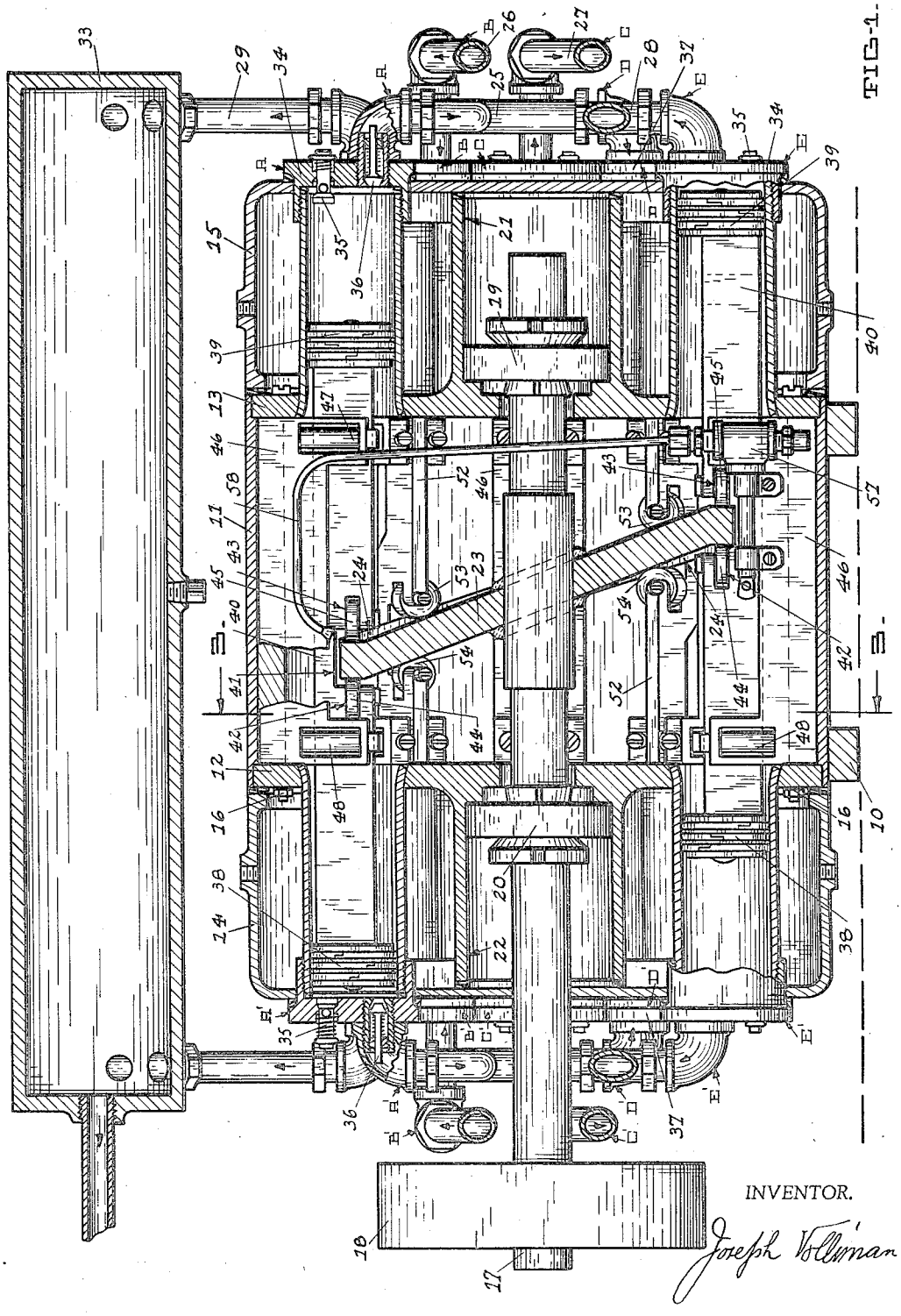
Jan. 7, 1936. J. VOLLIMAN 2,027,076

AIR COMPRESSING DEVICE

Filed July 24, 1934 3 Sheets-Sheet 1

FIG-1.



INVENTOR.

