Feb. 18, 1930. D. M. PUTNAM 1,747,457

COMPRESSOR

Filed Feb. 7, 1927 2 Sheets-Sheet 1

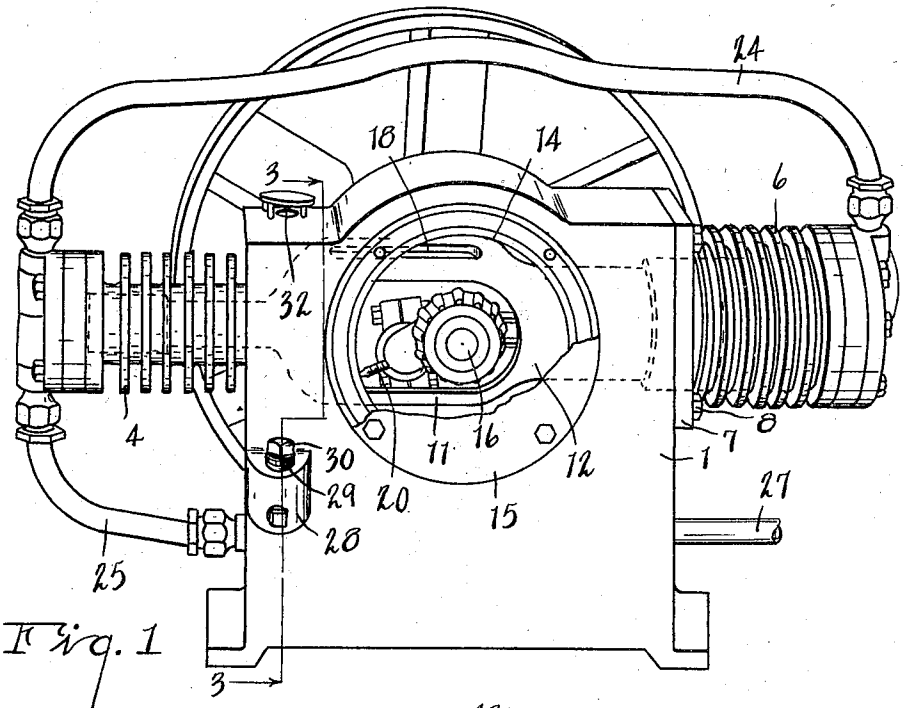



Fig. 1

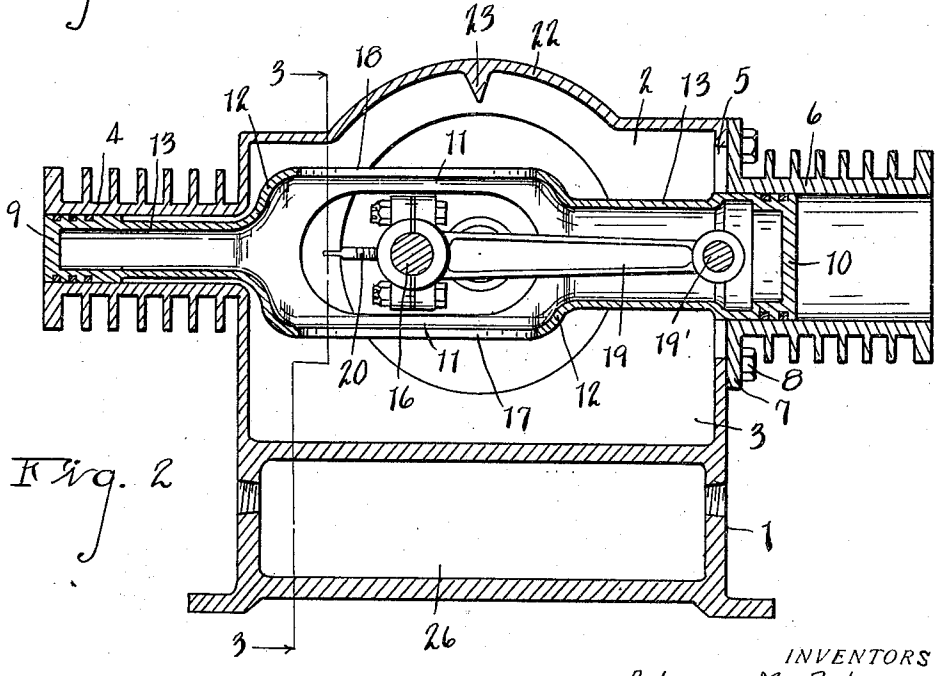



Fig. 2

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COMPRESSOR

Filed Feb. 7, 1927 2 Sheets-Sheet 2

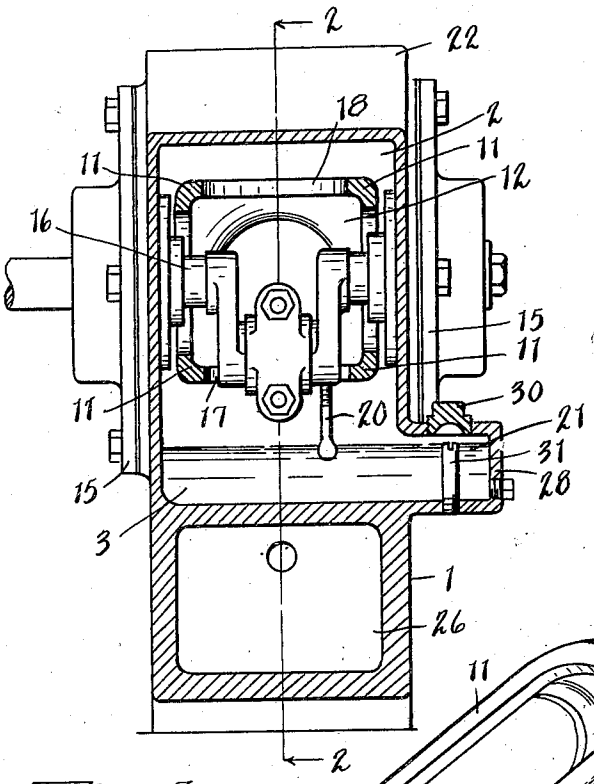



Fig. 3

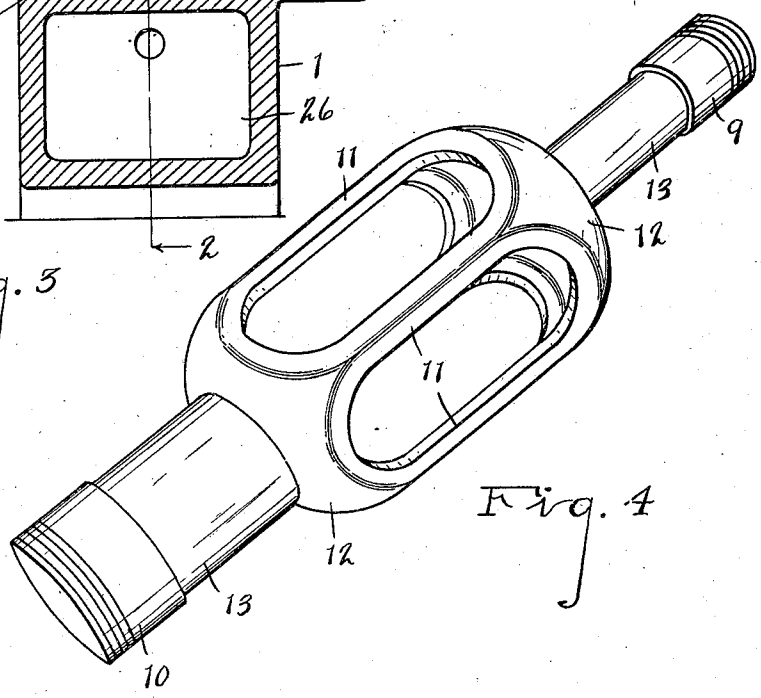



Fig. 4

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Patented Feb. 18, 1930 1,747,457

# UNITED STATES PATENT OFFICE

DELMER M. PUTNAM, OF BATTLE CREEK, MICHIGAN, ASSIGNOR OF ONE-HALF TO RHODA S. DUNLAP, OF BATTLE CREEK, MICHIGAN

## COMPRESSOR

Application filed February 7, 1927. Serial No. 166,485.

My improvements have been especially designed by me for embodiment in air compressors of the two-stage type and I have illustrated the same in the accompanying drawing as commercially adapted in that type of air compressor, although my improvements are desirable and readily adapted for use in multi-cylinder compressors and pumps of other types.

The main objects of this invention are:

First, to provide an improved pump or compressor having a unitary or integral piston member, the pistons and connecting yoke being formed integrally and machined en bloc.

Second, to provide an air compressor or pump in which a unitary cylinder block is provided, one of the cylinders being formed integrally with the cylinder block.

Third, to provide an air compressor in which the cylinder block is adapted as a lubricant receptacle which permits the disassembling and reassembling of the piston without draining off the lubricant.

Fourth, to provide a structure of the class described with an improved filling device which provides a gaging means for the lubricant.

Fifth, to provide a structure having these advantages which is very simple and economical.

Sixth, to provide an integral piston unit comprising a pair of pistons and a connecting yoke which is relatively light in weight and at the same time very strong.

