Jan. 18, 1955 O. T. QUINN 2,699,725

FLUID PUMPING APPARATUS

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Fig. 1.

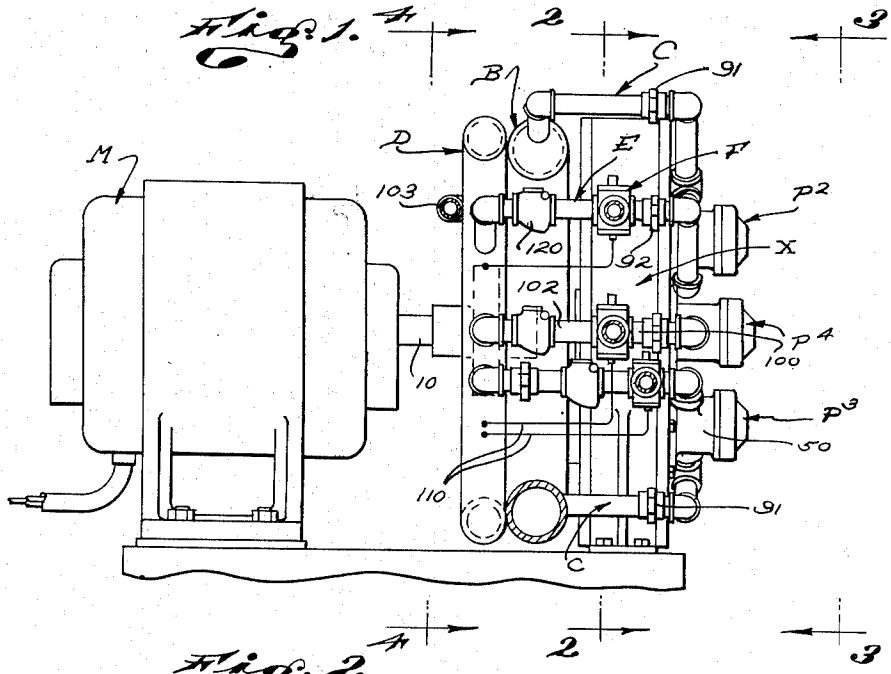
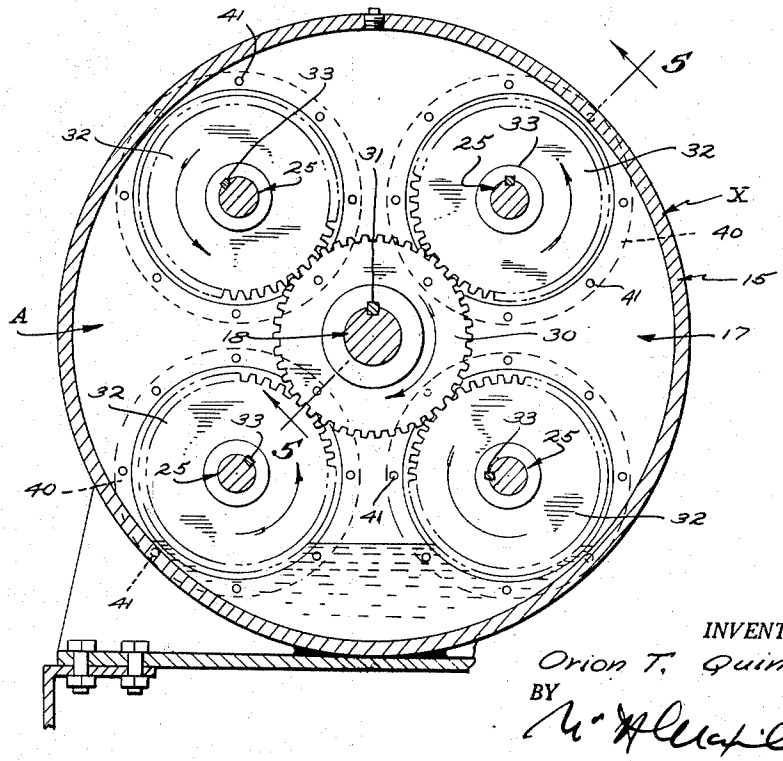



Fig. 2.




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Fig. 3.

