F. J. MILLER.

COMPRESSION RELEASE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JAN. 29, 1910.

962,160.

Patented June 21, 1910.

2 SHEETS—SHEET 1.

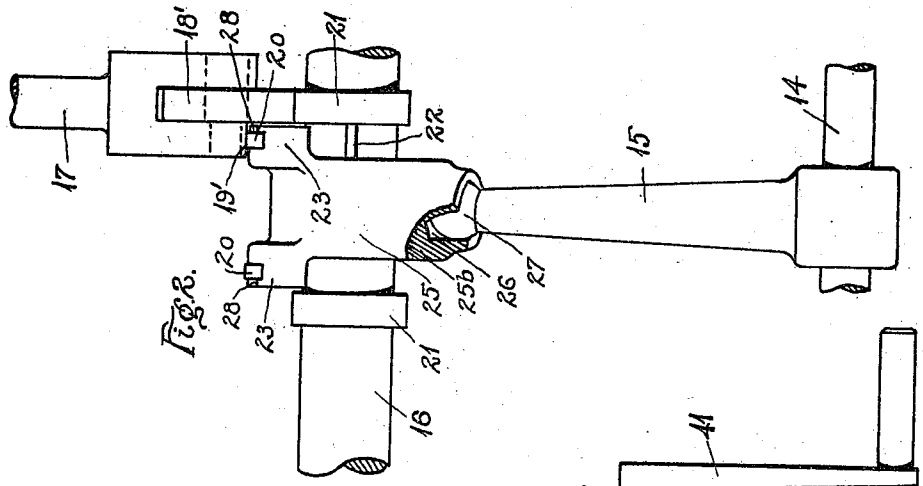


Fig. 2.

