March 21, 1939. C. E. BURCH 2,151,402

AIR COMPRESSOR

Filed March 15, 1937 3 Sheets-Sheet 1

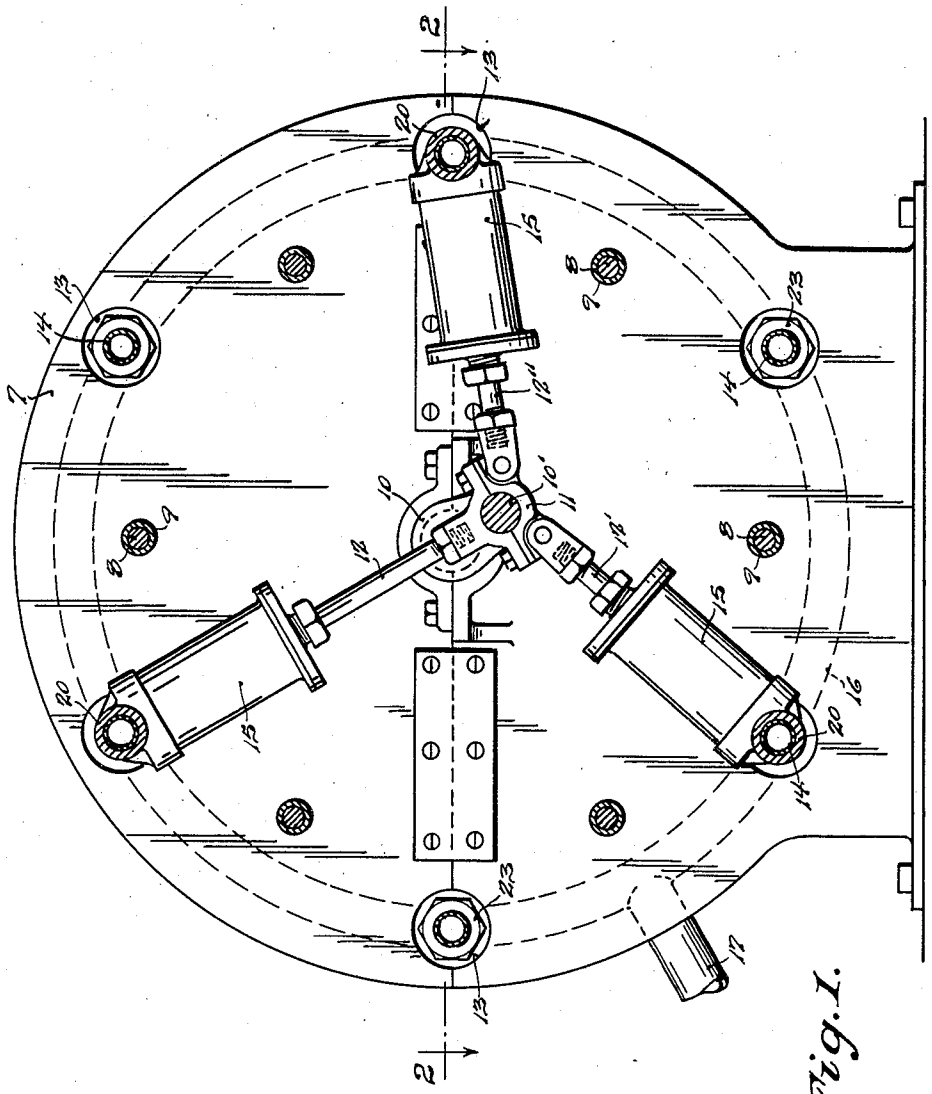

Fig. 1.