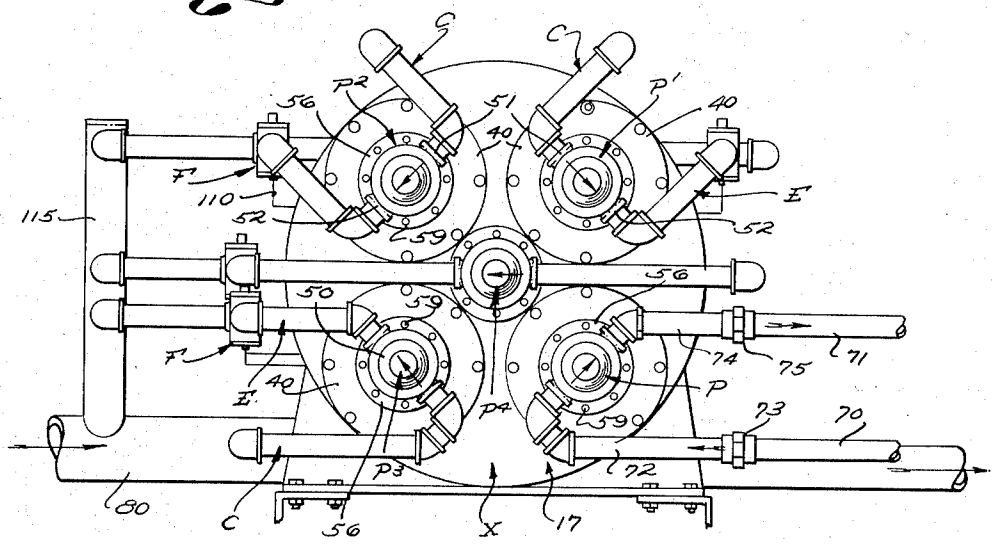
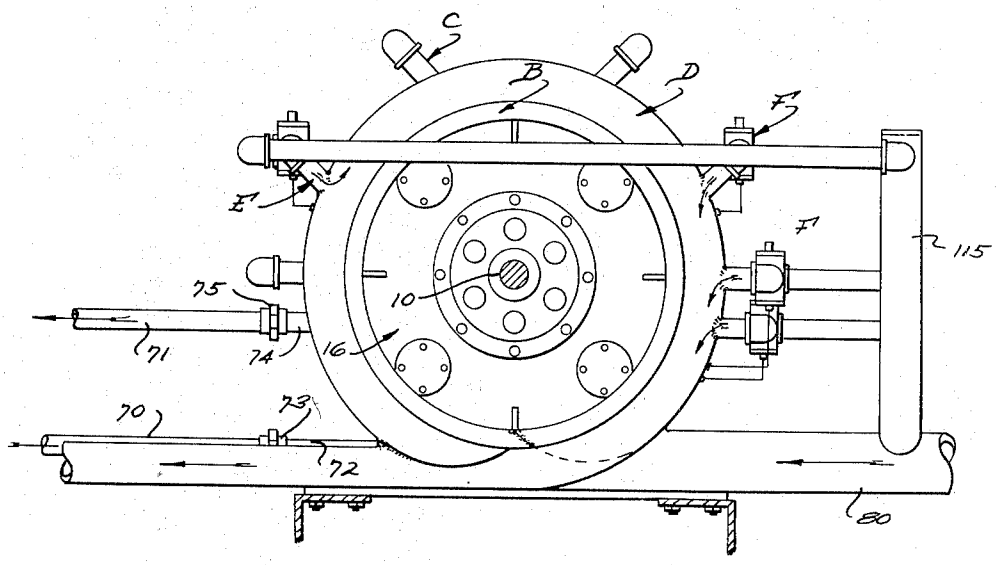



Fig. 4.




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Fig. 5.

