

July 7, 1964

O. E. ROSAEN ET AL
FLUID SUPERCHARGERS

3,139,905

Filed Sept. 11, 1961

4 Sheets-Sheet 1

FIG. 1.

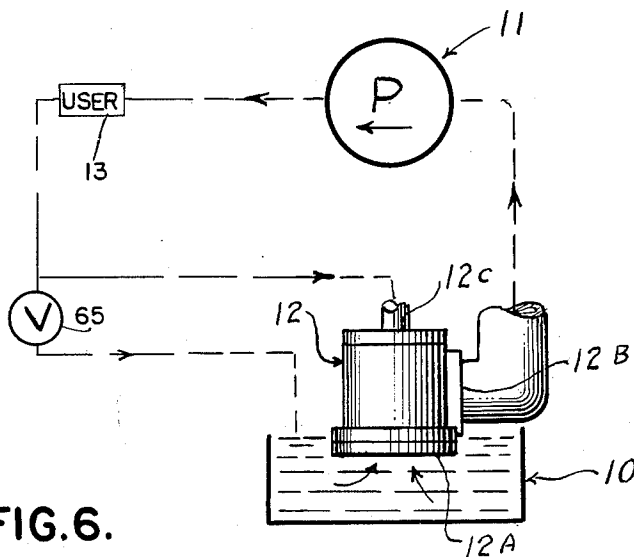
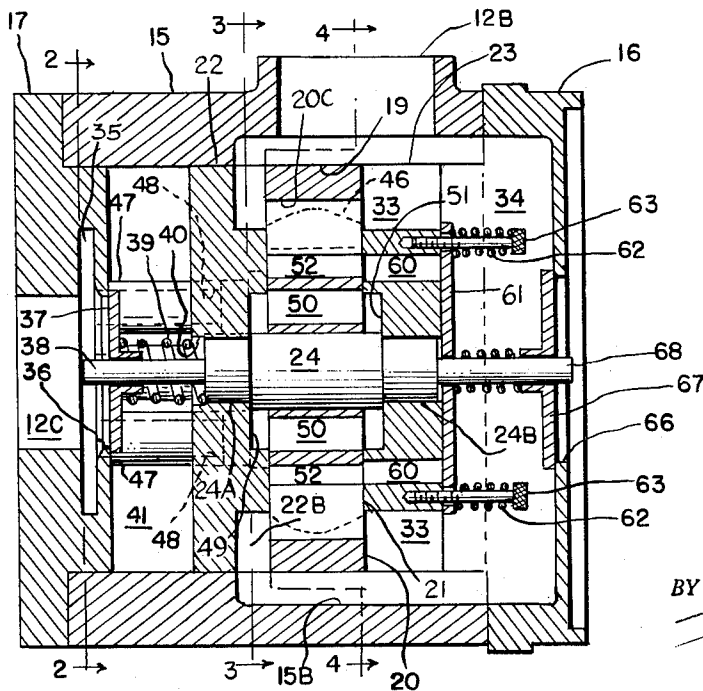


FIG. 6.



INVENTORS
OSCAR E. ROSAEN
NILS O. ROSAEN
BY *Shuck & Shuck*
ATTORNEYS

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O. E. ROSAEN ET AL

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FIG. 2.