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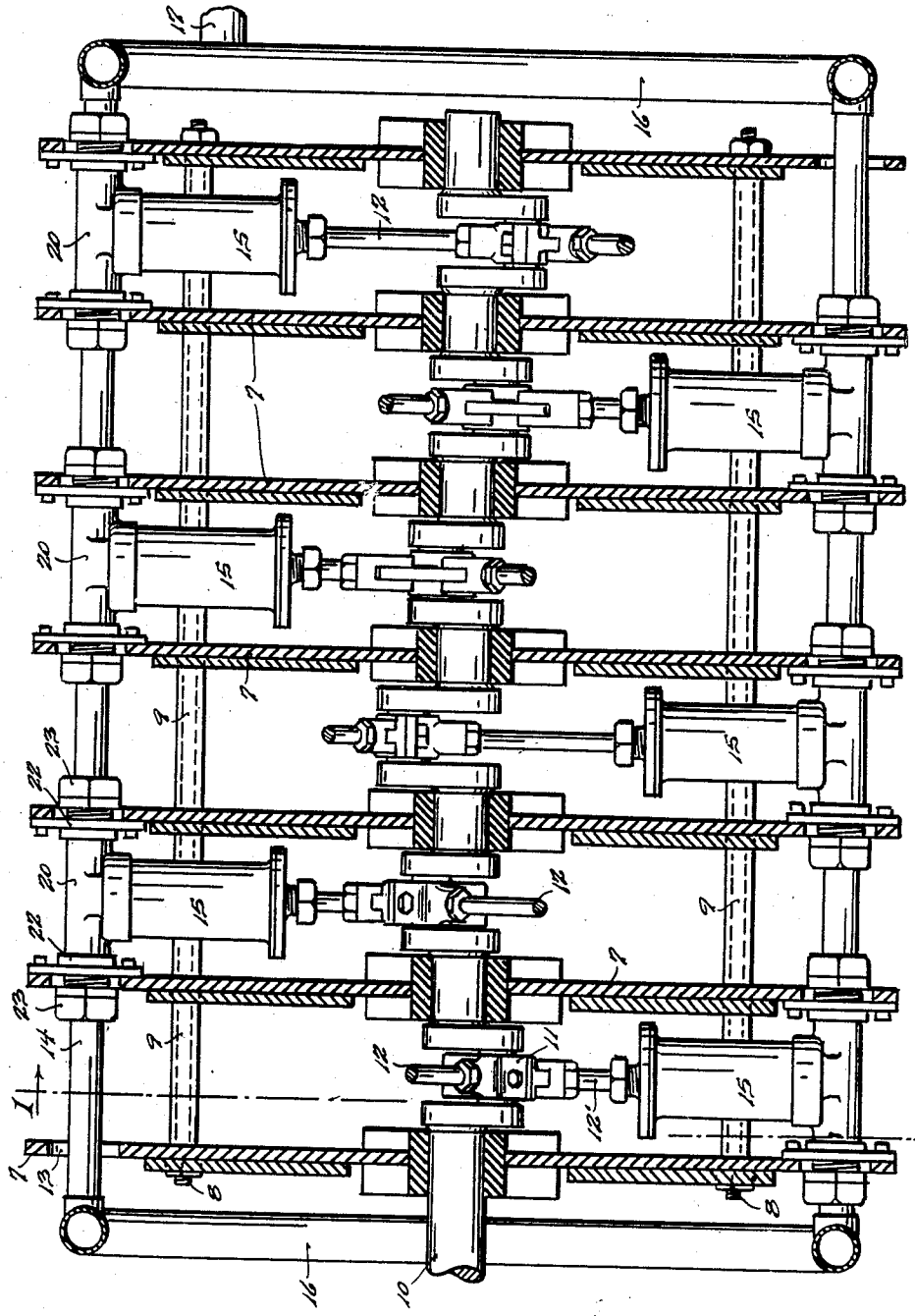

Fig. 2.

