O. GRAVDAHL.

MEANS FOR REVERSING EXPLOSION MOTORS.

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1,007,196. Patented Oct. 31, 1911.

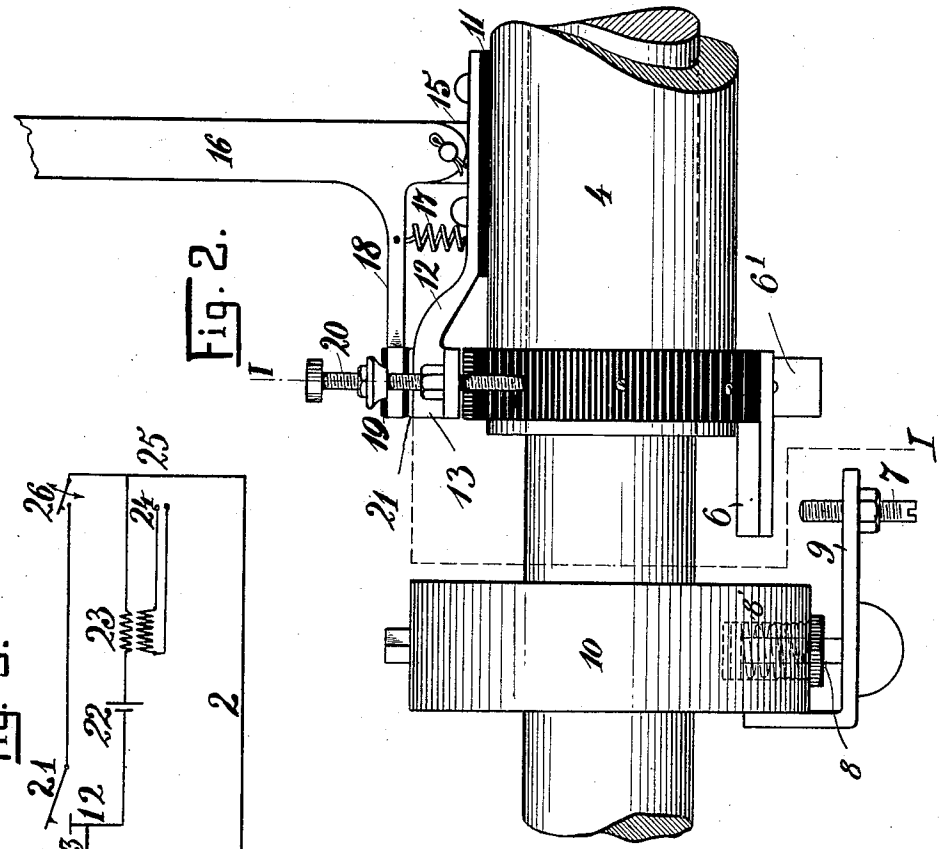

Fig. 2.

Fig. 3.

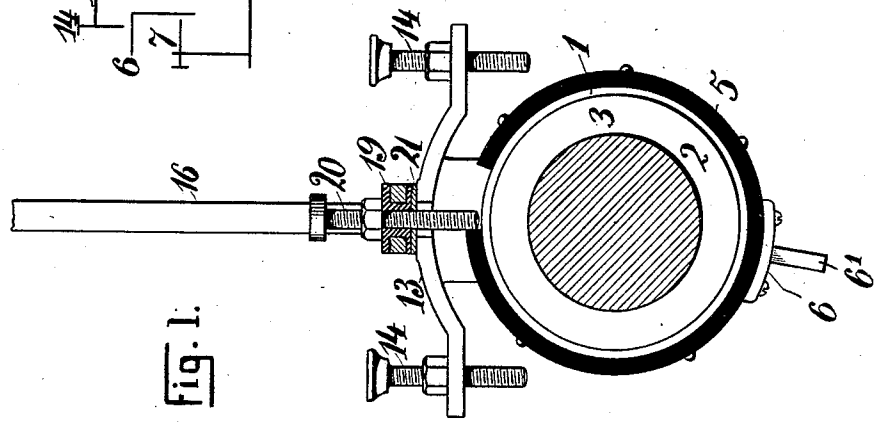

Fig. 1.

Witnesses.
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MEANS FOR REVERSING EXPLOSION-MOTORS.

