PUBLISHED
JUNE 8, 1943.
BY A. P. C.

B. R. PLANCHE
GAS COMPRESSING PLANT
Filed Jan. 27, 1942

Serial No.
428,380
2 Sheets-Sheet 1

Fig. 1

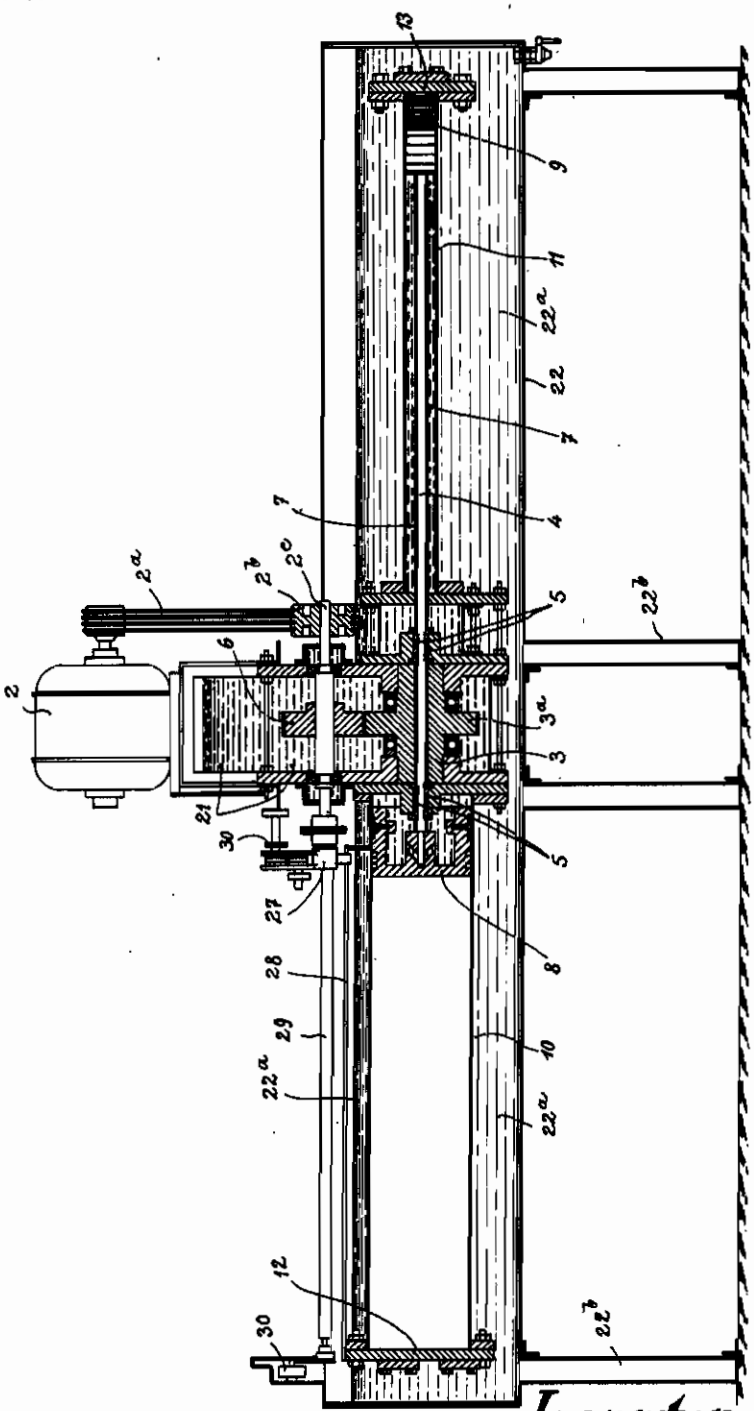

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Fig. 2

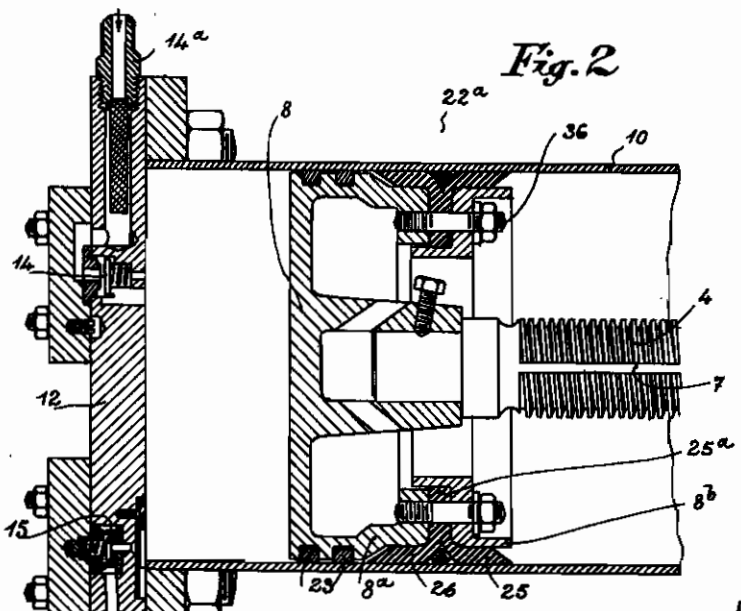

Fig. 3

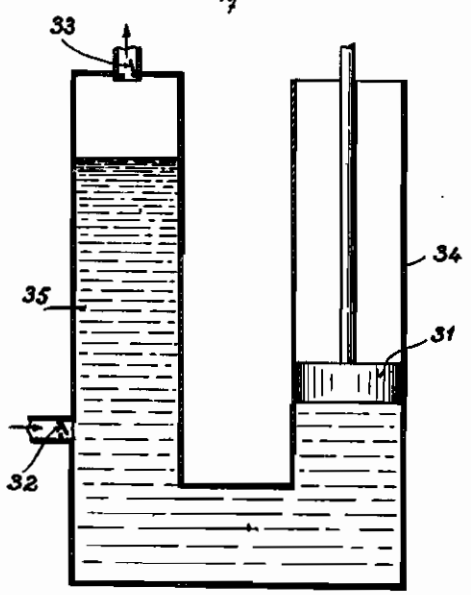

Fig. 4

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ALIEN PROPERTY CUSTODIAN

GAS COMPRESSING PLANT

Benjamin René Planche, Villefranche-sur-Saone, France; vested in the Alien Property Custodian

Application filed January 27, 1942

This invention has reference to plants for compressing gas under a high pressure and has for its primary object to provide a plant of this kind particularly utilisable for refilling with gas such as lighting gas compressed under suitable pressure steel bottles or tubes such as are employed either stationarily or for such uses as on board automotive vehicles for feeding internal combustion engines.

Another object of the invention is to provide an improved gas compressing plant by means of which steel bottle refilling may be completed within a few hours by an entirely automatic process carried out very gradually and requiring a minimum of supervision and labor.

A further object of the invention is to provide an improved gas compressing plant made up of a single or multiple low pressure unit and a single or multiple high pressure unit, said units being absolutely tight and mutually interconnected, the arrangement of the compression producing members being such as to provide slow operation and small delivery.

Another object still of the invention is to provide an improved gas compressing plant including fluid cooling means for the operative or movable parts performing the drive between a prime mover such as an electric motor and the low pressure and high pressure pistons, and further fluid cooling means for the outer surfaces of the stationary cylinder units in which said pistons are respectively moved responsive to rotation of said motor in periodically reversed directions.

