E. JEDRZYKOWSKI.

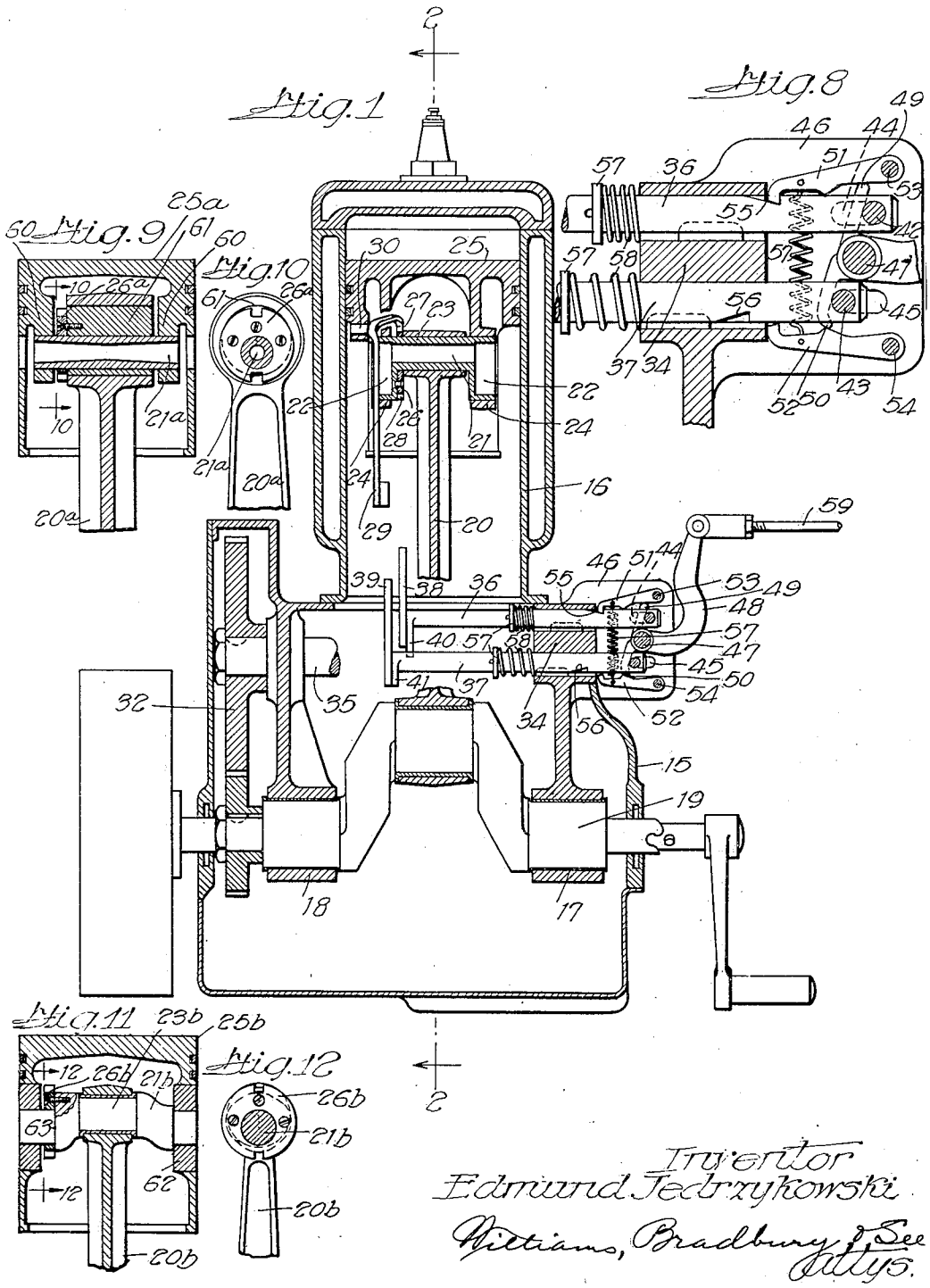
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 24, 1919.

1,386,114.

Patented Aug. 2, 1921.

3 SHEETS—SHEET 1.




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3 SHEETS—SHEET 2.

