

Aug. 1, 1939.

P. MANISCALCO

2,168,036

COMPRESSOR

Filed Jan. 19, 1938

5 Sheets-Sheet 1

Fig. 1

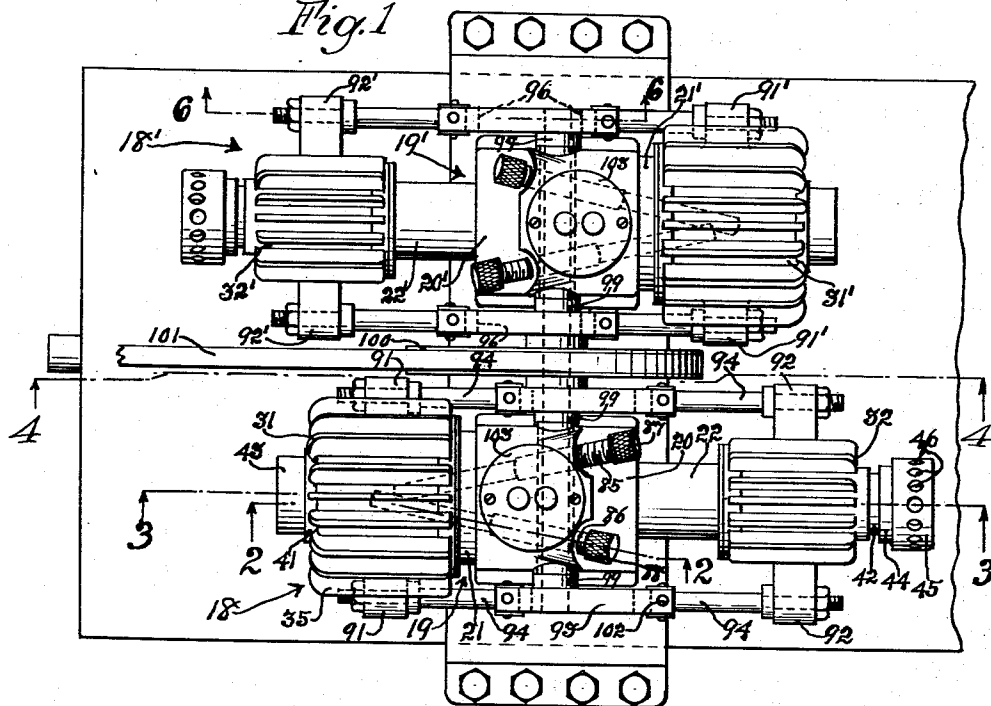
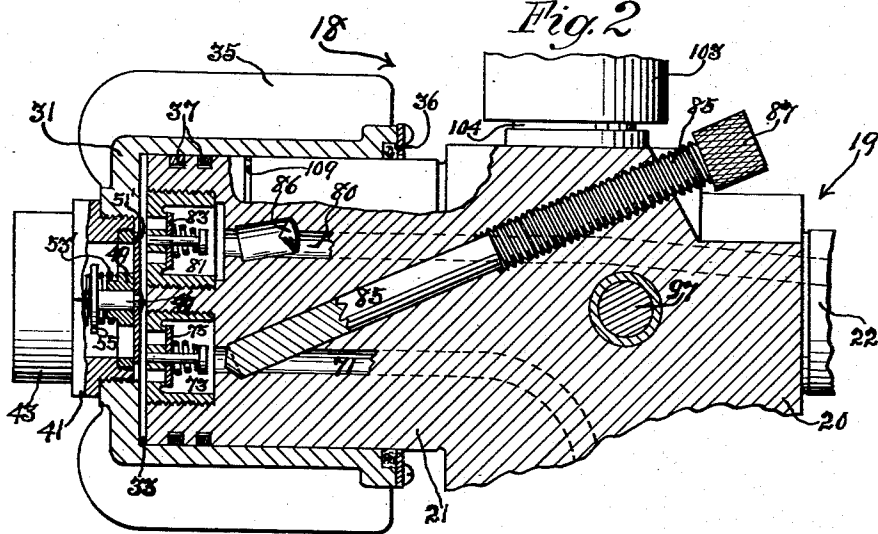