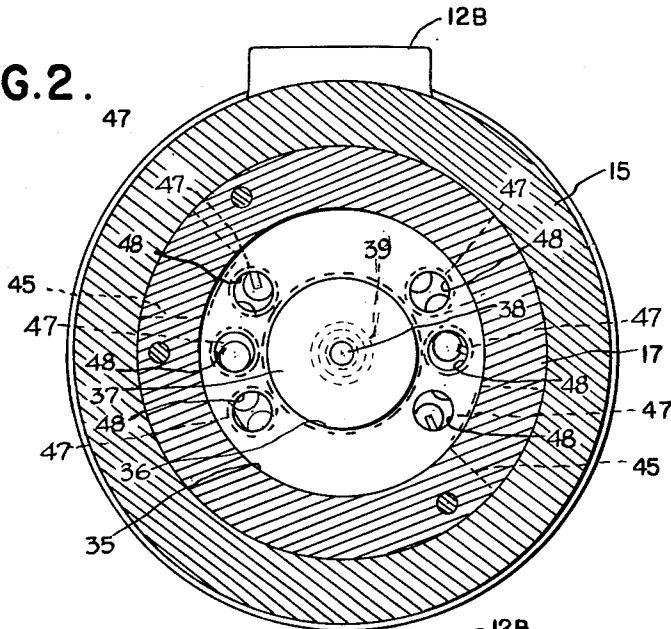
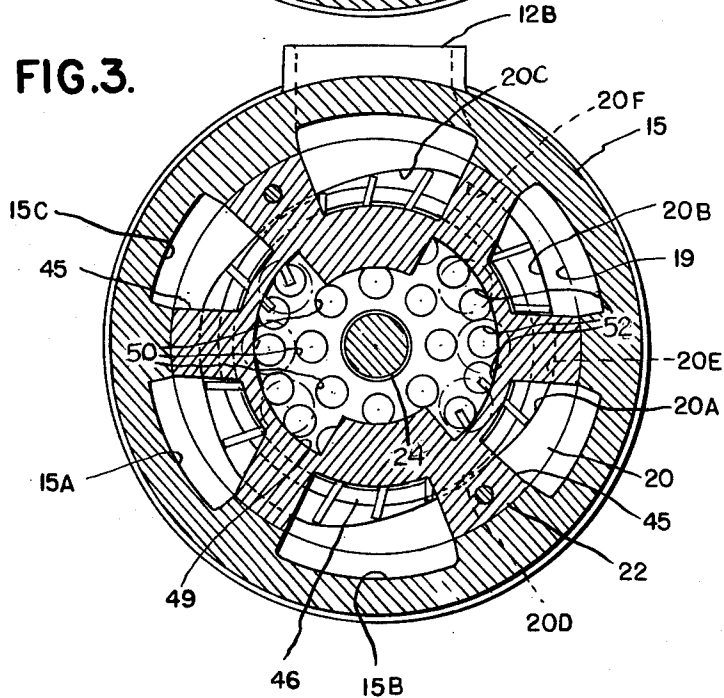


FIG. 3.



INVENTORS
OSCAR E. ROSAEN
NILS O. ROSAEN
BY *Stanke + Stanke*
ATTORNEYS

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FIG. 4.

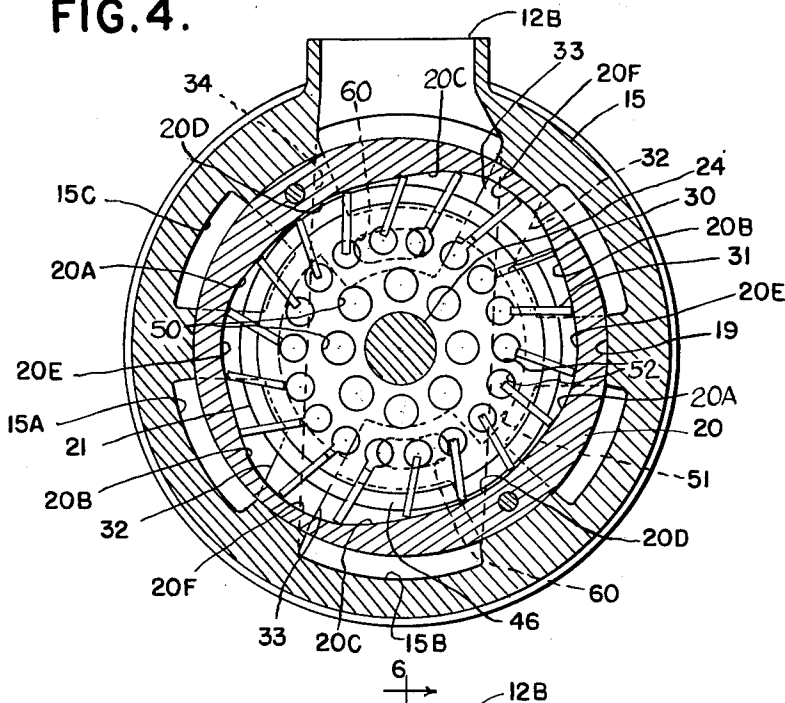
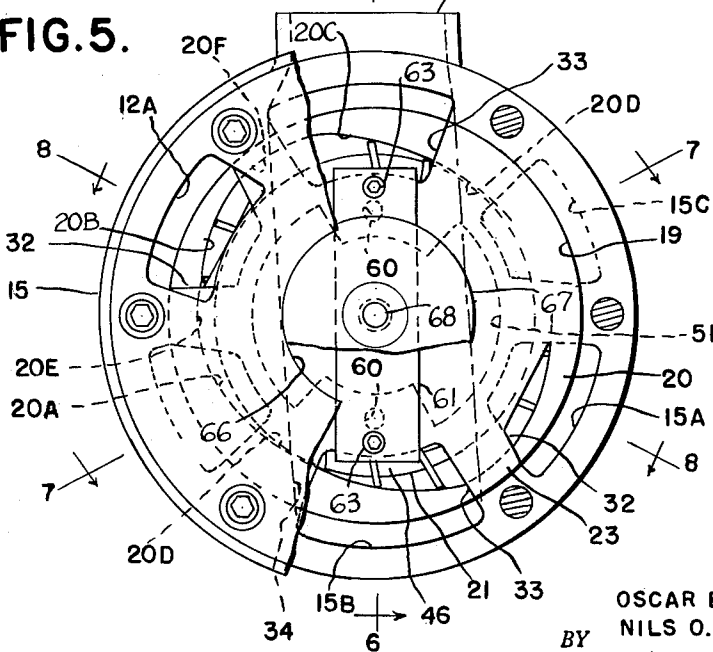


