invention to be preferable in practice to other forms which may be less costly to produce, since preciseness of result over long periods of hard use is of more importance to the purchaser than initial cost. Nevertheless, it is possible to considerably reduce the production cost by substituting other materials and well known fabrication methods for those materials and the machining specified in connection with this preferred embodiment, and still obtain a tool which will serve satisfactorily for a short period of time.

Whereas this invention is here illustrated and described in detail with respect to a particular preferred embodiment thereof, it should be understood that various changes may be made

therein and various other forms of the invention may be constructed on the basis of the teachings herein without departing from the scope of the following claims.

I claim:

1. An engine timing tool, comprising a rigid body member having a base portion adapted to rest substantially horizontally upon the cylinder head of the engine, bridging a recess in said cylinder head normally occupied by a fuel injector, and having, further, a portion extending angularly from said base portion so as to extend above the corresponding injection push rod of the engine when the tool is in operative position; mutually spaced means associated with said base portion for anchoring-engagement with studs of said engine which flank the said recess; a gauge mechanism carried by said angularly extending portion of the body member, in operative position for actuation by the said injection push rod of the engine; and a second gauge mechanism carried by said base portion of the body member in operative position for actuation by the particular piston of the engine associated with said fuel injector recess.

2. An engine timing tool, comprising a rigid body member having a base portion adapted to rest substantially horizontally upon the cylinder head of the engine, bridging a recess in said cylinder head normally occupied by a fuel injector, and having, further, a portion extending angularly from said base portion so as to extend above the corresponding injection push rod of the engine when the tool is in operative position; mutually spaced passages formed through said base portion for receiving respective studs of said engine which flank the said recess at opposite sides thereof; a gauge mechanism carried by said angularly extending portion of the body member, in operative position for actuation by the said injection push rod of the engine; and a second gauge mechanism carried by said base portion of the body member in operative position for actuation by the particular piston of the engine associated with said fuel injector recess.

3. An engine timing tool, comprising a rigid body member having a base portion adapted to rest substantially horizontally upon the cylinder head of the engine, bridging a recess in said cylinder head normally occupied by a fuel injector, and having, further, a bracket arm portion extending angularly from one end of said base portion so as to be disposed substantially vertically

relative to said base portion and to extend above the injection push rod when the tool is in operative position; a gauge mechanism carried by said bracket arm portion of the body member, in operative position for actuation by the said injection push rod of the engine; a second gauge mechanism carried by the bridging part of said base portion of the body member to extend into the said fuel injector recess in operative position for actuation by the particular piston of the engine associated with said recess; and a pair of stud-receiving passages formed through said base portion of the body member at opposite sides of said bridging part thereof for mating with a pair of cylinder head studs of the engine which flank the said fuel injector recess in alignment longitudinally relative to said base portion of the body member.

4. An engine timing tool, comprising a rigidly formed, elongate base member adapted to rest substantially horizontally upon the cylinder head of the engine, comprehending a recess therein normally occupied by a fuel injector; a rigidly formed, elongate bracket arm rigidly joined to said base member so as to extend upwardly above the corresponding injection push rod of the engine when the tool is in operative position; rigid gauge-mounting means formed at the upper part of said bracket arm; a movable gauge member slidably mounted in said gauge-mounting means, and extending downwardly in the operative position of the tool for engagement by the said injection push rod of the engine; a pair of stud-receiving passages formed through said base member, said passages being mutually spaced along the length of said base member for receiving a pair of cylinder head studs which flank the said fuel injector means at opposite sides thereof; an elongate gauge slideway member extending transversely through said base member between said stud-receiving passages and in fixed relationship with said base member, so as to be substantially vertically disposed in the operative position of said tool and depend into the said fuel injector recess; and gauge slide means movably mounted in said slideway, said slide means including a push rod member which projects from the lower rod of said slideway member for engagement by the corresponding piston of said engine.

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No references cited.