Fig. 2



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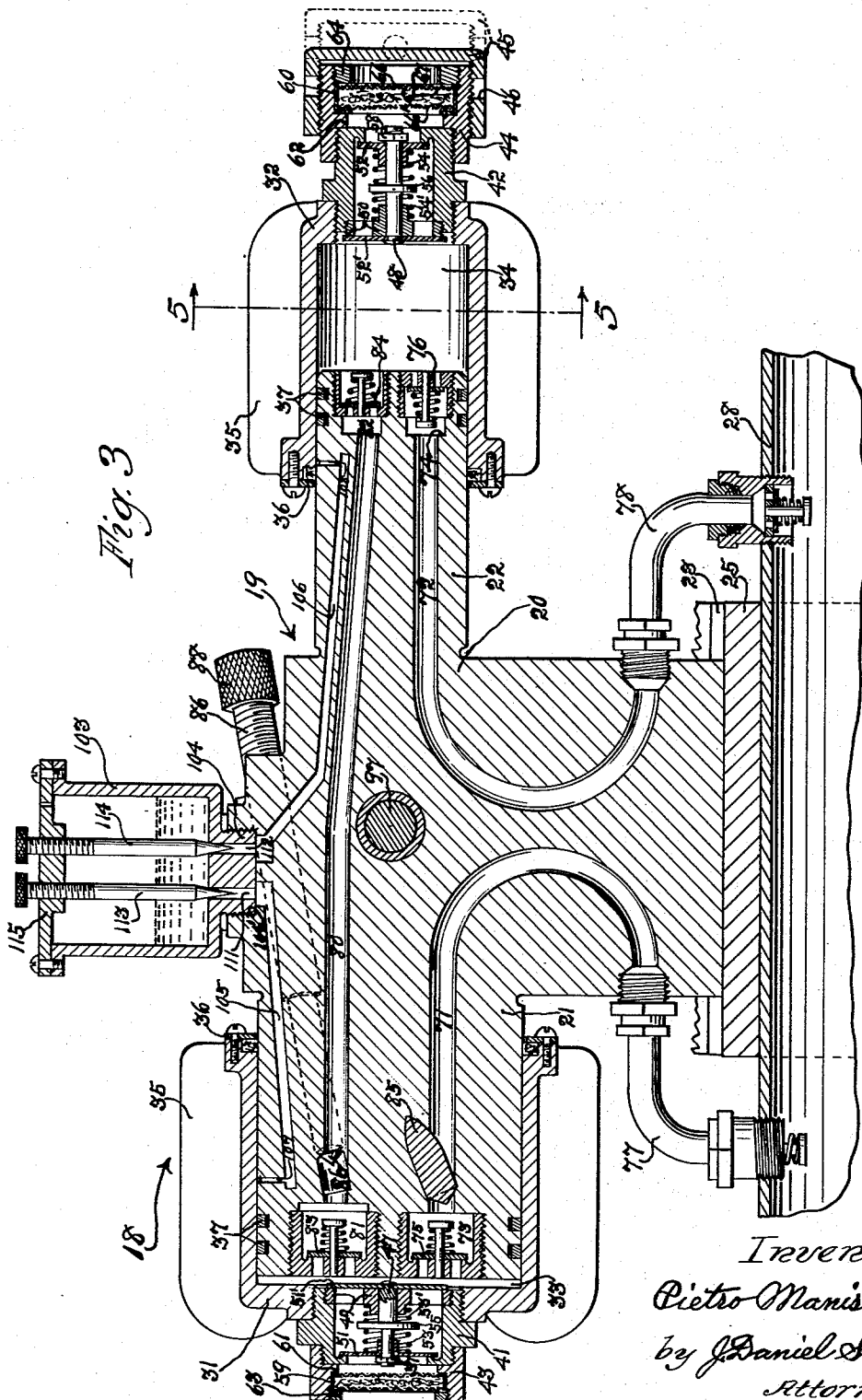
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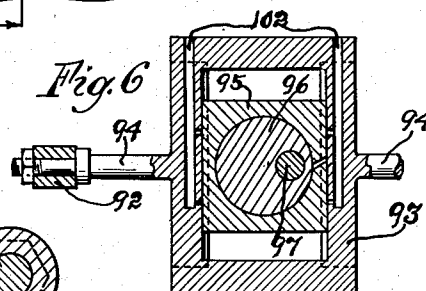
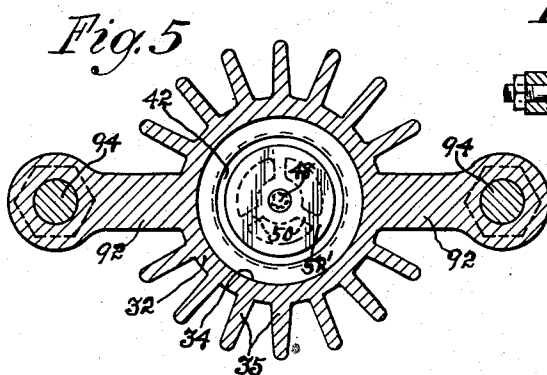
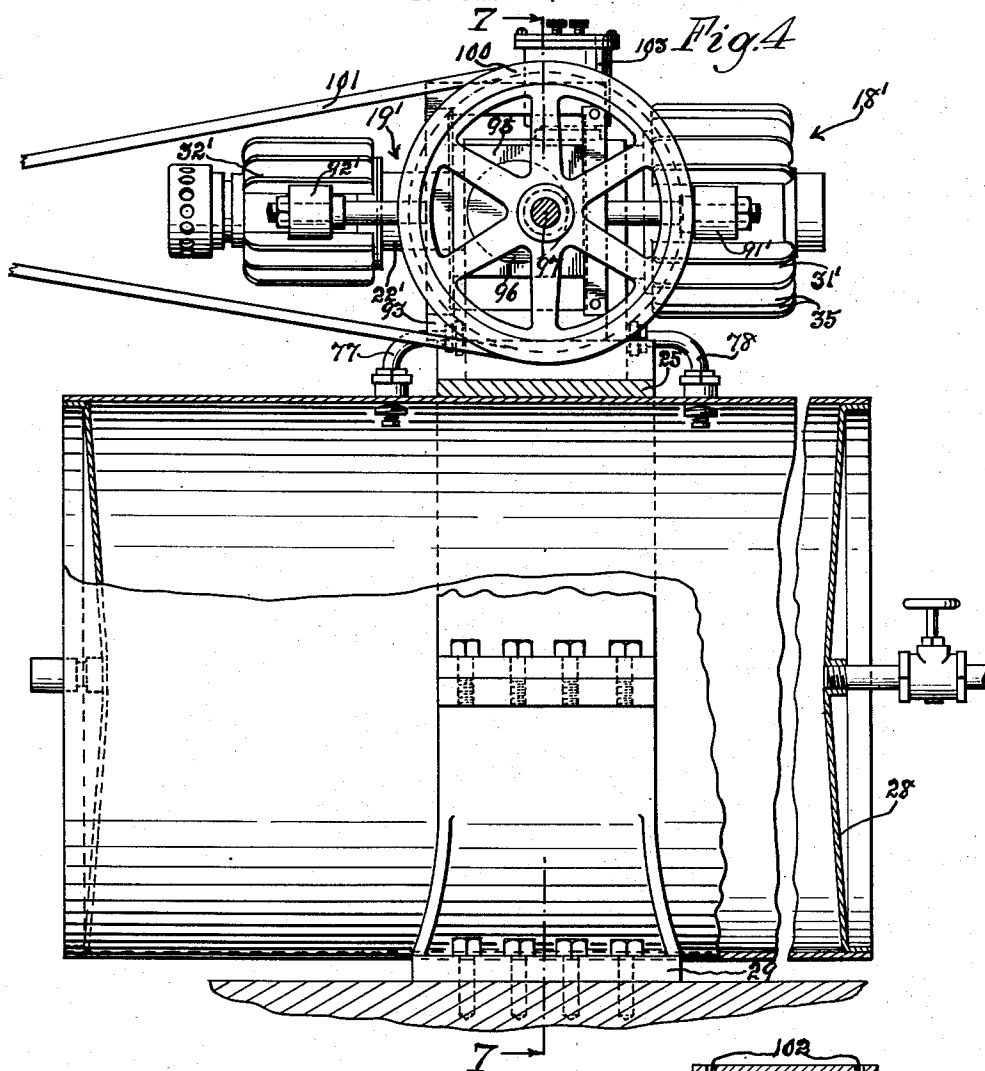
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COMPRESSOR