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To all whom it may concern:

Be it known that I, OLE GRAVDAHL, a subject of the King of Norway, residing at Christiania, Norway, have invented certain new and useful Improvements in Means for Reversing Explosion-Motors with Electric Ignition; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to internal combustion engines, and has for its object to provide mechanism for reversing such engines by means of the electric ignition apparatus thereof. For this purpose two ignition circuits are arranged (a primary and an auxiliary circuit) one of which, the primary circuit, is employed during the regular running of the engine in one direction or the other, and is broken or rendered inoperative when the engine is to be reversed, while the other, or auxiliary circuit, is closed for a short time on reversing the engine, the closing being effected in such manner that the ignition produced occurs at a moment when the engine piston is in a position different from that occupied when the ignitions produced during the regular running of the engine occur.

In order that the stress upon the shaft of the engine at the moment of reversing should be as little as possible, the reversing means are preferably arranged in such manner that the closing of the reversing circuit does not take place before the speed of the engine is reduced to a certain minimum by means of interruptions of the regular ignitions. To obtain this, the closing of the reversing circuit is preferably effected automatically, for instance, by means of a centrifugal switch or contact, but it may also be brought about by means of an ordinary switch, actuated by hand.

One form of the reversing mechanism constructed according to this invention is illustrated, by way of example, in the accompanying drawing, in which—

Figure 1 is a vertical cross section of the apparatus, taken on line I—I of Fig. 2. Fig. 2 is a side view of the same. Fig. 3 is a diagram of the electric circuit.

The mechanism comprises a metal ring 1 rotatably mounted upon the engine shaft 2, where it is guided between the collar 3, secured to the engine shaft, and a bearing 4. Said ring 1 is on the larger part of its surface covered with a layer of an insulating material 5, on which is secured a metal plate 6 provided with a projection 6′ which is also insulated from the ring 1. The plate 6 and its projection 6′ forms the contact device in the reversing circuit. One terminal of the auxiliary circuit comprises a screw 7 which is arranged in a threaded bore of an arm 9 secured to a rod 8. This latter is slidingly mounted in a radial bore in a ring 10, and is acted upon by a spring 8′, shown in dotted lines in Fig. 2, the pressure of which counteracts any outward movement of the rod 8. On the bearing 4 is secured a metal bar 12 which is electrically insulated from the bearing and also from the metal parts of the engine by means of a plate 11 of insulating material. This metal bar 12 is provided with an arched cross-piece 13, situated over the ring 1 some distance from the latter and provided at its ends with adjustable screws 14 which form the other terminal of the auxiliary circuit.

The bar 12 has an upwardly projecting lug 15, to which the lower end of a rod 16 is pivotally connected. The rod 16 has an angle bar 18, to which is secured one end of a spring 17, the other end of which is secured to the bar 12. In an electrically insulating bushing or block 19 secured to the end of the angle bar 18 is inserted a screw 20, which also projects through a metal plate 21 on the underside of the insulating bushing 19. Consequently the screw 20 as well as the plate 21 is electrically insulated from the rod 16.

When the rod 16 is in the position shown in the drawing, the plate 21 rests upon the cross piece 13, so that the screw 20 is electrically connected with bar 12, and at the same time the lower end of said screw projects between the two ends of the plate 5 and prevents the ring 1 from rotating with the shaft 2. From the screw 20 or plate 21 a conducting wire leads to one pole in a contact device 26 for the regular ignitions, (see Fig. 3,) the other pole of which is electrically connected with an induction coil 23, through the metal parts of the engine and a wire leading from said parts. From the

induction coil 23, in the secondary circuit of which the ignition device 24 with the spark gap is arranged, a wire is led through the source of current 22 to the bar 12.