Fig. 2

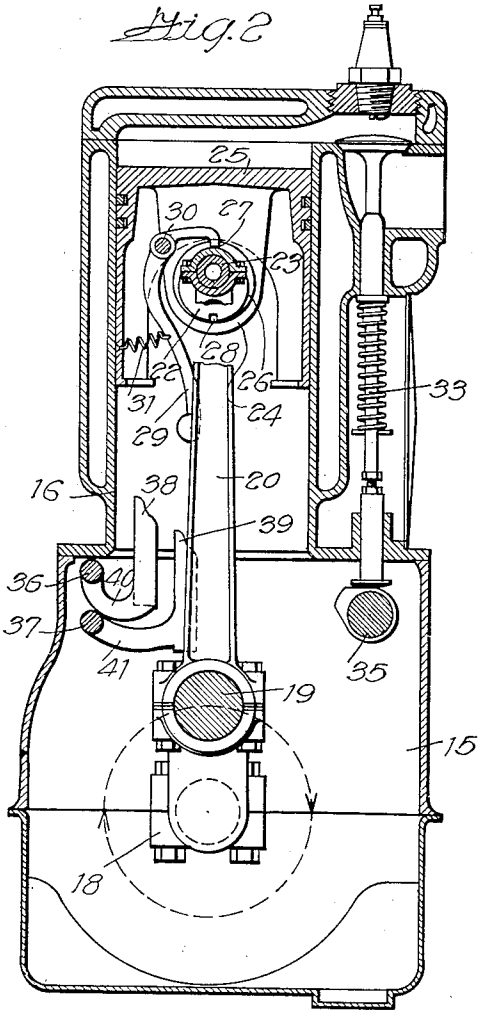
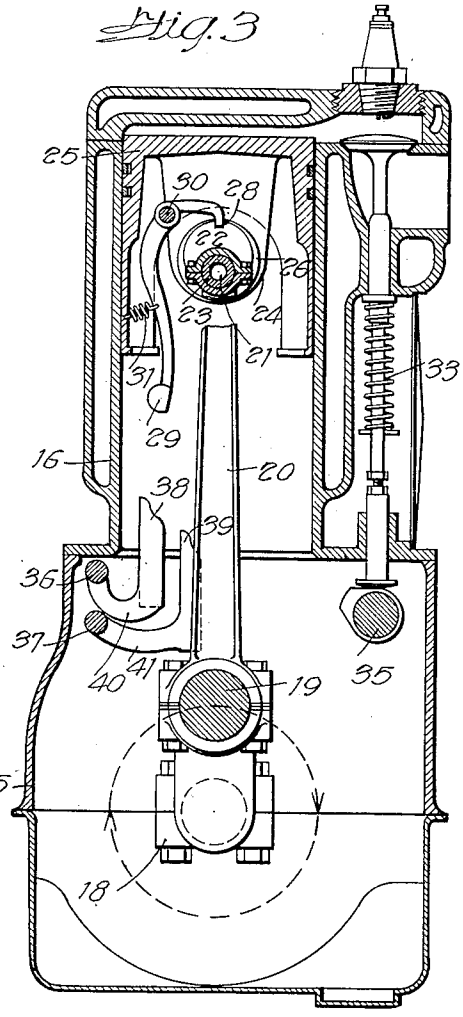



