Feb. 17, 1953 A. P. ANDERSON 2,628,765

COMPRESSOR

Filed Nov. 4, 1948 2 SHEETS—SHEET 1

Fig. 1

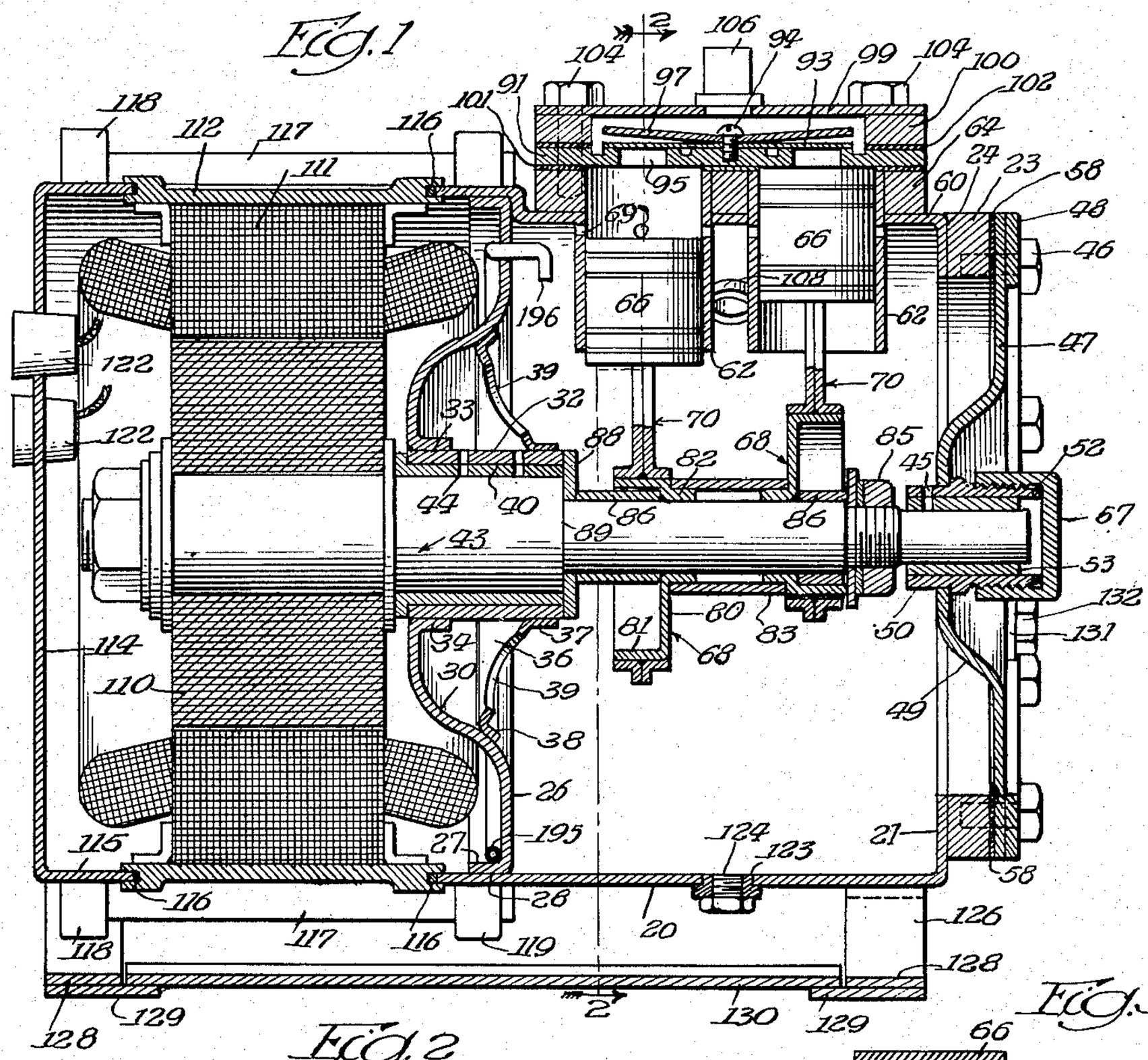


Fig. 2

