

June 18, 1940.

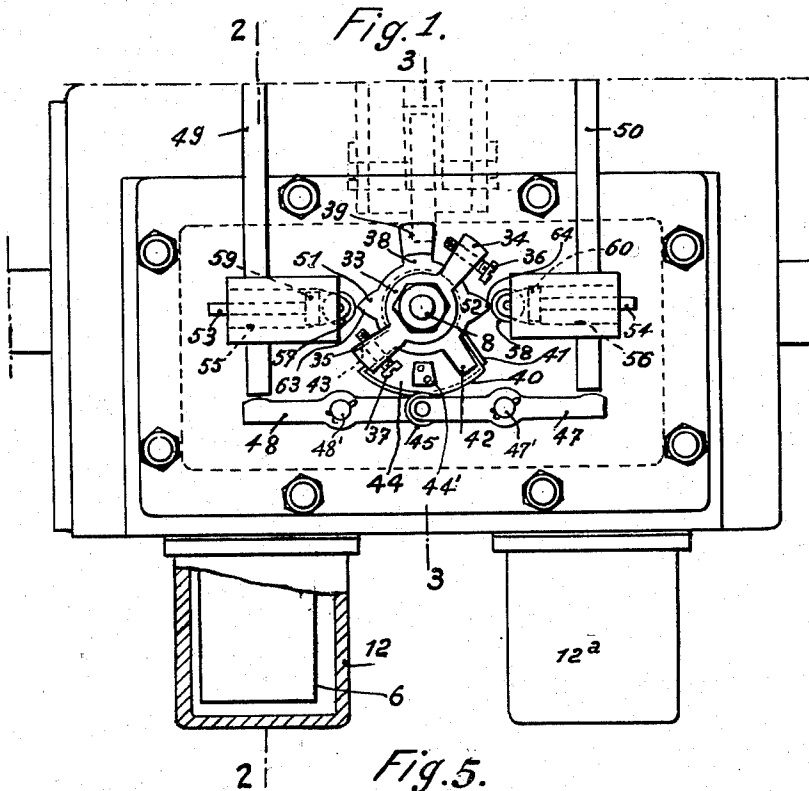
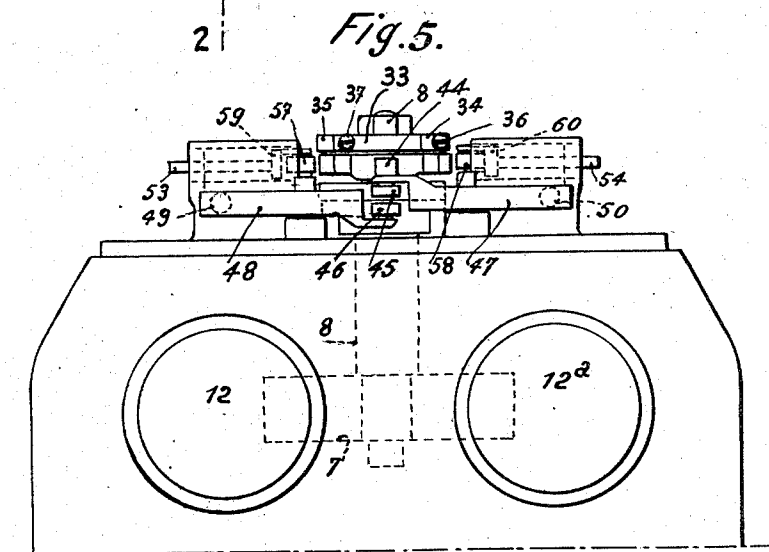
R. G. RINOT