Joseph Volliman

Jan. 7, 1936. J. VOLLIMAN 2,027,076

AIR COMPRESSING DEVICE

Filed July 24, 1934 3 Sheets-Sheet 2

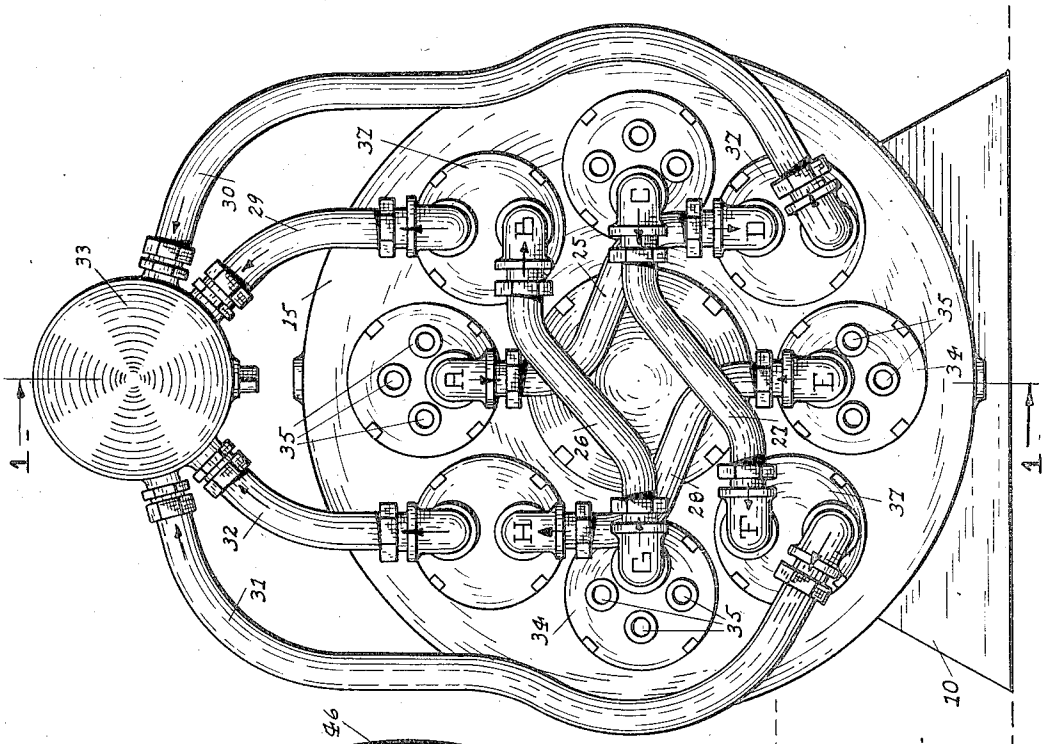


FIG-2.

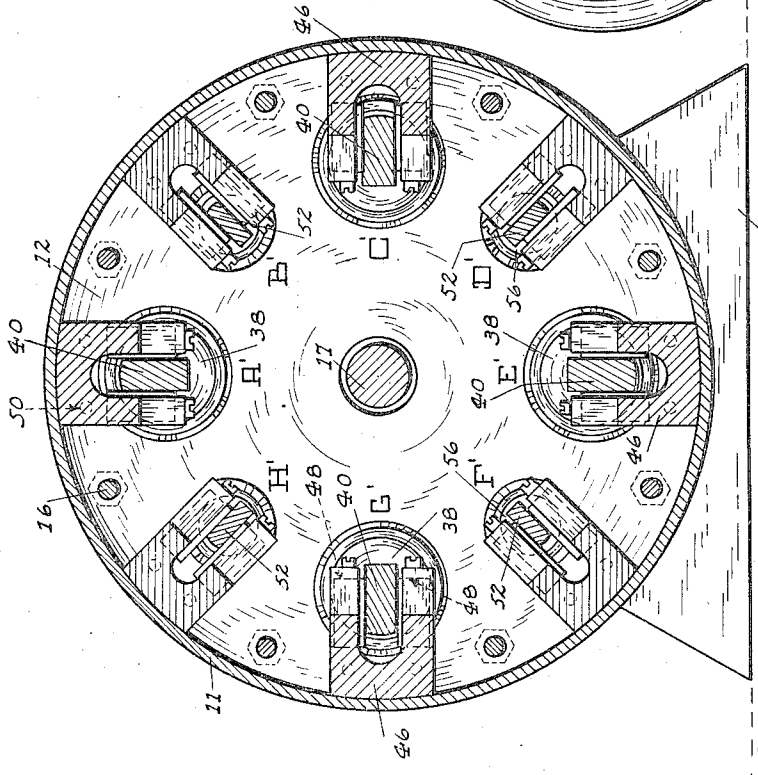


FIG-3.