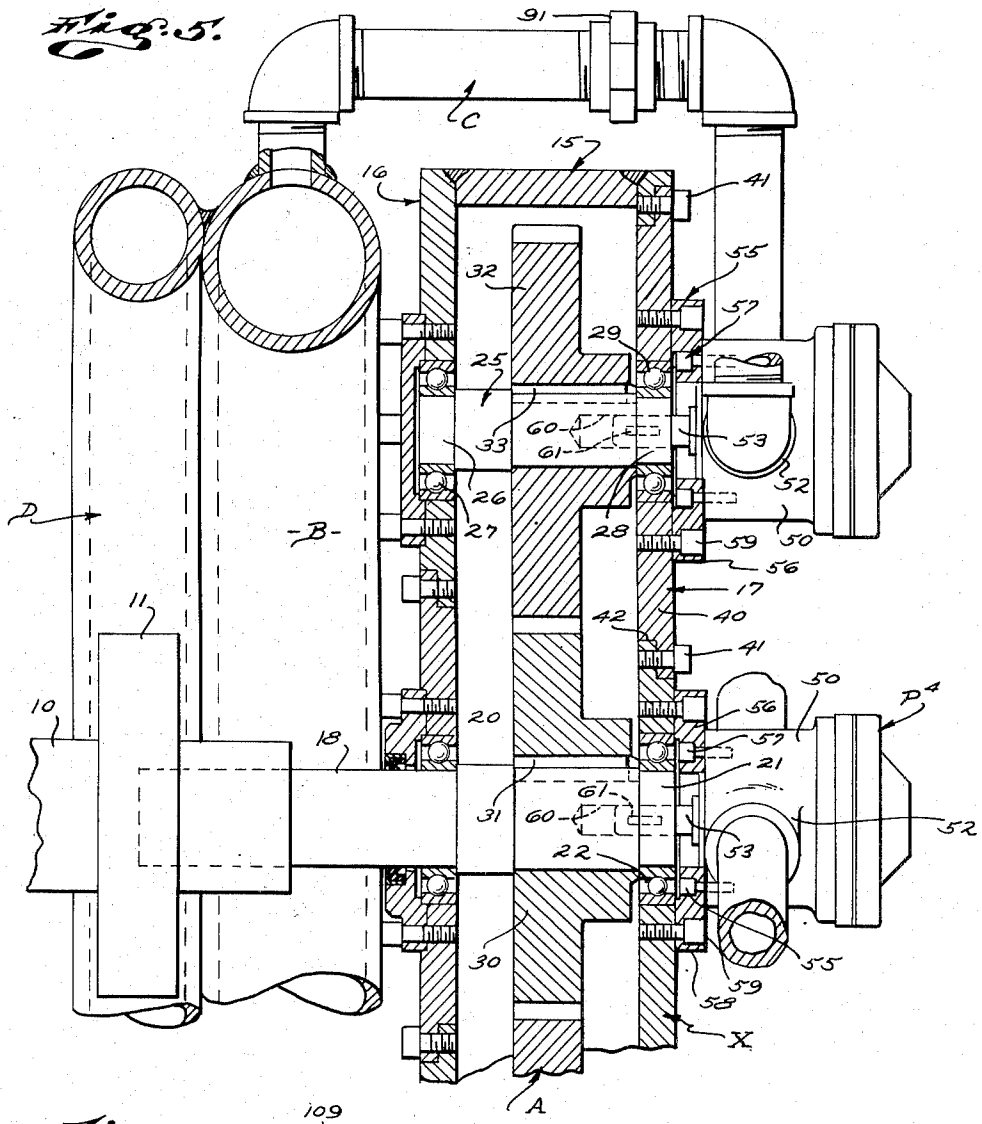
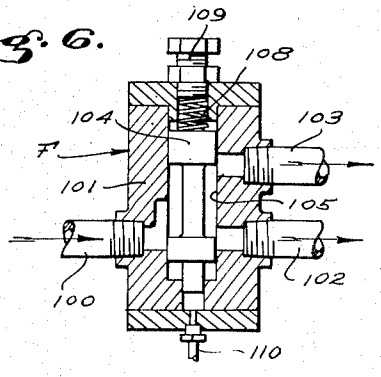



Fig. 6.




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2,699,725

# FLUID PUMPING APPARATUS

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Application April 23, 1952, Serial No. 283,918

14 Claims. (Cl. 103—4)

This invention relates to fluid pumping apparatus, it being a general object of the invention to provide a simple, practical dependable structure wherein a single power means operates a plurality of pumps, or the like.

There are various situations where fluid, say for instance, a liquid such as oil, is employed to actuate mechanisms or to perform useful work, and where such fluids are handled at rather high pressures, or where the volume of fluid required fluctuates or varies widely, or where other such factors result in complicated, costly and often impractical or inefficient pumping equipment.

It is a general object of this invention to provide fluid handling apparatus employing a single power means, say for example, a single motor to deliver fluid at various pressures and in varying volumes to meet working conditions without causing serious or undesirable fluctuations in the load upon the motor.

It is another object of this invention to provide apparatus of the general character referred to characterized by a plurality of individual pumping devices, or pump units, so related or coupled in the structure as to be individually removable or separable without materially disturbing other parts of the structure and so that remaining pumps, or pump units, remain effective.

Another object of this invention is to provide apparatus of the general character referred to wherein a single prime mover operates a plurality of separate pumps which are cooperatively related to simultaneously deliver fluid under pressure when fluid is required at a low pressure with the result that there is a substantial volume of fluid delivered while only certain of the pumps, or possibly but one of them, delivers fluid when it is required at a high pressure and when a limited volume is desired.

Another object of this invention is to provide apparatus of the general character referred to wherein a simple, practical, highly efficient power distributing means serves to receive power from a single prime mover, such as a motor, and operates to distribute it as by means of a plurality of sub-shafts to drive a plurality of separate units such as pumps, or the like.