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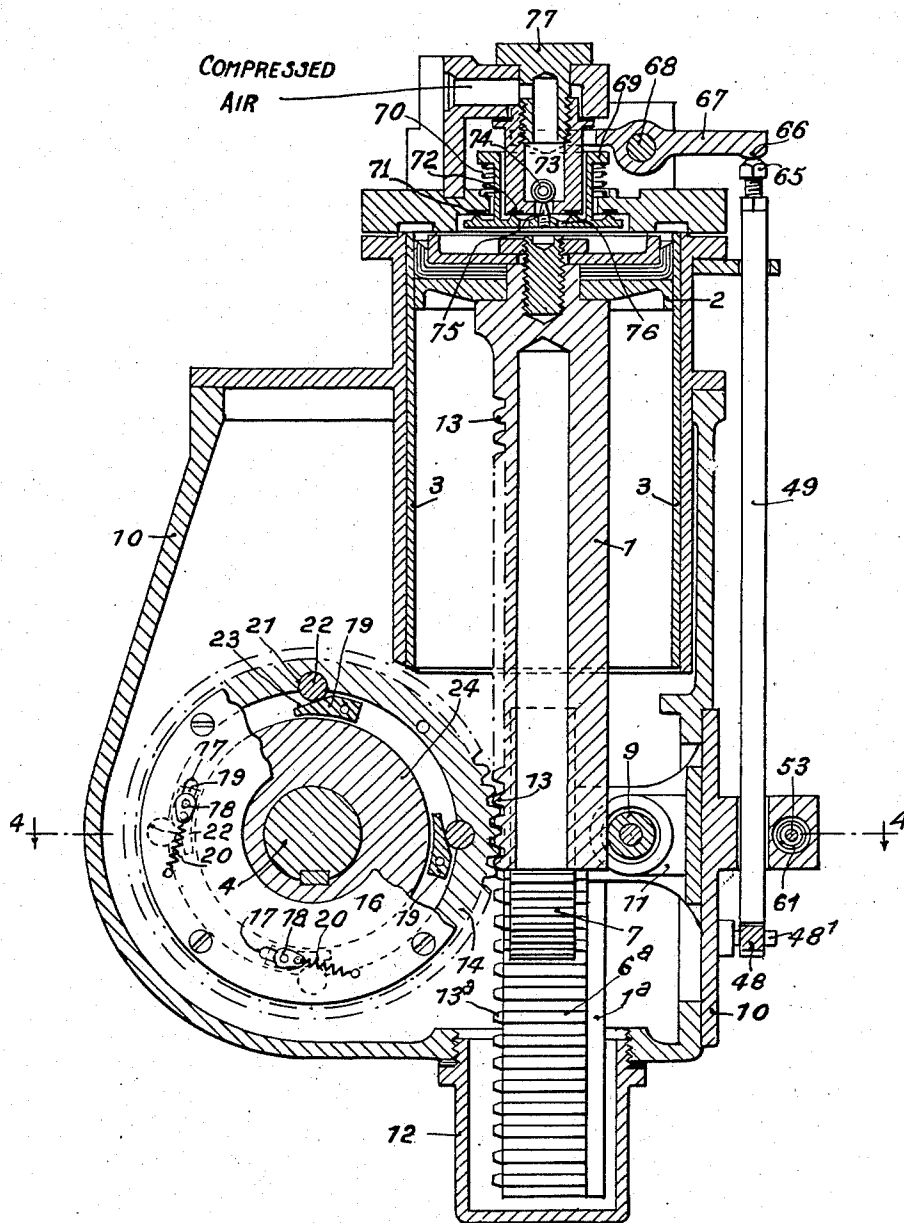
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Fig. 2.