INVENTOR.

Joseph Volliman

Jan. 7, 1936. J. VOLLIMAN 2,027,076

AIR COMPRESSING DEVICE

Filed July 24, 1934 3 Sheets-Sheet 3

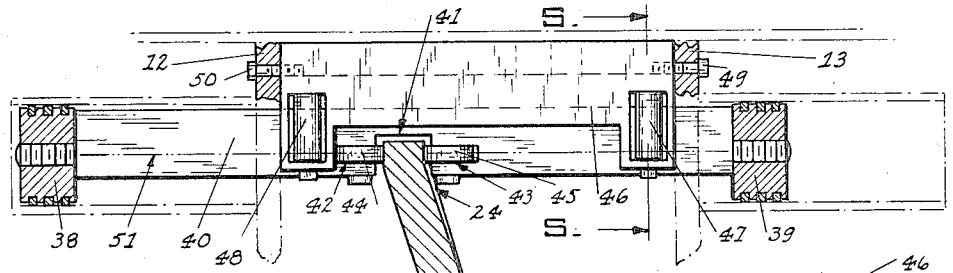
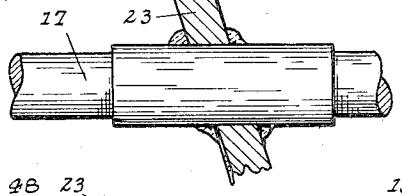


FIG.-4.



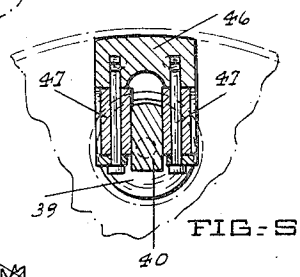


FIG.-5.

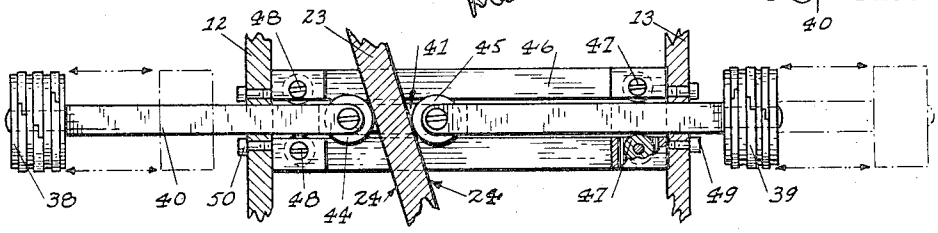


FIG.-6.

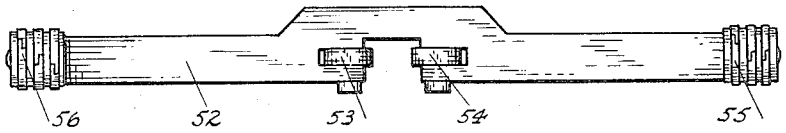


FIG.-7.

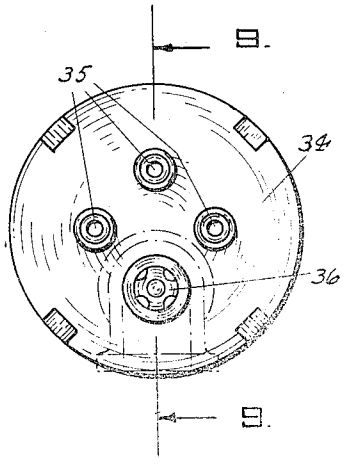


FIG.-8.

