July 26, 1927. 1,637,245

G. H. SCULLY

IMPULSE EQUALIZER FOR INTERNAL COMBUSTION ENGINES

Filed April 12 1926

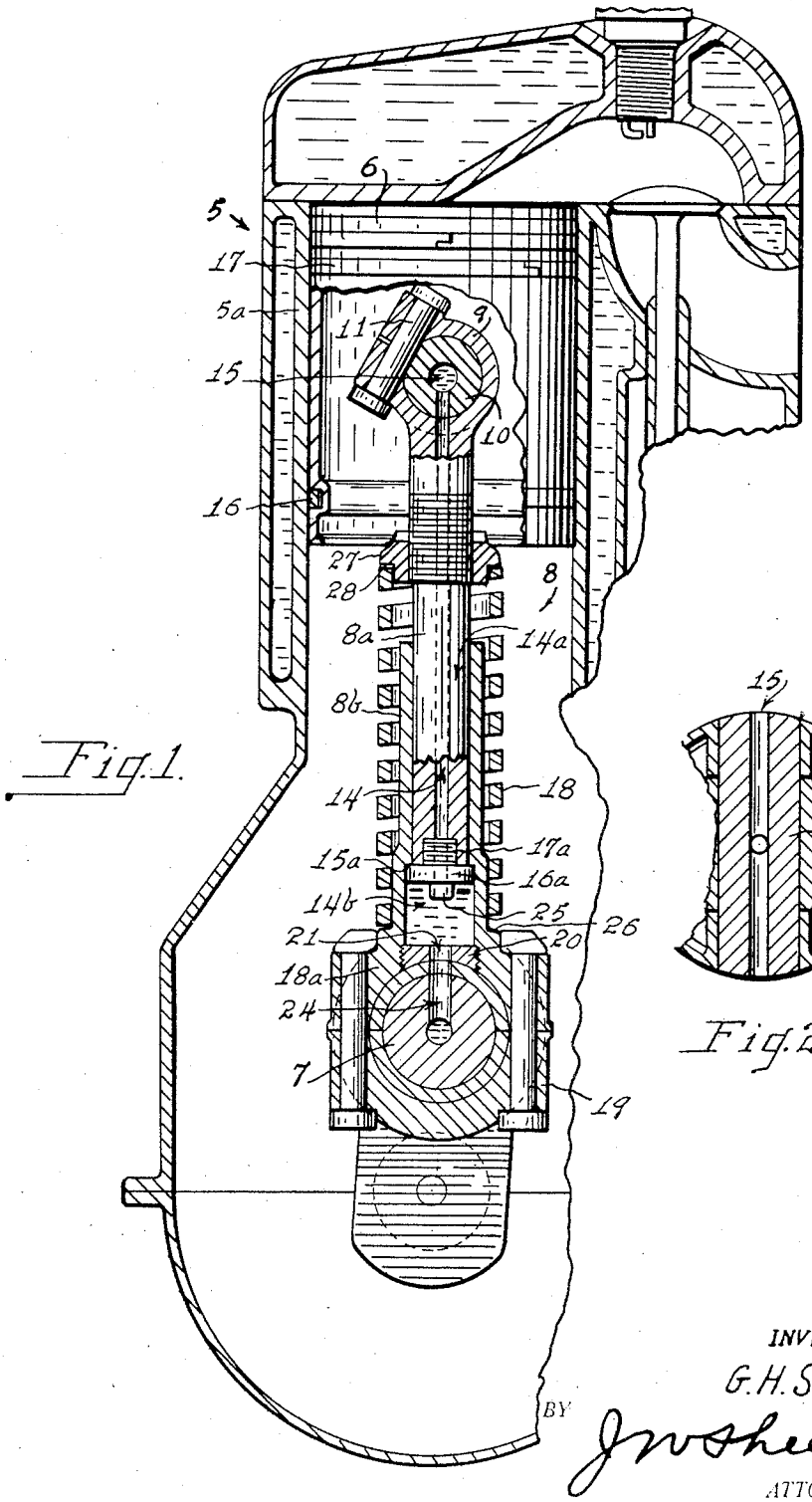


Fig. 1.

Fig. 2.

INVENTOR:
G. H. Scully,
BY
J. W. Sheely
ATTORNEY.

Patented July 26, 1927. 1,637,245

UNITED STATES PATENT OFFICE.

GEORGE H. SCULLY, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-THIRD TO CHARLES O. MIDDLETON, SR., OF BEVERLY HILLS, CALIFORNIA.

IMPULSE EQUALIZER FOR INTERNAL-COMBUSTION ENGINES.

Application filed April 12, 1926. Serial No. 101,377.

The present invention relates to internal combustion engines and the like, and pertains more particularly to improvements in the reciprocating parts thereof, such as pistons and connecting rods; the purpose of such improvements being essentially to increase the efficiency and improve the functioning of such engines.