Fig. 3




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Fig. 4

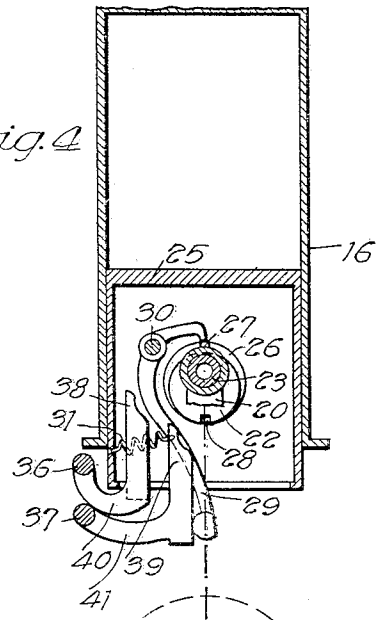



Fig. 5

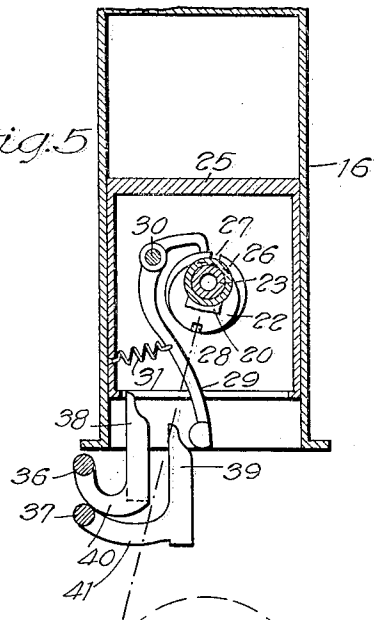



Fig. 6

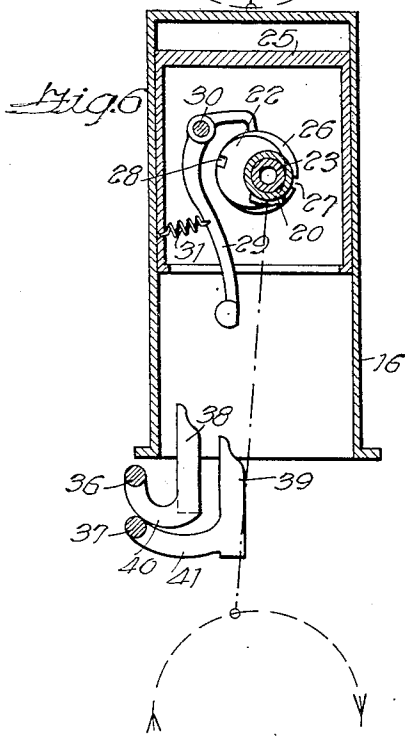
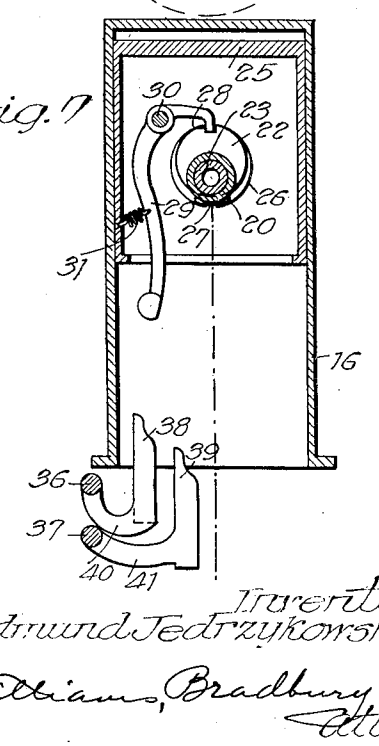



Fig. 7




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# UNITED STATES PATENT OFFICE.

EDMUND JEDRZYKOWSKI, OF CHICAGO, ILLINOIS.

## INTERNAL-COMBUSTION ENGINE.

1,386,114. Specification of Letters Patent. Patented Aug. 2, 1921.

Application filed October 24, 1919. Serial No. 332,909.

*To all whom it may concern:*

Be it known that I, EDMUND JEDRZYKOWSKI, a citizen of Poland, and resident of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Internal-Combustion Engines, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to improvements in internal combustion engines, and more particularly to an engine of this type wherein the effective length of the connection between the crank shaft and engine piston is capable of being adjusted to effect a variation in the combustion chamber volume, and consequently effect a variation in the compression of the engine.

Internal combustion engines wherein the combustion chamber volume is variable have been suggested in the past, but such engines have invariably comprised special mechanisms of a complicated nature for bringing about the change from high to low compression or vice versa. One of the salient features of my present invention consists in utilizing certain inherent characteristics of the engine cycle to bring about the desired change. It is well known to engineers skilled in the art to which this invention relates, that the engine crank pin meets with considerable resistance when starting to lift the piston on its upward strokes, and when reversing the direction of travel of the piston when it reaches upper dead center, as is evidenced by the familiar "knocking" due to the wearing of the babbitt or other bushing forming a part of the crank pin bearing. This resistance has been found to be due almost entirely to inertia forces which are stored up in the piston on its up and down strokes. Furthermore, it is known that these inertia forces reach their maximum values at lower and upper dead centers, and that they have a zero value at a point approximately midway between these points. My present invention enables me to utilize the above described values of the inertia forces at the above mentioned three points when bringing about the desired change, whether from high to low or from low to high compression, and to bring it about in such a manner that the stress, under which such few special devices as are employed are placed, is reduced to a minimum.

Another object of my present invention consists in the provision of a piston comprising an eccentric wrist pin with which cooperates a certain novel locking mechanism of my invention, the arrangement of parts being such that when said mechanism has been operated to release the wrist pin the said inertia forces act to effect a change from high to low or from low to high compression as desired.

It will be understood that the engine of my invention will be particularly advantageous in automobile work, where it is desirable from the standpoint of economy and power to shift from high to low compression and vice versa; as the position of the engine throttle may be varied. Also in aeroplane work, where, due to the diminishing density of the air at the higher altitudes, it is desirable that the engine shall operate with low compression on the ground and at the lower altitudes, and shall operate with high compression at the higher altitudes.

Further objects, advantages and uses of my improved engine will appear as this specification progresses. In the detailed description to follow, reference is made to the accompanying drawings, wherein—

Figure 1 is a longitudinal sectional view of an engine embodying the improvements of my invention, the several parts of the engine with which my invention is concerned being so arranged that the engine will operate with low compression;

Fig. 2 is a transverse sectional view taken along the line 2—2 of Fig. 1, looking in the direction indicated by the arrows;

Fig. 3 is a view similar to Fig. 2, with the several parts of the engine with which my invention is concerned so arranged as to cause the engine to operate with high compression;

Figs. 4, 5, 6 and 7 are diagrammatic transverse sectional views serving to illustrate the disposition of the eccentric wrist pin and associated parts throughout a characteristic change from low to high compression;

Fig. 8 is an enlarged detail sectional view ilustrating one form of mechanism which I contemplate employing in order to control the devices which bring about the change from high to low or from low to high compression, as desired;

Fig. 9 is a longitudinal sectional view of a piston embodying a modified form of eccentric or "crank" wrist pin, which is one of the salient features of my invention,

this particular arrangement comprising a straight conventional wrist pin and a eccentric sleeve interposed between the connecting rod and wrist pin;

Fig. 10 is a transverse sectional view taken along the line 10—10 of Fig. 9, looking in the direction indicated by the arrows;

Fig. 11 is a longitudinal sectional view through a piston embodying a further modification of the eccentric or "crank" wrist pin of my invention; and

Fig. 12 is a transverse sectional view taken along the line 12—12 of Fig. 11, looking in the direction indicated by the arrows.

