R. HUFF.

STARTING MECHANISM FOR HYDROCARBON ENGINES.

APPLICATION FILED JULY 20, 1906.

1,049,487.

Patented Jan. 7, 1913.

2 SHEETS—SHEET 1.

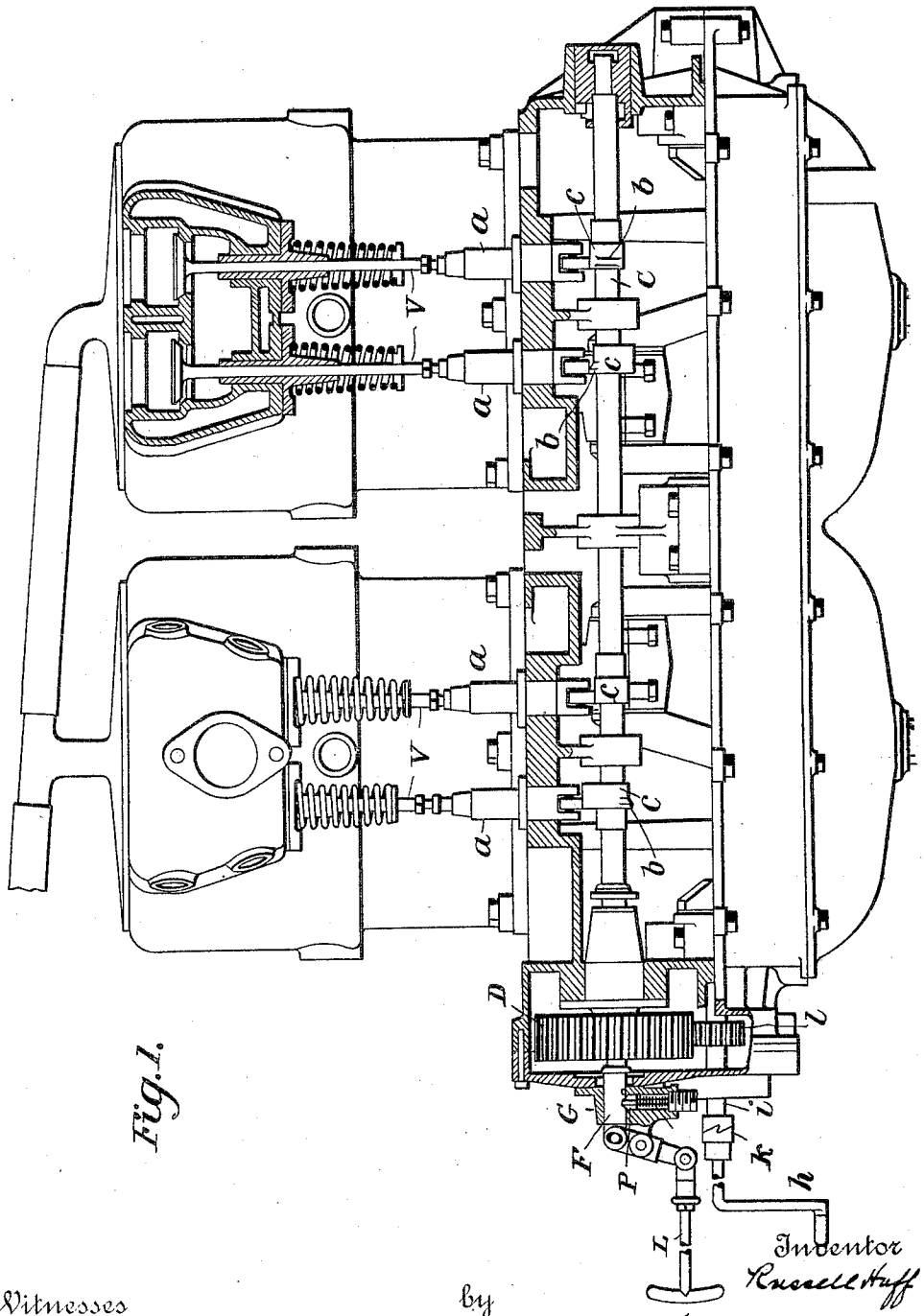

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

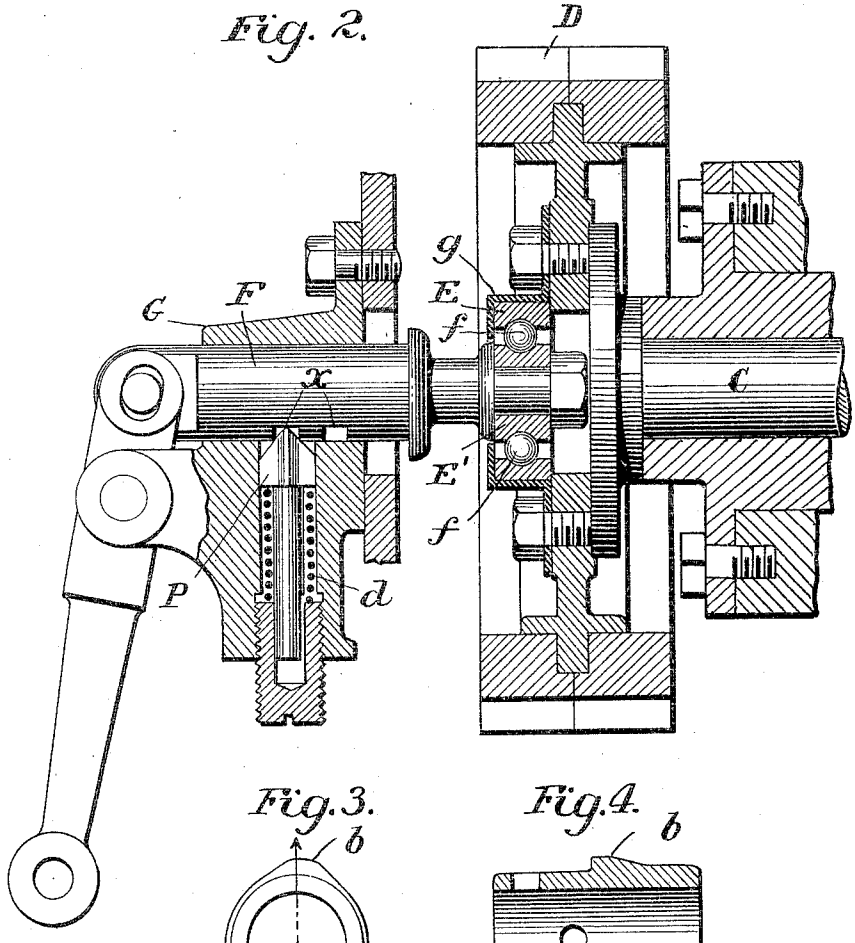


Fig. 3.

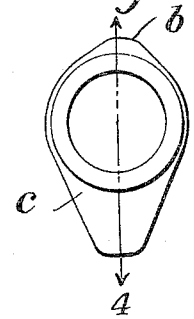
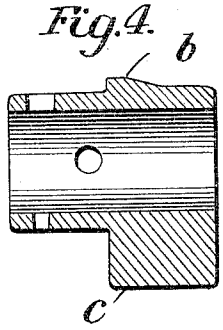


Fig. 4.



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UNITED STATES PATENT OFFICE.

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STARTING MECHANISM FOR HYDROCARBON-ENGINES.

1,049,487. Specification of Letters Patent. Patented Jan. 7, 1913.

Application filed July 20, 1906. Serial No. 327,049.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, residing at Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Starting Mechanism for Hydrocarbon-Engines, of which the following is a specification.

My invention relates to improvements in hydrocarbon engines and particularly to starting mechanism for hydrocarbon engines employed in motor vehicles.

The invention also consists in means for shifting the cam shaft of a hydrocarbon engine for the purpose of bringing normally inoperative cams into action in starting the engine to relieve the compression which tends to interfere with cranking or starting by hand.

The invention also consists in the peculiar mechanism employed for connecting the cam shaft with shifting means, and of other details, as fully set forth hereinafter and illustrated in the accompanying drawing, in which,

Figure 1 is a longitudinal section of a hydrocarbon engine having a rotatable and sliding cam shaft, and embodying my improvements; Fig. 2 is a sectional elevation, enlarged, of the shaft shifting and connecting means; Fig. 3 is an end view of one of the cams; Fig. 4 is a section on the line 4—4 of Fig. 3.