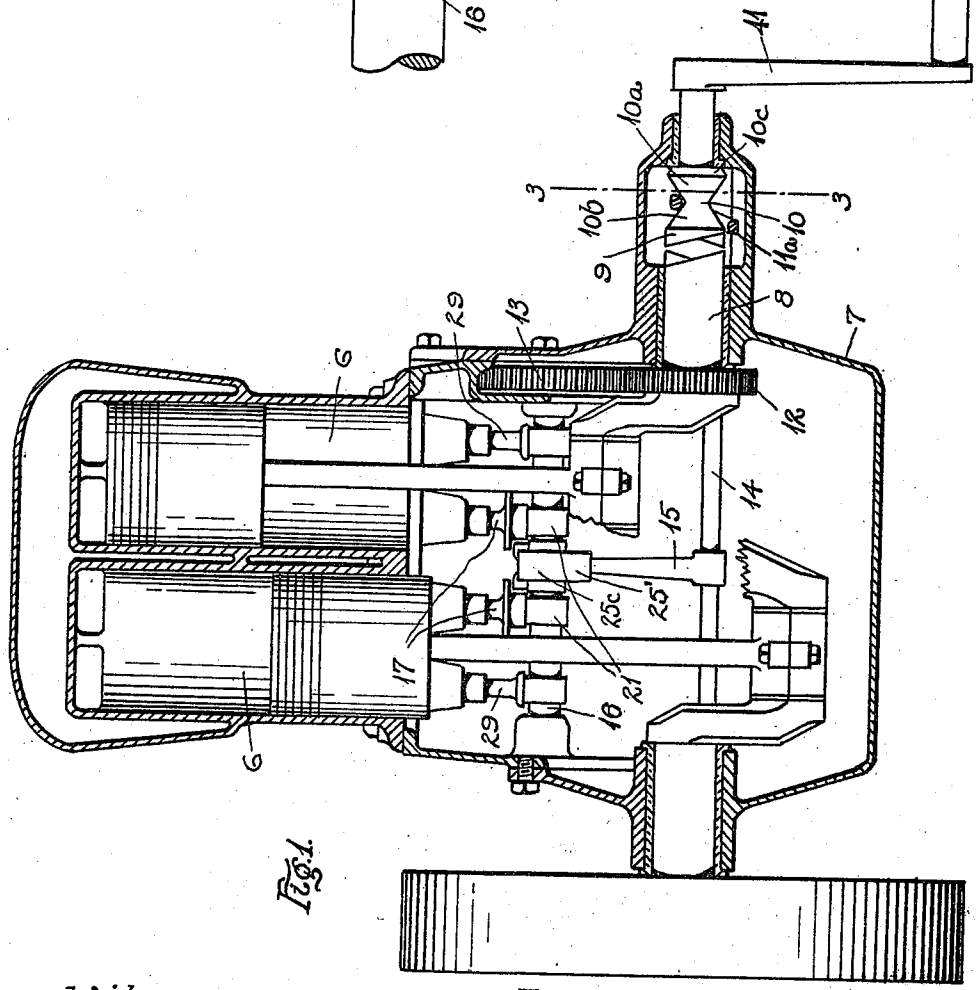


Fig. 1.

Witnesses:
Monroe E. Miller.
Stedman J. Rockwell.

Frank J. Miller, Inventor,
By Bommhardt & Co.
Attorneys.

F. J. MILLER.

COMPRESSION RELEASE FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED JAN. 29, 1910.

962,160.

Patented June 21, 1910.

2 SHEETS—SHEET 2.

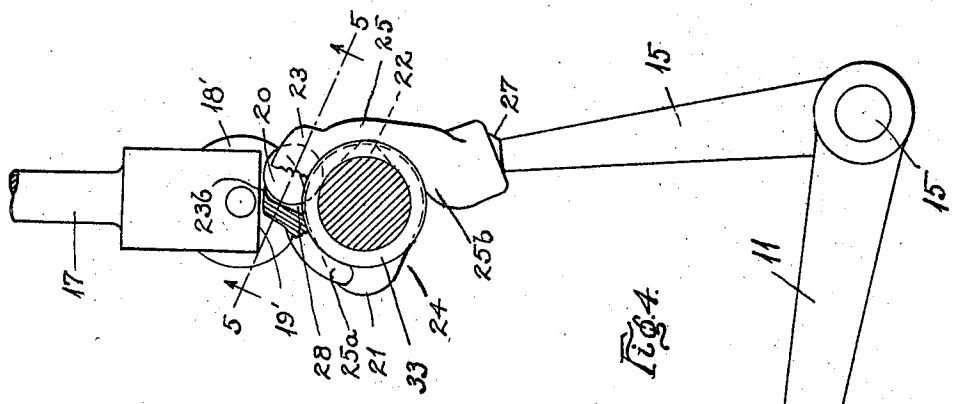


Fig. 4.

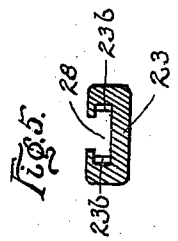
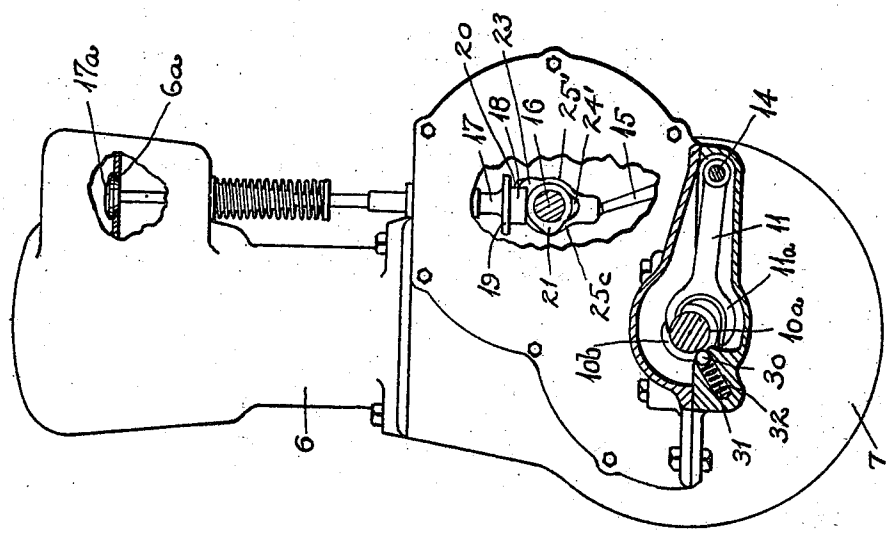


Fig. 5.