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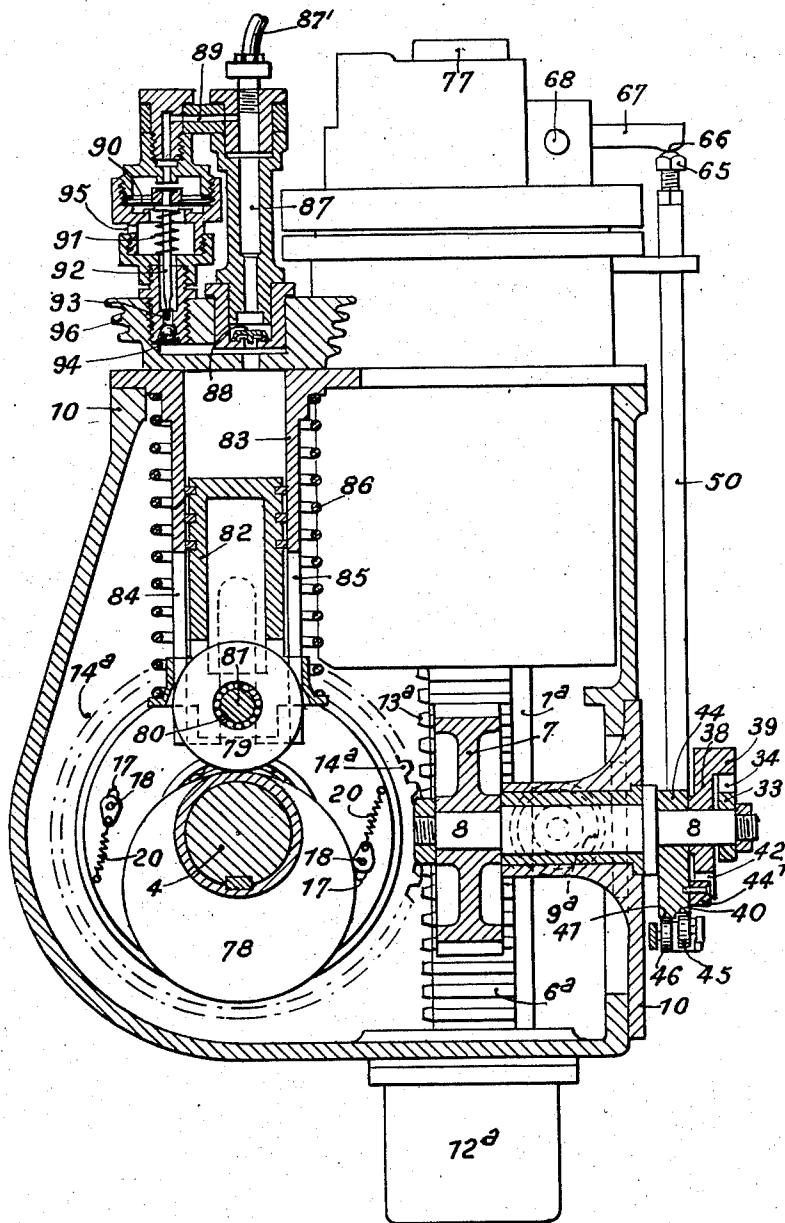
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Fig. 3.