Similar characters of reference refer to similar parts throughout the several views.

For convenience in description and illustration I have shown my invention as applied to what may be considered a conventional form of vertical single cylinder internal combustion engine of the four-stroke cycle type. However, I in no wise limit myself to this or any other particular type or kind of engine.

Referring to the drawings, and more particularly for the present to Figs. 1, 2, 3 and 8, the reference numeral 15 indicates the crank case which supports the usual cylinder 16. Mounted for rotation in crank shaft bearings 17 and 18 is the usual crank shaft 19, the crank pin of which is embraced by the lower end of the connecting rod 20, the upper end of which is secured in a like manner to the special wrist pin structure indicated generally by the reference numeral 21. It will be noted that the wrist pin structure 21 comprises piston pins or journals 22, and the pin 23, which is integral but eccentric with respect to the piston pins or journals 22. The eccentric pin 23 is embraced by the upper end of the connecting rod 20, as previously mentioned, while the piston pins or journals 22 are mounted in bearings 24, which are formed integral with the skirt of the piston 25. Interposed between the upper end of the connecting rod 20 and one of the bearings 24 is a ratchet disk 26 which, as is best illustrated in Figs. 2 and 3, is eccentric to both the pin 23 and the piston pins or journals 22. This ratchet disk 26 is secured in any suitable manner to the wrist pin structure 21 as, for example, by rivets, as shown, and is provided with two notches 27 and 28, which are disposed 180 degrees apart and arranged to accommodate the hooked end of the pawl lever 29, the lower end of which is slightly offset, as shown in Fig. 1, for a purpose which will presently appear. The pawl lever 29 is provided with a journal 30, by which it is pivoted to the skirt of the piston 25. Tension spring 31, disposed between the pawl lever 29 and the skirt of the piston 25, tends to impart a clockwise movement to the pawl lever 29, as the parts are viewed in Figs. 2 and 3.

In Fig. 2 the several parts of the engine with which my invention is concerned are shown in their respective low compression positions; and in Fig. 3 are shown in their respective high compression positions. The steps in the change from high to low compression will presently be described in detail. It will be noted that due to the eccentricity of the ratchet disk 26 the pawl lever 29, as seen in Fig. 2, is caused to project inwardly and away from the piston skirt against the tension of the spring 31, while in Fig. 3 the said pawl lever is caused to assume a position nearer the piston skirt and away from the center of the cylinder, being urged toward the piston skirt by the spring 31.

The valve operating mechanism and cam shaft are indicated generally by the reference numerals 32 and 33 respectively. These parts of the engine, as well as the fly wheel, starting crank, etc., are of conventional design, and therefore need not be described in detail.

Mounted for reciprocation in the bearings 34—34 in the engine crank case 15, and preferably disposed on that side of the crank shaft opposite the valve operating mechanism 33 and cam shaft 35 are two parallel shafts 36 and 37, which are disposed one above the other. These reciprocating shafts 36 and 37 are keyed against rotary movement and at their inner ends are provided with the offset cams 38 and 39 respectively, carried on suitable arms 40 and 41, the arm 40 being preferably arched downwardly, to permit free movement of the piston 25 under all operating conditions.

In Figs. 1 and 2, wherein the several parts with which my invention is concerned are shown in low compression positions, it will be seen that cam 39 lies directly beneath and in the path of the offset portion of the pawl lever 29, so that when the said offset portion of the pawl lever is carried downwardly by the piston it will ride upon the cam 39. As shown in Figs. 1 and 2, the cam 39 may be said to be in its "low to high" position, this expression indicating the change which said cam 39 is capable of bringing about when in this position, as will be hereinafter explained in detail.

In Fig. 3 the piston and associated parts are illustrated in their respective high compression positions, being the positions in which these parts are found after the change from low to high compression has taken place. It will be noted that the pawl lever 29 has moved into closer proximity with the piston skirt, due to the eccentricity of the ratchet disk 26, and is within the same longitudinal vertical plane as the cam 38, but not, however, in the same transverse vertical plane as this cam, since the cams 38 and 39 have not been moved. It will also be seen

that the pawl lever 29 clears the cam 39 when in the position shown in Fig. 3.