It is another object of this invention to provide a power distributing structure of the general character referred to characterized by a simple, practical, dependable construction which makes possible simple, rapid access to working parts for the purpose of effecting repairs or replacements, and wherein failure of any one part such as a sub-shaft, or parts related thereto, will not serve to disable the entire structure.

It is a further object of this invention to provide apparatus of the general character referred to wherein the several pumps involved are supplied with fluid from a supply manifold and deliver fluid to an outlet manifold, which manifolds are combined with or related to the other elements of the structure so that the apparatus as a whole is compact and the various parts thereof are conveniently accessible for servicing or repair.

The structure embodying the present invention is adapted to be driven by a single power means such as a motor, and a power distributing means is provided and includes a main shaft to be driven by the motor. A plurality of sub-shafts are parallel with the main shaft and are arranged in an annular series around the main shaft. A drive means from the main shaft to the sub-shaft may in a simple form include a drive pinion on the main shaft and gears on the sub-shafts and meshed with the pinion. A closed housing handles the parts above mentioned and preferably includes a cylindrical body and front and rear



walls that carry bearings that support the shafts. Sections of the walls are separable or removable to provide access to the interior of the housing and to facilitate the placing of parts in or removing of parts from the housing.

A plurality of pumps are combined with the several shafts; for example, there may be one pump for each shaft, that is, a pump at the center of the structure driven by the main shaft and an annular series of pumps, each of which is driven by a sub-shaft. Suitable means such as releasable drives, or couplings, connect the pumps, and the shafts that drive them and the pumps are mounted preferably by mounting means so that they can be readily detached from the housing and separated from their drive shafts.

Considered broadly each pump may be a separate or individual device handling fluid, as circumstances require, and if necessary or desired, various or different and separate fluids can be handled by the different pumps. In the particular situation hereinafter described, one pump is separate from all of the others while the remaining pumps form a group wherein the pumps are cooperatively related. In the structure to be described an inlet manifold is supplied with fluid and inlet pipes connect the inlet manifold with the inlet fittings of the pumps in the said group. An outlet manifold is provided and outlet pipes connect the outlet fittings of the pumps in the group with the outlet manifold. In a preferred arrangement the manifolds are annular, are arranged concentric with the housing, and are located adjacent the rear side of the housing to, in effect, occur between the motor and the housing. A pressure control means is provided and preferably includes a relief valve in the outlet pipe from each pump in the group. Each of these valves is such as to open and bleed off fluid when the pressure being delivered by the pump reaches a predetermined value. In a typical situation one pump with its relief valve is such as to deliver fluid at a low pressure say, for instance, five hundred pounds per square inch, and beyond that pressure the valve opens and fluid is bled so that it does not flow to the outlet manifold. Another pump may be such as to deliver pressure up to say a thousand pounds per square inch, beyond which pressure fluid is bled off. A third pump may deliver fluid up to say fifteen hundred pounds per square inch, and in the case to be described the last or final pump in the group, which pump is directly driven from the main shaft, delivers fluid up to a pressure of two thousand pounds per square inch.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form and application of my invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a side elevation of a typical embodiment of the invention showing a single motor driving structure provided by the invention. Fig. 2 is an enlarged, detailed, transverse sectional view taken as indicated by line 2—2 on Fig. 1. Fig. 3 is as end elevation taken as indicated by line 3—3 on Fig. 1. Fig. 4 is a transverse sectional view taken as indicated by line 4—4 on Fig. 1. Fig. 5 is an enlarged detailed sectional view of a portion of the structure, being a view taken as indicated by line 5—5 on Fig. 2, and Fig. 6 is an enlarged detailed sectional view of one of the relief valves employed in the structure.

The structure as provided by the present invention is adapted to be operated by a source of power, as for instance a prime mover, and in the drawings I have shown a motor M. The structure as provided by the present invention includes, generally, a power distributing means A adapted to drive or operate a plurality of pumps designated in the drawings as P, $P^1$, $P^2$, $P^3$, $P^4$. In the particular case illustrated, pump P is entirely independent of the other pumps in the structure, whereas the pumps $P^1$, $P^2$, $P^3$ and $P^4$ are cooperatively related by a structure including, generally, an inlet manifold B, inlet pipes C connecting manifold B with pumps and outlet manifold D, and outlet pipes E connecting the outlets from the pumps with the manifold D. A pressure control means F is provided whereby the action of each of the pumps coupled with or related to the mani-

folds B and D is governed so that the pumps selectively operate to deliver fluid up to certain pressures as required by the service to be performed.