On the engine running forward or backward the various parts of the mechanism will occupy the positions shown in Figs. 1 and 2, the current flowing through the primary circuit as follows, (see Fig. 3): from the battery 22, bar 12, plate 21, screw 20, contact device 26, the metal parts or frame 25 of the engine, the primary winding of the induction coil 23, and back to the battery 22. Each rush of current through this circuit will produce a spark in the spark gap of the ignition apparatus 24, and effect the ignition of the explosion mixture. When the engine is to be reversed, the rod 16 is moved to the right from the position shown in Fig. 2, whereby the contact between the bar 12 and the plate 21 is broken. The current through the primary circuit is thereby interrupted and the explosions cease. This movement of the rod 16 causes the lower end of the screw 20 to be lifted out from between the ends of the insulating plate 5, and the latter together with the ring 1 will, on account of the friction between the ring and shaft, rotate until the projection 6′ abuts against one of the screws 14 and thereby comes into electrical connection with the bar 12. If the rod 16 is now released, the lower end of the screw 20 will abut against the insulating plate 5 and prevent the plate 21 from coming into contact with the bar 12. The explosions having now ceased, the velocity of the shaft will decrease and the rod 8 will be drawn into the ring 10 and nearer to the shaft 2 by means of the spring 8′ acting on said rod. When the speed has reached a certain minimum, the screw 7 during its movement with the shaft 2 will, for a moment, come into contact with the plate 6, and the auxiliary circuit will be closed thereby as follows: Projection 6′, screw 14, cross bar 13, metal bar 12, battery 22, primary winding 23, metal parts of the engine 25, engine shaft 2, ring 10, arm 9, back to screw 7. The current induced in the secondary circuit of the induction coil will produce a spark in the ignition apparatus 24 and the explosion mixture will be ignited. The screws 14 are previously adjusted in such manner that the ignition will take place when the piston is about in the middle of a stroke. The explosion which takes place will therefore effect a backward movement of the piston from this middle position, and the reversing of the engine has taken place at the same moment the projection 6′ is withdrawn from the screw 14 by means of the friction between the shaft 2 and the ring 1. During the rotation of the ring relatively to the bar 12 the screw 20 will slide on the insulating plate 5 until it falls down into the opening between the ends of the latter, and by abutting against one of the ends of the plate stops the movement of the ring with the shaft. The bar 12 and the screw 20 are thereby brought into contact with each other and the explosions can take place regularly until the engine is to be again reversed.

I claim—

1. In an apparatus for reversing internal combustion engines, a normally closed primary circuit, a normally open auxiliary circuit, an electrical spark producer in said circuits, means for breaking the primary circuit, a contact device in the auxiliary circuit revolubly mounted on but insulated from the engine shaft, a stationary terminal in said auxiliary circuit insulated from the shaft and adapted to be engaged by said contact device, and an automatically operated centrifugal member adapted to engage the contact device when the latter is in engagement with the stationary terminal and to close said auxiliary circuit.

2. In an apparatus for reversing internal combustion engines, a normally closed primary circuit, a normally open auxiliary circuit, an electrical spark producer in said circuits, means for breaking the primary circuit, an adjustable terminal member in said auxiliary circuit insulated from the engine shaft, a contact insulated from and movable by the shaft into contact with said terminal member, a terminal in the auxiliary circuit electrically connected with the shaft, and means operated by a decrease in the velocity of the shaft to move said electrically connected terminal into the path of the insulated contact.

3. In an apparatus for reversing internal combustion engines, a primary circuit, an auxiliary circuit, an electrical spark producer in said circuits, contact pieces forming terminals of the primary circuit, means to move said terminals into and out of contact, a projecting terminal in the auxiliary circuit on one of said contacts insulated from the engine shaft, a contact revoluble on but insulated from the latter, means to hold the revoluble contact out of engagement with said projecting terminal when the primary circuit is closed, a terminal in the auxiliary circuit carried by and in electrical contact with the engine shaft and means operated by decreased velocity of the shaft to move the latter terminal into engagement with the revoluble contact.

4. In an apparatus for reversing internal combustion engines, a battery, a primary circuit, an auxiliary circuit, an electrical spark producer in said circuits a stationary contact connected with the battery and insulated from the engine shaft, a movable contact in the primary circuit to engage the stationary contact, an insulating plate rotatable on the engine shaft, adjustable ter-

minals in the auxiliary circuit mounted in the stationary contact, a contact carried by and revoluble with the insulating plate adapted to engage said terminals, means on the movable contact to hold the latter out of engagement with the stationary terminal during the movement of the revoluble contact, a ring on the engine shaft electrically connected therewith and a spring-urged terminal for the secondary circuit mounted in said ring and adapted to engage the revoluble contact when the velocity of the shaft is diminished.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

OLE GRAVDAHL.

Witnesses:

HENRY BORDEWICH,

AUG. OLSEN.