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54 **Close-coupled unitized power system assembly.**

57 A closely coupled power system assembly is disclosed in which a rotary lobe device (42), such as a pump, blower or a fan, is closely coupled to a variable speed drive (21) or gear-type hydraulic motor. Close coupling is accomplished by incorporating adaption structure for the two counter rotating shafts (44, 46) of the rotary lobe device (42) into the variable speed drive train (61) or hydraulic motor so that bearings (66, 67), gears (62, 63, 64), seals (49) and the like perform a dual function.

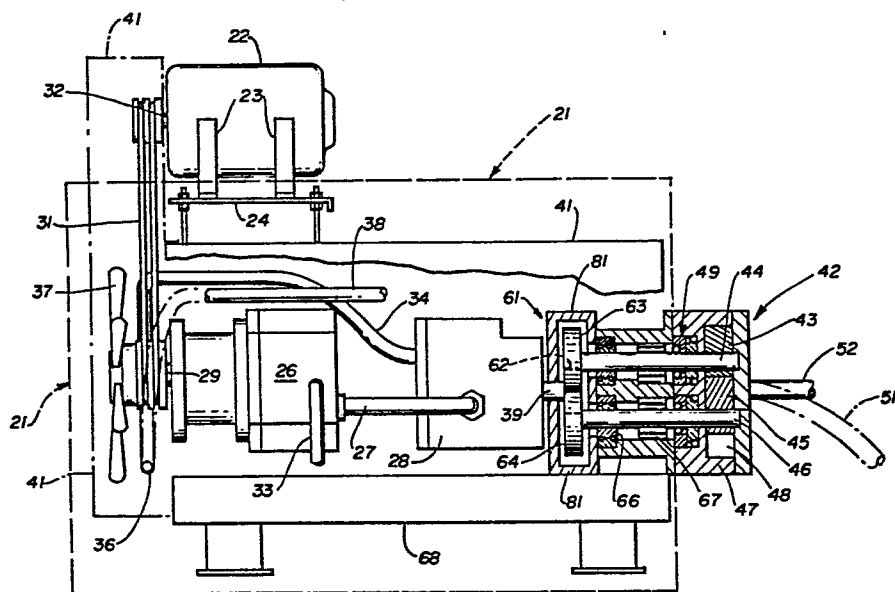


Fig. 1

TITLE: CLOSE-COUPLED, UNITIZED POWER SYSTEM ASSEMBLY

For many years the power systems which are used to drive a wide range of industrial apparatus, such as pumps, blowers, fans and the like, have been formed by the assembly of units or modules which are acquired from
5 one or more manufacturers. The modular approach to power system assemblies allows the industrial user to select a pump which has desired characteristics, combine it with a variable speed drive from another manufacturer and with a motor from still another manufacturer.

10. When the device or apparatus to be driven by the power system assembly is a rotary lobe device, the unit will normally include an adapter portion capable of being coupled to the output shaft of a motor or variable speed drive and formed to provide synchronous counter rotating
15 shafts which are coupled to the counter rotating lobes of the rotary lobe device. The adapter portion of the pump unit normally includes a casing or housing, seals, a second shaft, timing gears and bearings. The timing gears are coupled to cause synchronous counter rotation
20 of a second shaft mounted in a housing with the drive shaft that is coupled to the motor or variable speed drive. The two counter rotating shafts of the adapter portion of the pump unit drive the pump lobes.

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A rotary lobe pump alone is a relatively small and compact device. When sold in a modular form with the adapter portion, however, the size and complexity of the unit doubles as a result of the bearings, seals, 5 timing gears and second shaft in the adapter. Additionally, as would be expected, the adapter portion of the rotary lobe pump adds significantly to the cost of the unit and reduces the performance and efficiency of the pump by reason of losses in the couplings the 10 timing gears and the bearings.

Rotary lobe apparatus are usually driven by coupling the adapter portion of the apparatus to a motor or variable speed drive by means of a flexible coupling or the like. In each case, the adapter portion of the 15 rotary lobe unit makes direct coupling to variable speed drives relatively easy. When the drive assembly includes a variable speed drive or when the motor is a gear-type hydraulic motor, however, there exists a substantial and wasteful duplication of components. 20 Thus, gear-type hydraulic motors and variable speed drive assemblies include gears, bearings, seals, and even housings and support frames which are also present in the rotary lobe apparatus adapter. While there are many advantages from being able to form power system 25 assemblies from a plurality of components or units which can be coupled together for use in a wide range of applications, the result is a system having

undesirable bulk, cost, and loss of efficiency.

