F. W. PECK.

EXPLOSIVE ENGINE.

APPLICATION FILED FEB. 18, 1907.

999,518.

Patented Aug. 1, 1911.

2 SHEETS—SHEET 1.

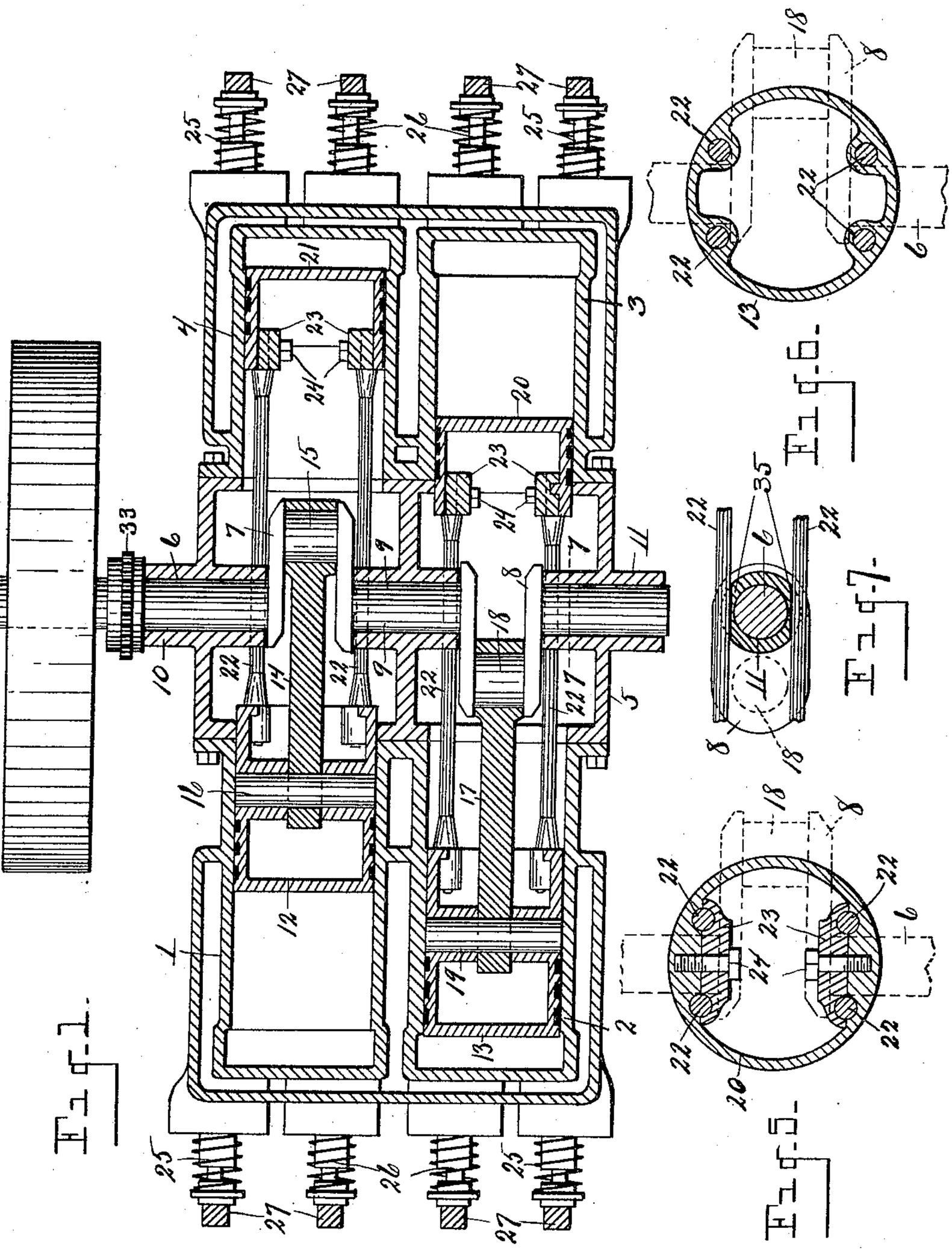

Fig. 1.

Fig. 6.

Fig. 7.

Fig. 5.