Projecting laterally through the outer ends of the shafts 36 and 37 and secured in any suitable manner thereto are the pins 42 and 43 respectively, the free ends of which ride respectively in slots 44 and 45 provided in the flanges 46, which are preferably formed integral with the bearing 34. Only one of the flanges 46 is shown. Secured in the flanges 46 and disposed between the shafts 36 and 37 is the transverse shaft 47, to which is pivotally secured the lever 48, the inner end of which is provided with the fingers 49 and 50, which are engaged by the pins 42 and 43 and coöperate with the cam faces provided on the latches 51 and 52 respectively. The latches in turn are pivoted at 53 and 54 to the flanges 46. The free ends of latches 51 and 52 are hooked, as shown, and are arranged to engage in transverse notches 55 and 56 formed in the shafts 36 and 37. The latches 51 and 52 are urged toward each other and into engagement with the shafts 36 and 37 by a tension spring 57. Provided on shafts 36 and 37 adjacent the bearing 34, are washers 57, which are held against inward movement by suitable pins as shown. Disposed on the shafts 36 and 37 between said washers and the bearing 34 are the compression springs 58, 58, each of which normally urges its associated shaft inwardly.

The operation of the mechanism just described is as follows: Clockwise movement of the lever 48 (Figs. 1 and 8) pulls the shaft 36 outwardly against the action of the spring 58. Outward movement of shaft 36 is continued until the hooked end of latch 51 engages in notch 55. The shaft 36 thus is locked against inward movement. Simultaneously with the just described operation of lever 48 the latch 52 associated with shaft 37 is released from notch 56 by the finger 50 which slides on the cam face of the said latch 52. Thereupon the shaft 37 is quickly urged inwardly by spring 58, until the pin 43 engages the inner end of slot 45. The operation just described brings the cam 39 into position to effect a change from low to high compression. As seen in Figs. 1 and 8, the lever 48 may be said to be in its "low to high" position.

After the desired change from low to high compression has taken place, during which change the several movable parts associated with the piston assume the high compression positions shown in Fig. 3, and it is desired again to change back to low compression, the operation is as follows: The lever 48 is given counter-clockwise movement to draw the shaft 37 and cam 39 outwardly against action of spring 58, until the hooked end of latch 52 engages in notch 56. At the same time the hooked end of latch 51 is disengaged by finger 49 from notch 55. Thereupon shaft 36, with its associated cam 38, is shot inwardly by spring 58, until pin 42 engages the inner end of slot 44.

It will be noted that the cams are brought into operating position by resilient means, as distinguished from positive means. The purpose of providing resilient means will be obvious from a consideration of the following: When, as just described, shaft 36 with its associated cam 38, is shot toward operating position by spring 58, it is possible that piston 25 may be at lower dead center or near that point. The cam 38 would in that event merely bear against the pawl lever 29 and slide into position as soon as the piston and pawl lever 29 move upwardly on the next stroke.

At 59 in Fig. 1 is shown a rod pivoted to the long arm of lever 48. I contemplate connecting this rod with any suitable control which may be located on the instrument board of the vehicle or machine with which the engine is associated. If desired rod 59 may be connected with the engine throttle or throttle control in such a way that when the throttle is opened to a position where the compression with the piston in high compression position would be too high, the lever 48 will automatically be shifted, so that the necessary change to low compression will occur. In aeroplane practice the rod 59 may be connected to means responsive to changes in air pressure, as for instance an aneroid mechanism. This kind of connection will provide automatic shift of cams 38 and 39 and consequently effect the desired changes in compression at the right air density.

Referring now more particularly to Figs. 4 to 7 inclusive, I will proceed to describe a characteristic change from low to high compression. In Fig. 4 the piston 25 and associated parts are illustrated in their low compression positions. The piston is at lower dead center just about to move upwardly, say on the exhaust stroke. This position is commonly known as the "zero degrees position." At this point, as well as at upper dead center, the reciprocating motion of the piston and its associated parts is reversed, the inertia of rest of these parts must be overcome before they commence to move on the next stroke. The offset portion of the pawl lever 29 is riding upon the cam 39, while its hooked end is disengaged from notch 27, the pawl lever still being urged in a clockwise direction by spring 31. The offset portion of pawl lever 29 first engages the cam 39 on the down stroke of the piston about ninety degrees before the position illustrated in Fig. 4 is reached.

In Fig. 5 the crank pin is shown moving

upwardly at a position about ninety degrees advanced from that shown in Fig. 4. At this point also there are practically no inertia forces acting in either direction. The crank pin in lifting the piston meets with positive inertia forces and slight back pressure. The axes of the eccentric wrist pin portion 23, pins or journals 22 and the crank pin all fall into line due to angularity of the connecting rod of the pawl lever 29 being disengaged from the ratchet disk 26. The hooked end of pawl lever 29 now rides upon the surface of the ratchet disk under tension of spring 31. Later on during the same upward stroke at a position 45 degrees advanced from the position shown in Fig. 5, the momentum of the piston parts has increased to such an extent that the piston travels upwardly faster than the upper end of the connecting rod. Thus in Fig. 6 the piston is shown as having gained considerably on the upper end of the connecting rod and the wrist pin structure 21 and the ratchet disk have turned relatively to the piston through a very substantial arc.