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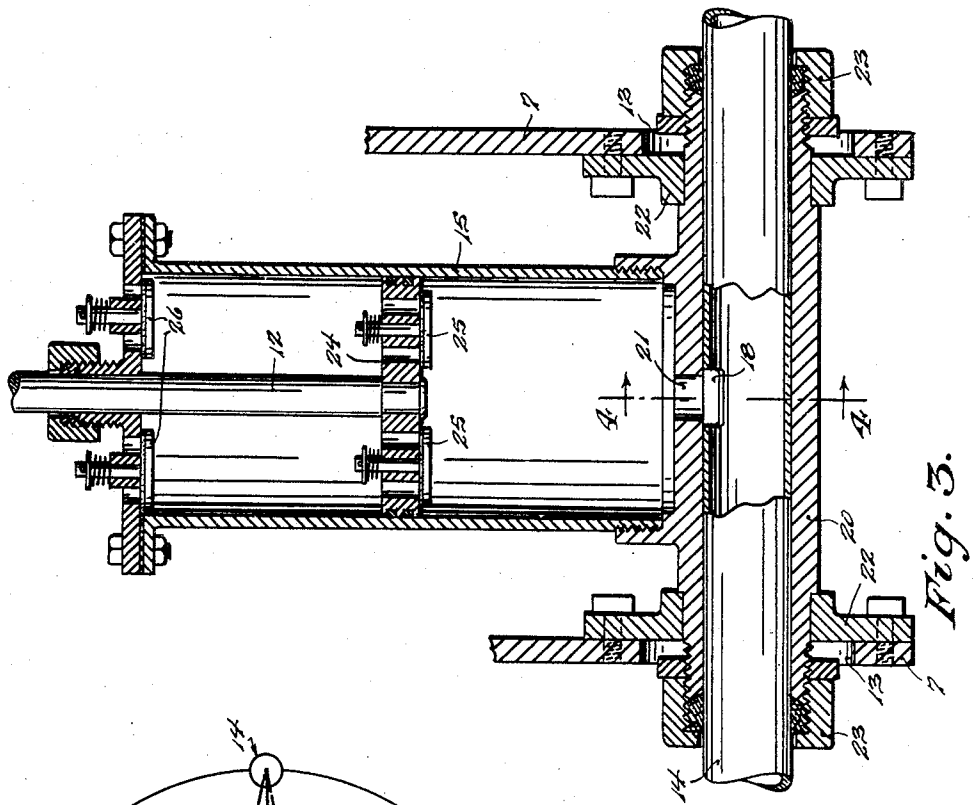

Fig. 3.

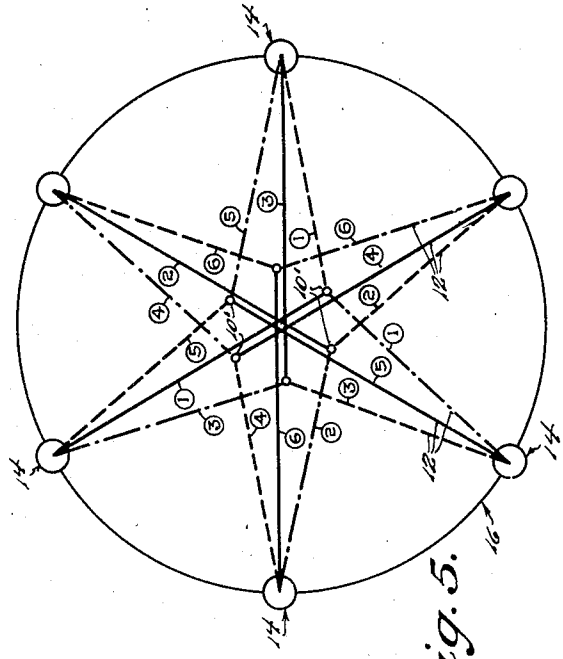

Fig. 5.

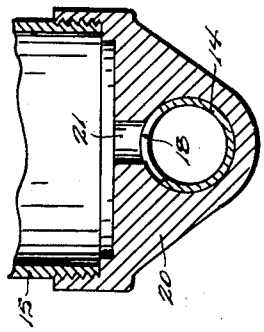

Fig. 4.

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UNITED STATES PATENT OFFICE

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AIR COMPRESSOR

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Application March 15, 1937, Serial No. 130,918

3 Claims. (Cl. 230—194)

This invention relates to air compressors and is especially directed to a reciprocating-piston character of air compressor.