For the purpose of illustrating my invention, I have shown it in connection with a hydrocarbon engine where a shaft C is mounted so as to slide in end bearings, and is rotated by means of suitable driving gears, one of which is shown, and is provided with cams *c*, acting upon the anti-friction rollers of plungers *a* arranged below the stems V of the exhaust valves of the engine, to thereby operate the same in proper time in the normal operations of the engine.

In order to relieve the compression which tends to interfere with the cranking or starting of the engine by hand, the shaft C is provided with minor or auxiliary cams *b*, shown as arranged upon and projecting from the cams *c*, which, however, are normally out of action, but can be brought to operate the plungers by shifting the shaft C longitudinally, and when so operated, the plungers will so lift the exhaust valves during a portion of the compression stroke as to allow portions of the gases to escape and reduce the extent of resistance which would result from the compression of the full gaseous charge. In order to shift the said shaft longitudinally from non-rotative shifting means, but maintain a proper flexible connection between said means and the shaft, I make use of the devices which I will now describe.

At one end of the shaft, as shown at the end provided with the gear D, is connected the outer race E of a ball bearing, and within the latter is the companion race E′, and in the said races are annular grooves to receive the usual balls *f*. The inner race is connected to a spindle F, which is mounted in a suitable bearing G in the frame of the apparatus so as to slide longitudinally therein, a lever or other operating device L being connected with the spindle to shift the same.