Fig. 3.



Witnesses:
Monroe E. Miller.
Stedman J. Rockwell.

Frank J. Miller, Inventor.
By Bommhardt & Co.
Attorneys.

UNITED STATES PATENT OFFICE.

FRANK J. MILLER, OF CLEVELAND, OHIO.

COMPRESSION-RELEASE FOR INTERNAL-COMBUSTION ENGINES.

962,160. Specification of Letters Patent. Patented June 21, 1910.

Application filed January 29, 1910. Serial No. 540,771.

To all whom it may concern:

Be it known that I, FRANK J. MILLER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Compression-Releases for Internal-Combustion Engines, of which the following is a specification.

This invention relates to starting devices for internal combustion engines, and has for its object to provide means for relieving the compression when the engine is started. It is illustrated as applied to a four cycle engine, and the compression is relieved by opening the exhaust valve during part of the compression stroke. The compression relieving devices are operatively connected to the clutch crank which engages the main shaft to start the engine, and the arrangement is such that the compression is automatically relieved when the clutch is engaged with the shaft. This avoids the use of independent levers or other parts for the purpose. Cam devices on the starting crank operate a rocker which acts to lift the exhaust valve push rod when the crank is turned, thereby relieving the compression, the cam shaft having an auxiliary cam which coöperates to properly time the lift of the valves.

The invention is illustrated as applied to a double cylinder engine, but obviously it is applicable to engines having any number of cylinders.

In the drawings, Figure 1 is a longitudinal section of an engine provided with the improvement. Fig. 2 is a side elevation in detail of a modification showing the compression relieving devices in operative position. Fig. 3 is a section on the line 3—3 of Fig. 1, parts broken away. Fig. 4 is an end view of the parts shown in Fig. 2. Fig. 5 is a section on the line 5—5 of Fig. 4.

Referring specifically to the drawings, 6 indicates the cylinders, 7 the crank casing, 29 the inlet valve rods, 8 the crank shaft, and 9 the starting clutch connected to the crank handle 41, and 30 a ball which snaps one way or the other over a ridge 10^c on the handle shaft, to hold the clutch in engagement or disengagement with the crank shaft, as the crank handle is pushed in or pulled out, said ball being pressed by spring 31 in recess 32.

The handle shaft has an integral double cone 10, the two parts of which are indicated at 10^a and 10^b, diverging from the central reduced portion. This double cone is engaged by the fork 11^a of an arm 11 projecting from a rock shaft 14 which extends across the crank casing parallel to the main shaft. This rock shaft also carries an upright arm 15 which terminates in a ball 27 fitting in a socket 26 in the lower end of a ring piece 25′. This ring piece has an opening 24′ which is larger than the main exhaust cams 21, so that the ring may be slipped on over the cams, said cams being mounted on the cam shaft 16 which is operated by gears 12 and 13 from the crank shaft.

The push rods 17 of the exhaust valves 17^a seating at 6^a terminate respectively in shoes 18 which are engaged by the exhaust cams 21, as shown in Figs. 1 and 3, or, as a modification terminate in heads provided with rollers 18′, as shown in Figs. 2 and 4.

The ring piece 25′, which extends around the cam shaft 16 is provided at the top with extensions 23 which carry rollers 20 in channels 28, said channels being undercut as indicated at 23^b to hold the rollers in place. These rollers are located to bear under the flanges 19 on the shoes of the push rods, as shown in Figs. 1 and 3, or in the modified form, under the heads at the lower ends of the push rods as shown at 19′ in Figs. 2 and 4. In each case each roller rests on the cam shaft 16 in line with the cam 22, and therefore is actuated at all times, but is inoperative except when the ring 25′ is turned to bring each of said rollers in line with the end of the push rod. When this is done the cam 22 will lift the roller and thus lift the corresponding push rod and valve to an extent sufficient to relieve the compression in the appropriate cylinder. The ring is enlarged or shaped as shown in order that it may be slipped onto or off the shaft over one or more of the cams 21. As shown in Fig. 4 the ring piece 25′ is substituted by a hooked piece 25 arranged to turn on the cam shaft and having an opening between the ends 25^a and 25^b thereof. The opening 24 is slightly greater than the diameter of the cam shaft 16 so that when piece 25 is slipped longitudinally off of the enlarged annular part 33 on the cam shaft, it can easily be slipped laterally off of the cam shaft. This makes it more convenient to remove said piece 25 than the ring 25′, which has closed side 25^c to prevent such