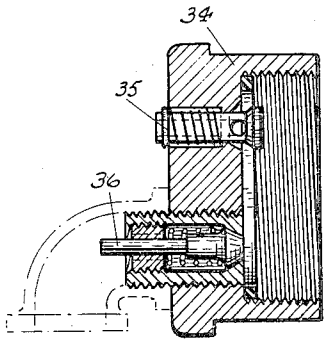


FIG.-9.

INVENTOR.

Joseph Volliman

Patented Jan. 7, 1936 2,027,076

UNITED STATES PATENT OFFICE

2,027,076

AIR COMPRESSING DEVICE

Joseph Volliman, San Francisco, Calif.

Application July 24, 1934, Serial No. 736,666

5 Claims. (Cl. 230—193)

The present invention relates generally to fluid pressure compressors, and has particular reference to fluid compressors of the cam actuated type employing low and high fluid compression cylinders and pistons arranged concentrically and opposed to each other for unitary action, the various low compression cylinders being arranged to by-pass to the high compression cylinders and thence to a fluid pressure receiver from which the fluid under extreme pressure is emitted for any desired purpose.

For example, on opposite ends of the device, low pressure cylinders alternate with high pressure cylinders, and each low pressure and high pressure set is connected by means of anti-friction free floating piston rods arranged to be actuated by an obliquely arranged disc cam carried by a shaft having suitable thrust bearing supports.

The principal object of the invention is the provision of a high pressure fluid compressor that embodies a plurality of sets of alternate low and high compression cylinders and pistons of double acting character by-pass-connected together as to opposite sets, in such a manner that a continuous flow of fluid under high pressure is constantly fed to a common storage receiver.

A further object of the invention is to provide a fluid compressor of the class described, that embodies a disc cam for reciprocating the double acting piston rods in such a manner that positively no lost motion or back lash takes place between the cam and its anti-friction piston rods; that is, the anti-friction elements of these piston rods constantly contact the operating track of the cam at all times, and thereby provide smoother and more positive action minus friction and power loss.

A still further object of the invention is to provide a high compression fluid compressor in which the piston rods are full floating upon the opposed pistons of each set, by means of anti-friction rollers adapted to contact the operating track of the cam and by sets of anti-friction rollers contacting the piston rods on either stroke thereof.

An additional object of the invention is the provision of a compressor of the class indicated that is much smoother in its action than compressors of the usual type due to the fact that no back lash or excessive strains occur in its operation, for the reason that the horizontal and vertical roller bearings float the piston rods; and the weight of these elements is therefore carried by the piston rings of the pistons, hence the desired smooth and free floating action of the piston rods and pistons arranged on opposite sides of the cam is successfully accomplished.

Additional to the foregoing objects is that of providing a compressor of the high compression type that employs no fly wheel due to the fact that all piston rods and pistons are properly balanced in their action, and that the action of the driving cam in relation to all piston rods and pistons is such that a constant and smooth rotary motion is applied to the driving shaft without undue strain or driving torque being transmitted thereto from the source of power.

Ancillary to the foregoing objects is that of providing a compressor which includes positive yet simple fluid ingress and egress valves that, respectively and effectively, control the breaking of the vacuum in the various cylinders and the egress of the highly compressed fluid pressure therefrom to the common receiver.

Other objects and advantages of the invention will become apparent with reference to the subjoined specification and the accompanying three sheets of drawings in which:—

Figure 1 is a longitudinal median section of the complete compressor, showing the driving mechanism, disc cam, free floating piston rods, low compression pistons, water jacketed cylinders, and some of the by-pass connections to the storage receiver, the section being indicated by the line 1—1 in Figure 2;

Figure 2 is an end elevation of the device as seen looking from the right hand end of Figure 1 and showing the various cylinder heads, valves, and by-pass piping from cylinder to cylinder and thence to the receiver;

Figure 3 is a transverse sectional view of the device showing the opposite end of the compressor from that disclosed in Figure 2, the section being taken through the several low and high compression free floating concentrically arranged piston rods, as indicated by the line 3—3 in Figure 1;

Figure 4 is a fragmentary sectional detail of a portion of the disc cam showing the associated anti-friction piston rods contacting the cam, also opposed pistons of a low pressure set;