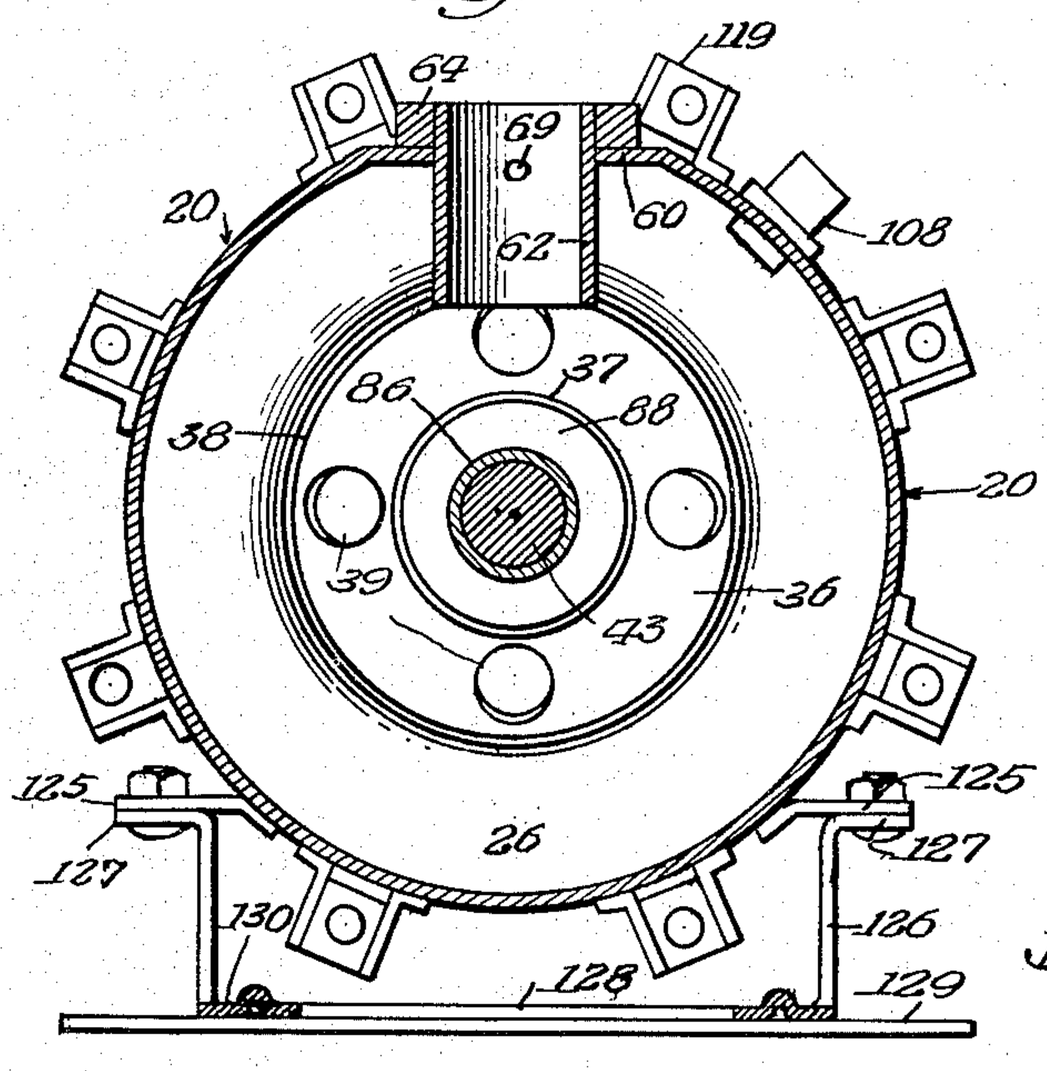
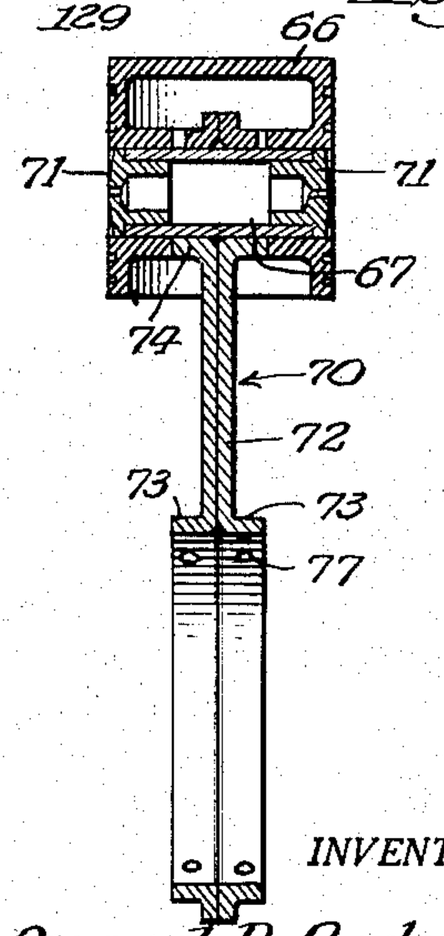


Fig. 3



INVENTOR.

August P. Anderson

By Fred Gerlach

his Atty.