In Fig. 6 the crank shaft pin is shown about 15 degrees below upper dead center. During the remaining 15 degrees of movement of the crank pin toward upper dead center the vertical movement of the crank pin is practically negligible. The piston, however, due to its momentum, continues to move upwardly until, as shown in Fig. 7, the axes of the eccentric wrist pin 23, the piston pins or journals 22 and the crank shaft pin all fall in line. Thereupon the hooked end of the pawl lever 29 engages in the notch 28 of the ratchet disk 26. The piston is now in its high compression position, the effective length of the connection between the piston and crankshaft having been increased by an amount equal to twice the eccentricity of the wrist pin 23 from the piston or journal pins 22. The operation which takes place bears quite a resemblance to the well known "snap the whip" action. This very quick change undoubtedly takes place on the exhaust stroke, because on this stroke the momentum of the piston is met by no measurable counterforce, as is the case on the compression stroke.

It is apparent that if the cam 39 is shifted to produce the change from low to high compression at very low speed when the inertia forces are low, the piston will reciprocate as usual with the pawl lever sliding over cam 39, until the engine speed is sufficiently high to set up sufficient momentum in the piston to effect the change.

To change from high to low compression the operation is as follows: The cam 38 is shifted into operating position and the cam 39 out of operating position. At low speeds the change occurs on the power stroke or during the compression stroke and at the high speeds the change occurs on either the power stroke, the suction stroke or the compression stroke. The piston coming down, say on the power stroke, the pawl lever 29 riding upon cam 38 becomes disengaged from the notch 28 in the ratchet disk 26. At about 120 degrees past upper dead center the angularity of the connecting rod with respect to the eccentric wrist pin 23 produces a rotative effort in the piston pins and the wrist pin structure turns in the piston to effect the change from high to low compression. The torque or twisting moment produced in the piston pin is equal to the inertia force stored up in the piston times a certain distance. This distance is represented by the distance between the axis of the wrist pin and the axis of the cylinder at the moment under consideration. In this operation the pressure within the cylinder would suffice to produce the change without the aid of inertia which, however, still functions.

In Figs. 9 and 10 I have shown a piston embodying a modified form of the eccentric or "crank" wrist pin forming a part of my invention. In these figures a straight wrist pin $21^a$ of conventional design is fitted in the bores formed in the bosses 60, 60, said bosses being formed integral with the skirt of the piston $25^a$, which, it will be seen, is also of conventional design. Rotatably mounted on the wrist pin $21^a$ is the eccentric sleeve 61 embraced by the upper end of the connecting rod $20^a$, which may if desired be similar in design to that shown at 20 in Figs. 1 to 3 inclusive, but which in Figs. 9 and 10 is shown as being of the closed end type. Integral or secured to the sleeve 61 in any suitable manner, as for example by screws, as shown, is the ratchet disk $26^a$, which is eccentric to both the wrist pin 21 and the sleeve 61. The operation of this form of wrist pin is apparent. The eccentric sleeve 61 turning on the wrist pin $21^a$ adjusts the effective length of the connection between the piston and crank shaft, the eccentric ratchet disk $26^a$ functioning the same as does ratchet disk 26 of Figs. 1 to 7 inclusive.

In Figs. 11 and 12 I have shown a still further modification of the eccentric or "crank" wrist pin of my invention. In these figures a crank-like wrist pin $21^b$ bears in bushings 62, which in turn have a driven fit in openings formed in the skirt of the piston $25^b$. Pivoted to the offset portion $23^b$ of the wrist pin $21^b$ is the upper end of the connecting rod $20^b$, which is of the type illustrated in Figs. 2 and 3. Secured in any suitable manner to an enlarged flat portion of the crank cheek 63 is the ratchet disk $26^b$, which is eccentric to both the portions $22^b$ and $23^b$ of the wrist pin $21^b$. The operation of this form of wrist pin is also

apparent. The eccentric wrist pin $21^b$, revolving about its axis as determined by bushings 62, changes the effective length of the connection between the piston and crank shaft by an amount equal to twice the eccentricity of the offset portion $23^b$. The ratchet disk functions as do the ratchet disks previously described.

While I have here illustrated but a number of embodiments of my invention, I do not limit myself to these constructions, but claim all further equivalent adaptations and modifications of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination with an internal combustion engine comprising a cylinder, piston and crank shaft, devices connecting said piston and crank shaft in driving relation, comprising means operated by the momentum of the piston at the end of a stroke thereof, to change the effective length of said driving connection, and instrumentalities associated with the connecting devices effective, after a change in the length of the driving connection, to maintain the then existing length of the driving connection throughout the several strokes of succeeding engine cycles.

2. In combination with an internal combustion engine comprising a cylinder, piston and crank shaft, a connecting rod joining said crank shaft and said piston in operative relation, means interposed between said connecting rod and said piston operated by the momentum of the piston at the end of a stroke thereof to change the effective length of the connection between said piston and said crank shaft and instrumentalities effective, after a change in the length of the driving connection, to maintain the then existing length of the driving connection throughout the several strokes of a succeeding engine cycle.

3. In combination with the piston, crank shaft and connecting rod of an internal combustion engine, means interposed between the piston and connecting rod to change the effective length of the driving connection between the piston and crank shaft, said means being actuated by the momentum of the piston, and means effective, after a change in the length of the driving connection, to maintain the then existing length of the driving connection throughout the several strokes of a succeeding engine cycle.