Objects pertaining to details and economies of my invention will definitely appear from the detailed description to follow. The invention is clearly defined and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawing forming a part of this application, in which:

Fig. 1 is a side perspective view of an air compressor embodying the features of my invention, a portion of one of the side plates being broken away to disclose parts within.

Fig. 2 is a detail vertical longitudinal section on a line corresponding to line 2—2 of Fig. 3, the crank being shown in a different position from that of Fig. 3.

Fig. 3 is a transverse section on a line corresponding to line 3—3 of Figs. 1 and 2, the crank, however, being shown in another position from that shown in Figs. 1 and 2.

Fig. 4 is a perspective view of the piston unit.

Referring to the drawing, my improvements in the embodiment illustrated comprise a unitary cylinder block 1 having a crank chamber 2 therein, the lower portion of this crank chamber forming a lubricant receptacle designated generally by the numeral 3.

In this embodiment the cylinder 4 is cast integrally with the cylinder block. Opposite this cylinder 4 the cylinder block has an opening 5 for the second cylinder 6. This cylinder 6 has a flange 7 at its inner end, the same being secured to the cylinder block by means of the bolts 8.

I provide a unitary piston unit comprising the pistons 9 and 10 connected by an integrally formed yoke. This yoke comprises spaced longitudinal bars 11 disposed in parallel spaced relation, the central portion of the yoke being rectangular in cross section as shown in Figs. 3 and 4, the bars being disposed at the angles of the rectangle.

At the ends of these bars are spherically curved or concavo convex end portions 12 which merge into the tubular necks 13 of the pistons. The opening 5 in the cylinder block is of such diameter as to permit the piston unit being introduced and removed through this opening when presented endwise thereto. Ordinary practice is to provide a spherically curved yoke to which the pistons are bolted. This requires separate and a very substantial amount of machining and the bolts are likely to loosen and clatter or cause serious injury in use.

With this arrangement of parts the piston unit is introduced and the removable cylinder 6 mounted on the cylinder block, the cylinder constituting a closure for the cylinder block opening. It will be noted that the opening 5 is above this lubricant level, so that it is not necessary to drain the crank case or lubricant

receptacle when it is desired to remove the piston unit for the purpose of reboring the cylinder, renewing piston rings or the like.

The bars 11 being substantially straight and parallel are in the most effective position to receive the thrust and pulling strains to which they are subjected in use. The curved end portions 12 are also well adapted to receive the stresses to which they are subjected, so that the piston unit may be made very light and yet effectively withstand the strains to which it is subjected.

The cylinder block or crank case is provided with side openings 14 closed by the side plates 15 carrying suitable bearings for the crank shaft 16. The top and bottom openings 17 and 18 of the yoke are of such size as to permit the crank to swing therethrough as shown in Fig. 3, thus permitting the yoke to be made of relatively small cross section.

The larger cylinder 13 is provided with a piston pin 19′ which is connected by the connecting rod 19 to the crank. A splash pin 20 is mounted on the crank to dip into the lubricant indicated at 21 in Fig. 3. The top of the crank case is curved or crowned at 22 and has a central depending drip lip 23 so that the lubricant splashed or thrown up by the crank pin tends to drip from this lip upon the crank.

Owing to the shape of the yoke and the closed ends of the piston unit the lubricant is not thrown or splashed directly into the cylinders but sufficient lubricant flows along the walls to secure effective lubrication. This is highly desirable as an excess of lubrication is objectionable in air pumps, the lubricant finding its way into the air.

The embodiment illustrated is of the two-stage type, the cylinder 6 being the initial cylinder, and this is connected by the pipe 24 to the second cylinder 4. The cylinder 4 is connected by the discharge pipe 25 to the cooling chamber 26 formed in the bottom of the cylinder block. The pipe 27 indicates the connection to the storage tank.

To provide an effective means for filling and preventing flooding, I provide the crank case with a boss-like extension 28 which has a filling opening 29 in the top closed by the plug 30. This filling extension is fully open to the lubricant chamber of the crank case so that there is an unrestricted flow of lubricant to the crank case and also the level of the lubricant may be readily determined by means of the gage pin 31. Lubricant should be maintained up to approximately the top of this gage pin but flooding is prevented owing to the fact that the lubricant will flow out of the filling opening in the event that too much is supplied.

32 illustrates a breather opening.