Feb. 17, 1953

A. P. ANDERSON

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2 SHEETS—SHEET 2

Fig. 7

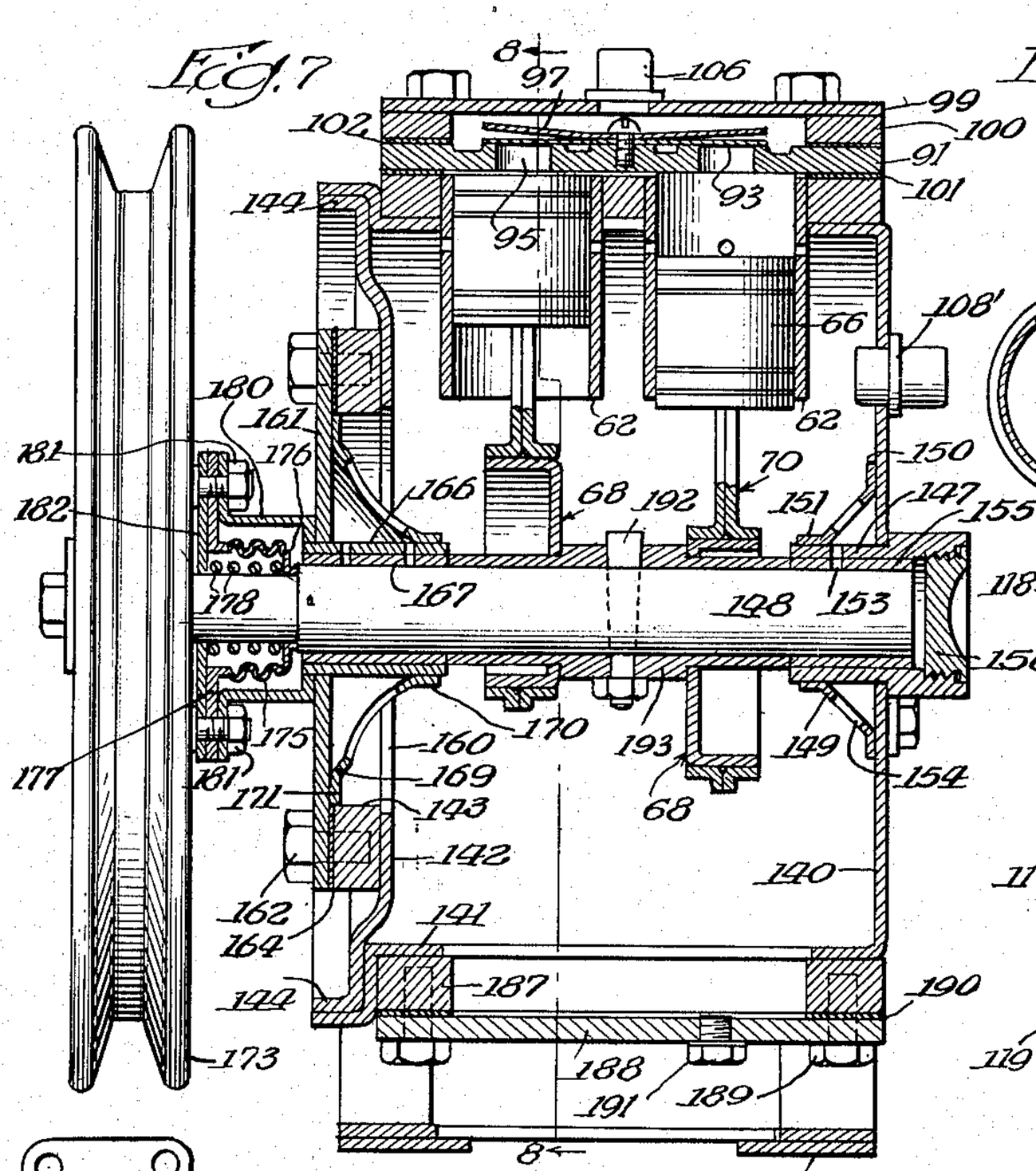


Fig. 4

