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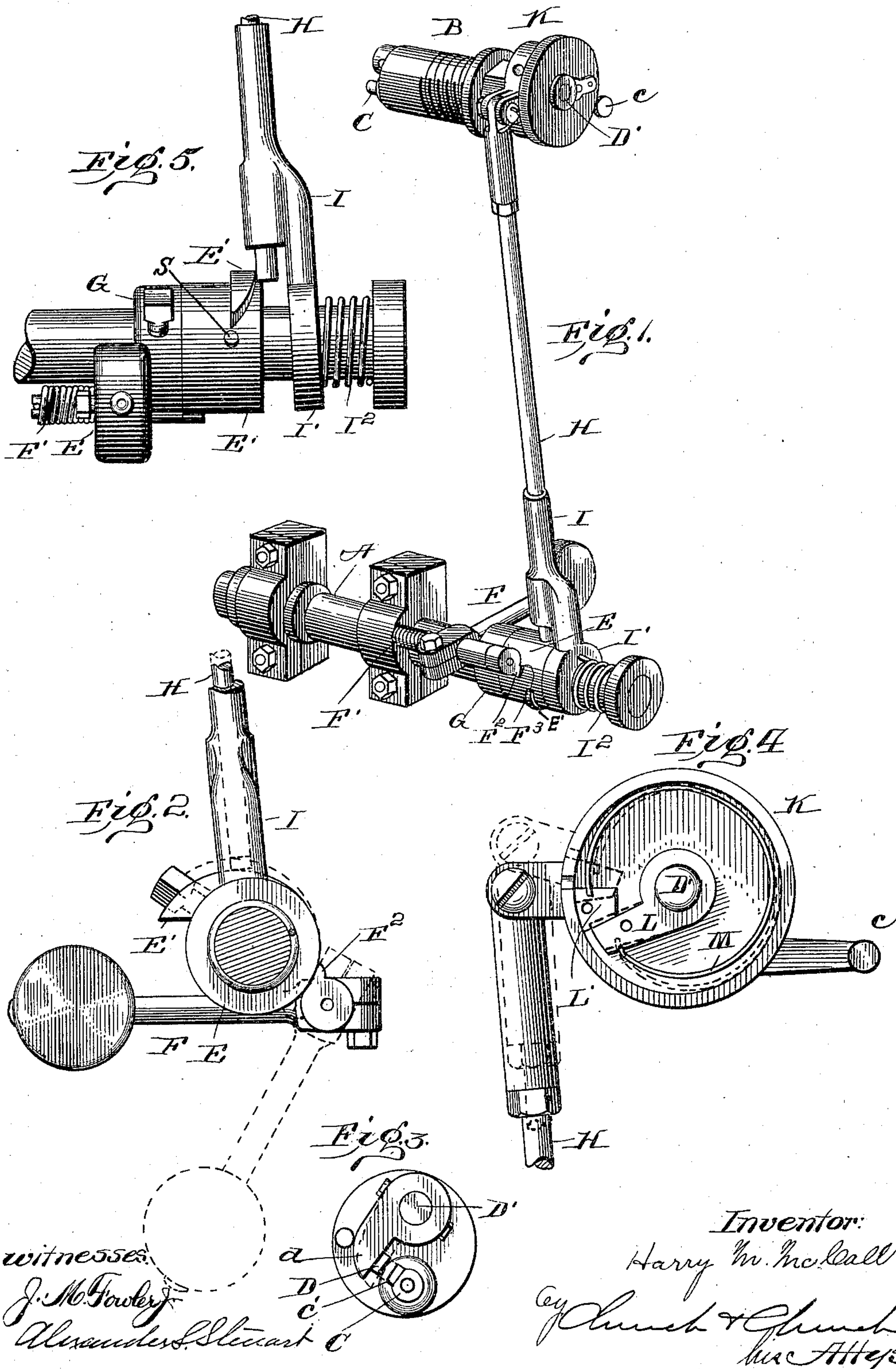
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H. M. McCALL.

SPARKING MECHANISM FOR INTERNAL COMBUSTION ENGINES.

(Application filed Dec. 22, 1900.)

(No Model.)



UNITED STATES PATENT OFFICE.