Accordingly, it is an object of the present invention to provide a unitized power system assembly having a simplicity of construction and cost as well
5 as enhanced efficiency.

It is a further object of the present invention to provide a unitized motor-pump assembly in which components are constructed to perform dual functions so as to enable a reduction in the number and
10 complexity of parts in the assembly.

Still a further object of the present invention is to provide an improved variable speed drive assembly suitable for close coupling of a rotary lobe pump or the like thereto.

15 The unitized power system assembly of the present invention has other objects and features of advantage which will become more apparent from and are set forth in more detail in the following description of the preferred embodiment and the accompanying drawing.

20 According to the invention there is provided a power system assembly having a drive unit including one of a gear type hydraulic motor and a motor coupled to a variable speed drive assembly, said drive unit further including a frame, bearing means mounted to said frame,
25 and an output shaft rotatably mounted in said bearing means and coupled to said one of said motor and said

drive assembly; and a rotary lobe device having two input shafts mounted for counter rotation to drive the same, said rotary lobe device further including means formed to and coupling said output
5 shaft of said drive unit to said input shafts of said rotary lobe device, characterised in that said means coupling said output shaft to said input shafts of said rotary lobe device is provided in said drive unit by a second output shaft, timing gear means coupling said
10 second output shaft to the first-named output shaft for synchronous counter rotation with respect thereto, and said bearing means in said drive unit being formed for rotatable support of said second output shaft from said frame; and the lobes of said rotary lobe device
15 being directly mounted to said first-named output shaft and said second output shaft of said drive unit for close-coupled driving of said rotary lobe device as a single unitized power system assembly.

The invention will now be described by way of
20 example with reference to the accompanying drawings in which:-

FIGURE 1 is a side elevational view, partially broken away and partially in cross section, showing a power system assembly constructed in accordance with
25 the present invention.

FIGURE 2 is an enlarged, side elevational view in cross-section of a portion of the power system assembly of FIGURE 1.

The power system assembly of the present invention is illustrated in the drawing by a drive unit, generally designated 21, which is surrounded by a broken line and is here illustrated as a hydraulic or hydrostatic variable speed drive. Drive unit 21 is formed for mounting of motor 22 thereto by means of brackets 23 which are secured to motor mount plate 24. Typically, the variable speed drive 21 and motor 22 will be purchased by the end user from various suppliers in accordance with the end user's requirements and will be mounted together for operation as a single drive unit.

As shown in the drawing, variable speed drive 21 is a hydraulic or hydrostatic drive having a variable displacement pump 26 hydraulically coupled at 27 to positive displacement hydraulic motor 28 thus, the input shaft of the variable speed drive is shown at 29 and is coupled by pulley belts 31 to the output shaft 32 of motor 22. Hydraulic fluid input from a sump (not shown) to pump 26 is provided through conduit 33 and stroke adjustment means (not shown) is used to vary the displacement of the pump, which is preferably pressure compensated, for input through conduit 27 to positive displacement motor 28. Conduit 34 is coupled to motor 28 and in turn to a radiator portion 36

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immediately proximate fan 37 of the drive for cooling of the hydraulic fluid before return through conduit 38 to the sump.

The output shaft 39 from hydraulic motor 28 will
5 have a speed which varies with respect to input shaft 29 as determined by variation of the displacement of hydraulic pump 26. Thus, the variable displacement pump enables variation of the drive speed of shaft 39 with respect to motor shaft 32.

10 In the usual configuration, shaft 39 is coupled to a gear reduction box (similar to gear means 61) and thereafter is supported by a bearing housing before shaft 39 protrudes from the variable speed drive housing 41. The end of the shaft 39 in FIGURE 1 does
15 not extend beyond housing 41 since it has been modified in accordance with the present invention, but in a conventional variable speed drive it would so extend and be provided with a key way or the like so that a flexible coupling or similar structure can be used to
20 couple drive unit 21 with the apparatus to be driven.