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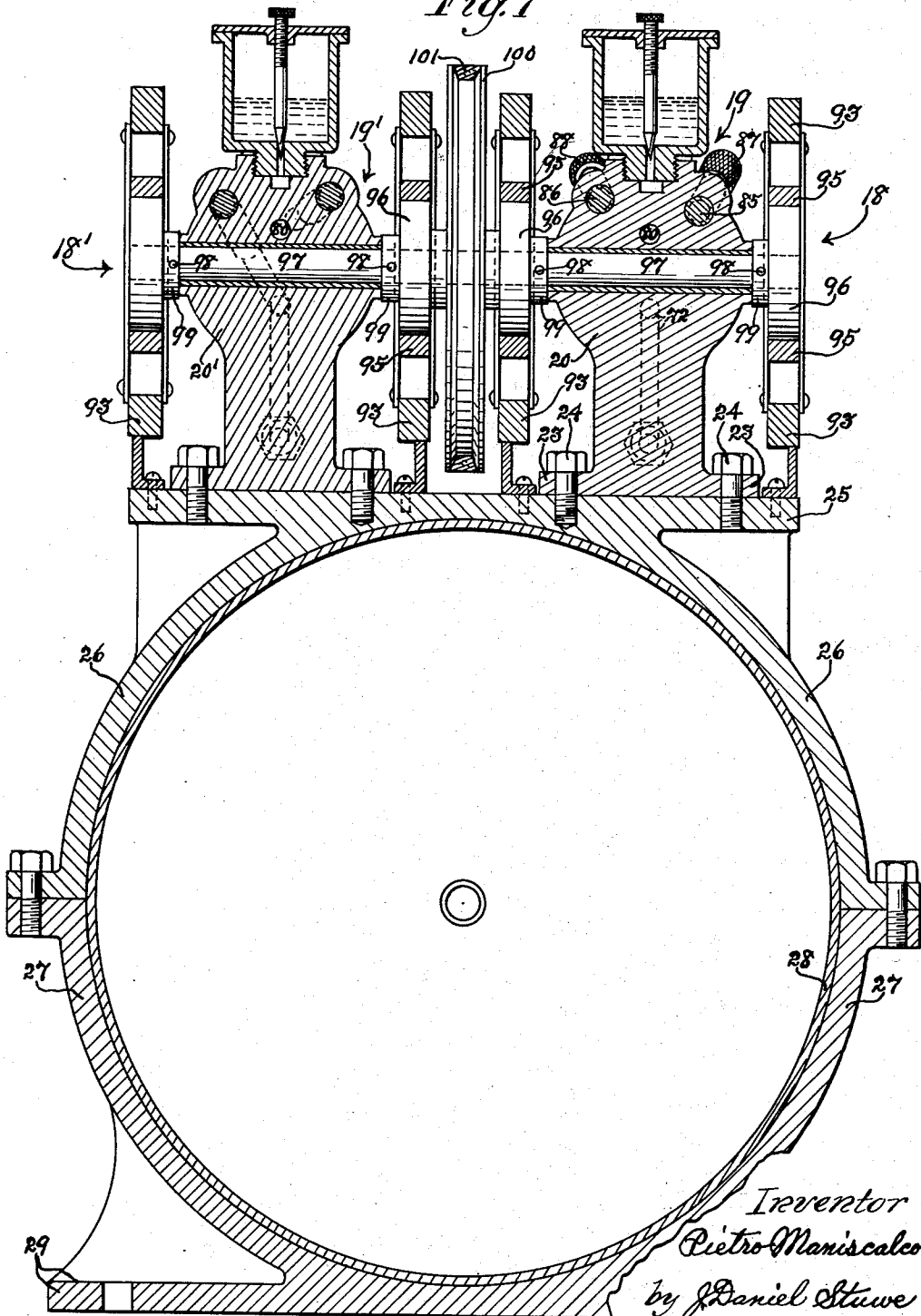
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COMPRESSOR

