

UNITED STATES PATENT OFFICE.

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MEANS FOR FACILITATING THE STARTING OF GAS OR SIMILAR ENGINES.

SPECIFICATION forming part of Letters Patent No. 702,797, dated June 17, 1902.

Application filed May 10, 1902. Serial No. 106,753. (No model.)

To all whom it may concern:

Be it known that I, JAMES HUTCHINGS, engineer, a subject of the King of Great Britain, residing at 101 Coleman road, Camberwell, London, England, have invented certain new and useful Improvements Relating to Means for Facilitating the Starting of Gas or Similar Engines, of which the following is a specification.

10 This invention relates to means for facilitating the starting of gas and similar engines, and refers chiefly to engines employing two or more working cylinders and intended for use on motor-vehicles. With engines of this

15 class as hitherto constructed it has been necessary in order to start the engine to revolve the crank-shaft one or more revolutions by hand on account of the inability of the driver or attendant to otherwise fire the requisite

20 cylinder to rotate the shaft in the proper direction. This operation, in addition to requiring the driver or attendant to leave his seat, is oftentimes performed with considerable inconvenience. To avoid these obstructions, it has been usual when it is required to

25 stop the vehicle for a short time to throw the driving mechanism out of gear and allow the engine to continue working, so that the restarting of the vehicle is effected by throwing the driving mechanism into gear again; but in this case there is a considerable waste

30 of the motive fluid. To avoid the necessity of keeping the engine at work, as last stated, it has also been proposed to explode by auxiliary electrical circuits the unexploded mixture which may be left in one or other of the

35 cylinders after the engine has been stopped working, and an indicator attached to some moving part of the engine has been provided to enable the operator to ascertain which of

40 the cylinders has drawn in the explosive mixture, and is therefore ready to be fired by the completion of the electrical circuit communicating with such cylinder. This method

45 is, however, not satisfactory for several reasons, one being that the indicator cannot be conveniently seen except in daylight, and another that through carelessness or mistake the operator may complete the wrong electrical circuit, and thereby run the risk of

50 causing more or less damage to the apparatus. The method which I employ, being virtually automatic, obviates these defects.

According to my invention, in addition to the ordinary contact device actuated by the engine for causing the electric current to operate the ignition devices of the various working cylinders, I mount on the cam-shaft or other moving part of the engine an additional contact device having terminals equal in number to the working cylinders. The said device is connected with shunt-circuits of the primary circuits of the aforesaid ordinary electric ignition devices and is provided with a push, key, or other circuit-closing contrivance within easy reach of the driver or attendant. The arrangement of the said additional contact device is such that one or other of its terminals is closed only when the piston in the corresponding cylinder is in a position to rotate the crank-shaft in the proper direction when the charge in that cylinder is ignited. This ignition may be effected by the driver or attendant closing the said shunt-circuit, with which the said additional contact device is connected by means of the aforesaid push or key, which latter is common to all the aforesaid shunt-circuits. In other words, I provide as many shunt-circuits as there are cylinders to be fired, the said circuits having breaks adapted to be closed in succession by a moving part of the engine and having also breaks adapted to be closed simultaneously by hand. The circuit which has both breaks closed at one time is the one through which the current from the battery will pass.

For the sake of general convenience the ordinary contact devices are preferably so constructed that they may be arranged in proximity to the aforesaid additional contact devices without the proper working of any of said contact devices being interfered with, and I inclose said ordinary and additional contact devices in a common casing or cover, by which they are protected from dirt and damp.

In order that my said invention may be clearly understood and readily carried into effect, I will now proceed to describe the same more fully with reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic view showing my invention applied to a two-cylinder gas-engine. Fig. 2 is a plan of contact devices constructed according to my invention, the casing or cover containing them being repre-

sented as being opened to enable its interior to be seen. Fig. 3 is a section taken approximately on the line xx of Fig. 2. Fig. 4 is a diagrammatic view representing my improved contact devices adapted to be used in connection with a four-cylinder engine. Fig. 5 is a section of the push or key which I prefer to employ to restart the working of the engine.

Like letters and numerals of reference indicate similar parts throughout the several views, and for the sake of distinctness I will use numerals to represent the usual mechanical parts of the engine, the electrical parts and connections or their accessories being indicated by alphabetical letters.