As illustrated in FIGURE 1, a rotary lobe device, here a pump generally designated 42, can be seen to be mounted to drive unit 21. The rotary lobe pump here illustrated includes a pair of lobes 43 and 45 mounted
25 for counter rotation to pump shafts 44 and 46, respectively. The pump further includes a housing 47 formed with a figure 8-type cavity 48 in which the lobes

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rotate, as is well known in the art. The pump further includes a seal and bearing structure 49 and an input port and conduit 51 (shown in phantom) and an output port with conduit 52 to enable pumping of the material to be handled by the pump assembly.

As thus far described, the components of the apparatus of the present invention can be found in the prior art. As will be apparent, however, an adapter means or the like is required and has been provided for coupling of the input shafts 44 and 46 for the pump to the output shaft 39 of the variable speed drive. In prior power system assemblies, pump 42 has been mounted to a separate base or frame which also carries an adapter portion in the form of timing gears, a second shaft, seals and shaft bearings, as well as an adapter housing. In the improved power system assembly of the present invention, however, the gears, bearings and seals commonly employed as part of variable speed drive 21 are given a dual function and the rotary lobe pump is directly coupled to variable speed drive unit 21.

As indicated above, shaft 39 is usually coupled to reduction gears and then supported by a large bearing assembly before a single output shaft protrudes from the variable speed drive unit. In the present invention, gear means, generally designated 61, are mounted to

output shaft 39. As illustrated, a reduction gear system is employed, as is conventional with variable speed drives, but the reduction gear system 61 now also performs a function of providing adapter means capable
5 of coupling directly to rotary lobe pump 42. Thus, a pinion gear 62 is mounted on shaft 39 and drives a first drive gear 63, which in turn is meshed with and drives second drive gear 64. The gears 63 and 64 are of the same diameter and accordingly are counter
10 rotating in synchronism.

Instead of having a single output shaft from the reduction gear means 61, however, a pair of output shafts are coupled to the counter rotating gears 63 and 64, and such shafts are advantageously provided by
15 common shafts 44 and 46 which input rotary lobe pump 42. Thus, bearing means 66 and 67 support shafts 44 and 46 for counter rotation to provide a variable speed drive unit having as its output counter rotating shafts to which a rotary lobe device such as a pump can be
20 directly and closely coupled.

The use of the reduction gear means, bearing means and seal means, as well as the frame of the variable speed drive, to provide a dual function of support of the output shaft means from the variable
25 speed drive and adaption of the output shaft means to provide counter rotating synchronous input shafts to

the rotary lobe pump has several important advantages. Since pump 42 is a relatively compact structure once the adapter is eliminated, frame 68 (schematically represented as a longitudinally extending beam) for the
5 variable speed drive can readily also support pump 42. The separate pump frame, therefore, can be eliminated. Similarly, a separate housing for an adapter and the bearings and shaft seals and separate timing gears found in the pump adapter can all be eliminated. Direct
10 coupling or mounting of the rotary lobe pump onto the output shafts of the variable speed drive also eliminates the need for flex couplings.

In addition to the elimination of a duplication of parts, the attendant cost and space savings, the
15 closely coupled power system assembly of the present invention also eliminates efficiency losses which would occur in the pump adapter timing gears, the pump adapter bearings, and the pump adapter seals, as well as in the flex coupling.

20 The ability to employ existing structure to eliminate the need for a pump unit which includes an adapter also can be achieved when drive means 21 is in the form of a hydraulic gear-type pump. As best may be seen in FIGURE 2, if pinion 62 and shaft 39, shown in
25 phantom, are eliminated and housing 81 is formed as a tight fitting housing which is sealed with respect to shafts 44 and 46 and which housing is provided with an

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input and output port, the gear reduction means 61 can essentially be seen to comprise a gear-type hydraulic motor. As such, the counter rotating gears 63 and 64 would be driven by a hydraulic working fluid, rather than shaft 39. In the usual gear-type hydraulic motor there is a single output shaft, but in the apparatus of the present invention, both gears 63 and 64 would be provided with output shafts, namely shafts 44 and 46, which again are provided with bearing means 66 and 67 and are directly coupled to lobes 43 and 45 of rotary lobe pump 42. The seals and bearings which would normally be present in any gear-type hydraulic motor can, therefore, be employed with the addition of a second shaft to provide the necessary structure for adaptation or input into a rotary lobe pump.