In a preferred or typical situation such as is illustrated in the drawings, a single prime mover or electric motor M is provided, and its drive shaft **10** is joined to the structure provided by the present invention by means of a suitable coupling **11**.

The power distributing means A as provided by the present invention includes, generally, a closed housing X which, in its preferred form, involves a cylindrical outer wall or body portion **15**, an inner end wall **16**, and an outer end wall **17**. The means A includes a main shaft **18** joined to the motor shaft **10** by the coupling **11** and extending into the housing X. In the case illustrated the main shaft **18** is supported by a suitable antifriction bearing **20** where it extends into the housing X through the rear wall **16**, and its terminal end portion **21** is supported by an antifriction bearing **22** in the front wall **17**.

The means A includes a plurality of sub-shafts **25**, and in a preferred arrangement the sub-shafts are arranged to extend parallel with the main shaft. They are spaced apart and are in an angular series surrounding and concentric with the main shaft **18**. In practice the number of sub-shafts may vary. In the case illustrated there are four sub-shafts **25**, and they are uniformly spaced about the main shaft.

In practice the mountings provided for the several sub-shafts may be the same. In the case illustrated each sub-shaft **25** has a rear end portion **26** supported by an antifriction bearing **27** carried by the rear wall **16** of housing X. A front end portion **28** of each sub-shaft is carried by an antifriction bearing **29** supported by the front end wall **17**.

A drive is provided between the main shaft **18** and the several sub-shafts **25**, and in the particular case illustrated this general drive provides for separate or individual driving of each of the sub-shafts. A drive pinion **30** is fixed on the drive shaft **18** within the housing X as by means of a key **31**. Drive gears **32** are fixed on the sub-shafts **25** as by means of keys **33**, and they mesh with the pinion **30**. The several shafts **25** are spaced apart about the main shaft so that the gears **32** are spaced apart or are entirely independent of each other, and in the case illustrated where the several sub-shafts **25** are equally spaced from the main shaft the several gears **32** are of the same size. It is contemplated, however, that if desired the sub-shafts may be variously spaced from the main shaft, and if the several sub-shafts are to be driven from a single pinion on the main shaft the gears on the sub-shafts will vary in size with the result that the several sub-shafts would operate at different speeds instead of uniformly as is the case with the construction illustrated.

In accordance with the present invention the bearing **29** carrying the outer end portion **28** of each sub-shaft **25** is supported by a detachable or removable section of the outer wall **27** of housing X. In the preferred construction each separable or removable section **40** of wall **17** supporting a bearing **29** is a round or disk-like plate supported at its periphery as by fasteners **41**, and when in place it closes an opening **42** provided in wall **17** which opening is of such size as to pass the gear **32**. Through the construction just described and which is best shown in Fig. 5 of the drawings, it will be apparent that the sub-shafts can be readily assembled with their gears **32** and then assembled in the housing X and engaged with the drive pinion **30** with the assembly established in operating condition by engagement of the fasteners **41**.

In accordance with the present invention the several pumps provided are combined with or coupled to the several shafts of the power distributing means A, and in a preferred arrangement such as is shown in the drawings there is a pump, or like unit, coupled with and driven by each shaft unit A. In the particular case illustrated pump P is coupled with and driven by one of the sub-shafts whereas pumps $P^1$, $P^2$, and $P^3$ are coupled with and driven by the other sub-shafts, pump $P^4$ being coupled to and driven by the main shaft **18**.

In accordance with the broader principles of the present invention the pumps employed in the mechanism may be varied widely in form or as to type, and they may



vary as to size or capacity. In the drawings and for purpose of illustration the several pumps are shown as being of the same type and they may be considered as being standard or typical gear type pumps, each with a case **50** having an external inlet fitting **51** and an external outlet fitting **52**. A drive shaft **53** for each pump projects from its case.

In accordance with the present invention each pump is releasably or detachably connected to the housing X preferably to the outer wall **17** of the housing, and in the drawings a suitable mounting means **55** is shown supporting each pump on wall **17**. The particular mounting means shown in the drawings includes a simple mounting plate **56** to which the pump case **50** is secured as by means of fasteners **57**. The mounting plate has a peripheral portion **58** projecting radially upon the pump case **50** and suitable fasteners such as screws **59** connect the peripheral portion of the plate **56** with the wall **17**, as clearly shown in Fig. 5 of the drawings.

The mounting means **55** just described supports each pump with its shaft **53** projecting toward the housing X, and in the case illustrated a suitable releasable driving connection is provided between each pump shaft **53** and a shaft of the means A. In the particular case illustrated each shaft in means A has a central end socket **60** slidably receiving a pump shaft **53**, and a key **61** keys or locks the shafts together or against relative rotation though allowing the pump shaft to be readily withdrawn from the socket whenever desired.