Figure 5 is a transverse sectional detail taken on the line 5—5 in Figure 4 and displaying one of the piston rod guide ways and its laterally disposed anti-friction rollers on opposite sides thereof;

Figure 6 is a horizontal sectional detail of a low compression set as illustrated in Figure 4,

and further illustrating the anti-friction hook-up relative to the disc cam;

Figure 7 is a plan detail per se of one of the high compression sets showing one of the piston rods, its opposed pistons and anti-friction roller means adapted to contact the cam;

Figure 8 is an enlarged end view of one of the cylinder heads showing the arrangement of the intake valves and the outlet valve; and

Figure 9 is a vertical section taken on the line 9—9 of Figure 8 and further illustrating the valve arrangement.

Referring now more particularly to Figures 1 and 2 of the drawings, the compressor embodies a suitable supporting base or frame **10**, a cylindrical or like casing **11** supported thereon, said casing having inner heads **12** and **13**, and outer water-jacketed head sections **14** and **15**, and the whole being held securely together by means of a plurality of stay bolts **16**, as indicated in Figure 3.

The low and high pressure cylinders respectively A, B, C, D, E, F, G and H and the cylinders A', B', C', D', E', F', G' and H' have their inner ends swaged into the heads **12** and **13**, as clearly depicted in Figure 1, and have their outer ends capped as will be hereinafter more fully set forth.

The driving means for the compressor consists of a driving shaft **17** having a driving pulley **18** mounted thereon, said shaft being mounted in suitable anti-friction bearings **19** and **20**, which bearings are mounted in cylindrical projections **21** and **22** integrally formed with the heads **12** and **13**, respectively.

The means for actuating the various pistons in the low and high compression cylinders comprises an obliquely positioned cam **23** having opposed annular track-ways **24**, arranged about the sides of the cam and adapted to contact the rollers of the various piston rods to cause their successive actuation, as hereinafter more fully set forth.

Referring particularly to Figures 2 and 3, in which the arrangement of the cylinders is clearly disclosed, it will be observed that the cylinders A, B, C, D, E, F, G and H shown in Figure 2 are alternate low and high compression cylinders, and that the cylinders A', B', C', D', E', F', G' and H' shown in Figure 3 are also alternate low and high compression cylinders; and said cylinders are all connected together and to the receiver in the following manner:—

In Figure 2 is shown the pipe arrangement which comprises a by-pass line **25** connecting low and high compression cylinders, respectively A and D, a line **26** connecting high and low compression cylinders B and G, respectively, a line **27**, connecting low and high compression cylinders C and F, respectively, and a line **28** connecting low and high compression cylinders E and H, respectively. Lines **29**, **30**, **31**, and **32** connect cylinders B, D, F, and H, respectively with the receiver **33**.

The cylinders A', B', C', D', E', F', G' and H' are arranged and hooked up in the identical manner as that described in relation to cylinders A, B, C, D, E, F, G and H, hence it is not thought necessary to describe these in detail.

The low compression cylinders A, C, E, and G and A', C', E', and G' are provided with screw cap heads, **34**, embodying air inlet valves **35**, and outlet or exhaust valves **36**, said valves, **36**, exhausting into the several lines **25**, **26**, **27** and **28**, and the lines **29**, **30**, **31** and **32** leading to the receiver **33**, said caps being shown in large detail in Figures 8 and 9.

The high compression cylinders B, D, F, and H, and B', D', F' and H', are provided with suitable caps **37**, and valves as above described.

The low pressure pistons **38** and **39**, and their common piston rods **40**, are illustrated in detail in Figures 4 and 6, and comprise flat bar sections having cut out central portions **41**, to receive the track sections **24**, of the cam **23**; and are additionally slotted as indicated at **42** and **43**, to receive anti-friction rollers **44** and **45**, which rollers contact opposite track-ways of the cam and prevent any lost motion or back lash between the cam and piston rods.

