United States Patent [19]

Mott, Jr. et al.

[11] **3,751,191**

[45] **Aug. 7, 1973**

[54] **HYDRAULIC PUMP AND COOLER UNIT**

[75] Inventors: **Carl W. Mott, Jr.**, La Grange Park; **Tommy A. Middlesworth**, Hinsdale, both of Ill.

[73] Assignee: **Mott Corporation**, La Grange, Ill.

[22] Filed: **Feb. 2, 1971**

[21] Appl. No.: **111,954**

[52] **U.S. Cl.** ..... **417/313**, 60/52 US, 60/52 HE, 165/122

[51] **Int. Cl.** **F04b 39/12**

[58] **Field of Search** ..... 417/313, 360; 60/52 HE, 52 US, DIG. 5, 52 HD; 184/104 R; 165/107, 121, 122; 415/121, 121 G; 180/53 R; 56/7

[56] **References Cited**

UNITED STATES PATENTS

R23,146	9/1949	Packwood	415/121 G
2,823,656	2/1958	Dolza	415/121 G
1,037,659	9/1912	Rembert	415/121 G
2,601,907	7/1952	Burrows et al.	415/121 G
1,728,740	9/1929	Wirt	165/121 X
3,148,502	9/1964	Granryd	60/52 HE X
1,762,028	6/1930	Phelps	415/121
2,672,000	3/1954	Speiser	56/7
3,429,110	2/1969	Straser	56/7

FOREIGN PATENTS OR APPLICATIONS

650,815	3/1951	Great Britain	415/121 G

Primary Examiner—Carlton R. Croyle
Assistant Examiner—R. J. Sher
Attorney—Hibben, Noyes & Bicknell

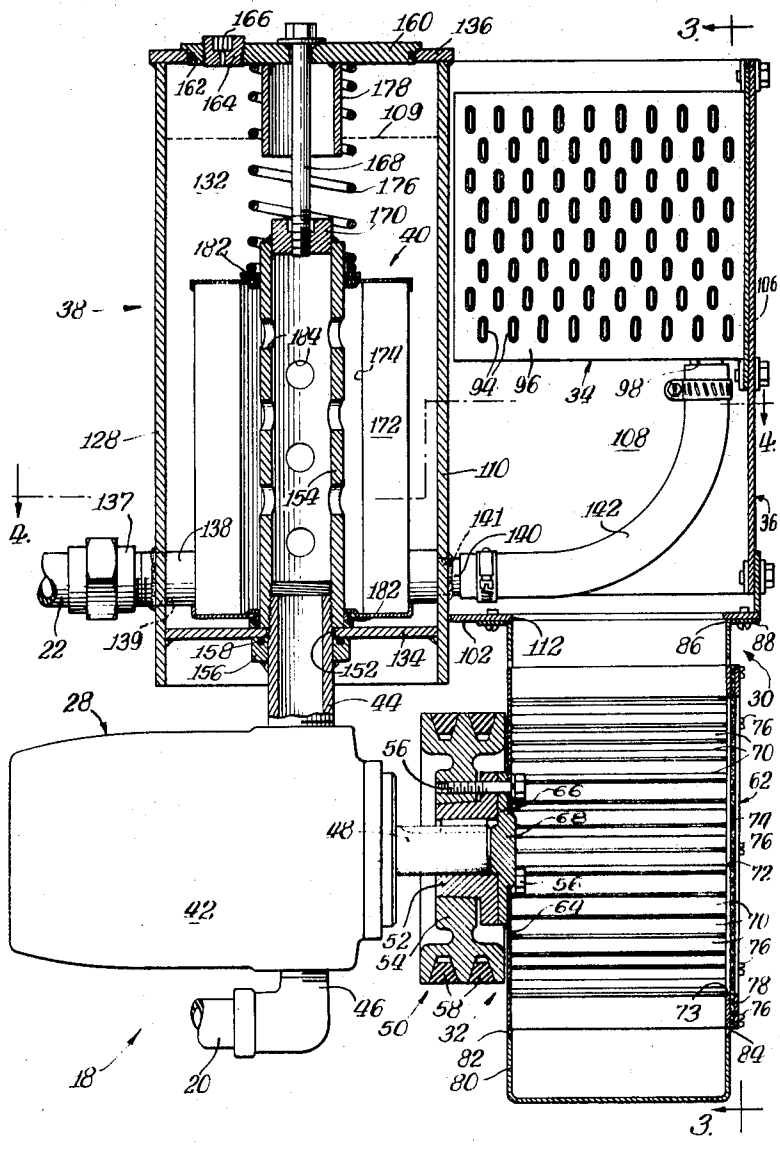
[57] **ABSTRACT**

An arrangement of a hydraulic pump and cooler unit for a hydrostatic drive mechanism, the unit comprises pump means, blower means, duct means, and heat exchanger means. The pump means and blower means are mounted on a single shaft so that they are coaxial and have common drive means. The heat exchanger means is located within the duct means, and both of said means are located directly above the blower means. The unit may include a reservoir means arranged side-by-side with the duct means and above the pump means. Said reservoir means may also include filtering means therein.

12 Claims, 5 Drawing Figures

United States Patent [19]
Mott, Jr. et al.

[11] **3,751,191**
[45] **Aug. 7, 1973**



PATENTED AUG 7 1973

3,751,191

SHEET 1 OF 3

Fig. 1.