In accordance with the broader principles of the present invention the several pumps, as driven by means A, may be incorporated in the machine so as to operate individually or independently of other pumps, or a plurality of the pumps driven may be related or cooperatively grouped. In the particular case illustrated pump P driven by one of the sub-shafts of means A is independent of all of the other pumps. Pump P is shown as receiving fluid from a supply line **70** and delivering it to an outlet line **71**. An extension **72** of the inlet fitting **51** of pump P is connected to line **70** by a releasable coupling **73** while an extension **74** of the outlet fitting **52** of pump P is connected to line **71** by a releasable coupling **75**.

Through the construction just described pump P can be coupled by means of its mounting means **55** with housing X to be driven by one of the sub-shafts **25** of means A entirely independent of and without in any way influencing or modifying action of the other pumps in the structure except, of course, as the pump P is connected to be driven it will require power and it will proportionately load the entire mechanism.

The pumps grouped or co-ordinated in accordance with the present invention, say for instance the pumps $P^1$, $P^2$, $P^3$ and $P^4$, are cooperatively related by means of the elements B, C, D, E and F.

The manifold B is an inlet or supply manifold adapted to be supplied with fluid as by means of a main line **80**. In the particular case illustrated separate inlet pipes C connect manifold B with the inlet fittings of the pumps included in the group above mentioned. In accordance with the preferred form of the invention each inlet pipe C is sectional; that is, it is such as to have sections releasably joined or connected by a coupling **91** in a manner such as is illustrated throughout the drawings.

The outlet manifold D is provided as a common receiver for the fluid delivered by the pumps included in the group under consideration. The outlet pipes E extend from the outlet fittings of the pumps to the manifold B, and it is preferred that each outlet pipe include sections joined by a releasable coupling **92**. The releasable couplings **91** and **92** make possible simple, quick separation of each pump from the balance of the structure as circumstances may require, and when a pump is removed or separated, the sections of pipes C and E coupled to the manifolds may be plugged or capped as required.

In the preferred form of the invention; that is, in the case illustrated in the drawings the manifolds B and D are annular in form and they are such that their outside diameters are substantially alike and are substantially equal to that of the housing X. The manifolds B and D are arranged side by side rearward of the housing X, or so that they occur between the motor M and the housing X. With this arrangement of manifolds the pipes connecting the manifolds and the pumps employed in the group of pumps form a simple, compact combination and

arrangement of parts leaving all of the pumps at the front of the housing free and unobstructed and readily accessible as will be apparent from the drawings.

In accordance with the preferred form of the invention a pressure control means F is provided in connection with each pump of the group coupled with the manifolds, and in a typical application of the invention the several control means F may be adjusted or related so that the several pumps of the group operate somewhat differently, that is, to deliver fluid up to selected pressures with the result that all pumps in the group operate at low pressure but only one operates at maximum, or high pressure.

In the particular case illustrated the means F in connection with each pump is a pressure relief device and may be a structure such as is shown in Fig. 6 of the drawings. As will be noted in Fig. 6, the section **100** of the outlet pipe from a pump connects into the body **101** of the means F. The section **102** of the outlet pipe connects with body **101** and extends to the outlet manifold D. A bleed line **103** connects with body **101** and a slidable control member or valve element **104** operates in a cylinder opening **105** in the body **101** between a position where all of the flow from section **100** passes to section **102** and a position where all of the flow from section **100** passes to the bleed line **103**. A spring **108**, under control of an adjusting screw **109**, normally yieldingly holds the valve member **104** in the position first mentioned. An actuating or pilot line **110** extends from manifold D to the body **101** so that fluid from manifold D acts on the valve **104**.

It will be apparent that the structure just described can be set or adjusted so that all of the fluid delivered by the pump with which the control F is related is passed to manifold D until such time as a given or predetermined pressure has been developed in manifold D following which the valve element **104** will shift in cylinder **105** against the action of spring **108** to bleed off part of the pumped fluid to the line **103**, and if pressure in manifold D is sufficiently great, the entire flow may be thus bled off. In the particular case illustrated the several bleed lines **103** from the means F extend to an accumulator **115** from which the fluid is fed to the line **80** supplying manifold B.