The race E may be secured to the shaft C or to the gear D in any suitable manner, but as shown it is held in place by means of an annular clamp plate *g*, having a flange by which it is bolted to the gear.

The inner race E′ fits a boss upon the spindle F and is clamped thereto by means of a nut screwing on to the end of the boss. The longitudinal movement of the spindle F, through the medium of its operating device, serves to shift the shaft C which, however, can rotate independently of the spindle; and the interposed anti-friction rolls serve to connect the same flexibly and prevent any lost motion between the shaft and the operating spindle, while permitting the free rotation of the shaft independently of the spindle, and reducing to a very great extent the friction between the two in shifting the shaft. Further, the said connection reduces the friction during the normal rotation of the shaft when the spindle holds it in its longitudinal position. To thus hold the shaft in longitudinal position, it is necessary to secure the spindle in the different positions to which it may be set, without permitting any motion, but in such a manner as to facilitate the shifting of the spindle by the shifting device. To this end I make use of a suitable detent, which will hold the spindle in either position to which it may be set. This detent may be separately operated and set by hand, but preferably is a yielding

detent which will normally hold the spindle in place, but will yield when a sufficient amount of force is applied to shift the spindle.

As shown, the spindle has separated notches or sockets x, x, adapted to receive the beveled end of a bolt P, sliding in a socket of the frame and carried toward the spindle by means of a spring d exerting sufficient power to hold the bolt in either notch during the operation of the apparatus, but capable of yielding when power is applied to move the spindle longitudinally, and bring the edge of either notch against the inclined face of the bolt, when the latter will be forced back until the other notch is brought above it, when it will spring into place.

In Fig. 1 I have shown the usual crank h for starting the engine of an automobile, which crank is normally idle and is connected to the starting shaft i by a clutch k. On the shaft i is a gear l in mesh with the gear D. To start the motor the cam shaft is first thrown into position to bring the auxiliary cams into operation and the crank is then turned in the proper direction. When the motor has started the crank is released and the cam shaft then thrown into its normal position.

Without limiting myself to the precise construction shown, I claim as my invention,—

1. In starting mechanism for hydrocarbon engines, the combination with a crank case and a longitudinally shiftable cam shaft therein having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a spindle adapted to be moved endwise and arranged coaxially with the cam shaft and connected therewith, and a handle outside of the crank case for shifting the spindle longitudinally.

2. In starting mechanism for hydrocarbon engines, the combination with a longitudinally shiftable cam shaft having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a non-rotatable spindle arranged coaxially with the cam shaft, ball bearings connecting and interlocking the cam shaft with the spindle, and means for shifting the spindle longitudinally.

3. In starting mechanism for hydrocarbon engines, the combination with a longitudinally shiftable cam shaft having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a non-rotatable spindle arranged coaxially with the cam shaft, concentric ball bearings connected respectively with the spindle and with the cam shaft, anti-friction balls arranged in said bearings, and means for shifting the spindle longitudinally.

4. In starting mechanism for hydrocarbon engines, the combination with a longitudinally shiftable cam shaft having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a spindle arranged coaxially with the cam shaft, means connecting the spindle with the cam shaft and permitting of relative rotation, and means for yieldably locking the spindle in different longitudinal positions.

5. In starting mechanism for hydrocarbon engines, the combination with a longitudinally shiftable cam shaft having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a spindle adapted to be moved endwise and arranged coaxially with the cam shaft and connected therewith by means permitting relative rotation, means for holding said spindle and shaft in different positions, and an operating device connected with the spindle to shift the same.

6. In starting mechanism for hydrocarbon engines, the combination with a longitudinally shiftable cam shaft having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a spindle connected with the cam shaft, said spindle being provided with a plurality of sockets, and a spring-actuated detent adapted to engage the sockets and yieldably hold the spindle in different longitudinal positions.

7. In starting mechanism for hydrocarbon engines, the combination with a longitudinally shiftable cam shaft having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a spindle, ball bearings connecting and interlocking the

cam shaft with the spindle, said spindle being provided with a plurality of sockets, and a spring-actuated detent adapted to engage the sockets and yieldingly hold the spindle in different longitudinal positions.

8. In starting mechanism for hydrocarbon engines, the combination with a longitudinally shiftable cam shaft having thereon two sets of cams, one of said sets of cams being adapted to relieve compression to facilitate starting the engine, of a starting shaft and crank therefor, and means for shifting the cam shaft preparatory to starting the engine, comprising a spindle arranged coaxially with the cam shaft, concentric ball bearings connected respectively with the spindle and with the cam shaft, anti-friction balls arranged in said bearings, and means for yieldably locking the spindle in different longitudinal positions.

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

RUSSELL HUFF.

Witnesses:
MARK C. TAYLOR,
H. M. ALLISON.