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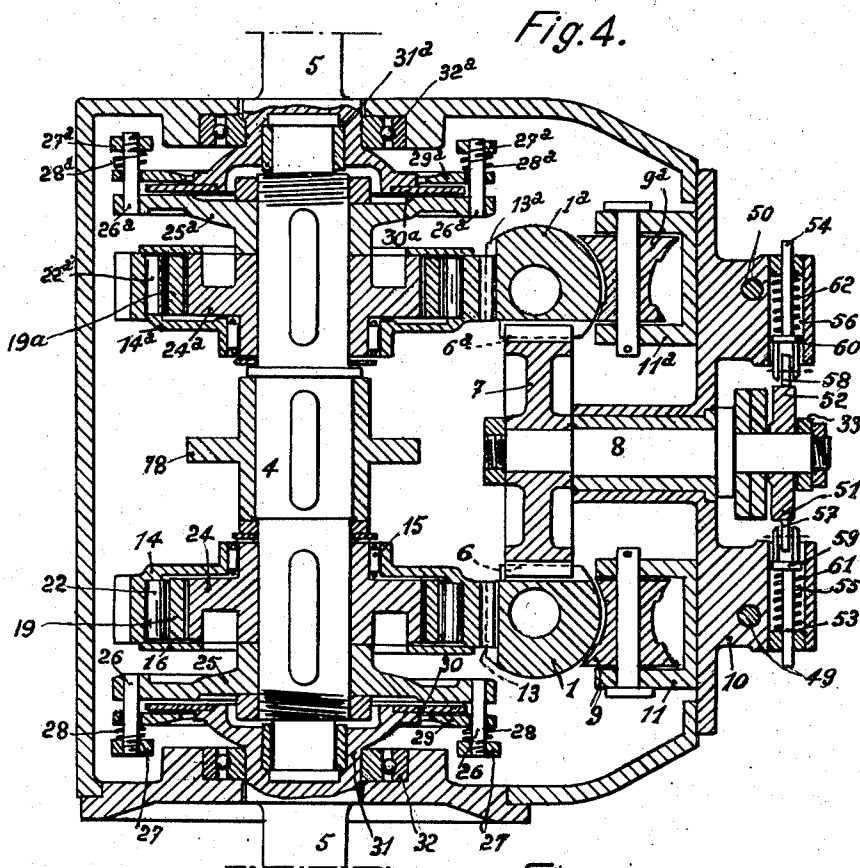
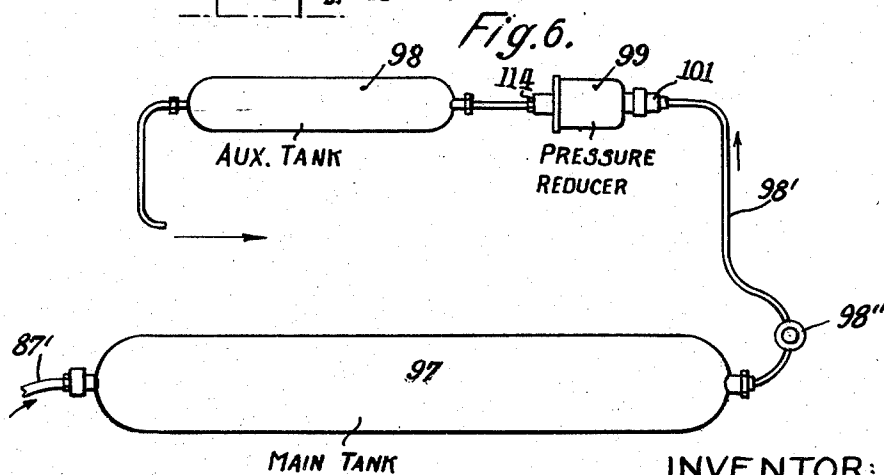
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Fig. 7.

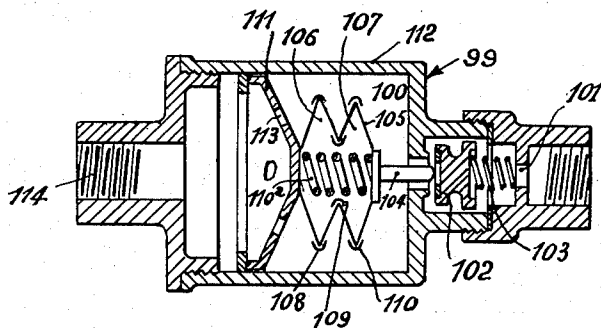


Fig. 8.

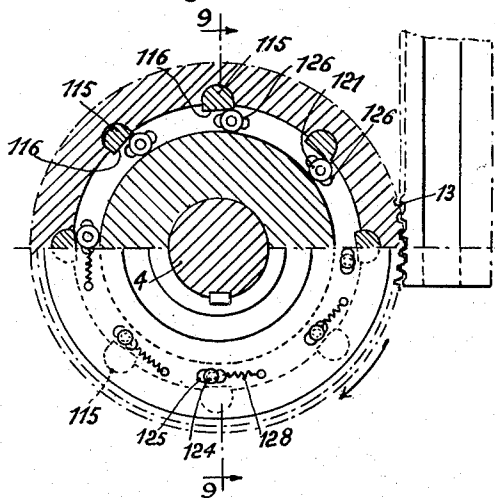


Fig. 9.