Referring more particularly to Figs. 1 to 3, 1 2 are the aforesaid cylinders, of which 1 is represented as being in the proper position for firing. 5 is the cam-shaft. 5^x is a crank-disk which I sometimes employ for the purpose of transmitting motion to said cam-shaft, and 6 is the crank-shaft. A' A² are the "ordinary" contact devices, which are mounted upon the cam-shaft and are adapted to be actuated by the engine. B is the additional contact device, which is also mounted upon the aforesaid cam-shaft and is adapted to be actuated by the push or key C. D' D² are the sparking-plugs, which are in connection with the secondary circuits of the coils $e' e^2$. E' E² are the primary circuits of said coils; F' F², the shunt-circuits, which latter comprise the terminals G' G² of the aforesaid contact device B and are adapted to be closed by the aforesaid push C, and H the casing or cover for the contact devices.

The ordinary contact device is provided with a ring or collar a , mounted fast upon the cam-shaft 5. One of the electrodes of the battery d is connected with any convenient portion of the frame of the engine, said frame thus being made to constitute part of the circuit of said battery in the ordinary way. Fixed terminals $a' a^2$ serve to connect the frame of the engine through the intervention of bridges $a^5 a^5$ with the various cylinders of the engine. The said bridges a^5 are in the form of bell-crank levers mounted upon pivots $a^6 a^6$, one arm of each of said levers carrying a projection a^7 , which is pressed against the ring or collar a by means of springs $a^8 a^8$ acting against the arms $a^9 a^9$ of said levers. The ring or collar a has in its periphery a depression a^{10} , into which enter in succession the aforesaid projections $a^7 a^7$, thereby enabling the bridges $a^5 a^5$ to oscillate for the purpose of successively establishing connection between the terminals $a' a^2$, respectively, and the frame of the engine for the purpose of closing the respective circuits and igniting the charges in the various cylinders.

The additional contact device comprises a cam-disk b , mounted fast upon the cam-shaft 5 and forming part of the shunt-circuits F' F²,

the said disk being provided at its periphery with the cam b' . (In Fig. 1 the ring or collar a and the cam-disk b are shown separately for convenience of illustration.) The terminals G' G² are provided with brushes or blades $g g$, arranged in such manner that when the engine comes to rest with one or other of its cylinders in a condition to be fired for the purpose of recommencing the working of said engine in the direction required the blade or brush corresponding to said cylinder will lie contiguous to the aforesaid cam b' . The shunt-circuit in which the said blade or brush is arranged is thus enabled to be closed by merely actuating the push C, the said push being adapted to simultaneously close the ends $f' f^2$ of both the shunt-circuits F' F², as shown in Fig. 5, without, however, connecting said shunt-circuits with each other. The circuit which for the time being has its other end closed by means of the terminal G' or that G² (in this case G') and the cam-disk b is the one which will be completely closed by the action of the push C.

The contact devices A', A², and B are inclosed in a fixed casing H, which is constructed in two portions $h h'$, connected together by a hinge h^2 , about which one of the said portions can be turned when it is desired to open the casing. The periphery of the casing is provided with perforated lugs or flanges $h^3 h^3$, into which when the casing is closed a bolt or screw can be inserted for the purpose of securing the two portions of said casing together. Rings or washers $h^4 h^4$, of insulating material, serve to insulate the terminals $a' a^2$ G' G² from the casing.

In the arrangement illustrated in Fig. 4 I employ four ordinary contact devices A' A² A³ A⁴ and an additional contact device B, having four terminals G' G² G³ G⁴, corresponding with the four cylinders 1 2 3 4 (not shown) of the engine. The arrangement and operation of the parts do not, however, require any special explanation, as they will be clear from the foregoing description.