FIG. 5.



INVENTORS
OSCAR E. ROSAEN
NILS O. ROSAEN
BY

Hauke & Hauke
ATTORNEYS

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O. E. ROSAEN ETAL

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FIG. 7.

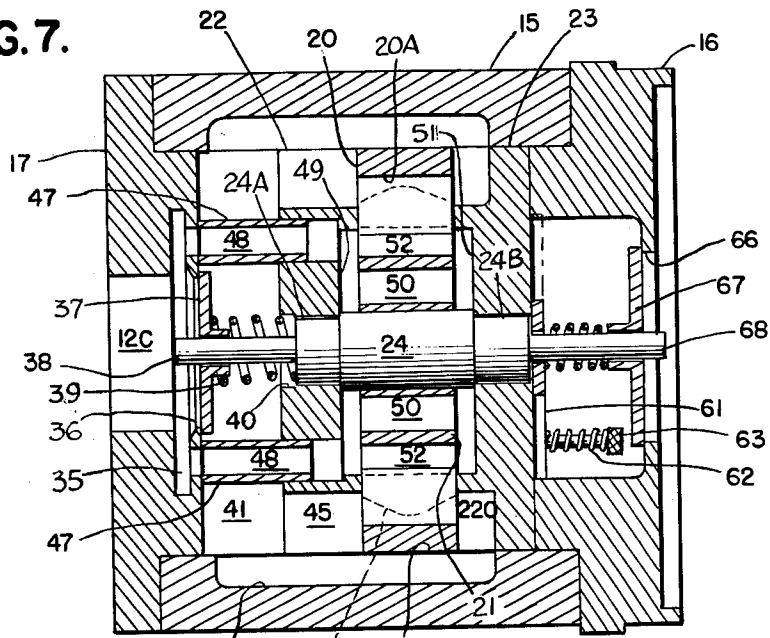
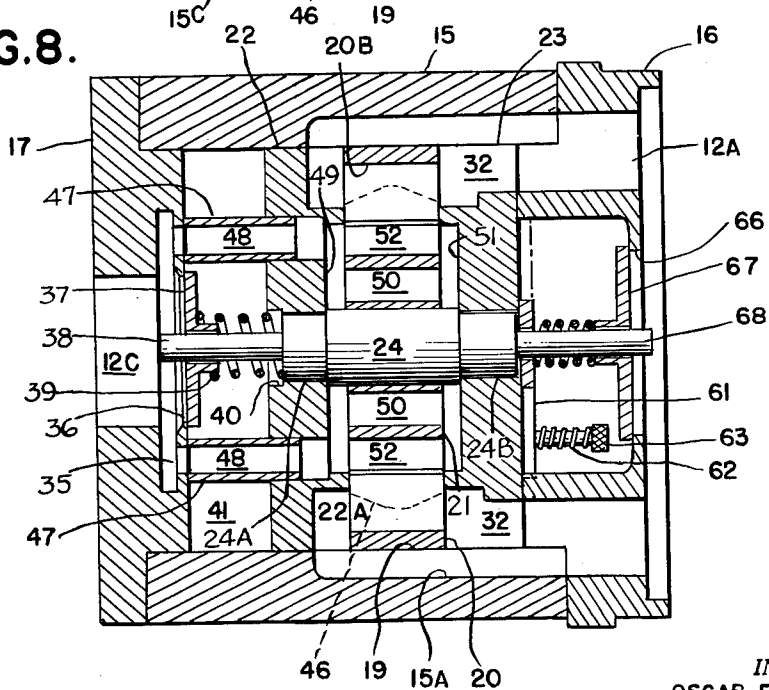