4. In combination with the piston, crank shaft and connecting rod of an internal combustion engine, means interposed between the piston and connecting rod and actuated by the momentum of the piston at the end of a stroke thereof, arranged to change the effective length of the driving connection between the piston and crank shaft, a device for locking said last mentioned means in either one of two positions, and instrumentalities for releasing said means from said locking device when the effective length of the driving connection aforesaid is to be changed.

5. In combination with the piston and crank shaft of an internal combustion engine, a driving connection between the piston and crank shaft, comprising means operable by the momentum of the piston at the end of a stroke thereof, arranged to change the effective length of said driving connections, devices for locking said means in one of two positions, and instrumentalities arranged when operated to cause the releasal of said means from the locking device to permit a change in the effective length of said driving connection to be brought about as aforesaid.

6. In combination with the piston, crank shaft and connecting rod of an internal combustion engine, an eccentric interposed between the connecting rod and piston, devices for locking said eccentric in either of two positions, and means for releasing said eccentric from the locking devices when desired.

7. In combination with the piston, crank shaft and connecting rod of an internal combustion engine, an eccentric interposed between the connecting rod and piston, devices for locking said eccentric in either of two positions, and means for releasing said eccentric from the locking devices when desired, said eccentric when released from the locking devices being operated by the momentum of the piston at the end of a stroke thereof, to change the effective length of the driving connection between the piston and crank shaft for the purpose set forth.

8. In combination with the piston and crank shaft of an internal combustion engine, a connecting rod having one end thereof operatively attached to said crank shaft, an eccentric between the other end of the connecting rod and said piston, together with devices arranged to lock the eccentric in one of a plurality of positions to maintain a driving connection of a certain length between the crank shaft and piston, and means for releasing the eccentric from the locking devices for the purpose set forth.

9. In combination with the piston and crank shaft of an internal combustion engine, a connecting rod having one end thereof operatively connected with said crank shaft, an eccentric member affording a variable connection between the connecting rod and piston, means for locking said eccentric member in either of two positions, and devices under the control of the operator arranged to release the eccentric from the locking means to permit the piston by its momentum at the end of a stroke thereof to

actuate the eccentric to change the effective length of the driving connection between the piston and crank shaft, for the purpose set forth.

10. In an internal combustion engine the combination with the piston, piston pin, crank shaft and a connecting rod having one end thereof operatively connected with said crank shaft, an eccentric member cammed with the wrist pin and operatively connected with said connecting rod, means for locking said eccentric member in a plurality of positions and thereby affording a variable connection between piston and crank shaft, and instrumentalities for releasing said eccentric member from said locking means to permit the piston by its momentum at the end of a stroke thereof to actuate the eccentric to change the effective length of the driving connection between the piston and crank shaft, for the purpose set forth.

11. In combination with the piston and crank shaft of an internal combustion engine, a pitman having one end thereof operatively connected with the crank shaft, an eccentric connecting the pitman with the piston, and means for locking the eccentric at one of a plurality of positions.

12. In combination with the piston and crank shaft of an internal combustion engine, a pitman having one end thereof operatively connected with the crank shaft, an eccentric connecting the pitman with the piston, and means for locking the eccentric at one of a plurality of positions, together with devices for releasing the eccentric from the locking means.

13. In combination with the piston and crank shaft of an internal combustion engine, a pitman having one end thereof operatively connected with the crank shaft, an eccentric connecting the pitman with the piston, and means for locking the eccentric at either one of two positions, and devices for causing the releasal of the eccentric from the locking means when a change in the effective length of the connection between the piston and crank shaft is to be brought about.

14. In combination with the piston and crank shaft of an internal combustion engine, a pitman having one end thereof operatively connected with the crank shaft, an eccentric connecting the pitman with the piston, and means for locking the eccentric at either one of two positions, together with devices arranged when operated to release the eccentric from the locking means.

15. In combination with the piston, crank shaft and pitman of an internal combustion engine, an eccentric connecting the pitman with said piston, and means carried by the piston for locking the eccentric in either one of two positions.

16. In combination with the piston, crank shaft and pitman of an internal combustion engine, an eccentric connecting the pitman with said piston, means carried by the piston for locking the eccentric in either one of two positions, together with means under the control of the operator for releasing the eccentric from the locking means when a change in the effective length of a connection between the piston and crank shaft is to be brought about.

17. An internal combustion engine comprising a piston, crank shaft and pitman together with eccentric means operated by the momentum of the piston arranged to vary the effective length of the driving connection between the piston and crank shaft and means for locking said eccentric means at one of a plurality of positions as desired.

18. In combination with the crank shaft, piston and pitman of an internal combustion engine, an eccentric wrist pin connecting the pitman with said piston, a latch carried by the piston arranged to lock said eccentric wrist pin in either one of two positions, and means arranged to be placed in a position where it engages said latch on an outward stroke of the piston to release the wrist pin and thereby permit the said eccentric wrist pin to turn, due to the momentum of the piston at the end of a stroke thereof, to change the effective length of the connection between the piston and crank shaft for the purpose set forth.