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Fig. 7



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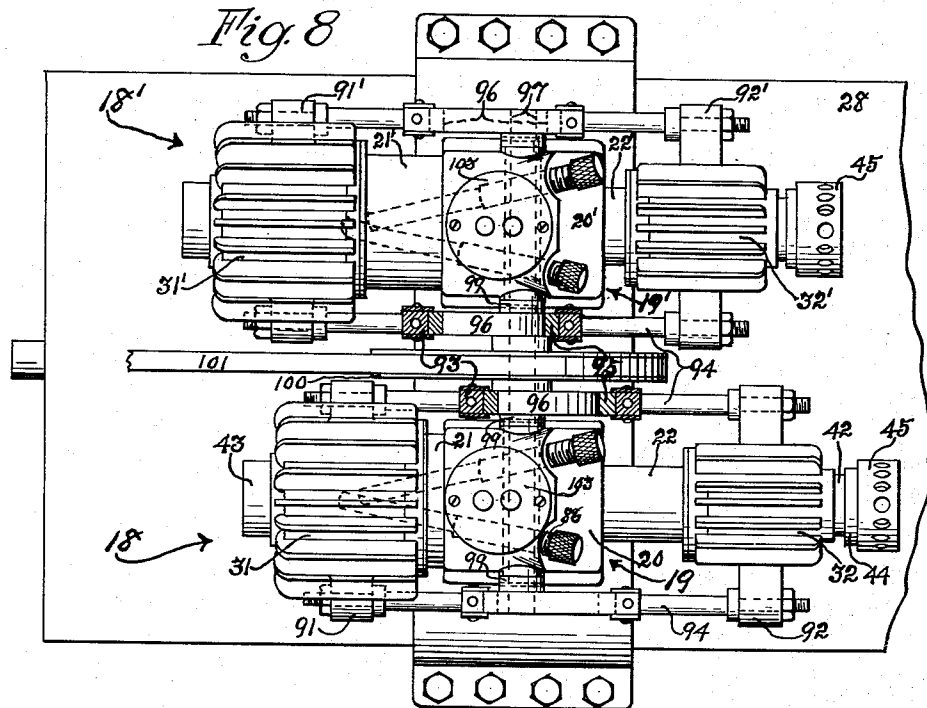
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Fig. 8



UNITED STATES PATENT OFFICE

2,168,036

COMPRESSOR

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Application January 19, 1938, Serial No. 185,723

17 Claims. (Cl. 230—40)

This invention relates to novel improvements in a compressor.

One of the main objects of this invention is to provide a compressor which can be utilized either as a single stage machine of high volume, or as a multiple stage machine of high pressure, and which can be readily converted by actuating a few valves, so as to serve for the desired purpose.

Another object of this invention is to provide a compressor of general utility adapted for compressing various fluids, such as air, vapor, ammoniac, and various gases, making it suitable for various uses including the refrigerating industry and the air conditioning industry.

