May 1, 1956 E. L. SHAW 2,743,674

SUPERCHARGED AIRCRAFT PUMP

Filed Aug. 26, 1952

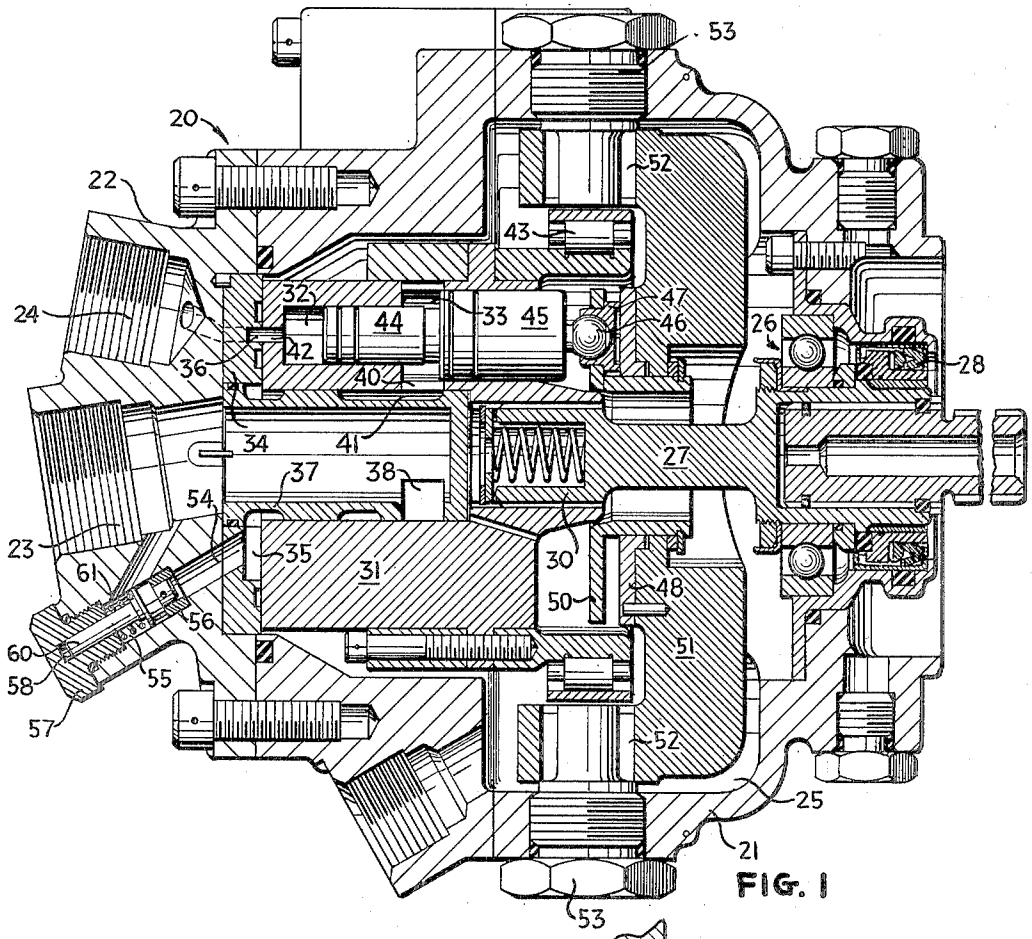


FIG. 1

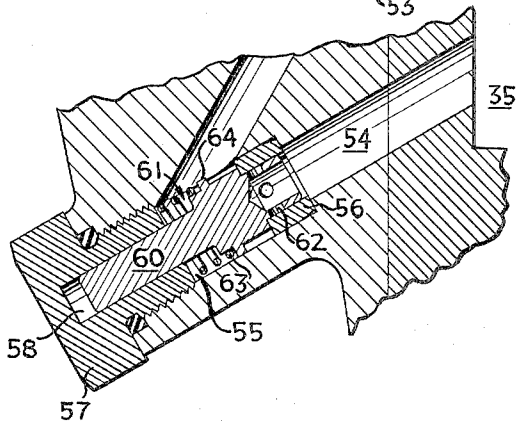


FIG. 2

INVENTOR.

EDWIN L. SHAW

BY

Herschel C. Omohundro

attorney

United States Patent Office

2,743,674

Patented May 1, 1956

2,743,674

SUPERCHARGED AIRCRAFT PUMP

Edwin L. Shaw, Columbus, Ohio, assignor to The Denison Engineering Company, Columbus, Ohio, a corporation of Ohio

Application August 26, 1952, Serial No. 306,399

2 Claims. (Cl. 103—162)

This invention relates to hydraulic apparatus and is more particularly directed to fluid pressure energy translating devices of the type used in aircraft.

Still more particularly the invention is directed to a fluid pump of the character illustrated in the copending application of Cecil E. Adams et al., Serial No. 234,634, filed June 30, 1951, now Patent No. 2,737,899, dated March 13, 1956, this pump having a booster or supercharger section which operates simultaneously with the main pumping section.