Still another object of the invention is to provide an improved gas compressing plant or installation wherein cooling of the cylinder and piston units is assisted by those members such as rings and gasket-like leather cups ensuring proper fluid tightness.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel construction and combination of parts that will be now described with reference to the accompanying diagrammatic drawings exemplifying a suitable constructional form and a variation and forming a part of the present disclosure.

In the drawings:

Figure 1 is an elevational view with many parts in section showing the compressing plant in its entirety, certain details being omitted for the sake of clearness.

Figure 2 is a detail sectional view drawn on a larger scale showing the low pressure piston and the associated cylinder end.

Figure 3 is a detail sectional view also drawn on a larger scale and showing the high pressure piston with the associated cylinder end.

Figure 4 is a diagrammatic simplified view showing a modified arrangement in which the operation takes place hydraulically instead of mechanically.

Like reference characters designate like parts throughout the several views.

The frame of the compressing plant shown on the drawings comprises a top bracket 1 on which is supported an electric motor 2 of suitable power and characteristics which through a belt 2^a, a pulley 2^b and an intermediate shaft 2^c drives a gear 6 fast upon said shaft and meshing with cog teeth on a flange 3^a formed integral with an elongated nut 3 which is so connected lengthwise to the adjacent frame parts as to be held thereby against longitudinal displacement.

Inside the nut 3 whose internal screw thread may have any suitable pitch is engaged a horizontally extending screw-threaded spindle 4 adapted to be slowly shifted as the nut rotates. Said spindle is held against rotation by splining keys or feathers 5 wedged in the adjacent frame parts and slidably received in longitudinal grooves or keyways 7 formed in said spindle 4. Owing to this arrangement, and as will be readily understood, when the motor 2 rotates in the one or the other direction responsive to the operation of a reversing switch as will be described hereafter, the splined screw-threaded spindle 4 is longitudinally moved either to the right or to the left at the proper slow speed which is required for conveniently performing adequate operation of the compressing plant.