Another object of this invention is to provide a compressor which is quickly convertible from a single stage to a multistage compressor, and which is of a balanced construction, this being preferably accomplished by providing a pair of compressor units mounted together and operated in unison.

Still another object of this invention is to provide such a convertible stage compressor in the shape of a pair of compressor units, so constructed and arranged and mounted that one of them can be readily removed and remounted, or have parts thereof separated and reversed, with respect to the other unit, in order to adapt the compressor device for use more particularly either as a single stage or as a multi-stage compressor.

A further object of this invention is to provide an improved inlet valve mechanism for such type of compressor, which includes means for filtering the entering fluid and is conveniently detachable and replaceable for inspection and repair.

These and various other objects and advantages are attained with this invention, as will become apparent from the following description, taken in connection with the accompanying drawings wherein the invention is illustrated in its preferred form, it being apparent that various other arrangements and forms of construction may be adopted for carrying out the objects and purposes of this invention.

In the drawings:

Fig. 1 is a plan view illustrating an embodiment of this invention in its preferred form of construction.

Fig. 2 is an enlarged partial vertical sectional view, taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged vertical sectional view, taken substantially on line 3—3 of Fig. 1, parts being omitted.

Fig. 4 is a vertical sectional view, taken on line 4—4 of Fig. 1.

Fig. 5 is a vertical cross-sectional view, taken on line 5—5 of Fig. 3.

Fig. 6 is a vertical sectional view, taken on line 6—6 of Fig. 1.

Fig. 7 is an enlarged vertical cross-sectional view, taken on line 7—7 of Fig. 4.

Figs. 8 and 9 are plan views of this form of compressor, with certain mechanism of one compressor unit changed from the position shown in Fig. 1, Fig. 8 showing one of the units reversed from the position shown in Fig. 1, and Fig. 9 showing the driving cams of one unit reversed from the position shown in Fig. 1; thereby adapting the whole compressor more particularly for single stage compression.

In the drawings I have illustrated a preferred embodiment of my convertible compressor. I have shown it as comprising a pair of compressor units 18 and 18' which are mounted adjacent each other, and are constructed alike and arranged to be reversible and interchangeable, so as to provide for economy in manufacture and in operation.

In this illustrated form the pair of compressor units 18 and 18' comprise a pair of stationary piston units 19 and 19' including, respectively, the central body part or block 20 and 20' having the larger pistons 21 and 21' and the smaller pistons 22 and 22' integral with said body parts 20 and 20' and extending in opposite directions therefrom. Each body part is provided with a pair of oppositely extending flanges 23 at its lower end, which are similarly arranged and placed so that the units are reversible and interchangeable, by manipulating the bolts 24 whereby they are mounted upon flanges 25, which are provided on upper band means 26 secured on lower band means 27 embracing a tank or reservoir 28 and mounted in position by the lower feet 29 on any suitable support.

A larger cylinder 31 and a smaller cylinder 32 are reciprocally mounted on the pistons 21 and 22 respectively, and provide thereon a larger chamber 33 and a smaller chamber 34; and a similar larger and smaller cylinder 31' and 32' are reciprocally mounted on pistons 21' and 22' respectively.

When the compressor is used as a multistage compressor, then the larger piston 21 and larger cylinder 31 serve as the primary piston and cylinder, for the primary compression, and the smaller piston 22 and smaller cylinder 32 serve as the secondary piston and cylinder, for the higher stage of compression.

The cylinders are preferably provided upon

their exterior with cooling fins 35 extending lengthwise of the cylinders, in the direction of their reciprocation; and each cylinder has an annular sealing ring 36 on the end embracing the piston; while the pistons are provided with suitable sealing rings or gaskets 37, to provide a fluid-tight fit.

The mechanism provided for converting the compressor from one stage to another comprises a fluid inlet device mounted on the outer end of each cylinder, and includes a pair of valve devices 41 and 42 removably mounted on cylinders 32 and 32', respectively, carrying fluid filtering devices 43 and 44 removably mounted thereon, to facilitate inspection, repair and replacement.

The fluid inlet means on the smaller cylinder is further provided with a closure member 45 which, as best shown in Fig. 3, is in the form of a closure cap having perforations 46 provided around its periphery, and is threaded on filtering device 44, so as to enable exposing parts of the perforations and regulate the admission of the fluid, if desired, or to close them fully when the compressor is utilized for multistage compression.

The valve devices 41 and 42 are preferably provided in the form of sleeves having, respectively, valve stems 47 and 48 slidable in stationary spiders 49 and 50 and carrying pairs of valve elements or plates 51 and 51', and 52 and 52', adapted to close the end ports in said sleeves; while pairs of springs 53 and 53', and 54 and 54', bearing against the opposite sides of collars 55 and 56 secured on said stems 47 and 48, urge said valve plates to the closed position. The outer plates 51 and 52 are thereby movable on their stems, with their springs 53 and 54, relative to their companion inner plates 51' and 52', and are thus self-adjusting on their valve seats. They are furthermore adjustable on the stems by manipulation of the nuts 57 and 58 threaded on the outer ends of the stems, as best shown in Fig. 3.