The combination of a gear-type hydraulic motor with a closely coupled rotary lobe pump has particular advantages in connection with applications in which it is desirable to have possible spark or combustion inducing engine remote from the pump. Instead of using a flexible mechanical power take off or coupling, hydraulic lines can be run to a remote location at which the gear-type hydraulic motor can be driven to in turn drive the rotary lobe pump.

As will also be appreciated, the direct coupling through a variable speed drive or gear-type hydraulic motor can be employed to drive other apparatus such as

mills, presses and the like which require or advantageously employ counter rotating driven elements.

CLAIMS:

1. A power system assembly having a drive unit including one of a gear type hydraulic motor (28) and a motor (22) coupled to a variable speed drive assembly (21), said drive unit further including a frame (68),
5 bearing means (66, 67) mounted to said frame, and an output shaft (44) rotatably mounted in said bearing means and coupled to said one of said motor and said drive assembly; and a rotary lobe device (42) having two input shafts (44, 46) mounted for counter rotation
10 to drive the same, said rotary lobe device (42) further including means formed to and coupling said output shaft (39) of said drive unit to said input shafts (44, 46) of said rotary lobe device, characterised in that said means coupling said output shaft (39) to said
15 input shafts (44, 46) of said rotary lobe device is provided in said drive unit by a second output shaft (46), timing gear means (63, 64) coupling said second output shaft (46) to the first-named output shaft (44) for synchronous counter rotation with respect thereto,
20 and said bearing means (66, 67) in said drive unit being formed for rotatable support of said second output shaft from said frame (68); and the lobes (43, 45) of said rotary lobe device being directly mounted to said first-named output shaft (44) and said second output shaft
25 (46) of said drive unit for close-coupled driving of said rotary lobe device (42) as a single unitized power

system assembly.

2. A power system assembly as claimed in Claim 1 characterised in that said drive unit is provided by a motor (28) coupled to a variable speed
5 drive (26) and said gear means (63, 64) is coupled to an output shaft (39) of said variable speed drive.

3. A power system assembly as claimed in Claim 2 characterised in that said variable speed drive assembly is a hydraulic variable speed drive (21) having
10 a variable displacement hydraulic pump (26) coupled to a positive displacement hydraulic motor (28).

4. A power system assembly as claimed in Claim 1 characterised in that said drive unit (21) includes reduction gear means (61), and said timing gear means
15 is provided by said reduction gear means.

5. A motor-pump assembly including
(a) a motor (28) having a motor output shaft (39);
(b) a variable speed drive (21) coupled to said motor output shaft (39) and having reduction gear means
20 (61), bearing means (66, 67), seal means (49), and a drive output shaft (44, 46);

(c) adapter means coupled to said drive output shaft and formed with timing gear means, bearing means, seal means, and a pair of adapter output shafts mounted
25 for synchronous counter rotation; and

(d) a lobe-roter pump (42) mounted to said adapter output shafts for driving thereof, characterised in that

said adapter means is incorporated into said variable speed drive (21) with said reduction gear means (61) providing said timing gear means, and said bearing means (66, 67) and said seal means (49) of said
5 variable speed drive (21) are formed for support of two output shafts (44, 46); and said lobe-rotor pump (42) is mounted directly to the two output shafts of said variable speed drive.

6. A variable speed drive assembly including a
10 housing (47), input shaft means (39) formed for coupling to a drive motor (28) and extending into said housing, output shaft means (44, 46) formed for coupling to an apparatus to be driven and extending from said housing, and speed variation means (26) mounted in said
15 housing and coupled to said input shaft means and said output shaft means, said speed variation means being formed for selective adjustment of the rate of rotation of said output shaft means relative to the rate of rotation of said input shaft means, characterised in
20 that said output shaft means is provided as a pair of rotatable output shafts (44, 46) extending from said housing; and gear means (63, 64) mounted in said housing and interposed between said pair of output shafts and said speed variation means (26) and formed and coupled
25 for synchronous counter-rotation of said pair of output shafts.

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7. A variable speed drive assembly as claimed in Claim 6 characterised in that said speed variation means is a hydraulic means including a variable displacement pump (26) coupled to said input shaft 5 means (39) and a positive displacement motor (28) coupled to said variable displacement pump; and said gear means (63, 64) is coupled to said positive displacement motor.