An object of this invention is to improve the efficiency and operating characteristics of the pump shown in such application.

Another object of this invention is to provide a supercharged aircraft pump having means incorporated therein to minimize the required size of lines supplying fluid to and conducting fluid from the pump.

It is also an object of the invention to provide a supercharged pump in which the supercharger operates simultaneously with the main section of the pump and means are provided to dissipate the excess fluid under pressure supplied by the supercharging apparatus.

Another object is to provide a pump of the character mentioned in which a relief valve controlled passage extends from the outlet of the supercharger to the inlet of the pump, this passage providing for the dissipation of excess supercharging pressure yet permitting the employment of a supply line of minimum size.

A further object of the invention is to provide a pump having fluid inlet and outlet ports, a supercharger pumping section which communicates with the inlet port and discharges fluid into an intermediate pressure manifold, the pump having a main pumping section which transfers fluid from the intermediate pressure manifold to the outlet port, the pump being further provided with a relief valve between the intermediate pressure manifold and the inlet port whereby excessive pressure in the intermediate manifold will be discharged to the inlet port to be recirculated through the pumping device.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of embodiment of the invention is clearly shown.

In the drawings:

Fig. 1 is a longitudinal sectional view taken through a fluid pressure translating device formed in accordance with the present invention.

Fig. 2 is an enlarged detail sectional view taken through the passage which establishes communication between an intermediate pressure manifold and the inlet port; this section also being taken through a relief valve provided in such passage.

Referring more particularly to the drawings, the numeral 20 designates the pump in its entirety. This pump includes a casing 21 which may be formed of a plurality of parts including an end cover 22 in which inlet and exhaust ports 23 and 24, respectively, are formed. The

casing provides a chamber 25 for the pumping mechanism. At the end of the casing opposite the cover 22, there is provided a bearing mechanism 26 for rotatably supporting a drive shaft section 27. This section includes a plurality of pieces which are splined together to provide flexibility in the drive shaft, the outer end of this section being formed for connection with a prime mover, not shown. The drive shaft extends through a packing 28 which prevents the escape of fluid from the interior of the pump casing. The inner end of the drive shaft has a splined connection as at 30 with a cylinder barrel 31, this member being formed also from a plurality of pieces and including piston chambers with sections 32 and 33 of different sizes.

The cylinder barrel is disposed in engagement at one end with a port plate 34, this member being pinned or otherwise secured to the cover 22 and having ports 35 and 36 formed therein, the former being designated as an intermediate pressure port and the latter the exhaust port, this port communicating with port 24 in the cover 22. The cover 22 has a pintle member 37 secured to the central portion thereof, this member 37 being hollow and communicating directly with the inlet port 23. The member 37 projects through the center of the port plate 34 and into a central opening formed in the cylinder barrel 31. Adjacent the inner end of the member 37, there is provided a laterally directed port 38, this port being disposed for registration with ports 40 formed in the cylinder barrel and communicating with the larger sections 33 of the piston chambers. The ports 40 also communicate with groove means 41 formed on the exterior of the pintle member 37, the grooves cooperating with the cylinder barrel to provide an intermediate pressure manifold which communicates with the port 35 formed in the port plate 34. The small sections of the piston chambers 32 communicate by way of ports 42 with the exhaust port 36 formed in the cylinder barrel, these ports also communicating with the intermediate pressure port 35 as the cylinder barrel revolves. It will be obvious that the communication between the ports in the cylinder barrel and the ports in the pintle and port plate 34 is intermittent due to the rotation of the cylinder barrel relative to the other members. The cylinder barrel is supported for rotation at the end opposite that engaging the port plate by radial bearings 43, these bearings being disposed between the cylinder barrel and a bearing race carried by the casing 21.

The piston chambers receive for reciprocatory movement therein piston elements having sections 44 and 45 corresponding in size to and received by the sections 32 and 33, respectively, of the piston chambers. These piston members are each provided with a spherical head 46 to which is secured bearing shoe 47 and which is formed for engagement with the flat surface of a cam plate 48, the bearing shoes being held in engagement with the cam surface by a retainer plate 50. This plate is suitably secured to a pivoted hanger 51 through the adjustment of which the angle of the cam may be varied. The hanger 51 is supported by bearing elements 52 which are, in turn, suitably supported by studs 53 threaded into the casing 21.

Valve plate 34 and cover 22 are provided with passage means 54 which establishes communication between the intermediate pressure port 35, and the manifold connected therewith, and the inlet port 23. This passage is formed by a plurality of drilled openings which communicate with a chamber 55 formed in the cover 22. This chamber receives a valve seat insert 56, the latter having a central opening communicating with the portion of the passage 54 extending from the intermediate pressure port. The outer end of the chamber 55 is closed by a plug 57 having a socket 58 formed therein for the reception of a

stem **60** provided on a relief valve element **61**. The socket **58** cooperates with the opening in the valve seat insert to guide the valve **61** in its movement toward and away from the valve seat. As shown in Fig. 2, the end of the valve disposed in the opening in the insert is provided with an internal opening and transversely extending ports **62** which, when the valve is moved toward the plug **57**, will be exposed to establish communication between the intermediate pressure port **35** and the inlet port **23**. The valve is normally urged toward a closed position by a coil spring **63** disposed between a flange **64** formed on the valve stem and the inner end of the valve plug **57**. The tension of the spring will determine the pressure at which the valve will open to establish fluid flow from the intermediate pressure port to the inlet port.