FIG. 8.



INVENTORS
OSCAR E. ROSAEN
NILS O. ROSAEN
BY
Handwritten signature
ATTORNEYS

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3,139,905

FLUID SUPERCHARGERS

Oscar E. Rosaen, Grosse Pointe Farms, and Nils O. Rosaen, Bloomfield Hills, Mich. (both of 1776 E. Nine Mile Road, Hazel Park, Mich.)

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1 Claim. (Cl. 137-566)

Our invention relates to fluid pressure systems and more particularly to a fluid motor-pump or supercharger adaptable to a fluid supply system to provide for increased flow rate with a minimum expenditure of power.

In the supply of fluid to pressure systems, many cases arise in which, due to various causes such as low temperature or long supply lines, the pressure drop across the pressure pump increases to a point at which destructive cavitation occurs. Heretofore, various types of supply pumps have been used to boost the flow rate from the reservoir or sump to the pressure pump, but such pumps require additional power sources which in many cases make them impractical.

An object of the present invention is to solve the aforesaid difficulty by providing an improved fluid operated pump which utilizes system pressure economically as a motive power to produce higher flow rates than heretofore have been produced.

Another object of the invention is to provide an improved fluid supercharger by constructing a vane-type pump in which rotating power is supplied by directing fluid pressure behind the vanes.

For a more complete understanding of the invention, reference may be had to the accompanying drawings illustrating a preferred embodiment of the invention in which like reference characters refer to like parts throughout the several views and in which:

FIG. 1 is a diagrammatic view of a preferred fluid pressure system incorporating the present invention.

FIG. 2 is a lateral cross-sectional view of a preferred fluid motor-pump or supercharger as taken substantially on the line 2-2 of FIG. 6.

FIGURES 3 and 4 are cross-sectional views of the supercharger taken substantially on the lines 3-3 and 4-4 respectively of FIG. 6.

FIG. 5 is an end view of the supercharger as seen from the right of FIG. 6 and with portions broken away to illustrate interior sections.

FIG. 6 is a longitudinal cross-sectional view taken substantially on the line 6-6 of FIG. 5.

FIG. 7 is a cross-sectional view taken substantially on the line 7-7 of FIG. 5.

FIG. 8 is a cross-sectional view taken substantially on the line 8-8 of FIG. 5.

A preferred fluid system, illustrated in simplified form in FIG. 1, comprises a reservoir 10, a pressure pump 11, and a supply motor-pump or supercharger 12. Fluid enters a supply inlet 12A of the supply pump 12 and is discharged from a pressure outlet 12B, from which it is delivered to the intake side of the pressure pump 11. Fluid under pressure is then delivered from the outlet side of the pressure pump to the fluid pressure user 13. Fluid from the user is then returned to the reservoir 10 through a valve 65 which, when partially closed, will divert some fluid pressure to a pressure inlet 12C of the supercharger 12.