The filtering devices 43 and 44 are preferably in the form of sleeves or cages which are threaded onto valve devices 41 and 42, to be readily removable and replaceable; and include filtering members 59 and 60 seated on inner flanges 61 and 62, being removably retained by washers 63 and 64 threaded in the sleeves of said devices 43 and 44. Each filtering member preferably includes a ring provided with a pair of spaced screening elements 66 and 66' having filtering material 67, such as mineral wool packing, therebetween which is readily removable and renewable by removing the retaining washer and withdrawing said member.

Discharge conduits 71 and 72 extend from pockets 73 and 74 containing check valves 75 and 76 in the ends of the pistons 21 and 22, respectively, said conduits extending thru the body part 20 and being connected by valved conduits 77 and 78 with the fluid reservoir 28. A channel 80 extends thru the pistons and thru the body part, from a pocket 81 to a pocket 82 in the ends of the pistons, which have check valves 83 and 84 therein, thus providing a direct passage for the primarily compressed fluid from the larger chamber 33 to the smaller chamber 34 to undergo its second stage of compression.

Manually operable control valves 85 and 86 are provided for closing, and also for regulating the effective sizes, of the discharge conduit 71 and the channel 80, respectively. These control valves are preferably in the forms of threaded stems 87 having knobs 87 and 88 on their outer ends, and

the stems extend at a slant thru the body part 20 and the piston 21, adapted to be moved into the end of said conduit and of said channel, closely adjacent the pockets 73 and 81, thus avoiding any large quantity of fluid being entrained in the conduit or the channel and its pocket, back of the particular control valve which is closed.

In the form of this invention illustrated the means for reciprocating the cylinders comprises pairs of arms 91 and 92, and 91' and 92', extending laterally from the cylinders 31 and 32, and 31' and 32', respectively, and a pair of eccentric devices at the opposite sides of each body part 20. Each eccentric device includes a frame 93 from which a pair of shafts 94 extend to said cylinder arms and are secured thereto, so that the cylinders 31 and 32 of each compressor unit reciprocate together. Said frame has a plate 95 slidable vertically therein, wherein the eccentric 96 rotates, as best shown in Fig. 6. A drive shaft 97 extends thru the several eccentrics and is secured therein, preferably by means of pins 98 driven thru the shaft and thru collars 99 integral on the sides of the eccentrics, as best shown in Fig. 7. These pins may be removed, thus enabling the shaft and eccentrics to be separated and the desired parts to be withdrawn and interchanged or reversed.

The drive shaft is actuated in an approved manner, as for instance by means of a flywheel 100 secured on the shaft, centrally between the two parallel compressor units, as best shown in Fig. 7, and is driven by a belt 101 or similar driving means, whereby the two sets of eccentrics are rotated to reciprocate the frames 93 and the cylinders.

As best shown in Fig. 6, lubricating channels 102 are provided in the frame, and branch grooves lead therefrom to the eccentric, for lubricating these parts.

Lubricating means is also provided for automatically lubricating the parts of the cylinders which reciprocate on the pistons, and this comprises a lubricant cup 103 removably mounted with its neck 104 in a mouth or opening 104' provided in the top of body part 20 of each piston unit. A pair of channels 105 and 106 extend from said mouth thru the body part 20 and the pistons 21 and 22, respectively, and have outlet ducts 107 and 108 arising from their ends to grooves 109 on the surfaces of the pistons, as indicated in Figs. 2 and 3. Two ducts 111 and 112 extend thru neck 104 to said channels 105 and 106 respectively, and regulating stems 113 and 114 are threaded thru the cover 115 of said cup, having their lower ends adapted to enter and restrict said ducts, for individually regulating the automatic seepage of lubricant there-thru into channels 105 and 106.

The drawings show the mechanism arranged to function as a multi-stage compressor. The fluid is initially taken in thru filter member 43 and valve member 41, and the control valve stem 85 is moved inward to close discharge conduit 71 and prevent the flow of primarily compressed fluid from the larger chamber 33 thru conduit 71 directly to the reservoir. Valve stem 86 is in its retracted or open position, enabling the primarily compressed fluid to flow from chamber 33 thru channel 80 to the smaller or secondary chamber 34, to be subjected to the secondary or higher stage of compression. The closure cap 45 has been moved inward to fully close all perforations 46, and prevent direct intake of fluid

to this secondary chamber 34. The highly compressed fluid is then conducted thru conduits 72 and 78 to the reservoir.

To use the mechanism for single stage compression, the closure cap 45 is moved outward, substantially to the position indicated in dotted lines in Fig. 3, thus admitting fluid thru the perforations 46, thru filter member 44 and valve member 42, on this secondary cylinder, as well as thru the intake members on the primary cylinder 31. Control valve 36 is closed and control valve 35 is opened, thus preventing flow of compressed fluid from chamber 33 to chamber 34, but enabling it to flow from said chamber 33 thru conduits 71 and 77 directly into the reservoir.