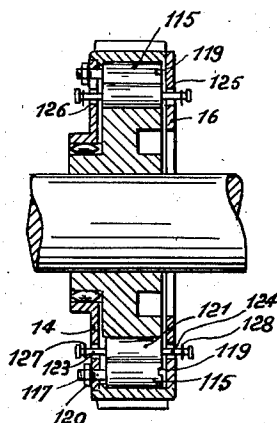


Fig. 10.



Fig. 12.

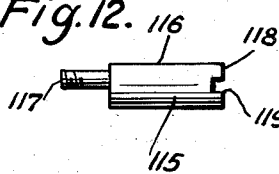


Fig. 13.

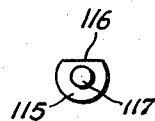


Fig. 11.



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UNITED STATES PATENT OFFICE

2,204,698

STARTER

Roger Georges Rinot, Paris, France

Application April 14, 1936, Serial No. 74,336
In France April 25, 1935

1 Claim. (Cl. 121—37)

This invention relates to a starter for explosion engines of any kind in which the driving medium is a fluid under pressure, for instance compressed air.

The main object of my invention is to provide a starter of the character indicated which will be very effective and economical in use, and reasonably simple in construction.

Another object is to have such a starter which imparts uniformly the same impulse to the shaft to be driven at each starting operation and within the various members are merely subjected to the same and no undue stresses.

A further object is to have the reciprocated members constantly balanced during movement.

Yet another object is to have all the mechanical members safely operating in oil while avoiding transmission losses.

It is also an object to automatically check any untimely return movements of the engine.

Other objects and the various advantages will appear hereinafter as the specification proceeds.

The following description, given by way of example only, will point out the features of the invention.

In the accompanying drawings:

Fig. 1 is a partial elevation of the starter;

Fig. 2 is a section, made according to line 2—2 of Fig. 1. Fig. 3 is a similar section on line 3—3 of Fig. 1;

Fig. 4 is a section made according to line 4—4 of Fig. 2;

Fig. 5 is a partial underside plan view;

Fig. 6 shows the arrangement of the compressed air tanks;

Fig. 7 is an axial section of the pressure reducing device;

Fig. 8 shows a modification in the mode of actuation of the main shaft of the starter, in the upper portion in cross section, in the lower portion in elevation;

Fig. 9 is an axial section taken on the line 9—9 in Fig. 8.

Fig. 10 is an elevation and Fig. 11 an end view of a roller appearing in the upper and lower portions of Fig. 9.

Fig. 12 is an elevation and Fig. 13 an end view of a wedge member also appearing in Fig. 9.

The driving elements of the starter are constituted by pistons the rods of which are designated by reference numbers 1 and 1^a and one head of which can be seen at 2. This head has reciprocating movement in a cylinder 3. Both cylinders are parallel and arranged at right angles to the main shaft 4 of the starter, which

shaft 4 is coaxial with the shaft 5—5 to be driven.

The piston rods 1 and 1^a are each provided with a rectilinear set of teeth 6—6^a each set being arranged opposite the other. One and the same pinion 7, having a cylindrical set of teeth, constantly meshes with the sets of teeth 6 and 6^a. Said pinion is keyed on a shaft 8.

Guides 9 and 9^a, attached to the casing 10 by supports 11 and 11^a, are provided for guiding the piston rods 1 and 1^a. Pits 12—12^a allow the complete stroke of the pistons.

The transformation of the rectilinear movement of the pistons into a movement of rotation is effected through the medium of rack devices. For that purpose, each of the piston rods, 1 and 1^a, is provided with a rectilinear set of teeth 13 and 13^a. These teeth mesh with toothed crown wheels 14 and 14^a resting on the shaft 4 through the medium of a needle bearing 15. A ring 16, fitted about shaft 4, is rigid with this crown wheel.

Apertures such as 17 (Fig. 2) are provided opposite each other in the crown wheel 14 and ring 16. In two corresponding apertures is fitted, with some play, a pin 18 rigid with a shoe member such as 19 thus mounted between the lateral part of the crown 14 and a sleeve 24 keyed to the shaft 4. A spring, such as 20, connects the pin 18 to a fixed point of the crown wheel 14.