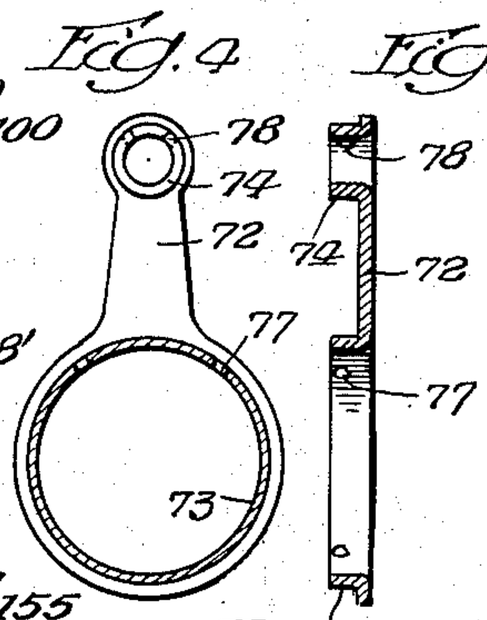


Fig. 5

Fig. 6

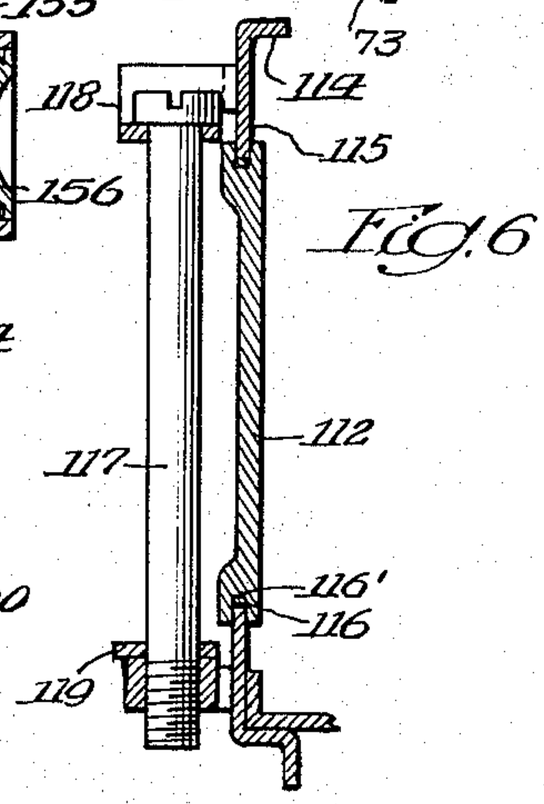


Fig. 8

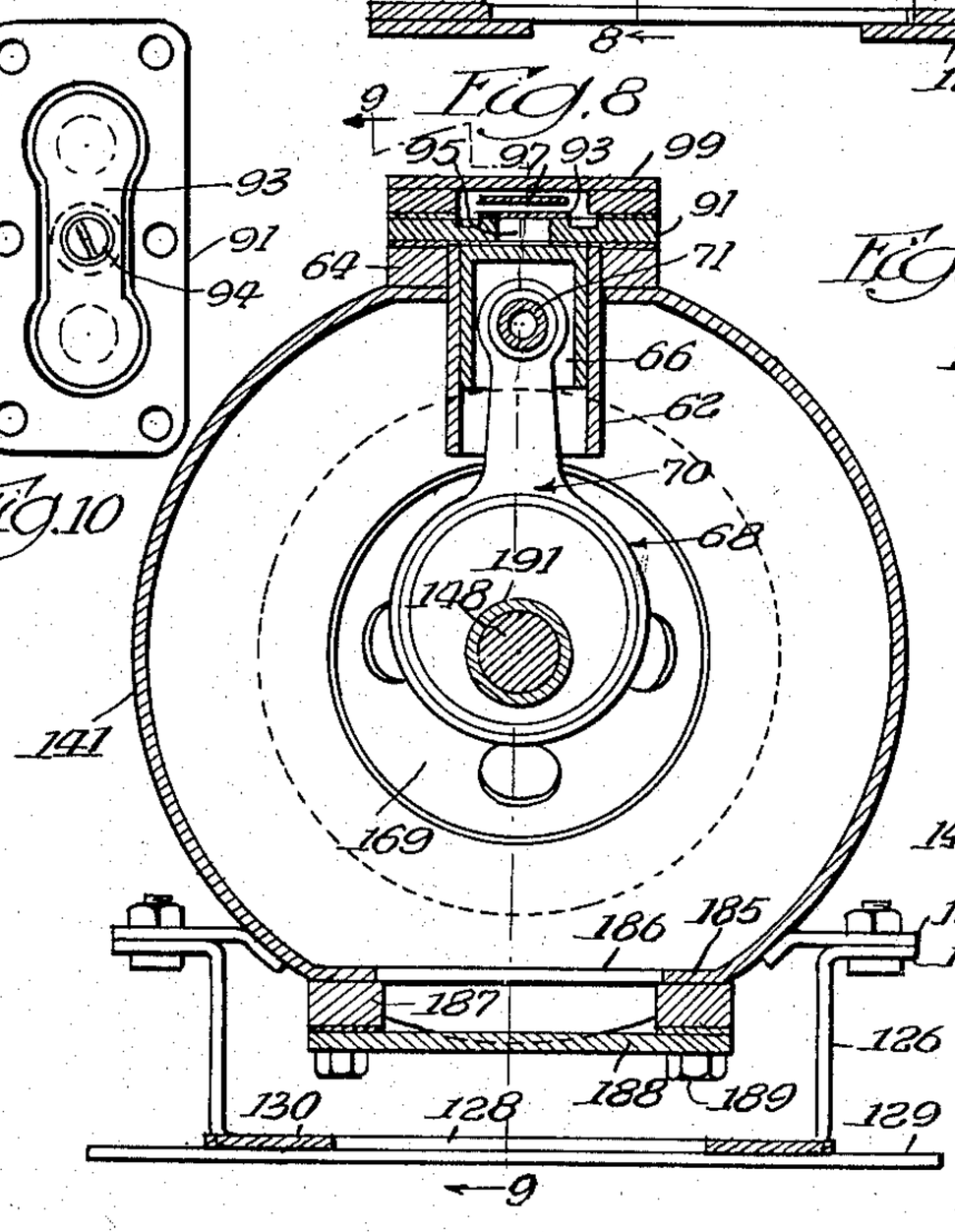
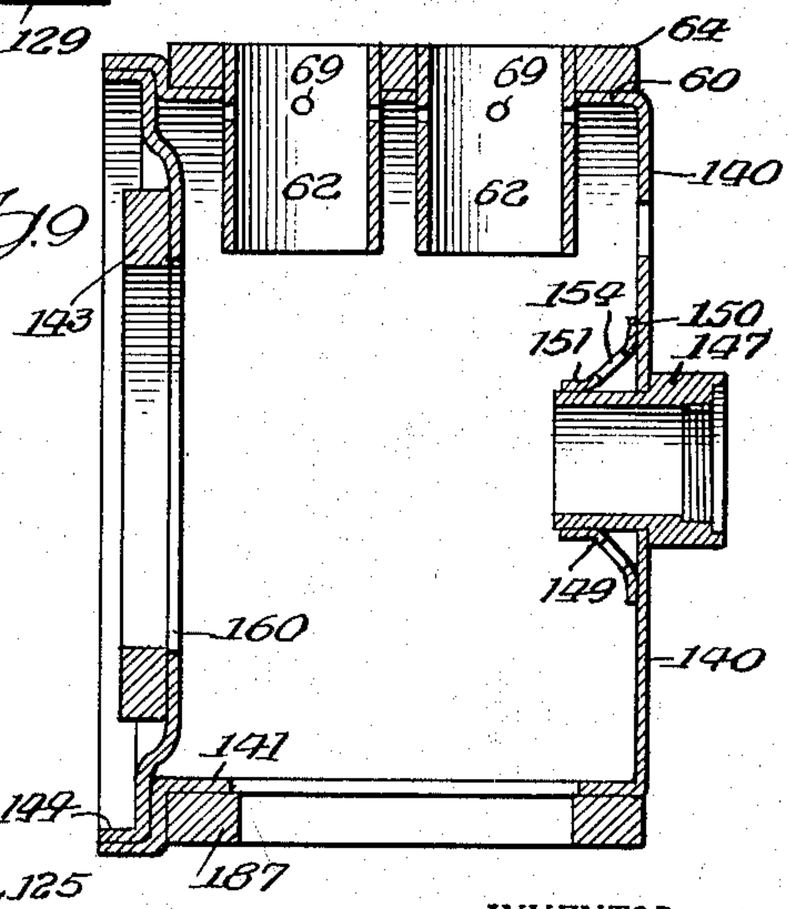