I have illustrated my improvements in a form or embodiment which I have found very practical. I have not attempted to illustrate or describe certain modifications and adaptations which I contemplate as I believe this disclosure will enable those skilled in the art to embody or adapt my invention as may be desired.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The combination of a cylinder block provided with a crank chamber adapted as a lubricant receptacle, there being a boss-like filler extension at one side of said lubricant chamber having an unrestricted side opening to the chamber and a filling opening at the top, said crank chamber having an arched top with a centrally disposed depending drip lip at the crown thereof, a lubricant gage pin below said filling opening, oppositely disposed cylinders, at least one of which is removable, an integral piston unit comprising a pair of opposed pistons and a connecting yoke therefor, said yoke comprising longitudinal bars disposed in spaced rectangular relation providing top, bottom and side yoke openings, said bars being connected to said pistons by curved end portions merging into the bars and pistons, the cylinder opening of said cylinder block being of such size as to receive said piston unit when it is presented endwise thereto, a crank shaft disposed through the side openings of said yoke, the top and bottom openings of the yoke being of such size as to permit the crank to swing therethrough, a connecting rod connecting one of said pistons to said crank, and a splash pin on said crank.

2. The combination of a cylinder block provided with a crank chamber adapted as a lubricant receptacle, there being a boss-like filler extension at one side of said lubricant chamber having an unrestricted side opening to the chamber and a filling opening at the top, a lubricant gage pin below said filling opening, oppositely disposed cylinders, at least one of which is removable, an integral piston unit comprising a pair of opposed pistons and a connecting yoke therefor, said yoke comprising longitudinal bars disposed in spaced rectangular relation providing top, bottom and side yoke openings, said bars being connected to said pistons by curved end portions merging into the bars and pistons, the cylinder opening of said cylinder block being of such size as to receive said piston unit when it is presented endwise thereto, a crank shaft disposed through the side openings of said yoke, the top and bottom openings of the yoke being of such size as to permit the crank to swing therethrough, and a connecting rod connecting one of said pistons to said crank.

3. The combination of a cylinder block provided with a crank chamber adapted as a lubricant receptacle, oppositely disposed cyl-

inders, one at least of which is removable, an integral piston unit comprising a pair of opposed pistons and a connecting yoke therefor, said yoke comprising longitudinal bars disposed in spaced rectangular relation providing top, bottom and side yoke openings, said bars being connected to said pistons by curved end portions merging into the bars and pistons, the cylinder opening of said cylinder block being of such size as to receive said piston unit when it is presented endwise thereto, a crank shaft disposed through the side openings of said yoke, the top and bottom openings of the yoke being of such size as to permit the crank to swing therethrough, and a connecting rod connecting one of said pistons to said crank.

4. In a compressor, the combination of a cylinder block having a crank chamber therein adapted as a lubricant receptacle, said chamber having a side extension provided with a filling opening, a gage visible through said filling opening, cylinders carried by said cylinder block, a pair of opposed pistons and connecting yoke therefor, said cylinder block having a curved top portion with a centrally disposed lubricant drip lip, a crank provided with a lubricant splash pin, and a connecting rod connecting one of said pistons to said crank.

5. In a compressor, the combination of a cylinder block having a crank chamber therein adapted as a lubricant receptacle, cylinders carried by said cylinder block, a pair of opposed pistons and connecting yoke therefor, said cylinder block having a curved top portion with a centrally disposed lubricant drip lip, a crank provided with a lubricant splash pin, and a connecting rod connecting one of said pistons to said crank.

6. In a compressor, the combination of a cylinder block having a crank chamber therein adapted as a lubricant receptacle, said chamber having a side extension provided with a filling opening, a gage visible through said filling opening, cylinders carried by said cylinder block, a pair of opposed pistons and connecting yoke therefor, and a connecting rod connecting one of said pistons to said crank.

7. A structure of the class described comprising a cylinder block provided with a crank chamber adapted as a lubricant receptacle, there being a boss-like filler extension at one side of said lubricant chamber and a filling opening at the top, and a lubricant gage pin below said filling opening.

8. The combination of an integral cylinder block unit comprising a crank chamber adapted as a lubricant receptacle and having a boss-like filler extension at one side having an unrestricted side opening to the lubricant receptacle and a filling opening at the top, and an upright lubricant gage pin disposed below said filling opening.

9. In a structure of the class described, the combination of a cylinder block provided with a pair of spaced cylinders, at least one of which is removable, an integral piston unit comprising a pair of opposed pistons and a connecting yoke therefor, said yoke having spherically curved ends joining the pistons and parallel longitudinal connecting bars merging into said curved ends and disposed in spaced rectangular relation providing top, bottom and side yoke openings, the said cylinder opening in said cylinder block being of such size as to receive said piston unit when it is presented endwise thereto, a crank shaft disposed through the side openings of said yoke, the top and bottom openings of said yoke being of such size as to permit the crank to swing therethrough, a piston pin within one of said pistons, and a connecting rod for said piston pin to the crank.

In witness whereof I have hereunto set my hand.

DELMER M. PUTNAM.