WITNESSES

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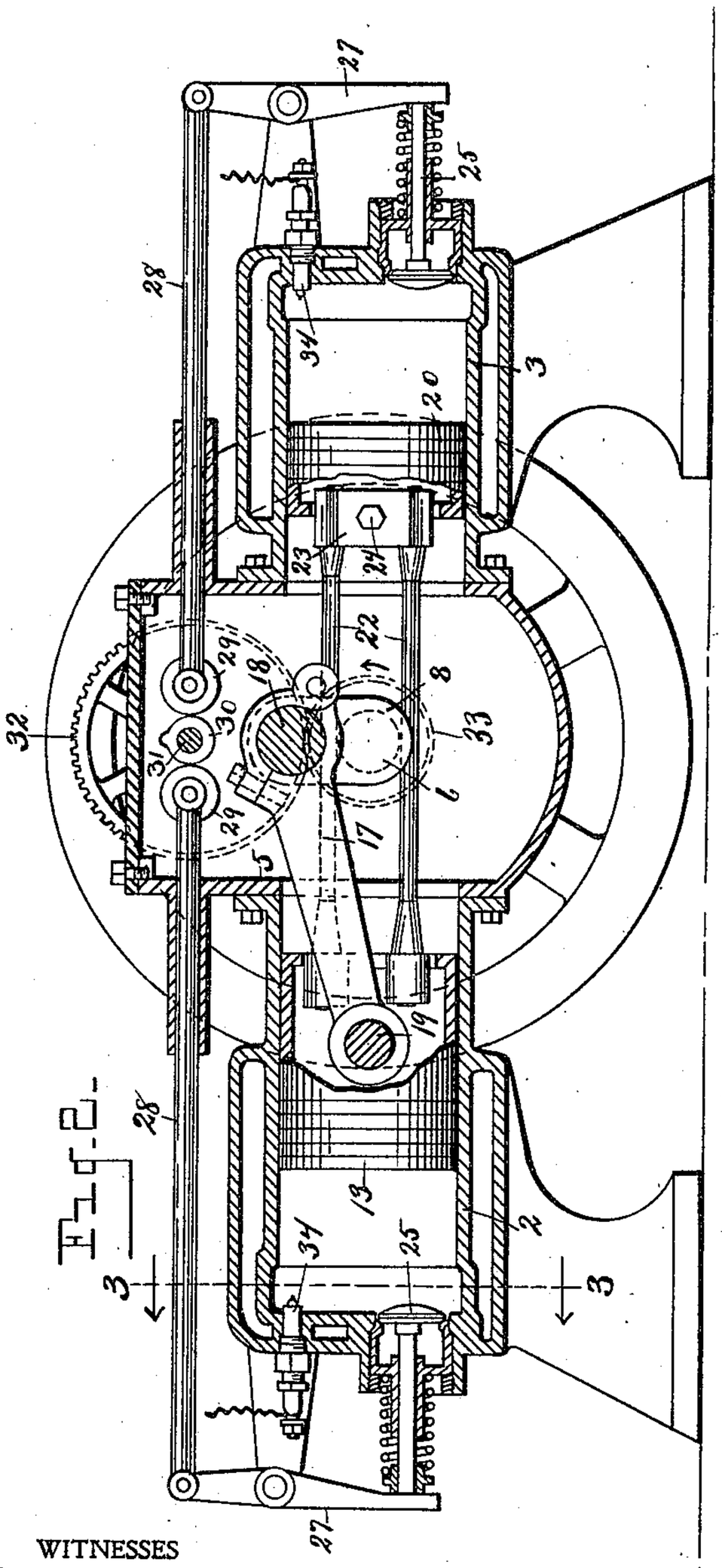

FIG. 2.