HARRY M. McCALL, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO THE
PITTSBURGH GAS ENGINE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

SPARKING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

SPECIFICATION forming part of Letters Patent No. 687,925, dated December 3, 1901.

Application filed December 22, 1900. Serial No. 40,813. (No model.)

To all whom it may concern:

Be it known that I, HARRY M. McCALL, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny, State of Pennsylvania, have invented certain new and useful Improvements in Sparking Mechanism for Internal-Combustion Engines; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to improvements in devices for igniting the explosive mixture in internal combustion engines, the object of the invention being to provide a simple, compact, highly efficient, and durable mechanism for operating the sparking contacts between which the electric spark is formed to ignite the explosive mixture, a further object of the invention being to provide a means whereby the starting and control of the engine may be effected through the automatic adjustment of the contact-controlling mechanism, so as to create the spark when the piston is at different points in its path of travel.

To these ends the invention consists in certain novel details of construction and combinations and arrangements of parts, all as will be now described, and pointed out particularly in the appended claims.

In the accompanying drawings, Figure 1 is a perspective view of a sparking mechanism with the contacts and operating devices shown in their proper relative positions, but omitting the supporting-frame save for the bearings for the operating-shaft. Fig. 2 is a detail view of the sparker-cam and its governor, showing the relative positions of the parts in dotted lines when the governor-lever is thrown outward by centrifugal force due to the speed of the engine. Fig. 3 is a detail face view of the sparking contacts at the inner end of the sparker-plug. Fig. 4 is a similar view, looking at the opposite end of the sparker-plug, with the cap of the spring-box removed, the parts in this view being shown in full and dotted lines at opposite extremes of their movement. Fig. 5 is a detail eleva-

tion illustrating the action of the sparker-cam when the engine is turned backwardly.

Like letters of reference in the several figures indicate the same parts.

In said drawings the letter A indicates a shaft which is adapted to be rotated from the drive-shaft of the engine in any suitable or ordinary manner and at a speed in proportion to the speed of the engine-shaft.

B indicates a sparker-plug which is adapted to be inserted through the walls of the cylinder or explosion-chamber, as the case may be. The plug B carries a fixed contact C, suitably insulated therefrom, with means, such as a binding-post *c*, at the outer end for the attachment of one wire of the sparking circuit and at the inner end a contact-surface *c'*, with which a movable contact is adapted to coöperate. In the form of device illustrated the movable contact D is mounted on an arm *d* of a shaft D', journaled in the plug B and adapted to be oscillated by means of a connection at its outer end extending down into position to be moved by a cam carried by the shaft A. The cam just referred to is lettered E in the accompanying drawings and is preferably mounted loosely on the shaft A, so as to be capable of a limited independent oscillatory movement, such movement being controlled by a weighted governor-lever F, journaled in a suitable collar or carrier G, mounted rigidly on the shaft A and in such position and relation to said shaft A that by the rotation of said shaft it may be thrown outwardly against the tension of a spring F' to move the cam with relation to the shaft so as to advance the cam projection of the cam more or less, as the case may be. The connection between the governor-lever and the cam is preferably formed by an arm F² on the shaft of the governor-lever, which arm takes into a slot or recess F³ in the cam E. The cam projection E' of the cam E is adapted to pass beneath the lower end of a rod H, extending upwardly through a movable guide I and connected at its upper end by a pivotal connection with the casing K of a spring-box, which is loosely journaled on the shaft of the movable contact. Said shaft, as shown in

Fig. 4, is provided with an arm L, and the spring-box is provided with a projection L', adapted when they contact and the rod H moves downwardly to separate the sparking contacts; but when moved in the opposite direction the said contacts are brought together through the medium of a spring M, mounted in the spring-box and tending at all times to hold the projections L and L' together, so as to move in unison.