It will be understood in the consideration of this invention that particularly in the case of engines operating on the "explosion" cycle (otherwise known as the cycle in which combustion takes place at constant volume), the maximum pressure is exerted on the piston when it is in upper dead center position. At such position the angle of thrust on the crank shaft is particularly ineffective; the effectiveness of the thrust of the piston on the crank shaft being greatest at a point at about 95 degrees removed from top dead center. However, when the piston has completed one half, or more, of its outward stroke, the hot gases in the cylinder have lost much of their pressure due to expansion and loss of heat through the cylinder walls of the engine.

It is therefore another and important object of this invention to temporarily reserve some of the energy of the explosion until the crank shaft and connecting rod are at such an angle that the thrust of the piston is most effective, and then to deliver this reserved energy to the crank shaft. Incidentally it is another object of the invention to prevent sudden and excessive forces from acting on the rod and shaft bearings.

Another object of the invention is to provide for improved lubrication of the reciprocating parts; which parts are ordinarily quite difficult to keep lubricated.

It is generally conceded that the thermodynamic efficiency of an engine is the highest when the heat of combustion is added at constant pressure rather than constant volume. With explosive mixtures, such as gasoline vapor and air where combustion cannot be controlled, usual automobile engines are not ordinarily adapted to maintain the charge at constant pressure while the heat of combustion is being added.

It is another object of the present invention to provide for readily converting an explosion cycle engine into one that operates upon a cycle in which at least some of the heat is added at changing volume or substantially constant pressure.

Still another object of the present invention is to provide for readily and economically applying the invention to existing types of internal combustion engines.

Still other objects and advantages of my invention will appear hereinafter.

The invention is illustrated by the accompanying drawings, in which:—

Figure 1 is a view in vertical section of an internal combustion engine cylinder to which a preferred embodiment of the invention is applied.

Figure 2 is a view in cross section of the piston taken on a horizontal line through the center of the wrist pin thereof.

More specifically, 5 indicates the usual internal combustion engine cylinder in which is provided the reciprocal piston 6. The piston is connected with the crank shaft 7 by means of a connecting rod, generally indicated in the drawing by the numeral 8. In the present embodiment the small end bearing 9 of the rod is clamped directly to the wrist pin 10 with the aid of the bolt 11, so that the wrist pin oscillates in the piston bosses 12. The rod is provided with a longitudinal bore 14 leading to a communicating bore 15, which extends longitudinally through the wrist pin, whereby lubricating oil may travel through the connecting rod to a point between the lowermost piston ring 16 and the next upper ring 17.

The rod is yieldably extensible and compressible. Such characteristic on the part of the rod may be attained in various manners, but for the sake of illustration the rod is shown as divided into two sections 8^a and 8^b; a compression spring 18 being employed to constantly urge one section outwardly of the other, whereby the rod as a whole yieldably tends to increase its length up to a prescribed limit. The lower rod section is tubular; being provided with the internal bore 14^a which is abruptly increased in diameter at the lower end, as at 14^b. Thus a shoulder 15 is provided which coacts with an annular enlargement 16^a on the other rod section to limit outward movement of the one rod section with regard to the other rod section.

In the present embodiment the annular enlargement is removable; being formed somewhat in the manner of a cap screw with

a reduced externally threaded shank 17ª. The lower rod section is provided with an integral box-end 18ª, whereby, with the use of a lower box-half 19, it is oscillatably connected with the crank shaft. The enlarged bore 14ᵇ of the lower rod section is closed by a screw plug 20 having a central aperture 21. When the rod is extended the maximum distance, a fluid space 14ᵇ, of appreciable depth, exists under the lower end of the upper rod section directly within the lower rod section; said space being a portion of bore 14ᵇ. Aperture 21 provides for admitting oil to the space 14ᵇ. The most suitable method for admitting oil to space 14ᵇ depends largely upon the lubricating system of the engine, and in this instance it is assumed that the lower end of the rod is lubricated by an oil duct 24, which conveys oil through the crank shaft. The member 16ª on the upper rod section is provided with a small depending extension 25 adapted to enter and substantially close the aperture 21 as the upper rod section moves toward the lower rod section.

Said lower rod section is provided with a spring seat 26, and the upper rod section is provided with an adjustable nut 27 providing another spring seat 28 spaced well above seat 26. The compression spring is held compressed between the respective spring seats; the nut 27 being employed to adjust the spring to the proper resistance.

Before describing the full operation of the illustrated embodiment of the invention it should be explained that the actual functioning of the device depends somewhat upon the cycle of operation of the engine, and it will be assumed in the following description of its operation that the engine illustrated is arranged to ordinarily operate on the four stroke cycle in which the charge is ignited at about top dead center of the piston and allowed to combust as rapidly as possible.