In a typical situation, that is, where the structure of the present invention is to be used for supplying fluid to a hydraulic machine, such for example as a press, it is desirable that a volume of fluid be initially supplied at a reasonable pressure, whereas as the load develops or the work is advanced the volume of fluid may be reduced, whereas higher pressure is desired. To meet such a situation with a structure such as is illustrated in the drawings the means F related to pump $P^1$ may be set so that pump $P^1$ delivers fluid to manifold D up to a pressure of say five-hundred pounds, per square inch, after which flow from pump $P^1$ bleeds to the accumulator **115**. The means F of pump $P^2$ can be set so that this pump delivers fluid to manifold D up to a pressure of say a thousand pounds per square inch, after which fluid bleeds to the accumulator. Pump $P^3$ may have its means F set to deliver fluid to manifold D up to a pressure of say fifteen hundred pounds per square inch beyond which pressure fluid bleeds to the accumulator **115**, and finally pump $P^4$ may have its means F set at the maximum pressure desired, say for example at about two thousand pounds per square inch, beyond which pressure fluid from pump $P^4$ bleeds to the accumulator **115**.

With the combination and relationship of parts just described it will be apparent that as pressure develops in manifold D the volume of fluid delivered to the manifold decreases until finally there is a minimum volume of fluid delivered to the manifold, but this fluid is at a maximum pressure. Through this regulation of pressure and volume the load on the motor M, though subject to some variations, is not subject to extreme load variation and, consequently, motor M will operate under normal conditions at a substantially uniform rate even though there are marked variations in the operating conditions of the equipment supplied by the structure hereinabove described.

In accordance with the preferred form of the invention a check valve **120** is provided in the section **101** of each outlet pipe from means F to manifold D serving to pass fluid only from the means F to the manifold D. The check valves positively prevent pressures developing in manifold C acting back upon means F or the pumps related thereto which have operated to bleed or which may have for any reason failed or become inoperative.



From the foregoing description it will be apparent that with the structure provided any one or possibly more of the pumps employed in the apparatus can be detached and removed for purpose of replacement or repair without disturbing the other pumps. If desired or necessary, the pumps incorporated in the group where they are coupled to the manifolds can be varied in number and the desired group action obtained by suitable adjustment of the means F. It is notable also that with the construction and arrangement provided the pump $P^4$, which is the pump of the group serving delivery fluid at the highest pressure, is directly coupled to the main shaft of the means A, there being no drive gear operating this pump as is the case of the other pumps employed in the structure.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. In combination, a housing having a body and front and rear walls closing the body, the front wall having a detachable section, a main shaft entering the housing and adapted to be driven, a drive pinion on the main shaft within the housing, a sub-shaft carried by the housing spaced from the main shaft, a drive from the main shaft to the sub-shaft and located in the housing including a gear on the sub-shaft and meshed with the pinion, and a pump at the exterior of the housing and driven by the sub-shaft, the pump being carried by said section of the front wall and said section of the front wall providing access to the interior of the housing for passage of the gear into and out of the housing.

2. In combination, a housing having a body and front and rear walls closing the body, the front wall having an annular series of openings therein and detachable sections closing the openings, a main shaft entering the central portion of the housing, a plurality of sub-shafts carried by the housing and each having an end accessible at one of said sections of the front wall, a drive pinion on the main shaft, a gear on each sub-shaft meshing with the pinion, a plurality of pumps, means detachably mounting a pump on each of said sections of the front wall to be at the exterior of the housing at the outer side of the front wall and in driving engagement with the sub-shaft at the section, the gears being removable from the housing through said openings when said sections are detached.

3. In combination, a main drive shaft, a plurality of pumps, releasable drive couplings connecting the pumps and shaft whereby the pumps are simultaneously driven from the shaft and are individually releasable from the shaft, means supplying fluid to the pumps, means receiving fluid from the pumps including a fluid handling outlet from each pump, and pressure regulating means in connection with said outlets whereby each pump operates to deliver fluid under pressure only up to a predetermined pressure, said predetermined pressure for each pump being different.

4. In combination, a main drive shaft, a motor adapted to drive the shaft, a plurality of pumps, releasable drive couplings connecting the pumps and shaft whereby the pumps are simultaneously driven from the shaft and are individually releasable from the shaft, means supplying fluid to the pumps, means receiving fluid from the pumps including a fluid handling outlet from each pump, and pressure regulating means in connection with said outlets adapted to bleed off pumped fluid whereby each pump operates to deliver fluid under pressure only up to a predetermined pressure, said predetermined pressure for each pump being different.

5. In combination, a main drive shaft, a plurality of pumps, releasable drive couplings connecting the pumps and shaft whereby the pumps are simultaneously driven from the shaft and are individually releasable from the shaft, means supplying fluid to the pumps, means receiving fluid from a group of some only of the pumps including a fluid handling outlet from each pump, and pressure regulating means in connection with said outlets from the pumps in said group whereby each pump

in the group operates to deliver fluid under pressure only up to a predetermined pressure, said predetermined pressure for each pump in the group being different.