19. In combination with an internal combustion engine, comprising a piston, crank shaft and connecting rod, an eccentric for changing the effective length of the driving connection between said piston and crank shaft, a latch for locking said eccentric in one of a plurality of positions, said latch having different angular displacements in its various locking positions, and means arranged to engage said latch at any locking position to release said eccentric.

20. In combination with an internal combustion engine comprising a piston, crank shaft, and connecting rod, an eccentric interposed between said piston and connecting rod for changing the effective length of the driving connection between said piston and crank shaft, a latch carried in said piston for locking said eccentric in one of a plurality of positions, said latch having different angular displacements in its various locking positions and means arranged to engage said latch at any locking position to release said eccentric.

21. In combination with an internal combustion engine comprising a piston, crank shaft and connecting rod, devices for changing the effective length of the driving connection between said piston and crank shaft, means for locking said devices, a cam for releasing said locking means and means for moving said cam into and out of co-acting relation with said locking means.

22. In combination with an internal combustion engine comprising a piston, crank shaft and connecting rod, devices for changing the effective length of the driving connection between said piston and crank shaft, means for locking said devices in one of a plurality of positions, said means being arranged to occupy different relative locking positions, a cam for releasing said locking means, and means for moving said cam into and out of co-acting relation with said locking means.

23. In combination with an internal combustion engine, comprising a piston, crank shaft and connecting rod, devices for changing the effective length of the driving connection between said piston and crank shaft, a latch for locking said devices in either of two positions, said latch having different angular displacement at the two locking positions and a cam arranged to be moved to engage said latch in either of its adjusted positions.

24. In combination with an internal combustion engine, comprising a piston, crank shaft and connecting rod, an eccentric in said piston for changing the effective length of the driving connection between said piston and crank shaft, a pawl lever for locking said eccentric in one of a plurality of positions and means arranged to engage said lever to release said eccentric to permit the same to turn due to the momentum of the piston, said eccentric being arranged to move said latch whereby it will not engage said releasing means upon continued reciprocation of said piston.

25. In combination with an internal combustion engine, comprising a piston, crank shaft and connecting rod, an eccentric in said piston for changing the driving connection between said piston and crank shaft to effect a change in the compression of said engine, a pawl lever in said piston for locking said eccentric in one of a plurality of positions, means for engaging said lever to release said eccentric, said means comprising cams arranged to be moved into the path of said piston beyond the limit of the stroke thereof, said lever being arranged to be engaged by one of said cams when it is desired to change the compression of said engine.

26. In combination with an internal combustion engine comprising a cylinder, a piston therein, a crank case, a crank shaft therein and a connecting rod joining said piston and crank shaft, an eccentric interposed between said piston and connecting rod for changing the length of the driving connection between said piston and crank shaft, a pawl lever for locking said eccentric and means for engaging said pawl lever to release said eccentric, to permit the same to turn to effect a variation in the compression of the engine, said means comprising rods extending transversely in said crank case, cams secured to the ends of said rods arranged to engage said lever to release said eccentric, spring means normally urging said rods into operative position, notches in said rods and latches arranged to engage normally in said notches to lock said rods in inoperative position against tension of said spring means, and means for simultaneously moving one of said rods out of operative position and locking the same and for releasing the latch which locks the other of said rods whereby the rod may be moved into operative position under tension of its associated spring means.

27. In combination with an internal combustion engine comprising a cylinder, a crank case, piston, crank shaft and connecting rod, an eccentric for changing the effective length of the driving connection between said piston and crank shaft, a pawl lever for locking said eccentric in either high or low compression position, means for engaging said lever at the end of a piston stroke to effect a change in the compression of the engine, comprising rods extending transversely in the crank case, means for simultaneously moving one of said rods into operative position and moving the other of said rods out of operative position.

28. In combination with an internal combustion engine, comprising a cylinder, crank case, piston, crank shaft and connecting rod, instrumentalities for changing the effective length of the driving connection between said piston and crank shaft, comprising an eccentric, and devices for locking said eccentric in either high or low compression position, means for engaging and releasing said locking devices comprising rods in the crank case urged normally into co-acting relation with said locking devices and means for simultaneously releasing one of said rods from inoperative position and withdrawing the other of said rods from operative position.

29. In combination with an internal combustion engine, comprising a crank shaft and connecting rod, an eccentric in said piston for changing the length of the driving connection between said piston and crank shaft to effect a change in compression of said engine, a pawl lever for locking said eccentric in one of a plurality of positions, means operable by a change in density of the air for engaging said lever to release said eccentric substantially as described.

In witness whereof I hereunto subscribe my name this 22d day of October, 1919.

EDMUND JEDRZYKOWSKI.

Witnesses:
EDNA O. GUSTAFSON,
IRENE RASMUSSEN.