During the first two strokes of the cycle, namely, the suction stroke and the compression stroke, no change in the effective length of the rod takes place; the spring being so set that the rod cannot be decreased in length by the compression alone. For the sake of simplicity and comparison it will be assumed that the usual compression pressure of the engine is 60 pounds, while the maximum explosion pressure is about 250 pounds. The spring is adjusted to compress when subject to approximately such maximum explosion pressure. It will be understood, of course, that this pressure varies slightly even under constant load conditions, but it shall also be considered that the resistance of a spring increases as it is compressed. Therefore, the spring is set at such pressure that it will be acted upon and compressed, to some degree at least, by any explosion pressure coming within a reasonable range.

When the piston is approximately dead center on the compression stroke, the charge is fired and the resultant rapid combustion raises the charge to maximum pressure almost instantly and causes the gases to reach maximum pressure. The spring gives under this sudden rise of pressure allowing the piston and the upper rod section to descend at a rate more rapidly than would ordinarily be provided for by movement of the crank. For example; in a certain size of engine the crank might have to move as much as 20 degrees in order to allow the piston to descend one-half inch, were it not for the yieldably extensible connecting rod. In an engine to which this invention is applied the piston and upper rod section may descend, under the pressure of the exploded charge, a distance of one-half inch while the crank is moving a negligible degree. In other words, the charge is free to expand and deliver a portion of its energy to the spring while the crank is practically motionless. Therefore, it may be said that the charge expands under a condition of increasing volume and at substantially constant pressure, thereby giving up a part of its energy to the spring before such energy can be dissipated through heat losses through the cylinder walls.

As the crank continues to move, the charge further expands, until the pressure diminishes to such an extent that the spring begins to return to normal. Such action may take place close to the forty-five degree angle of the crank, at which time the thrust of the spring is quite effective on the crank and imparts an added impulse to the crank at that time. By reserving a portion of the energy of the explosion, and subsequently delivering it to the crank when same is at a more effective angle, an engine is caused to run smoother, and a four cylinder engine with this invention applied, behaves more like an eight cylinder engine of the ordinary type.

When the spring is regaining normal position, the upper rod section moves upwardly relative to the lower rod section, creating a suction or pressure decrease in the space between the rods. Thus, oil is drawn into this space. When the lower rod section is again moved downwardly under the thrust of the explosion, the oil is displaced from the said space at appreciable pressure, and a part of this oil is quite forcibly moved through the upper rod section and wrist pin to lubricate the piston between the two lowermost rings. Just as the projection on the lower end of the upper rod section enters the aperture of the lower rod section, further escape of oil from the space is restricted, and thus the upper rod section is cushioned and prevented from forcibly striking the lower rod section.

It will be apparent now that I have pro-

vided means for reserving a part of the energy of the explosion and for delivering this energy to the crank, and I have also provided for cushioning the rod sections and for increasing forced lubrication, and while I have shown and described a specific construction and arrangement of parts for carrying out my invention, I do not limit myself thereto, and I may employ any construction and arrangement of parts coming within the scope of the appended claims.

I claim:—

1. In an internal combustion engine, a crank, a piston, a fluid conveying connecting rod connecting said crank and piston; said rod comprising relatively movable parts providing a pumping chamber therebetween, and means whereby a sudden thrust imposed on said piston will cause said rod to pump oil through the rod to lubricate the piston.

2. In an internal combustion engine, a cylinder, a piston movable to compress gases in said cylinder to a given maximum compression pressure, a crank for reciprocating said piston, an extensible connecting rod connecting said piston and said cylinder, and a spring holding said rod extended; said spring capable of holding said rod fully extended against the said maximum compression pressure.

3. In an internal combustion engine, a cylinder, a piston movable to compress gases in said cylinder to a given maximum compression pressure, a crank for reciprocating said piston, an extensible connecting rod connecting said piston and said cylinder, and a spring holding said rod extended; said rod consisting of two telescoping sections, a shoulder to each section, the spring being compressed between said shoulders and one shoulder being adjustable to compress said spring sufficiently to offset the thrust extended on the piston by the said maximum compression pressure.

4. In an internal combustion engine, a crank, a piston, a cylinder in which said piston is movable by said crank to compress gases to a given maximum compression pressure, a lower connecting rod section connected to said crank, an upper connecting rod section attached to said piston; said lower rod section formed with a bore of enlarged diameter at the lower end and of decreased diameter at the upper end to provide an intermediate internal shoulder; the upper rod section fitting telescopically in the said decreased bore, an annular enlargement to the lower end of said upper rod section; said annular enlargement being disposed in said increased bore to abut said internal shoulder to limit outward movement of the upper rod section with regard to the lower rod section, and means urging the upper rod section outwardly of the lower rod section to hold said annular enlargement against said shoulder.

5. The engine as in claim 4 and in which said last named means is adjusted to hold the parts in the said respective positions against the force of such maximum compression pressure.

GEORGE H. SCULLY.