In FIGS. 2-8, the supercharger 12 is illustrated in more detail as comprising a housing 15 having end plates 16 and 17, the end plate 16 incorporating the supply inlet 12A as seen in FIG. 8 and the end plate 17 incorporating the pressure inlet 12C as seen in FIG. 6.

The housing 15 has a chamber 19 provided with a peripheral cam insert 20, within which rotates a rotor 21. A cheek plate structure 22 bears on one face of the

rotor 21, and a second cheek plate structure 23 bears on the other face of the rotor 21. The rotor 21 is rotatably carried on a stepped shaft 24 which is centrally supported as at 24A and 24B.

The rotor 21 has a plurality of angularly spaced lateral slots 30 disposed in planes parallel to and spaced from the axis of the rotor 21. Vanes 31 slidably carried in the slots 30 are thus inclined as shown with respect to radial planes. The vanes 31 are engaged at their outer ends with the inner peripheral surface of the cam insert 20 and are guided thereby in extension from and retraction into the slots 30. The rotor rotates in a counterclockwise direction as seen in FIG. 4.

As the rotor 21 moves, fluid is drawn in the inlet 12A and through a pair of oppositely disposed passages 32 provided through the cheek plate 23 as shown in FIGS. 2, 4, 5 and 8, the passages being open to the spaces between the rotor 21 and the cam insert 20. The vanes 31 impel the incoming fluid to a subsequent area open to passages 33 angularly spaced, as shown in FIGS. 4, 5 and 6, from the passages 32 and interconnected by a passage 34 provided on the inner side of the end plate 16. The fluid is then discharged from the outlet 12B openly connected with the passage 34.

The end plate 17 is provided with a recess 35 connecting the pressure inlet 12C with an intake port 36 against which bears a valve plate 37 piloted on a reduced portion 38 of the shaft 24 and resiliently urged against the inner face of the end plate 17 by a spring 39 seated in a recess 40 provided in the outer side of the cheek plate 22. On the buildup of fluid pressure at the inlet 12C, the valve plate 37 opens and fluid under pressure enters a chamber 41 provided between the end plate 17 and the outer surface of the cheek plate 22.

Passages 45, extending through the cheek plate 22 as shown in FIGS. 2, 3 and 7, are angularly spaced from the passages 32 and 33 provided through the other cheek plate 23, and connect the chamber 41 with other areas between the rotor 21 and the cam insert 20. The inner cam peripheral surface of the cam insert 20 has symmetrical sets of three slopes 20A, 20B and 20C connected by steps 20D, 20E and 20F as shown in FIG. 4. The steps 20D are closely adjacent the outer peripheral surfaces of the rotor 21, steps 20E are spaced a short radial distance outward, and steps 20F are spaced a greater radial distance outward. The steps 20E extend generally from the areas open to the pressure inlet passages 45 to the areas open to the supply inlet passages 32, the steps 20F extend generally from the areas open to the supply inlet passages 32 to the areas open to the outlet passages 33, and the steps 20D extend generally from the areas open to the outlet passages 33 to the areas open to the pressure inlet passages 45. The steps are joined by the slopes 20A, 20B and 20C as shown, such that the outer edges of the vanes 31 will be guided smoothly from one step to the other.

In operation the fluid under pressure from the passages 45, entering in the vicinity of the slopes 20A, exert a driving force on the trailing sides of the vanes 31, impelling the rotor counterclockwise as seen in FIG. 4 and clockwise as seen in FIG. 5. Then, as the vanes extend in the areas of the slopes 20B, suction at the supply inlet passage 32 is produced. When the vanes 31 are retracted upon moving into the areas of the slopes 20C, the fluid is discharged from the outlet passages 33 and thence from the outlet 12B.

It will be noted that the outer periphery of the rotor 21 is beveled on both edges as at 46. This makes easier the complete filling of the pumping cavities by eliminating as much restriction at the inlet passages as possible.

The rotor itself is balanced on all sides by the extension of the passages 32, 33 and 45 to both sides of the

rotor, as shown respectively in FIGS. 8, 6 and 7 by means of recesses 15A, 15B and 15C provided in the inner surface of the housing 15 leading respectively to recesses 22A, and 22B, of the cheek plate 22 and to recesses 22C of the cheek plate 23.