The ends of the screw-threaded spindle 4 are provided respectively with a low pressure piston 8 and a high pressure piston 9. Said pistons are housed for longitudinal motion in internally machined steel tubes or sleeves 10, 11 which form the compression cylinders. The cylinder 10 corresponds to the low pressure stage, while the cylinder 11 which is of much smaller cross sectional area corresponds to high pressure stage. Said sleeves or cylinders 10, 11 are tightly closed at their outermost extremities by end plates 12, 13 respectively. The end plate 12 of the low pressure compressor (Fig. 2) is provided with a spring-urged suction valve 14 and with a spring-urged delivery valve 15 controlling the outlet to a low pressure delivery pipe 15^a. The valve 14 similarly controls the inlet through a suction pipe 14^a. The end plate 13 of the high pressure compressor (Fig. 3) is provided likewise with a high

pressure suction spring-urged valve 16 controlling the inlet through a suction pipe 18a and with a high pressure delivery pipe 17 controlling the outflow through a delivery pipe 17a. The fluid circulation takes place as depicted by the arrows.

The low pressure delivery pipe 15a and high pressure suction pipe 16a are connected to an intermediate tank 40 which may be of any known form and which thus provides intercommunication between the cylinders 10, 11.

All the movable parts of the operating mechanism are immersed in a pool of oil or equivalent liquid enclosed in an overhead central or primary container 21 while the stationary parts of the plant are cooled either by a mass of water 22a enclosed in an elongated vat or secondary container 22 supported by uprights 22b as shown in Fig. 1 or, alternatively, by strong ventilating means (not shown) which may be of any conventional construction.

It will be understood that at each reciprocating motion of the spindle 4 the oil is driven out of the piston chamber of the cylinder 10 or 11 and flows back into the central or primary container 21, whence it is introduced into the opposite piston chamber of the other cylinder, and so forth, thereby ensuring a continuous oil stirring and circulating action which facilitates heat exchange and cooling.

Owing to this arrangement and to proper use of well cooled gasket-like leather cups as hereinafter described, it becomes possible to give the pistons proper fluid tightness which, in cooperation with the provision of the tight suction and delivery valves, ensures the proper drawing in of very small quantities of fluid at a time and their correct deliveries under suitable building up pressure.

The arrangement of the gasket-like leather cups is advantageously as follows in order to protect them from undue heating and the consequent damage which might ensue therefrom:

As shown in Fig. 2, the low pressure piston 8 is made hollow so that the oil pool in which the movable parts of the mechanism are immersed may adequately cool it from within. Moreover, the piston 8 is provided at the front end of its skirt with a plurality of heat exchanging rings 23, two of which are provided by way of example in the constructional form shown.

As the high pressure piston 9 (shown separately in Fig. 3) cannot be made hollow as otherwise its recesses would not be sufficient to enable the heated oil to flow away, said piston is provided with a larger number of heat exchanging rings such as 24. In the constructional embodiment shown, six of these rings 24 are provided. Moreover, the rod of said piston has a cross sectional size matching that of the cylinder bore so as to assist cooling owing to conductiveness.

As a means of safety, two or more leather cups such as 25 may be arranged one after the other in the direction in which pressure exerts itself. Moreover, on both pistons, for low and for high pressure operation respectively, an additional leather cup 26 is so arranged as to extend in the opposite direction, thereby constituting an oil-tight gasket.

The leather cups fitted on the skirt of the low pressure piston 8 shown in Fig. 2 form an integral body having a splayed outline and comprise a common inner retaining flange 25a clamped home between an inner collar 8a on the piston skirt and a counter-elbowed keeper ring 8b, bolts 36 being engaged through coincident holes in said collar and ring.

The reciprocatory motion is obtained as shown in the drawings by reversing the current feed to the electric motor 2. To that effect, a nut member 27 splined on a rod 28 so as to held against rotation is associated with a screw-threaded rod 29 with a view to following the movements of the low pressure piston 8. At the end of its stroke said nut member 27 operates either of a pair of oppositely disposed contact studs 30 which are so wired in a conventional way (not shown) as to reverse the current feed to the electric motor 2, whereby the direction of rotation of its shaft is reversed and the screw-threaded spindle 4 rotates in the opposite direction.

Each cylinder unit may be duplicated or multiplied so as to form a composite assembly whose cylinders may be juxtaposed side by side, the reversing and reciprocating mechanism being then common to all cylinders. This modified arrangement will be readily understood by anyone skilled in the art and does not require special illustration. The expression "cylinder unit" used in the claims will be meant to also involve this constructional modification.

Control of the operation may be performed either mechanically as in the above described constructional example or hydraulically. Where the cylinders would be arranged vertically instead of being mounted horizontally, the pistons may be replaced by a mass of liquid so enclosed in a container as to alternately rise and sink therein under the pushing stress exerted by a plunger or like actuator. This constructional modification is diagrammatically illustrated in Fig. 4 wherein 31 designates the plunger adapted to move upwardly or downwardly in one upright leg 34 of a U-shaped liquid container whose other upright leg 35 is provided on its side wall with a suction valve 32 and at its top end with a gas delivery valve 33. In this constructional modification, the plant may also comprise one or several pressure stages.

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