Fig. 10

Fig. 9



INVENTOR.

August P. Anderson

By Fred Gerlach

His Atty.

Patented Feb. 17, 1953

2,628,765

UNITED STATES PATENT OFFICE

2,628,765

COMPRESSOR

August P. Anderson, Goshen, Ind.

Application November 4, 1948, Serial No. 58,257

10 Claims. (Cl. 230—58)

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The invention relates to compressors of the type used for refrigerating systems.

One object of the invention is to provide a compressor which includes a case or housing which can be constructed of stampings for low cost production.

Another object of the invention is to provide a compressor which includes a case which can be produced of stampings and which is adapted to form a part of a sealed motor-compressor unit.

Another object of the invention is to provide a compressor which includes pitmen and eccentrics which can be formed of stampings.

Another object of the invention is to provide a compressor case which can be formed of stampings with reinforcing elements.

Other objects of the invention will appear from the detailed description.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings—

Fig. 1 is a vertical central longitudinal section of a motor compressor unit exemplifying the invention.

Fig. 2 is a section of the compressor case and parts brazed thereto, taken on line 2—2 of Fig. 1

Fig. 3 is a transverse section illustrating the pitman and a piston connected thereto.

Fig. 4 is a detail of one of the sections of a pitman, the rim being shown in section.

Fig. 5 is a longitudinal section of one of the pitman sections.

Fig. 6 is a section illustrating one of the devices for securing the motor housing on the compressor case.

Fig. 7 is a section illustrating the compressor with a belt-drive.

Fig. 8 is a section taken on line 8—8 of Fig. 7.

Fig. 9 is a section taken on line 9—9 of Fig. 8, of the compressor case and parts brazed thereto.

Fig 10 is a plan of one of the cylinder heads with the valve therein.

The compressor comprises generally a case or housing, a pair of cylinders each with a piston slidably mounted therein, a drive-shaft enclosed in the case, eccentrics driven by the shaft, pitman for operating the pistons from the eccentrics, an electric motor enclosed in an auxiliary housing section, a connection for returning the low pressure refrigerant from the refrigerating system, and valve means for controlling the delivery of high pressure refrigerant from the case to the refrigerating system.

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The case comprises a shell generally designated 20 with an inturned flange 21 at one end, in which is formed an opening for access to the interior of the case, and a ring 23 which is brazed at 24 to the outer face of flange 21. The opposite side of the case is closed by a head 26 which is provided with an outturned flange 27, the periphery of which is brazed at 28 to the inner face of the shell 20. Head 26 is formed of a plate or stamping and is bulged outwardly as at 30 for transverse rigidity. A bearing 32 for the drive-shaft is brazed at 33 to an inturned flange 34 on the head 26. Bearing 32 is also supported by a stamped disk 36 which is provided with a flange 37 which is brazed to the periphery of bearing 32, and an outer flange 38 which is brazed to the inner face of head 26. Disk 36 also reinforces the head 26 transversely. This exemplifies a head forming one side of the case, which consists of a stamping for supporting the bearing 32, and a reinforcing disk for the bearing brazed to the head 26 and bearing 32. Disk 36 is provided with openings 39 which permit oil from the case to be splashed to the bearing 32. A bushing 40 is supported in bearing 32. A drive-shaft 43 is journalled in bushing 40 and is lubricated by oil supplied thereto through oil-ports 44 in bushing 40 and bearing 32.

A removable closure for closing and opening one end of the case comprises a plate 47 and a reinforcing ring brazed to the outer face and around the margin of said plate. Plate 47 is provided with a central inward bulge 49 for reinforcing said plate transversely. A bearing 50 is brazed in a central opening in plate 47. One end of drive-shaft 43 is journalled in a bushing 53 in bearing 50. Oil is splashed to shaft 43 through a port 55 in bearing 50 and bushing 53. The outer end of bearing 50 is closed by a screw-cap 57, which is provided with a gasket 52 to form a seal. A packing gasket 58 is interposed between plate 47 and ring 23. This exemplifies a removable end-closure which includes a stamping with an integral annular bulge in which the bearing 50 is supported and brazed, and which is transversely rigid.