In operation as the shaft A rotates the rod H will be elevated, putting the spring M under tension and bringing the sparking contacts together; but as the cam projection E' moves away from beneath the rod H the spring M will assert itself, driving said rod H downwardly quickly, and when the projections L and L' come together the sparking contacts are separated with a snapping action, which causes the spark to bridge the gap between the contacts in a manner well understood by engineers and electricians skilled in this art. The action of the spring in the spring-box is to separate the contacts by a blow rather than by a slow movement. Thus the spark is created at exactly the instant when the rod H is descending, and by varying the time when said rod shall descend, as by advancing or retarding the action of the cam projection with relation to its shaft, the time of explosion with relation to the position of the piston may be regulated. A buffer S may be inserted in the cam to arrest the rod H. In order to permit the backward rotation of the drive-shaft, the cam projection E' is sharpened at its highest point or side and the rod H is rounded at its lower end, whereby if said shaft be rotated backwardly, as is frequently the case when the engine is being stopped, the said cam projection will contact with one side of the rod H and move the same laterally or longitudinally of the shaft A, such movement being permitted by forming the bearing I as part of a collar or sleeve I', surrounding the shaft A, and providing a spring I² for holding the bearing I in its normal position. Obviously other means may be employed for holding the rod H in its normal position which will permit said rod to move transversely when the engine is rotated rearwardly, but will cause it to ride up on the cam projection whenever the engine is running and it is desired to create a spark for igniting the charge.

As is well understood, in the manipulation of gas-engines when running at full speed or under load the explosion or spark for creating the explosion takes place at or slightly before the crank of the engine is on its center or the piston at the extreme of its backward movement. Because of this fact difficulty has been experienced in starting the engine, for in moving the piston slowly by hand the explosion is liable to take place before the crank passes its center, and hence the engine may be started reversely. For this reason the adjustment of the present device is made to create the spark when the governor-lever is

at its inner position after the crank has passed its center and the piston has begun its forward movement. Thus the engineer may start the engine as slowly as desired, and the explosion will take place at the proper time to drive the piston forwardly and the crank-shaft in the proper direction. In order now to bring the sparking time into proper relation to the piston and crank-shaft movement, the speed of the engine will swing the governor-lever outwardly and correspondingly move the projection E' of the cam rearwardly with relation to its shaft. It is preferred that the adjustment should also be made so that the governor-lever will be swung outwardly to its limit as soon as a reasonable speed is acquired by the engine and will be held in its outward position by centrifugal force during the time the engine is running. With this arrangement it will therefore be seen that no hand manipulation of either the sparker-cam or of the electric circuits is necessary in starting the engine, but, on the contrary, the adjustment is all automatically made both for starting and for securing the highest efficiency while the engine is running.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a sparking mechanism for gas-engines the combination with a drive-shaft adapted to be operated from the engine-shaft, a cam mounted thereon and having a cam projection sharpened at its abrupt side, of a sparker-operating rod having its lower end which contacts with said cam projection, mounted in a spring-pressed transversely-movable bearing whereby when the shaft is turned reversely said rod will be displaced transversely without operating the sparking contact; substantially as described.

2. In a sparking mechanism for gas-engines the combination with a drive-shaft adapted to be driven from the engine-shaft and a cam mounted thereon having a cam projection sharpened at its abrupt side, of a sparker-operating rod adapted to cooperate with said cam projection, a bearing for the end of said sparker-rod having a collar surrounding the drive-shaft and a spring for holding said collar and bearing in position, whereby when the drive-shaft is rotated reversely said rod and bearing will be displaced transversely without operating the sparking contact; substantially as described.

3. In a sparking mechanism for gas-engines, the combination with the plug adapted to be screwed into the cylinder and having a fixed contact at the inner end, a shaft journaled in said plug and having the arm at the inner end with a movable contact thereon adapted to cooperate with the fixed contact, and an operating stop-arm on the outer end of said shaft, of a casing journaled loosely on the shaft and inclosing the operating-arm, a projection on the inner side of the casing adapted to contact with said stop-arm, a

spring confined within the casing for holding said stop and arm together, an operating-rod pivotally connected with the casing and an operating-cam coöperating with the rod; substantially as described.

4. In a sparking mechanism for gas-engines, the combination with a cam-shaft adapted to be rotated by the engine, a collar fixed on said shaft to rotate therewith, a shaft journaled in said collar, a governor-lever on one end of said shaft and a spring for holding said governor-lever against outward move-

ment, of a cam journaled on the cam-shaft and having a cam projection and slot or recess, an arm on the governor-lever shaft entering said recess to advance the cam with relation to the shaft as the governor-lever swings outwardly and a sparking contact controlled by the cam; substantially as described.

HARRY M. McCALL.

Witnesses:

ALEXANDER S. STEUART,
THOMAS DURANT.