In the operation of the pump, the driving shaft **27** is revolved by the prime mover and, in turn, transmits such motion to the cylinder barrel. Due to the inclination of the cam **48**, the pistons will be reciprocated in the piston chambers, the cam being so inclined that, as the larger sections of the piston chambers communicate with the port **38**, the pistons will move in an outward direction. Then, when the larger sections of the piston chambers communicate with the port **40**, the pistons will be moved into the piston chambers. This action of the pistons will suck fluid into the piston chambers from the port **38** and expel this fluid through port **40** to the intermediate pressure manifold. Also as the cylinder barrel revolves, the smaller sections of the piston chambers will communicate with the intermediate pressure port while the pistons are being moved outwardly of the piston chambers and with the exhaust port **36** when the pistons are being returned into the piston chambers. This action of the pistons will transfer fluid from the intermediate pressure port to the exhaust port **36**.

Since the volumetric capacity of the larger piston chambers is greater than the capacity of the smaller piston chambers, the latter will not be capable of utilizing all of the fluid delivered by the larger piston sections. The fluid pressure will, therefore, increase in the intermediate pressure zone and fluid under pressure will be supplied to the smaller piston chambers. Since an excess volume of fluid is supplied by the supercharging section of the pump, some means must be provided to dissipate this excess fluid and prevent the generation of excessive pressures in the intermediate pressure zone. For this purpose, the passage **54** and relief valve **61** have been provided. When the pressure in the intermediate pressure port increases sufficiently, the relief valve will be caused to move to an open position and some of the fluid may then flow from intermediate pressure port through the passage **54** to the inlet port **23**. In the pump illustrated, the supercharging pump section has a capacity to deliver a volume of fluid substantially 25% in excess of the capacity of the main pumping section. With the by-pass passage shown in the drawings and described, this 25% excess capacity of the supercharger is recirculated. By this recirculation, the supply line extending to the inlet port **23** may be made smaller. If this excess fluid were discharged into a drain line, the inlet or supply line would necessarily be required to have 25% more capacity. It should be obvious that, by providing a by-pass passage between the intermediate pressure port and the inlet port, and controlling fluid flow therethrough by a relief valve, the operating characteristics of the device are improved. Its manufacturing costs are decreased and its adaptability to cramped working spaces generally found in aircraft is increased.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

I claim:

1. In a fluid pressure energy translating device, a casing having inlet and outlet ports; a cylinder barrel disposed for rotation in said casing, said cylinder barrel having piston chambers with sections of different sizes; valving means disposed between the portion of said casing containing said inlet and outlet ports and said cylinder barrel, said valving means having a cavity formed therein which cooperates with said cylinder barrel to form an intermediate pressure manifold, a high pressure port in said valving means communicating with said outlet port, means connecting the larger sections of said piston chambers alternately with said inlet port and said intermediate pressure manifold and the smaller sections of said piston chambers alternately with said intermediate pressure manifold and said high pressure port upon rotation of said cylinder barrel; piston elements with sections corresponding in sizes to the sections of said piston chambers disposed for reciprocation therein; cam means for controlling the reciprocation of said pistons; a passage extending from said intermediate pressure manifold to said inlet port; and a relief valve in said passage.

2. In a fluid pressure energy translating device, a casing having inlet and outlet ports; a cylinder barrel disposed for rotation in said casing, said cylinder barrel having piston chambers with sections of different sizes; valving means disposed between the portion of said casing containing said inlet and outlet ports and said cylinder barrel, said valving means having a cavity formed therein which cooperates with said cylinder barrel to form an intermediate pressure manifold, a high pressure port in said valving means communicating with said outlet port, means connecting the larger sections of said piston chambers alternately with said inlet port and said intermediate pressure manifold and the smaller sections of said piston chambers alternately with said intermediate pressure manifold and said high pressure port upon rotation of said cylinder barrel; piston elements with sections corresponding in sizes to the sections of said piston chambers disposed for reciprocation therein; cam means for controlling the reciprocation of said pistons; a passage extending from said intermediate pressure manifold to said inlet port; a valve supported in said passage for movement toward open position in response to pressure in said intermediate pressure zone; and spring means between said valve and a portion of said casing, said spring means tending to resist opening movement of said valve.

References Cited in the file of this patent

UNITED STATES PATENTS

2,270,263	Butler	Jan. 20, 1942
2,494,606	Anderson	Jan. 17, 1950
2,522,890	Peterson	Sept. 19, 1950
2,604,047	Beaman et al.	July 22, 1952
2,608,933	Ferris	Sept. 2, 1952

FOREIGN PATENTS

121,688	Australia	1946