As previously set forth, the mounting flanges 23 and 25, on the opposite sides of the compressor units 18 and of the supporting bands 26 are arranged and spaced equally; and likewise, the conduits 77 and 78 are arranged equally; in such a manner that either compressor unit can be reversed on its mounting from the position shown in Fig. 1, wherein the larger primary cylinders of the two compressor units are located at opposite ends, to the position shown in Fig. 8, wherein said primary cylinders are located at the same end.

The arrangement of the units as shown in Fig. 1 is well adapted for multistage compression, as the power used to operate the smaller cylinder 32, with its smaller quantity of fluid under higher compression, is substantially equal to the power used to operate the larger cylinder, with its larger quantity of fluid under lower compression, thus taking a constant or balanced application of driving power.

When the device is desired more particularly for use as a single stage compressor then the arrangement of Fig. 8 is preferred to that of Fig. 1, and is readily effected by mounting one of the compressors reversed from the position shown in Fig. 1; since the larger cylinder of one unit and the smaller cylinder of the other unit are then moved together for each compression stroke, thus again utilizing a constant or balanced application of power for reciprocating the mechanism in both directions.

Fig. 9 also illustrates the movement together of the larger cylinder of one compressor unit with the smaller cylinder of the other unit, both being mounted abreast and moved together in the same direction; thereby likewise utilizing a balanced application of power for reciprocating the two compressor units, when intended more particularly for single stage compression.

This different mounting arrangement of the compressor units shown in Fig. 9 from that shown in Fig. 1, is readily accomplished by withdrawing the pins 98 from the sleeves 99 of the eccentrics of one unit, and rotating these two eccentrics one-half turn or thru 180°, while moving this compressor unit thru one-half reciprocation, into equal position with the companion compressor unit and its eccentrics, and again driving the pins 98 into position.

This construction and arrangement of the various members and the balanced mounting means, provided for these two compressor units combined, insures a balanced and smooth application of the driving power and provides a highly efficient compressor, which is adapted for various purposes and is readily convertible from one stage of compression to another, to be properly suited for the particular purpose desired.

I claim:

1. A compressor comprising in combination a stationary piston unit including a plurality of pistons extending in different directions, a cylinder movable on each piston, providing a plurality of cylinder chambers, valved inlet means on the end of each cylinder, a valved discharge conduit extending from each chamber, channel means extending thru the unit from one chamber to another to provide direct communication therebetween, and control valve means adapted to close either the channel means or the discharge conduits except one, whereby the compressor can be readily converted and utilized either for single stage or for multistage compression.

2. A compressor comprising in combination a stationary piston unit including an intermediate portion having pistons of different diameters extending in different directions therefrom, a cylinder reciprocable on each piston, providing a plurality of cylinder chambers of different capacities, valved inlet means mounted on each cylinder, means for closing the inlet means on the cylinders except the one having the largest chamber, a valved discharge conduit extending from each chamber, a valved channel means extending thru the unit, from a larger chamber to a smaller one, to provide direct communication between them, and control valve means adapted to enter and close said channel means, or said discharge conduits except the one extending from the smallest chamber, whereby to readily convert the compressor and utilize it either as a single stage or as a multistage compressor.

3. A compressor comprising in combination a stationary piston unit including a central body portion having a pair of pistons extending in opposite directions therefrom, a pair of cylinders reciprocable on the pistons and providing a pair of cylinder chambers, one adapted to serve as a primary chamber and the other as a secondary chamber, a valved inlet member on each cylinder, means for closing the inlet member to the secondary chamber, a valved channel extending thru the unit, directly connecting the two chambers, a valved discharge conduit extending from each chamber thru its piston, and a pair of control valves, one adapted to close the channel and the other adapted to close the discharge conduit extending from the primary chamber, whereby to readily convert the compressor and utilize it either for single stage or for multistage compression.

4. The subject matter set forth in claim 3, wherein the control valves are in the form of stems extending into one of the pistons to close either the channel or the discharge conduit leading from the primary chamber, closely adjacent said chamber.

5. The subject matter set forth in claim 3, wherein the closure means of the secondary chamber is adjustably mounted on its inlet member, whereby to close and also to regulate the admission of fluid thru said member.

6. The subject matter set forth in claim 3, wherein the inlet member on the secondary chamber comprises a readily removable sleeve and the means for closing the inlet member includes a cap adjustably mounted over its inlet end whereby to close and also to regulate the admission of fluid thru said inlet means.