These piston rod connections are full floating upon their pistons **38** and **39**, and are guided in this manner by means of guide ways **46**, in which are roller sets **47** and **48**, said guide ways being mounted between the heads, **12** and **13**, and held securely in place by means of cap screws **49** and **50**, Figures 4 and 6. It will thus be observed that the piston rods are full floating upon their respective pistons, and friction and back lash in these is practically eliminated. It will also be noted with reference to Figure 4, that the pistons **38** and **39** and the piston rollers **44** and **45** are in direct axial alignment, as indicated by the dot-and-dash line **51**, whereby a straight line thrust is delivered by the cam to said rollers, piston rods and pistons, thus eliminating all torsional strains which may be transmitted to these parts when in operation.

In Figure 7, I have illustrated one of the high compression piston rods **52**, having rollers **53** and **54**, and the smaller pistons **55** and **56**, these pistons operating in guides of anti-friction character the same as the guides **46**, shown in Figures 4, 5 and 6; these making the high compression rods and pistons fully free floating as are the low compression rods and pistons as above set forth.

The cam **23** and the various sets of piston rod anti-friction rollers **44** and **45**, and rollers **53** and **54**, of the high compression sets, are constantly oiled by means of a circulating oil pump **57**, shown mounted within the casing **11**, and having a jet pipe, **58**, mounted, as clearly shown in Figure 1, to deliver oil to the cam and associated working parts at all times.

It will thus be observed that I have provided a combined low and high compression compressor of substantially frictionless character, and one that is positive in its operation, compact, and practically noiseless in action; hence it requires less power for its operation, and is, therefore, much cheaper to operate and maintain than the usual compressor of this type.

I claim and desire to secure by Letters Patent of the United States the following:—

1. A compressor of the class described, embodying, in combination, a plurality of opposed alternate low and high compression cylinders, pistons arranged in said cylinders, rectangularly shaped piston rods connecting said pistons for unitary action, anti-friction rollers carried by said rods, and anti-friction rollers arranged to guide said rectangular shaped rods, a driving shaft, a disc cam obliquely and integrally mounted on said shaft, and having track-ways operable between said first mentioned rolls, a receiver associated with the compressor, by-pass lines connecting certain low and high compression cylinders, and lines leading from certain of said cylinders to said receiver.

2. A compressor of the class described, embodying, in combination, a plurality of opposed alternate low and high compression cylinders, pistons arranged in said cylinders, rectangularly shaped piston rods connecting said pistons for unitary action, anti-friction rollers carried by said rods, and lateral anti-friction rollers arranged to guide said rods, a driving shaft, a disc cam obliquely mounted on said shaft, and having track-ways operable between said first mentioned rollers, a receiver associated with said compressor, by-pass lines connecting certain low and high compression cylinders, and lines leading from certain of said cylinders to said receiver, and valve means carried by said cylinders to control the ingress and egress of fluid thereto and therefrom.

3. In a double acting compressor of the class described embodying opposed sets of low and high compression cylinders arranged in alternate relation, ingress and egress valves arranged in said cylinders, pistons in said cylinders, rectangular piston rods connecting said pistons, anti-friction means carried by said rods and anti-friction guides therefor, said guides comprising rollers, cam means associated with said rods and having track-ways contacting said first mentioned anti-friction means, means for driving said cam, and means for by-passing compressed air from certain of said low compression cylinders to certain of said high compression cylinders.

4. In a double acting compressor of the class described embodying opposed sets of low and high compression cylinders arranged in alternate relation, ingress and egress valves arranged in said cylinders, pistons in said cylinders, piston rods connecting said pistons, said pistons being rectangular in cross section, anti-friction means carried by said rods and anti-friction guide rollers therefor, cam means associated with said rods and having track-ways contacting said first mentioned anti-friction means, means for driving said cam, and means for by-passing compressed air from certain of said low compression cylinders to certain of said high compression cylinders, said anti-friction means causing the rods to become full floating upon their respective pistons.

5. In a compressor of the class described, embodying a plurality of concentrically and alternately arranged sets of low and high compression cylinders by-pass connected together, pistons mounted in said cylinders, rectangular rods connecting said pistons and having roller means associated therewith to cause their free floating movement, said means embodying rollers arranged in the ends of said pistons, and guide rollers arranged to contact the sides thereof, and an obliquely and integrally formed cam having its track-ways entering between said first mentioned rollers to cause the free floating reciprocation of said rods.

JOSEPH VOLLIMAN.