The latter is provided with recesses 21, four in number in the example shown, in which rollers 22 are arranged.

Upon actuation of crown wheel 14 in a clockwise direction by the downward movement of the piston rod 1, these rollers are wedged in the angle formed by an oblique portion 23 of the shoe members 19 and firmly press the latter against the outer periphery of the sleeves, 24, 24^a. This action is facilitated by the effect of the springs 20, which constantly press the shoe 19 against the corresponding roller 22.

Discs 25—25^a are also keyed on shaft 4, near each of the sleeves 24—24^a. These discs carry at their periphery, pins or gudgeons 26—26^a, the heads 27—27^a of which, moreover adjustable in position, serve as bearings for calibrated springs 28—28^a which, through the medium of crown wheels 29—29^a shiftably mounted on the pins 26—26^a, press packings 30—30^a against the outer face of discs 25—25^a.

By the action of the various springs 28, regularly distributed about the crown wheel 29, and of the packing 30 rigid with a cap 31 presented by the shaft 5 to be driven, a stress limiting

clutch is provided between this shaft and the shaft 4 of the starter.

Shaft 5 rests on the casing through the medium of ball bearings 32—32^a.

- 5 The actuation of shaft 4 is alternately effected by each of the pistons, the driving phase of the latter being that of the downward stroke of their rod, respectively 1 and 1^a.

Owing to the presence of pinion 7, the speeds 10 of the piston rods are, at every instant, equal in absolute value but of reverse directions. The members receiving a reciprocating movement, being of symmetrical structure, are therefore constantly balanced.

- 15 During the downward stroke of rod 1 for instance, the actuation of shaft 4 is effected through the medium of the crown wheel 14 owing to the wedging of the rollers 22 in the angle 23 formed by the shoe members 19. During this phase, the 20 other piston idly rises, the shoe members 19^a being no longer pressed against sleeve 24^a by the action of the rollers 22^a. At the end of the stroke, the functions of the pistons are inverted.

The actuation of shaft 5 by shaft 4 is effected 25 through the medium of the clutch devices above described. In this way, the members of the starter are subjected only to stresses smaller than that from which the elements of the clutch slip one of the other. In these conditions, an untimely 30 return movement has not any prejudicial influence on the members of the starter. This protection is moreover practically indispensable for the proper operation of the starter, considering that a rotation, in a direction reverse to the normal 35 direction of shaft 4, causes the movement of the piston rods 1 and 1^a to be stopped owing to their common engagement with pinion 7.

The clutch devices moreover ensure the checking of the return movements of the engine and 40 avoid the dangers they involve.

In this case, the gaskets 30—30^a slide against the exterior surface of discs 25—25^a, the braking strain being produced by the action of springs 28—28^a.

- 45 For distribution purposes, a small bar 33 (Figs. 1 and 5) is keyed, outside the casing 10, at the end of shaft 8. This bar ends in two heads 34 and 35 traversed by screws, 36 and 37 respectively, which serve as stopping members. A catch 50 38 is mounted loose on the shaft 8; this catch carries a finger 39 extending outside the plane of the catch and which is thus within the plane of the trajectories of the screws 36 and 37. The catch presents in its plane tappets 42 and 43.

- 55 A sector 44 is mounted loose on the shaft 8 behind the catch 38 (Fig. 1). On the periphery of this sector there are arranged two cams 40 and 41, with symmetrical profiles. This sector carries a boss 44' which extends beyond its plane 60 so as to be in the plane of the trajectory of the tappets 42 and 43.

- Cooperating with the cams 40 and 41 there are 65 rollers, 45 and 46 respectively, carried at the end of levers 47 and 48, mounted to oscillate around axes 47', 48', integral with the case 10. The other ends of the levers 47, 48 are in contact with the valve rods 50 and 49.