8. A variable speed drive assembly as claimed 10 in Claim 7 and characterised in that a lobe-rotor pump (42) is close coupled directly to said pair of output shafts (44, 46).

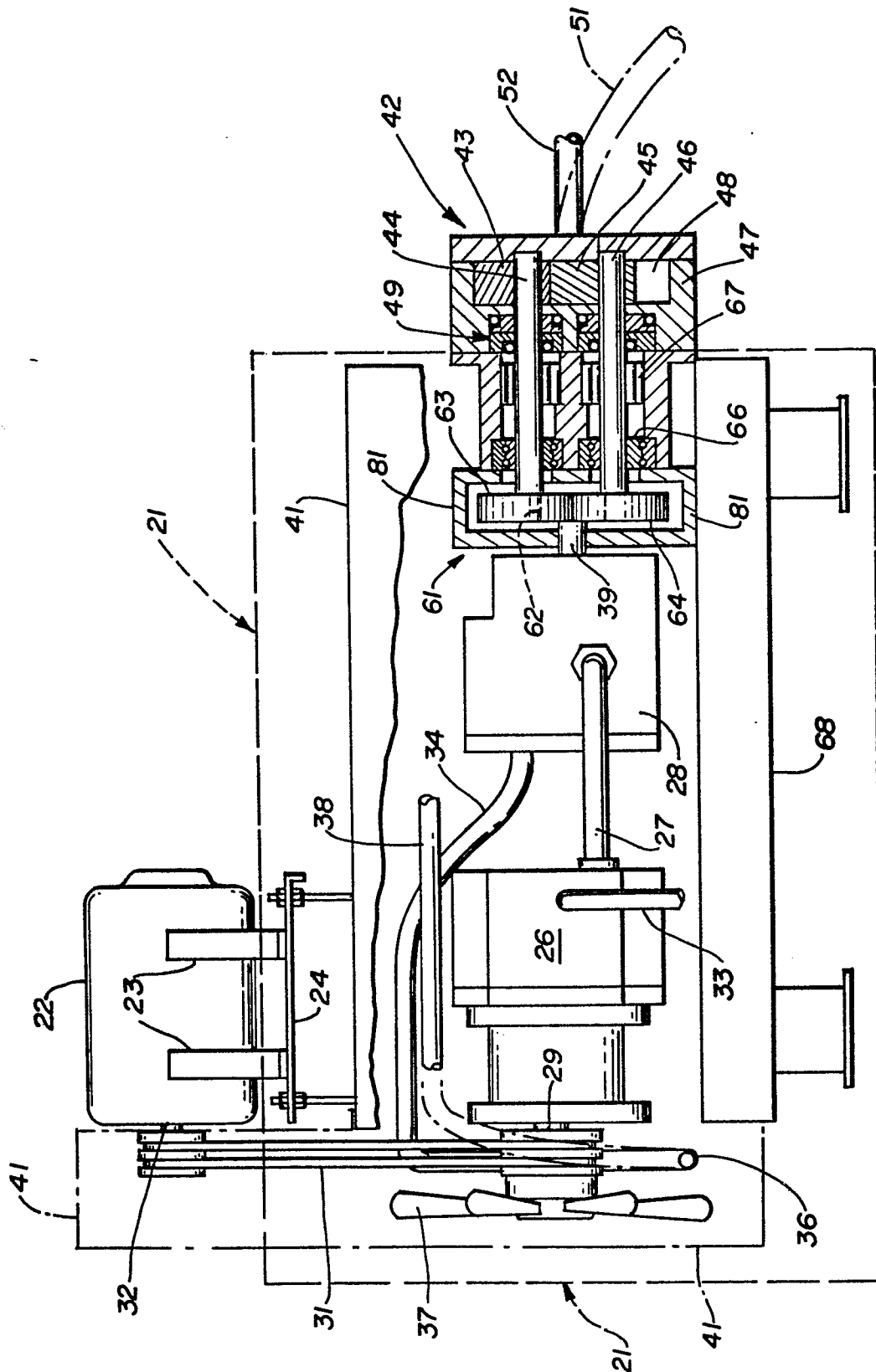


Fig. 1