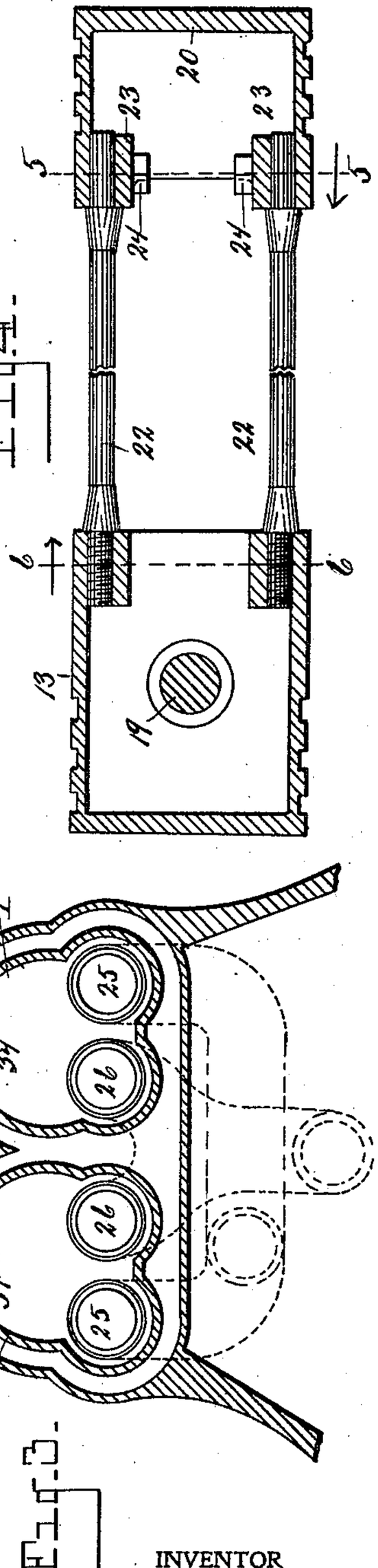

FIG. 4.

FIG. 3.

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UNITED STATES PATENT OFFICE.

FREDERICK W. PECK, OF DETROIT, MICHIGAN.

EXPLOSIVE-ENGINE.

999,518. Specification of Letters Patent. **Patented Aug. 1, 1911.**

Application filed February 18, 1907. Serial No. 357,808.

To all whom it may concern:

Be it known that I, FREDERICK W. PECK, a citizen of the United States, residing at Detroit, in the county of Wayne, State of Michigan, have invented certain new and useful Improvements in Explosive-Engines; and I do 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 the figures of reference marked thereon, which form a part of this specification.

This invention relates to new and useful improvements in explosive engines, and consists in the construction and arrangement of parts hereinafter more fully set forth and pointed out particularly in the claim.

The objects of the invention are to produce a four-cylinder engine wherein the maximum of power may be attained with a minimum of weight, and wherein provision is made for balancing the parts so as to greatly reduce vibration; to construct the engine so as to enable ready access to all of the interior parts thereof; to provide for connecting the opposed pistons in pairs so as to reduce the bearings to the minimum and afford two free running pistons; to provide for so locating the bearings of the crank shaft as to prevent the springing thereof when receiving the thrust from the pistons and to provide for constructing the cranks and pins in a double opposed cylinder engine sufficiently heavy to properly carry the strain imparted thereto by the piston thrust.

The above objects are attained by the structure illustrated in the accompanying drawings, in which—

Figure 1 is a horizontal section through the cylinders and pistons of an engine embodying my invention, the crank shaft appearing in elevation. Fig. 2 is a longitudinal section through one pair of cylinders, the pistons in said cylinders being partly broken away to show connection between the crank shaft and one of the pistons and the coupling rods joining the opposed pistons in pairs. Fig. 3 is a transverse section through one end of two of the cylinders, as on line 3—3 of Fig. 2. Fig. 4 is a longitudinal section through a pair of the pistons, showing the manner in which they are connected. Fig. 5 is a transverse section through the inner end of the short piston as on line 5—5 of Fig. 4. Fig. 6 is a similar section through the long piston as on line 6—6 of Fig. 4. Fig. 7 is a transverse section through the crank shaft and bearing as on line 7—7 of Fig. 1.

Referring to the characters of reference, 1, 2, 3 and 4 designate the cylinders which are cast in pairs, and which at their base are securely bolted to the crank case 5 which is interposed between the inner ends of said pairs of cylinders. Passing through the crank case is the crank shaft 6 carrying the opposed cranks 7 and 8, a central bearing being provided for said shaft at 9 between the cranks, and end bearings being provided for said shaft in the ends of the crank case, as at 10 and 11.