- The catch 38 is moreover provided with diametrically opposed projections 51, 52 of a prismatic shape. These projections cooperate with 70 rollers 57, 58 carried at the ends of rods 53 and 54 arranged in seats 55 and 56 integral with the case 10. Shoulders 59, 60, provided on the rods 75 53, 54, serve as a support for helical springs, 61,

62, wound around said rods, the other support of which is the bottom of the seats 55, 56.

In the position shown in Fig. 1, the dog or catch 38 has been turned, by the action of the screw 36 on the finger 39, until the edges 63 and 64 are in contact with the rollers 57 and 58. At the following moment, and the rotation of the bar continuing, the action of the springs 61 and 62 imparts a powerful impulse to the dog 38 by the pressure of the rollers 57, 58 against the slopes of the prismatic projections 51, 52 and the tappet 43 violently strikes against the boss 44' (direction of rotation reverse to the clockwise direction;) the sector 44 thus turns suddenly around the shaft 8, while cam 41 simultaneously depresses the roller 46 of lever 48 and thereby actuates the latter with consequent sudden raising of the valve rod 49. At the same time the low portion of cam 40 moves under roller 45 of lever 47 upon which the valve rod 50 rests. 20 Thus a free operation of the valve rods 49 and 50 results as an advantage of this invention.

Each of the valve rods, 49 for instance (Fig. 2) carries, at its upper end an adjustable abutment screw 65 constantly in contact with the end 66 25 of a fork 67 pivoted about a pin 68. These forks each engage with a valve head such as 69. The head 69 is constantly urged upwardly, position of admission, by a spring 70. Fluid-tightness is obtained by packings 71 and 72. 30

Compressed air is admitted through a chamber 73 in communication with the cylinder in the upper position of the head 69, owing to the lifting of a ball 74 by a needle 75 rigid with the head. Orifices 76 are formed in said head for the passage of compressed air. A plug 77 closes the upper part of chamber 73. 35

For simplification and for greater compactness, a compressor is moreover incorporated with the starter in one and the same unit. 40

For that purpose, the shaft 4 carries an eccentric wheel 78 which engages with a roller 79, having a large rolling surface, said wheel being mounted, through the medium of a needle bearing 80, on a pin 81, carried by a piston 82. 45

This piston moves in a cylinder 83; two longitudinal grooves 84 and 85 allow the passage of the roller 79. The return of piston 82 downwardly is effected through a powerful spring 86, surrounding the cylinder 83, and taking a bearing 50 on a fixed part of the casing 10.

The compressed air is delivered through a pipe line 87, separated from the inner space of the cylinder 83 by a free valve 88. The delivery pressure acts, through a tubular member 89, on the upper face of a diaphragm 90, on the other face of which a calibrated spring 91 exerts its action. The downward displacements under the influence of the delivery pressure, are reproduced by a rod 92 which, for the depressed position of diaphragm 90, unseats, through a needle 93, a ball 94 which separates, upon efficient operation of the compressor, the compression chamber from the atmospheric air suction port 95. 55

It will be understood that as long as the delivery pressure remains lower than a predetermined value, the rod 92 remains in its upper position and allows the ball 94 to fit upon its seat upon upward movement of piston 82. The tank 70 in communication with the pipe line 87 is then supplied with compressed air.

On the contrary, beyond this value, the ball 94 remains constantly unseated, so that the compressed cylinder charge, instead of lifting the 75

valve 88, escapes in the atmosphere through port 95.

Fins or gills 96 are provided for cooling purposes at the upper part of the compressor.

5 The compressed air is sent through a pipe fitting 87' into a tank or reservoir which, preferably, feeds the starter through the medium of a second tank. Such an arrangement is shown in Fig. 6 of the accompanying drawings.

10 The tank fed by the compressor, or main tank, 97, is separated from the auxiliary tank 98, by a pressure reducing device 99 which maintains the pressure existing in tank 98 to a constant value.