As its principal object, the present invention aims to improve the efficiency of engines of the above character and this I achieve by associating the cylinders of a multiple-cylinder engine in such a manner that the related pistons act to compress under pressure in a peculiarly advanced manner by which the pressure upon the compressing piston in no way opposes the simultaneous suction-stroke travel of an associated piston. A further and related object of the invention is to provide, through the association referred to, a more effective balance as between the several pistons of the engine than has heretofore been possible.

The foregoing, together with further and more particular objects and advantages, will become apparent in the course of the following detailed description and the claims annexed thereto, the invention consisting in the novel construction, adaptation, and combination of parts hereinafter described and claimed.

In the drawings:

Figure 1 is a transverse vertical section taken on the line 1—1 of Fig. 2 to illustrate a compressor constructed according to the now preferred embodiment of the present invention.

Fig. 2 is a horizontal section taken on the section line 2—2 of Fig. 1, the view being somewhat schematic in that each of the several indicated cylinders, for simplicity in illustration, is represented as lying in a common horizontal plane whereas (note Fig. 5) the first, second, fourth and fifth cylinders, assuming the engine to be in that position of its cyclical activity shown in Fig. 1, properly are inclined slightly above and below this plane.

Fig. 3 is an enlarged fragmentary longitudinal vertical section detailing the construction of one of the air-compressing cylinders and the supporting manifold by which the same is pivotally carried.

Fig. 4 is a fragmentary vertical section taken on the line 4—4 of Fig. 3; and

Fig. 5 is a diagrammatic end view indicating the axial lines of the several cylinders in the relative positions in which the same lie at that selected point in the cyclical activity of the compressor represented in Figs. 1 and 2.

The reference numeral 7 designates fixed annular plates which lie in longitudinally spaced relation and are rigid with respect to a suitable engine base. The plates, seven in number, are interconnected by rods 8 and associated spacers 9 and centrally of each provide a main bearing for a six-throw crank shaft 10 of which the several crank pins 10' lie in the spaces between the separated plates. The crank pins respectively are engaged by a connecting rod bearing 11 to which are attached three rods located at angles of 120° to one another.. Of these rods, indicated by 12, 12' and 12'', the former is represented as being fixed to and the other pair of rods as pivotally engaging the bearing member 11 although it is obvious that the plates 7 might be spaced to a greater extent and the crank shaft formed to allow the rods to lie in side-by-side relation and each find a direct bearing on the crank pin.

The plates, adjacent the perimeter thereof and at intervals of 60°, provide openings 13 aligned longitudinally of the engine and through these openings are received manifold pipes 14. The pipes, operating as wrist pins, provide a pivotal mounting for cylinders 15 and these cylinders I arrange in alternating relation which is to say that the cylinders, three in number, associated with the second pin of the crank shaft lie between the cylinders associated with the first crank pin. Each of these circumferentially-spaced pivot-forming manifolds connect with one another through the instrumentality of end conduits 16, from which a delivery pipe 17 leads to a suitable pressure tank or directly to the work, as may be desired.

As respects said cylinder mounting, each manifold provides slots 18 in the transverse vertical planes of related alternate crank pins and fitting over such slotted portions are wrist-type sleeves 20 which rigidly engage the respective cylinder. Egress ports 21 in the sleeves lie in registering relation to the slots 18 to obtain communication as between the cylinder chamber and the manifold. At each end of the sleeves are external bearing surfaces which find a seat in the bore of collars 22 bolted to the plates 7. Terminal threads on the sleeves accommodate packing assemblies of which the followers are denoted by 23.

Each cylinder is of closed design with the bottom wall thereof axially bored for the reception of the respective connecting rod to which is coupled a piston 24 fitted with spring-closing check valves 25 permitting passage of air in the down-stroke travel of the piston only. In said bottom wall of the cylinders are similarly acting check valves 26.