Within the cylinders 1 and 2 are the pistons 12 and 13 respectively, piston 12 being connected to the crank 7 by the connecting rod 14, one end of which is journaled upon the journal or pin 15 of said crank, the other end being journaled upon the piston pin 16. In like manner, piston 13 is connected with crank 8 through the connecting rod 17 journaled at one end upon the pin 18 of said crank, and at the other end upon the piston pin 19. By this arrangement, it will be noted that only the pistons 12 and 13 in the long cylinders 1 and 2 are connected directly to the cranks. Within the short cylinders 3 and 4 are the relatively short pistons 20 and 21 respectively, each of which is coupled to its opposed piston in the opposite long cylinder by the coupling rods 22, of which there are four for each pair of pistons. Said rods are threaded at one end for attachment to the long pistons 12 and 13 into tapped apertures in which they are screwed, as shown in Fig. 6, and at the other ends are secured to pistons 20 and 21 by means of the clamping plates 23 which are made to clamp the ends of said rods by passing the screw bolts 24 through said plates and into the walls of said pistons, as clearly shown in Fig. 5, thereby coupling the opposed pistons in pairs and enabling each pair of pistons to be connected to the crank shaft through the medium of a single crank and a single connecting rod. It will be noted that the crank shaft passes between the coupling rods which are spaced such distance apart as to enable the full size of the crank shaft to be employed within the crank case. It will also be ob-

served that the pistons are connected by the coupling rods after the crank shaft has been placed in its bearings, obviating the necessity of passing the shaft and cranks longitudinally between said rods and enabling cranks and crank pins to be employed of greater transverse area than the crank shaft, an arrangement which renders the crank shaft strong and rigid at the point of the application of thrust from the connecting rods, and obviates the liability of heating the crank pins by increasing the bearing surface thereof.

The pistons 12 and 13 with which the cranks are directly connected, are made long so as to afford sufficient bearing in their respective cylinders to obviate the liability of cramping, while the pistons 20 and 21 being free running, are made short so as to reduce the weight and minimize the friction. By this arrangement of connecting the four pistons in pairs and transmitting their impulses to the shaft through two connecting rods and two cranks, two free running pistons are afforded, and at the same time the use of two cranks, two connecting rods, two crank pins, and two piston pins is obviated, while two trunk pistons are replaced by two light ones and one pair of cylinders is rendered proportionately shorter, thus considerably reducing the weight of both the cylinders and pistons as compared with other engines of the four cylinder type, at the same time doing away with at least four bearings and a corresponding amount of friction.

Each cylinder is provided with a suitable exhaust valve 25 and with a suitable intake valve 26. These valves are actuated through the medium of the levers 27, to the ends of which are pivoted the actuating rods 28, whose inner ends extend into the case and carry the antifriction rollers 29 that are in peripheral contact with a cam ring 30 on a transverse shaft 31 journaled in the case and carrying a gear wheel 32 driven from a pinion 33 on the crank shaft. There are employed as many of the rods 28 as are necessary to properly actuate the valves of the cylinders, all of which are operated by the shaft 31 in the manner illustrated in Fig. 2. The arrangement of the parts is such that the explosions occur sequentially in cylinders 1, 2, 3 and 4, whereby in a four-cycle type of engine, two impulses are imparted to the crank shaft during each revolution thereof.

To enable a crank shaft to be employed of maximum transverse area, with a minimum cylinder-bore, and at the same time provide for coupling the pistons by the four coupling rods, it may be necessary, in some instances, to cut away the bearings of said shaft to afford a free travel for said rods, as shown at 35 in Fig. 7, an arrangement which is preferable to reducing the length of the shaft bearings.

Having thus fully set forth my invention, what I claim as new and desire to secure by Letters Patent, is:—

An explosive engine comprising two pairs of opposed cylinders located side by side, the cylinders of each pair being disposed in axial alinement, a crank case between said pairs of cylinders to which the cylinders of each pair are detachably connected, a relatively large crank shaft journaled in the case having two opposed cranks, shaft bearings in said case extending to the faces of said cranks and having flattened sides, pistons in said cylinders, four independently removable rods detachably and adjustably connecting in pairs the pistons in the axially alined cylinders, said rods embracing the flattened sides of the shaft bearings adjacent the faces of the cranks to keep them within the area of the bore of the cylinders, said cranks being greater in width than the horizontal spaces between the parallel piston rods to afford said cranks the required transverse area, and a single connecting rod connecting each pair of pistons to one of said cranks.

In testimony whereof, I sign this specification in the presence of two witnesses.

FREDERICK W. PECK.

Witnesses:
O. B. Baenziger,
I. G. Howlett.