15 This pressure reducing device is shown in longitudinal section, on a large scale, in Fig. 7. It comprises a chamber 100 connected to tank 97 by a fitting 101 and a pipe line 98'. A valve 102 is arranged at the inlet of this chamber. It is on the one hand urged in closed position by a light spring 103 and can, on the other hand, be subjected to the action of a rod 104 rigid with a collapsible box 105, composed of one or more elements, two in the example illustrated, 106 and 107, and directed according to the axis of said box.

The distortion of box 105 is prevented in the transverse direction by hoops 108, 109 and 110.

20 This box contains a calibrated spring 110^a, arranged in alignment with rod 104. It is carried by a wall 111 rigid with the body of the pressure reducing device and said wall is provided with orifices 113 for the passage of air towards the auxiliary tank through a pipe line 114.

25 If the pressure existing in tank 98 is sufficient, its action on box 105 is such that, notwithstanding the presence of the spring 110^a, the rod 104 is in offset position and does not prevent the closing of valve 102 by the action of the air at a high pressure contained in tank 97.

30 If, on the contrary, the pressure in tank 98 lowers, for instance owing to one or more startings, the action of spring 110^a is sufficient for causing the valve 102 to be lifted and for causing tank 98 to be fed up to the desired rate of pressure.

35 The setting in action of the starter is simply obtained by causing tank 98 to communicate with the chamber 73 by opening a cock 98'' on the line 98' connecting the reservoir 97 to the reducing member 99.

40 According to the modification, illustrated in Figs. 8 to 13, of the mode of actuation of the main shaft of the starter, the wedging members are constituted by wedges 115 shown in Figs. 12-13; these wedges are in the shape of a cylinder provided with a flat portion 116 and they terminate in a screw-threaded portion 117; on the head 118 is formed a slot 119 for the introduction of a screw-driver. The wedges 115 are rendered rigid with the crown wheel 14 by means of nuts 120; they are given the exact necessary set-

ting by rotation under the action of a screwdriver introduced in slot 119.

With these wedges cooperate rollers 121, shown in Figs. 10 and 11, provided at their ends with small rods 123 and 124; the latter are fitted into apertures 125 and 126 provided, on the one hand, in ring 16 and, on the other hand, in crown wheel 14. To these small rods are secured springs 128 and 127, the other ends of which are attached to ring 16 and crown wheel 14, respectively.

10 This mode of actuation has the advantages that it is the same members which are used at one and the other ends of the main shaft of the starter, and this ensures a standardization of the manufacture. Moreover, these members are simple, not costly, and they can be easily fitted up in position. Furthermore, they ensure an actuation which is positive, even in oil in cold weather and absolutely progressive even for a violent putting in communication with the source of energy, and finally, without appreciable wear, even after a very long time of use, resulting therefrom.

I claim:

15 In a compressed fluid starter for explosion motors, the combination of two cylinders, two pistons individually reciprocable in these cylinders, two piston rods, two relatively angularly disposed flat surface portions on the piston rods, a toothed rack on each of said flat surface portions, a pinion having a shaft and meshing with the two toothed racks, a small bar member keyed on the shaft of said pinion, heads serving as abutment elements at the ends of said small bar member, a disc loosely mounted on the shaft of said pinion, a finger rigid with said disc and serving as an abutment element corresponding to and receiving impulses upon opposite portions thereof from said two abutment elements, prismatic shoulders on this disc, two rollers individually and slidably mounted in two boxes, elastic means, said rollers being subjected to the action of said elastic means and said elastic means resiliently yielding when the rollers are pushed down by said shoulders and returning its energy after the rollers pass the crests of the shoulders, two drivers carried by said disc, two cams mounted concentrically with the shaft of said pinion, a boss integral with these two cams, two levers, two rollers cooperating with said cams and carried at one end of each of said levers, two distribution valves having stems constantly in contact with the other ends of said levers so that the admission and exhaust in the cylinders, though occurring at the end of the stroke of the pistons, are energetically controlled by reason of the energy restored by the elastic means, a driven shaft, and means for transmitting the motion of each of the pistons to the guided shaft only during the working stroke of said pistons.

ROGER GEORGES RINOT.