The outer side of the cheek plate 22 is provided with a plurality of tubular elements 47 as shown in FIGS. 2, 6, 7 and 8, having passages 48 which connect a recess 49 provided on the inner side of the cheek plate 22 with the pressure filled recess 35 in the end plate 17. The rotor 21 has a plurality of lateral passages 50 at all times connecting the recess 49 with a similar recess 51 in the inner side of the other cheek plate 23. As the rotor 21 revolves, lateral passages 52 provided at the inner ends of the vane slots 30 will open to radially outer portions of the recesses 49 and 51 to admit pressure to the inner ends of the vanes 31 during those intervals when the vanes 31 are moving along the cam steps 20D, slopes 20A, steps 20E, slopes 20B and steps 20F, thus holding the vanes 31 out against the cam slopes and steps at all times during extending movement.

This pressure is relieved only during the interval of vane retraction when moving along slopes 20C by the registry of the lateral passages 52 with arcuate ports 60 provided through the cheek plate 23 and communicating with the passage 34 as shown in FIGS. 2 and 4. A slight pressure at this time is maintained, however, by means of a valve plate 61 retained over the outer ends of the ports 60 by means of light springs 62 carried by screws 63 secured to the cheek plate 23 as shown in FIGS. 5, 6, 7 and 8.

The cross sectional areas of the fluid spaces between the rotor and the cam slopes and steps are so chosen that operating fluid pressure, which is relatively small, entering the inlets 45 will produce the greatest fluid flow rate with an efficient expenditure of energy.

The balancing of the rotor, through the symmetrical arrangement and the admission of operating pressures to all portions of the rotor provides for extremely smooth performance at high velocity even with extremely heavy viscous fluids. When utilized in a system such as that of FIG. 1, cavitation of the pressure pump 11 is virtually impossible since adequate fluid supply is always assured, and tendencies of the pump 11 to exceed permissible pressure drop values results in greater pressure differential between the pressure inlet 12C and the user 13 producing an increase in flow rate through increased rotational speed of the rotor 21.

When used in such a fluid system, the fluid may, and in the case of oils for example, will warm up sufficiently so that the supercharging by the unit 12 is not necessary. At such time, the valve 65 in the pressure return line to the inlet 12C may be more fully opened either manually or automatically, and the supercharger will cease to operate to merely operate in an idling condition. Fluid then will be drawn from the reservoir 10 into a port 66, opening a spring-loaded valve 67 which is piloted on a shaft end 68 as shown in FIGS. 5-8, to admit fluid directly to the passage 34 from whence it is discharged through the outlet 12B without entering the rotor chamber. It will be noted that by varying the closure of the valve 65, the

pressures in the entire system can be regulated as desired.

Although only one preferred embodiment of the present invention has been described, it will be apparent to one skilled in the art to which the invention pertains that various changes and modifications may be made therein without departing from the spirit of the invention or the scope of the appended claim.

We claim:

In a fluid system having a fluid reservoir, a primary pump, a fluid user, conduit means connecting the intake side of said pump with said reservoir, the discharge side of said pump with said fluid user and the discharge side of said fluid user with said reservoir; a supercharging means carried in said conduit means intermediate said reservoir and said pump, said supercharging means comprising

- (a) a housing having a supply inlet connected with said reservoir and discharge outlet connected with the intake side of said pump,
- (b) a fluid pressure operated pumping means carried in said housing and conducting means connected with said conduit means intermediate said fluid user and said reservoir whereby fluid pressure produced by said primary pump operates said pumping means,
- (c) said pumping means being operable to pump fluid from said supply inlet to said discharge outlet,
- (d) a selectively operable valve means carried in said conduit means intermediate said fluid user and said reservoir downstream of said conducting means whereby to selectively vary fluid pressure to said pumping means to control the operation thereof.
- (e) a second inlet provided in said housing and connecting said reservoir with said discharge outlet, and
- (f) a normally closed pressure responsive valve means carried in said second inlet and being operable to open upon the fluid pressure in said conducting means being decreased to a predetermined value whereby upon said pumping means being deactivated a fluid path will be opened directly from said inlet to said discharge outlet and bypassing said pumping means.

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