7. A compressor comprising in combination a stationary piston unit including a central body portion having a larger piston and a smaller pis-

ton extending in opposite directions therefrom, a pair of cylinders reciprocable in unison on the pistons and providing a larger and a smaller cylinder chamber thereon, valved inlet means mounted on the outer end of each cylinder to admit fluid to its chamber, means for closing the inlet means on the cylinder of the smaller chamber, a valved channel extending thru said body portion and pistons, directly connecting the two chambers, a valved discharge conduit extending from each chamber thru its piston, and a pair of control valves, one adapted to enter and close the channel and the other adapted to enter and close the discharge conduit extending from the larger chamber, closely adjacent said chamber, whereby the compressor can be readily converted and utilized either for single stage or for multistage compression.

8. A compressor comprising in combination a stationary piston unit including a central block having a larger piston and a smaller piston extending in opposite directions therefrom, a larger cylinder and a smaller cylinder reciprocable on said pistons in unison and providing a larger and a smaller cylinder chamber thereon, respectively, valved inlet means removably mounted on the outer end of each cylinder to admit fluid to its chamber, means for closing the inlet means on the smaller cylinder, a valved channel extending thru said pistons and block, directly connecting said chambers, a valved discharge conduit extending from each chamber thru its piston, and a pair of control valves including stems extending thru a pair of bores provided at a slant in the block and in the larger piston to join the discharge conduit in said piston and also the channel, adapting said valve stems to close said conduit and said channel adjacent their intake ends, whereby the compressor can be readily converted and utilized either for single stage or for multistage compression.

9. A compressor comprising in combination a stationary piston unit including a body portion having a pair of pistons extending in opposite directions therefrom, a pair of cylinders reciprocable on the pistons and providing a pair of cylinder chambers thereon, one adapted to serve as a primary chamber and the other as a secondary chamber, a valved inlet member on the outer end of each cylinder, means for closing the inlet member on the cylinder of the secondary chamber, a valved channel extending straight thru said pistons and body portion from one chamber to the other, a valved discharge conduit extending from each chamber thru its piston, and a pair of control valves operable manually outward of the piston unit, adapted to close or to restrict the channel and the discharge conduit extending from the primary chamber, closely adjacent said chamber, whereby the compressor can be readily converted for use as either a single stage or a multistage compressor.

10. The subject matter set forth in claim 9, wherein the cylinders have substantially open ends, and the inlet means include sleeves threaded in said ends and provided on their outer ends with readily removable filtering means.

11. A compressor mechanism comprising a pair of adjacent and parallel compressor units, each containing a stationary piston body having a pair of pistons thereon, a pair of cylinders reciprocable on the pistons, providing cylinder chambers one of which is adapted to serve as a primary chamber and the other as the secondary

chamber, fluid inlet means on the cylinders, means for closing one thereof, channel means directly connecting the chambers, discharge conduit means extending from the chambers, also control valve means on the channel means and on the discharge conduit means extending from the primary chamber, to facilitate adjusting each compressor unit individually either for single stage or for multistage compression, driving means for reciprocating the pair of compressor units together, and supporting means for said units, provided with means for detachably and reversibly mounting said units in position thereon, whereby one of said units can be readily remounted or readjusted relative to the other unit, to adapt the compressor mechanism more particularly either for single stage or for multistage compression.

12. The subject matter set forth in claim 11, wherein the driving means comprises a drive shaft having eccentric driving means for each unit thereon which is readily reversible, whereby the two compressor units may be readily adjusted to be reciprocated either together in the same direction or in opposite directions.

13. In a compressor including a stem-shaped piston and a sleeve-like cylinder having its inner end slidable thereon and having a substantially open end, fluid inlet mechanism comprising a valved sleeve removably threaded in said open end, and a filtering device in the form of a cage threaded on the outer end of said sleeve and including a filtering member removably carried in the cage.

14. The subject matter set forth in claim 13, wherein a closure cap is adjustably mounted on the outer end of the filtering cage, and one of them is provided with perforations, adapted to close the fluid inlet and also regulate the admission of fluid thereto.

15. A valve mechanism comprising a valve sleeve having a pair of ports at its ends provided with a valve stem carrying a pair of spring-closed valve plates, one plate being automatically adjustable relative to the other, a cage with filtering means removably mounted on the outer end of the sleeve, and means adapted to close the inlet of fluid to the cage and filtering means.

16. The subject matter set forth in claim 15, wherein the means for closing the inlet consists of a closure cap having peripheral perforations and being threaded on the inlet end of the cage, adapted to regulate the inlet as well as to close the same.

17. A compressor comprising in combination a piston unit including a pair of pistons extending in opposite directions, a pair of cylinders thereon providing cylinder chambers, adapted to serve as a primary chamber and a secondary chamber, there being relative reciprocation between the pair of cylinders and the pair of pistons, valved inlet means on each cylinder, means for closing the inlet means of the secondary chamber, valved discharge conduit means extending from each chamber, valved channel means extending thru the unit directly connecting the two chambers, and control valve means adapted to close either said channel means or the discharge conduit means extending from the primary chamber, whereby to readily convert the compressor and utilize it either as a single stage or as a multistage compressor.

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