When it is desired to stop the vehicle, it will be necessary to throw the engine out of gear with the driving mechanism of said vehicle and to cut off the supply of electric current from the battery d , which latter action is effected by means of the switch d^x , arranged in any appropriate position. To restart the running of the vehicle, the switch d^x must be again closed and the push C actuated. The vehicle is then thrown into gear with the engine after the working of the latter has recommenced. It may here be remarked that it is found in practice that engines having two or four working cylinders usually, if not invariably, come to rest with one of said cylinders in a condition to be fired for the purpose of restarting the working of the engine if said engine has been put out of gear, as described, previously to its stopping. It will therefore be possible under these circumstances for engines pro-

vided with my improved starting device to be restarted by means of the latter. In the case of an engine having two cylinders (assuming that the cranks of the crank-shaft are at an angle of one hundred and eighty degrees to one another) one of two positions is assumed by the pistons of said cylinders on stopping, (assuming also that the engine was running lightly immediately prior to its stopping,)—namely, that in which the piston of the leading cylinder is on its working stroke, or in which the piston of the following cylinder is on its compression-stroke, or in which the piston of the leading cylinder is on its compression-stroke and the piston of the following cylinder on its suction-stroke. In the former case the charge in the leading cylinder would be ignited for the purpose of restarting the engine. In the latter case the charge in the following cylinder would be ignited, said charge having been brought to a condition of sufficient compression by the recoil of the compressed charge in the leading cylinder. In the case of a four-cylinder engine when thrown out of gear with the vehicle prior to its stopping it almost always happens that one or other of the pistons comes to rest on its working stroke. The corresponding cylinder will accordingly be fired when the appropriate circuit is closed by the push C.

I do not confine myself to the exact details of arrangement and construction described and shown, which may be varied or modified as may be desired without departing from the nature of my invention. For instance, the bridges $a^5 a^5$ may be in permanent connection with the terminals $a' a^2$ and may also touch the collar a , the said collar, however, being formed of a hard insulating material and being provided with a contact piece or pieces adapted to intermittently come into electrical contact with the aforesaid bridges for the purpose of closing the respective primary circuits. Similarly the blades $g' g^2$ upon the terminals $G' G^2$ may permanently touch the disk b , which latter may also be composed of an insulating material and may be provided with a contact piece or pieces adapted to close the appropriate shunt-circuit when the push C is actuated, the said contact-pieces upon the collar a and the disk b being according to this form of my invention flush with the peripheral surfaces of said collar and disk, respectively. It will also be obvious that the push C may, if desired, be arranged approximately at the point C^x , Fig. 1, in which case the cam-disk b would be insulated from the cam-shaft 5.

If desired, the contact devices adapted to be operated by the engine may be of any other appropriate form than that described and shown, which is given by way of example only. Furthermore, the additional contact device or the ordinary contact device, or both, may be adapted to be mounted upon the crank-shaft or upon other appropriate mov-

ing part of the engine instead of upon the cam-shaft.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a combustion-engine having a plurality of working cylinders, the combination with said cylinders of an electrical starting device comprising separate circuits for the several cylinders, said circuits being provided with breaks adapted to be successively closed by the engine when working, and also with breaks adapted to be closed simultaneously with each other by hand.

2. In a combustion-engine having a plurality of working cylinders, the combination with said cylinders and the crank-shaft of an electrical starting device comprising a corresponding number of circuits each of which is broken at two points, means, coöperating with the crank-shaft, for successively closing said circuits at one broken point in each, and hand-operated means for closing simultaneously at the second broken point in each all of said circuits, substantially as and for the purpose specified.

3. In a combustion-engine having a plurality of working cylinders, the combination with said cylinders and the crank-shaft of an electrical starting device comprising shunt-circuits that are in communication with the respective cylinders and each broken at two points, an individual stationary contact-piece in each circuit at one of said broken points, a rotary contact-piece coöperating with the crank-shaft and adapted to make contact successively with said stationary contact-pieces, and a hand-operated circuit-closer common to all of said circuits and located at the second broken point in each so as to close said second broken points and thus complete one of the circuits, substantially as described.

4. In a combustion-engine having a plurality of working cylinders, the combination with said cylinders and the crank-shaft of a corresponding number of shunt-circuits communicating therewith, said circuits each being broken at two points, a terminal in each circuit at one of said points, an elastic blade contact-piece carried by each of said terminals, a common rotary contact-piece in said circuits, said rotary contact-piece being adapted to coöperate with the crank-shaft so as to successively make contact with the aforesaid stationary contact-pieces, and a push common to all said circuits and adapted to close the said circuits simultaneously at the second broken point in each for the purpose of completing one of the circuits, substantially as described.

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 22d day of April, 1902.

JAMES HUTCHINGS.

Witnesses:

W. E. SYKES,

T. SELLY WARDLE.