6. In combination, a main drive shaft, a plurality of pumps, releasable drive couplings connecting the pumps and shaft whereby the pumps are simultaneously driven from the shaft and are individually releasable from the shaft, means supplying fluid to the pumps, means receiving fluid from the pumps including a fluid handling outlet from each pump, and pressure regulating valves in connection with said outlets whereby each pump operates to deliver fluid under pressure only up to a predetermined pressure, said predetermined pressure for each pump being different.

7. In combination, a main drive shaft, a plurality of pumps, releasable drive couplings connecting the pumps and shaft whereby the pumps are simultaneously driven from the shaft and are individually releasable from the shaft, means supplying fluid to the pumps, means receiving fluid from the pumps including a fluid handling outlet from each pump, a check valve in each of said outlets, and pressure regulating valves in connection with said outlets between the check valve and pump whereby each pump operates to deliver fluid under pressure only up to a predetermined pressure, said predetermined pressure for each pump being different.

8. In combination, a main shaft adapted to be driven, a plurality of sub-shafts spaced apart and from the main shaft, drive means whereby the sub-shafts are driven by the main shaft, a plurality of pumps, means releasably coupling each pump with one of the shafts whereby all of the pumps are driven simultaneously and are subject to being individually released, an inlet duct extending to each pump, and an outlet duct extending from each pump, each duct including a releasable coupling.

9. In combination, a power distributing means including a plurality of laterally spaced parallel shafts adapted to operate simultaneously, pumps individually releasably engaged with said shafts to be driven thereby, an inlet manifold, inlet ducts from said manifold to the pumps, an outlet manifold, and outlet ducts from the pumps to the outlet manifold, each duct including a releasable coupling.

10. In combination, a drum shaped housing, a plurality of shafts carried by the housing and adapted to operate simultaneously, a plurality of pumps at one end of the housing and each in driving engagement with one of the shafts, an annular fluid handling manifold concentric with and adjacent the housing at the other end thereof, and fluid handling ducts connecting the pumps and the manifold.

11. In combination, a drum shaped housing, a central drive shaft entering the housing from the rear side thereof, a plurality of sub-shafts carried by the housing and driven by the drive shaft, a motor spaced from



the rear side of the housing and driving the drive shaft, a plurality of pumps at the front side of the housing and each in driving engagement with one of the sub-shafts, an annular inlet manifold concentric with the housing and located between the housing and motor, inlet ducts connecting said manifold and the pumps, an annular outlet manifold concentric with the housing and located between the motor and housing, and outlet ducts connecting the pumps and the outlet manifold.

12. In combination, a drum shaped housing, a plurality of shafts carried by the housing and adapted to operate simultaneously, a plurality of pumps at one end of the housing and each in driving engagement with one of the shafts, two annular fluid handling manifolds concentric with and in side by side relation adjacent one end of the drum, inlet ducts connecting the pumps with one manifold and outlet ducts connecting the pumps with the other manifold.

13. In combination, a drum shaped housing, a plurality of shafts carried by the housing and adapted to operate simultaneously, a plurality of pumps at one end of the housing and each in driving engagement with one of the shafts, two annular fluid handling manifolds concentric with and in side by side relation adjacent one end of the drum, inlet ducts connecting the pumps with one manifold and outlet ducts connecting the pumps with the other manifold, the ducts extending across the periphery of the housing and spaced therefrom and extending between the pumps and the manifolds.

14. In combination, a drum shaped housing, a plurality of shafts carried by the housing and adapted to operate simultaneously, a plurality of pumps at one end of the housing and each in driving engagement with one of the shafts, two annular fluid handling manifolds concentric with and in side by side relation adjacent one end of the drum, inlet ducts connecting the pumps with one manifold and outlet ducts connecting the pumps with the other manifold, the outside diameters of the manifolds being substantially the same as that of the housing and the ducts extending across the periphery of the housing and spaced therefrom and extending between the pumps and the manifolds.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,879,219 | Harbison | Sept. 27, 1932 |
| 1,937,367 | Vickers | Nov. 28, 1933 |
| 2,146,123 | Logan | Feb. 7, 1939 |
| 2,256,743 | Kleekner | Sept. 23, 1941 |
| 2,354,992 | Gottlieb | Aug. 1, 1944 |
| 2,432,825 | Sloane | Dec. 16, 1947 |
| 2,481,047 | Sloane | Sept. 6, 1949 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 364,631 | Great Britain | Jan. 4, 1932 |