removal and consequently must be removed over the cams 21, with difficulty at times, especially in an engine having a number of cylinders. Hooked piece 25 can also be removed without interfering with the cam shaft. Ring piece 25′ also rests on an enlarged annular part 33 on the cam shaft.

As shown especially in Fig. 1, the fork 11^a is skewed, so that one of its branches rests at the high point of the cones 10^a and 10^b and the other on the low point, and when the crank is pushed in or pulled out said branches travel either up or down the respective cones, whereby the shaft 14 is rocked accordingly.

In operation, when the crank 41 is pushed in to start the engine the clutch 9 is engaged, and the upper branch of the fork 11^a travels up the cone 10^a. This rocks the shaft 14 and swings the arm 15 to the right. Fig. 3 shows the normal position and Fig. 4 the position just described. When the arm 15 is so swung to the right, the ring 25′, or the piece, 25 is shifted or turned on the cam shaft, carrying the rollers 20 between the cam shaft and the lower ends of the push rods, and when the cam comes around each roller is lifted and will strike and lift the push rod, and thereby open the appropriate exhaust valve. When the handle crank is pulled out and the clutch disconnected the lower arm of the fork 11^a rides up on the cone 10^b, thereby swinging the parts to original position, with the rollers 20 set off to one side out of line with the valve rods, and accordingly inoperative. In assembling or disassembling the parts the ball 27 can be removed from the socket 26 by swinging arm 15 to a considerable extent.

It is evident that the operation of the compression release devices is automatic with the operation of the starting crank, and hence but a single manipulation is necessary in order to start the engine and to release the compression. As shown, one arm 15 and associate parts operate both of the exhaust valves. More arms and devices may be added for engines having additional cylinders.

What I claim as new is:—

1. The combination with an explosive engine having an exhaust valve and its stem, and a shaft having thereon a cam for operating said valve, of a pressure-relieving cam on said shaft, a starting device for the engine, a member supported and mounted to turn on said shaft and movable into and out of position between said pressure-relieving cam and the valve stem, and means automatically operated by the starting device to so move said member.

2. The combination with an explosive engine having an exhaust valve and its stem, and a cam shaft for operating said valve, of an auxiliary cam on the said shaft, a ring piece mounted to turn on said shaft, a roller carried by the said piece and movable therewith into and out of position between the auxiliary cam and the valve stem, and means to turn the said piece.

3. The combination with an explosive engine having a cam shaft, of a starting crank movable into and out of operative engagement with the crank shaft of the engine, a double cone on the shaft of said starting crank, a rock shaft, a fork projecting from the rock shaft and embracing said cone, whereby the fork is swung and the rock shaft is turned when the crank is pushed in or out, and means actuated by the rock shaft and coöperating with the cam shaft to relieve compression in the engine cylinder when the starting crank is operated.

4. The combination with an explosive engine having an exhaust valve and its stem, and a shaft having thereon a cam for operating said valve, of a pressure relieving cam on said shaft, a ring piece hung upon said shaft and arranged to be turned around the same, a roller carried by said ring piece, in the line of movement of the pressure relieving cam, and movable to position between said cam and the valve stem when the ring is turned in one direction, and a lever connected to the ring, for turning the same, when the engine is started.

In testimony whereof, I do affix my signature in the presence of two witnesses.

FRANK J. MILLER.

Witnesses:

MONROE E. MILLER,

STEDMAN J. ROCKWELL.