The shell 20 is provided with a flattened upper portion 60. A pair of radial cylinders 62 extend through said flattened portion and through a reinforcing plate 64, the inner face of which is brazed to the flattened portion 60 of shell 20. The outer periphery of the outer end portions of cylinders 62 are brazed in plate 64 and the flattened portion 60 of the shell. Each cylinder consists of a section of straight tubing. A piston

66 is slidable in each cylinder 62 and is operable by an eccentric 68 and by a pitman generally designated 70. Each piston has journalled therein a wrist-pin 67 to which a pitman 70 is connected. Each wrist-pin 67 consists of a piece of straight tubing and shouldered studs 71 in the ends of the tubing. Each pitman 70 consists of a pair of mating stampings, each of which comprises a flat side 72, an outturned cylindrical flange 73 fitting around an eccentric 68 and an outturned cylindrical flange 74 fitting around a wrist-pin 67. Oil-ports 77 extend through flanges 73 for lubricating the eccentric, and oil-ports 78 extend through the flanges 74 for lubricating the wrist-pin bearing. The abutting faces of the flat sides of the sections are brazed together. This exemplifies a pitman which is composed of stampings brazed together and flanges forming bearings for the eccentrics and wrist-pin.

Each eccentric 68 consists of a stamping and includes a flat side-wall 80 and a rim-forming flange 81 projecting from one side of wall 80, and a hub 82 projecting from its other side. The flange 81 fits in the flanges 72 of a pitman 70.

A sleeve 83 fits around and is brazed to the hubs 82 of the eccentrics 68. The eccentrics and sleeve 83 are confined on shaft 43 by a nut 85 and spacer sleeves 86. A thrust-bearing 88 engages a shoulder 89 on shaft 43 and is engaged by the inner sleeve 86. The hubs 82 of the eccentrics are connected by a suitable spline to shaft 43 for rotating the eccentrics.

A cylinder-head 91 extends over the outer ends of cylinders 62 and the reinforcing plate 64. A reed-valve 93 and a stop 97 are secured by screw 94 on the top of cylinder-head 91, and said valve controls the outflow of fluid from cylinder 66 through openings 95 in head 91. A sealing-gasket 101 is interposed between said head and plate 64. A flat stamped plate 99 having a frame 100 brazed to its inner face forms a cover or closure for the chamber for valve 93, and is removably secured to the case by screws 104 which extend through plate 99, frame 100, cylinder head 91, and are threaded into the reinforcing frame 64. A sealing-gasket 102 is interposed between head 91 and frame 100.

A nipple 106 is brazed in plate 99 for a pipe connection to the condenser of the refrigerating system. A nipple 108 extends through shell 20 for connection to the suction line of the refrigerating system for delivering the fluid into the casing for the compressor. A nipple 123 is brazed to the lower portion of shell 20 for a screw-plug 124 to drain lubricating oil from the case. A nipple 131 is brazed into the head 47 for a filler plug 132 for lubricating oil.

The electric motor for driving shaft 43 is mounted at the outer side of the head 26 of the casing, and comprises a rotor 110 on shaft 43 and a stator 111 mounted on the inner periphery of a ring 112. Ring 112 is clamped endwise between the shell 20 and an outer head which is formed of a stamping and comprises a side-wall 114 and an inturned flange 115. One end of the shell 20 extends into an annular groove 116 in ring 112, and the inner end of flange 115 extends into a similar groove 116 at the opposite end of ring 112. Ring 112 which supports the stator 111 is clamped between flanges 115 and shell 20 by a series of screws 117 which extend through stamped lugs 118, which are brazed to flange 115 and similar lugs 119 brazed to shell 20. Sealing gaskets 116′ are confined in the grooves 116

in ring 112. Head 114, 115, ring 112 and one end of shell 20 form an auxiliary housing or case for the motor at one end of the compressor case. Plugs 122 are provided in the head 114 for the lead wires to the stator 111. A characteristic of this construction is that the ring 112, in which the stator is mounted, is exposed for heat transfer from the motor to the outside of the case. This results in efficient cooling of the motor.

A pipe 195 is soldered to the outer side of plate 26, extends from the lower portion of the motor compartment, and is provided with a discharge terminal 196 at its upper end which extends through said wall, for returning to the crankcase oil which may leak between shaft 43 and bushing 40 into said chamber. When the compressor is shut down for a sufficient period, the pressure in the crank case and the motor compartment will equalize. When the compressor starts, the pressure in the crankcase is more rapidly reduced than it is in the motor-compartment, and this differential in pressure will cause any oil in the bottom motor-compartment to be forced through pipe 190 and returned to the crankcase.

The shell and stamped parts are usually formed of suitable steel which can be shaped to the desired contour. The cylinders are formed of sections of seamless steel tubing. The stamped shell functions as the body of a crankcase.

A base for supporting the compressor-motor unit is formed of stampings, and comprises a pair of strips 125 which are brazed to opposite sides of shell 20, a pair of brackets with legs 126 which have their upper ends 127 bent outwardly and bolted to strips 125, and an integral cross-member 128 between said legs, cross-bars 192 brazed to the underside of cross-members 128, and longitudinal bars 130 extending between and brazed to cross-bars 129. This exemplifies a base which consists of stampings brazed together.