Believed to be clear is the system of compres-

sion employed, the check valves **26** admitting atmospheric air behind the up-stroke movement of the piston, the check valves **25** in the latter being held in their seated position throughout the greater portion of the piston's downstroke movement and being unseated only as the compression pressure of the air below the piston exceeds the pressure obtaining in the manifold, the connecting arranagement of the latter acting to deliver to each cylinder in the down-stroke movement of the piston therein a volume of compressed air equivalent to that simultaneously displaced from another cylinder in the engine. According to the present invention, eighteen or more cylinders afford the degree of balance required to effectively equalize compressor stresses, six of these cylinders or, stated otherwise, one cylinder from each of the six manifold-coupled groups of three, acting in unison.

Utilizing, according to location relative to the crank shaft, the numerals **1** through **6** as a means of identifying the cylinders, the numeral **1** for example indicating the axial lines of the three cylinders whose pistons connect by the rods **12**, **12'**, or **12''**, as the case may be, with the first pin of the crank shaft, the numeral **2** the axial lines of the three next adjacent cylinders which engage the second crank pin, etc., I illustrate in Fig. 5 the relative location of each of the several cylinders in an eighteen-cylinder compressor engine from which it will be readily seen that the cylinders associated with the first, third, and fifth crank pins find their pivotal mounting on one group of equally spaced manifolds while the cylinders associated with the second, fourth, and sixth crank pins find their pivotal mounting on the intervening manifolds. In said diagrammatic view, full lines are employed to represent the six cylinders under full compression action, dash lines the six cylinders approaching compression action, and dash-and-dot lines the six cylinders which in their up-stroke activity expel a volume of air equivalent to the volumetric displacement of the pistons of the preceding cylinder group, the latter two cylinder groups thereby effectively balancing one another in that the end pressures thereon are equalized. As distinguished from the progressively built-up compression pressures peculiar to the conventional reciprocating-piston type of compressor unit, the present invention compresses only at the extreme of the down-stroke travel of the pistons. The invention has a further advantage in that a fixed compression value is obtained, the compressor being incapable of compressing the air within the manifold beyond a known point and thereby maintaining the pressure constant without the necessity of employing safety valves or the equivalent thereof in the system. By the expedient of admitting air to the cylinders at a pressure in excess of atmospheric, the pressure value of the engine is increased.

Modifications will readily occur and I accordingly intend that the hereto annexed claims be given an interpretation in their scope commensurate with the state of the advance in the art.

What I claim, is:

1. In an air compressor, in combination with a plurality of radially disposed pistons and a driving crank common to each of the pistons and centrally disposed with respect thereto, cylinders for the pistons pivotally mounted in uniformly-spaced relation circumferentially about the axis of the crank, said pivotal mounting comprising hollow wrist pins of which the cavities thereof are in constant communication with the bore of the related cylinder at one end thereof, and a connecting manifold providing constant communication between each of said wrist-pin cavities, the cylinder-and-piston assembly providing valved openings acting to admit air for compression purposes to the ends of the cylinders opposite the wrist pins in one stroke of the piston cycle and pass the air under the influence of compression action thereon to the other ends of the cylinders in the opposite-stroke of the piston cycle.

2. The compressor defined in claim 1 wherein the crank is of six-throw design and wherein the cylinder-and-piston assemblies are associated in sets of three with each pin of the crank shaft.

3. In an air compressor, in combination, a six-throw crank shaft having its cranks uniformly spaced circumferentially of the crank shaft, pistons and rods for driving the pistons connected in sets of three with each pin of the crank shaft, pivotally mounted cylinders for the pistons arranged in radial uniformly-spaced relation circumferentially about the crank shaft, means permitting admission of air for compression purposes to the crank ends of the cylinders as the pistons move away from the crank shaft, means permitting passage of the admitted air under the influence of compression action thereon to the outer ends of the cylinders as the pistons move toward the crank shaft, and means comprised of a system of manifolds connecting the outer ends of the cylinders of the compressor and obtaining constant communication as between the same for maintaining, in said outer ends of the cylinders, a relatively uniform pressure throughout the cyclical activity of the pistons, thereby applying pressure on the pistons during their movement towards the crank shaft which pressure is exceeded by the compression pressure of the admitted air only near the end of said piston movement.

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