The operation of the construction described will be as follows: The motor will drive shaft 43 and the eccentrics 68 which will impart reciprocating strokes to the pistons. At the inner ends of the instrokes of the piston, low pressure fluid in the compressor case will pass through ports 69 into the cylinders 62, and during the outstrokes of the pistons the fluid will be compressed and forced past the valves 93 into the valve chamber and thence through nipple 106 to the condenser of the refrigerant line. During the operation of the motor, the heat therefrom will be transferred through the ring 112 to the outside of the compressor case for increased cooling efficiency.

In Figs. 7 to 9 the invention is exemplified with a belt-driven shaft for the compressor. The compressor comprises a shell which includes wall 140 at one end and an annular wall 141 formed of a stamping, a plate 142 at the opposite end of the case, and a reinforcing ring 143 having its inner face brazed to the outer face of plate 142. Plate 142 has an opening 160 conforming to the opening in ring 143, and is provided with an outturned flange 144, which fits in the annular wall 141 of the shell. Flange 144 and the inner face of the margin of plate 142 are brazed to the shell. The flange 144 and the inner face of plate 142 are brazed to the shell. A bearing 147 for one end of the drive shaft 148 extends through and is brazed to end-wall 140 of the case. A bronze-bushing 155 in which the drive-shaft 148 is journalled, is mounted in bearing 147. Bearing 147 is also supported by a stamped conical reinforcing plate 149, which has an inner

flange 151 brazed to the bearing 147, and an outer flange 150 brazed to wall 140. A port 153 conducts oil to the bearing 147. Openings 154 are provided in reinforcing plate 149 for the splash of oil to the oil-port 153. A screw-cap 156 seals the end of bearing 147.

The opening 160 in end-wall 142 of the case and the ring 143 provides access to the interior of the case, and is closed by removable closure which comprises a flat stamped cover-plate 161 which is secured by screws 162 to ring 143. A sealing gasket 164 is interposed between ring 143 and plate 161. A bearing 166 is brazed in and extends through plate 161 and is provided with a bushing 167 in which drive-shaft 148 is journalled. Bearing 166 is additionally supported by a conical stamped plate or disk 169 which is provided with an inner flange 170 which is brazed to the periphery of bearing 166 and an outer flange 171 which is brazed to the inner face of plate 161. A pulley 173 for a drive-belt is provided with sufficient weight to function as a flywheel and is suitably and removably secured to the outer end of drive-shaft 148.

A sealing device for the drive-shaft 148 adjacent pulley 173 comprises a bellows-type member 175 between a ring 176 fitting around shaft 148 and a plate 177, and a coil-spring 178. The sealing member 175 is confined, and plate 177 is supported in a housing 180 which is formed of a stamping and brazed to cover-plate 161. Spring 178 extends between ring 176 and an abutment plate 182 and urges the non-rotatable ring 176 into contact with a shoulder on shaft 148 to form a seal for the oil and low pressure fluid in the case. Bolts 181 extends through a flange on housing 180, plate 177, and a plate 182 for mounting the sealing device in the housing 180 around shaft 148.

The lower portion of the annular wall 141 is flattened at 185 and provided with an opening 186 for access to parts in the case. A flat reinforcing plate 187 with an opening conforming to the opening 186 is brazed to the flat portion 185 of the shell. A cover-plate 188 is removably secured by screws 189 which are threaded to the plate 187. A sealing gasket 190 is interposed between plates 188 and 187. A drain-plug 191 for oil is screw-threaded into cover-plate 188.

The eccentrics in the construction shown in Fig. 7 are brazed to a sleeve 193 which is secured to shaft 148 by a wedge-key 192. The sides of the eccentrics are brazed to shoulders formed on the sleeve. An inlet nipple 108' for low pressure refrigerant extends through and is brazed in the side-wall 140 of the case.

The construction of cylinders 62, cylinder head 91, cover-plate 99, pistons 66, pitman 70, and the outlet valve as shown in Figs. 7 to 9, is the same as the corresponding elements hereinbefore described. The supporting-base for the case is also of the same construction hereinbefore described. The outlet connection 106 is also of the same construction hereinbefore described. The operation of this construction will be similar to that hereinbefore described, except that the drive-shaft of the compressor will be belt-driven.

The invention exemplifies a compressor which includes an enclosing case which is adapted for production, as much as is practical, from stampings or plate-metal, and in which reinforcing elements, where necessary, are brazed to the stamped shell of the case. The eccentrics and the pitman are also of a construction which can be produced from stampings for quantity production. The invention also exemplifies a sealed compressor and motor unit which includes, so far as is practical, stamped parts.

In fabricating the elements, the parts to be joined are spot-welded into their assigned positions and then copper-brazed together for securely joining them and preventing leakage at the joints. The term "braze" as herein used is to be understood as including similar methods of joining metal parts together.

The invention is not to be understood as limited to the details described, since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

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

1. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shafts, comprising: a stamped cylindrical shell provided with a flat portion; cylinders for the pistons formed of straight tubing extending through and projecting outwardly from the flat portion of the shell; a flat reinforcing plate abutting and brazed to the projecting portions of the cylinders, and having its outer end substantially flush with the outer ends of the cylinders, and a cylinder-head removably secured on the reinforcing plate on the shell.

2. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shaft, comprising: a stamped cylindrical shell provided with a flat portion; cylinders for the pistons formed of straight tubing extending through and projecting outwardly from the flat portion of the shell; a flat reinforcing plate abutting and brazed to the projecting portions of the cylinders, and having its outer end substantially flush with the outer ends of the cylinders, a cylinder-head removably secured on the reinforcing plate on the shell, and a cover including a stamped plate having a reinforcing rim brazed thereto, removably secured on the head.

3. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shaft, comprising: a stamped cylindrical shell, at one of its ends; cylinders formed of tubing brazed to the shell; end closures for the shell, one of which comprises a stamped plate brazed into one end of the shell and the other of which includes a stamped plate with a reinforcing brazed thereto and is removably secured to the other end of the shell; shaft-bearings brazed to the wall and the plates of the end closures respectively; and an annular angular reinforcing plate between and brazed to one of the bearings and one of the plates of the end closures.

4. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shaft, comprising: a stamped cylindrical shell, at one of its ends; cylinders formed of tubing brazed to the shell; end closures for the shell, one of which comprises a stamped plate brazed into one end of the shell and the other of which includes a stamped inturned flange and a stamped plate with a reinforcing ring brazed into said inturned flange and is removably secured to the other end of the shell; shaft-bearings brazed to the wall and the plate of the end closures respectively; and an annular angular reinforcing plate between and brazed to the bearings and the end closures, respectively.

5. A case for a compressor including a drive-

shaft and pistons operated by elements on the drive-shaft, comprising: a stamped cylindrical shell, at one of its ends; cylinders formed of tubing brazed to the shell; end closures for the shell, one of which comprises a stamped plate brazed in one end of the shell and the other of which includes a stamped plate with a reinforcing ring brazed to the shell and is removably secured to the other end of the shell; shaft-bearings brazed to the wall and the plate of the end closures respectively; an annular angular reinforcing plate between and brazed to one of the bearings and the fixed plate, and an annular angular reinforcing plate between the other bearing and the plate of the removable end closure.

6. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shaft, comprising: a stamped cylindrical shell with an annular flange, at one of its ends; cylinders formed of tubing brazed to the shell; end closures for the shell, one of which comprises a stamped plate brazed into one end of the shell and the other of which includes a stamped plate with a reinforcing ring brazed thereto and is removably secured to the other end of the shell; shaft-bearings brazed to the wall and the plate of the end closures respectively; the fixed stamped plate having a central bulged portion around one of the bearings; and an annular angular reinforcing plate between and brazed to said one of the bearings and the bulged portion.

7. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shaft, comprising: a stamped cylindrical shell with an annular flange, at one of its ends; cylinders formed of tubing brazed to the shell; end closures for the shell, one of which comprises a stamped plate fixed to one end of the shell and the other of which includes a stamped plate with a reinforcing ring brazed thereto and is removably secured to the other end of the shell; shaft-bearings brazed to the wall and the plate of the end closures respectively; the fixed plate and the plate of the removable end closure having central bulges, around the bearings, and an annular angular reinforcing plate between and brazed to one of the bearings and the bulged portion of the fixed plate.

8. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shaft and for a motor including rotor on the shaft and a stator, comprising: a stamped compressor-shell including a cylindrical wall; cylinders brazed in the shell; a stamped plate brazed in one end of the shell and forming an end closure; an end closure for the other end of the shell; shaft bearings in the end closures; the motor including a rotor on the shaft and a stator; an imperforate ring having its outer periphery exposed and engaging the periphery of the stator and in which the stator is directly supported; an outer end closure for the motor having a flange; the ring fitting between one end of the shell and the flange on the outer end closure; and means outside of the ring for clamping the ring between the shell and the outer end closure for the motor.

9. A case for a compressor including a drive-shaft and pistons operated by elements on the drive-shaft and for a motor including rotor on the shaft and a stator, comprising: a stamped compressor-shell including a cylindrical wall; cylinders brazed in the shell; a stamped plate brazed in one end of the shell and forming an end closure; an end closure for the other end of the shell; shaft bearings in the end closures; the motor including a rotor on the shaft and stator; an imperforate ring having its outer periphery exposed, and engaging the periphery of the stator and in which the stator is directly supported, having annular grooves in its ends in one of which one end of the shell is seated; an outer end closure for the motor having a flange seated in the other groove; and means outside of the ring for clamping the ring between the shell and the outer end closure for the motor, including lugs brazed to the shell and last named closure and screws between said lugs.

10. A case for a compressor including a drive-shaft and pistons operated by eccentrices, comprising: a stamped shell including an annular wall, cylinders for the pistons formed of tubing brazed in the shell, end-closures for the shell, shaft bearings brazed in said end-closures, the drive-shaft extending through the bearings, a sleeve between the bearings and keyed to the drive-shaft, stamped eccentrics having hubs extending into and brazed to the inner face of the sleeve, and stamped pitmen including sides having their faces brazed together and outwardly extending flanges fitting around the eccentrices and outwardly extending flanges for connecting the pitmen to the pistons.

AUGUST P. ANDERSON.

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