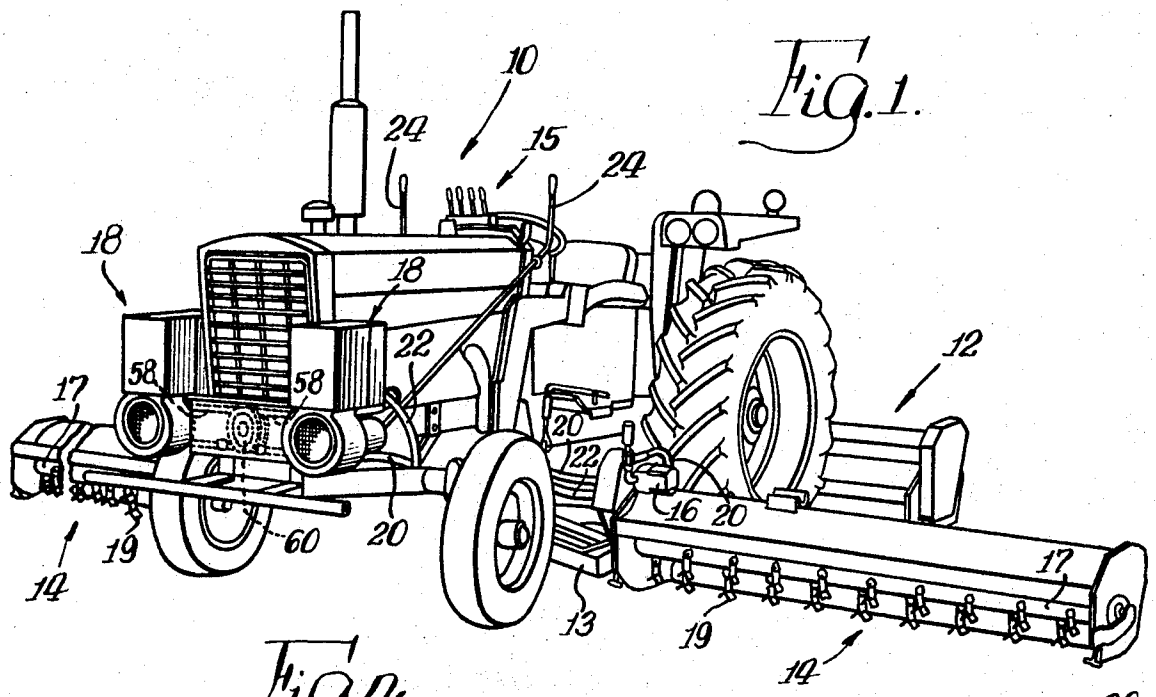
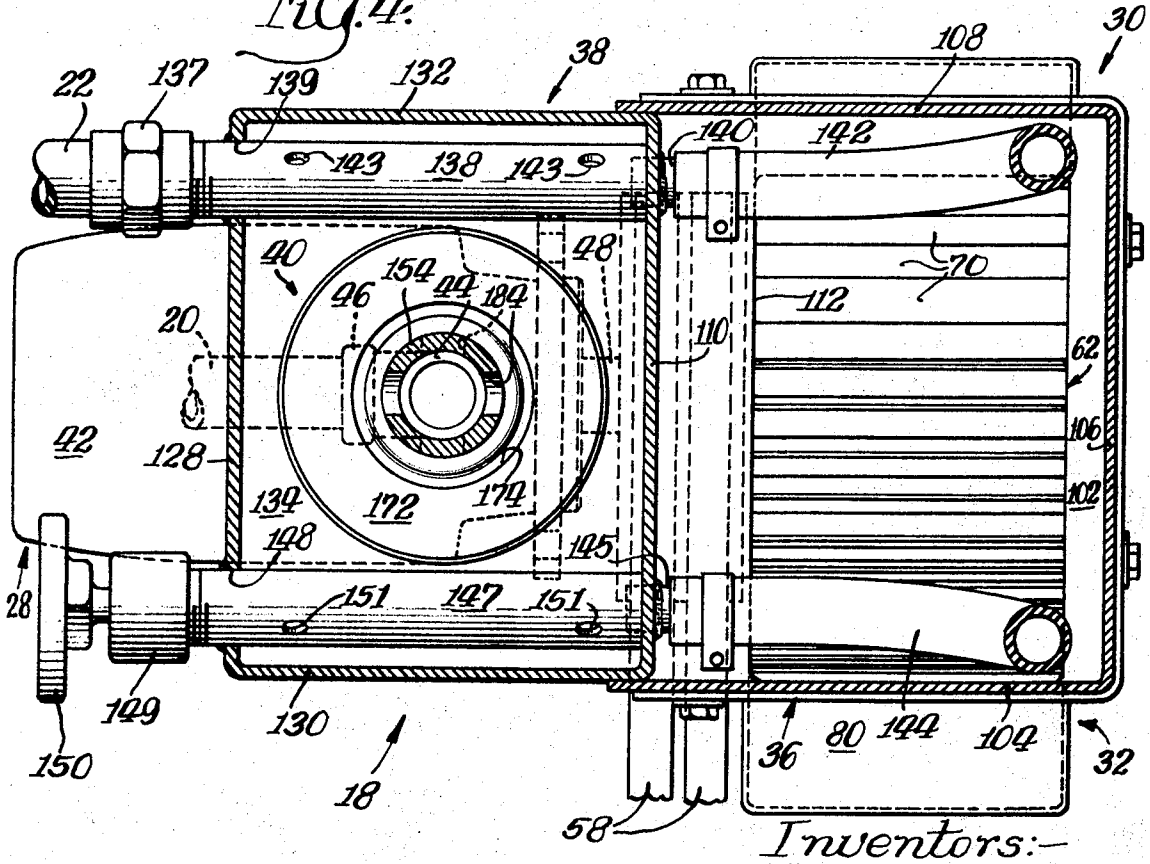


Fig. 4.



Inventors:-
Carl W. Mott, Jr.,
Tommy A. Middlesworth,
By Hitbon, Noyes & Bicknell,
Attys.

Fig. 2.

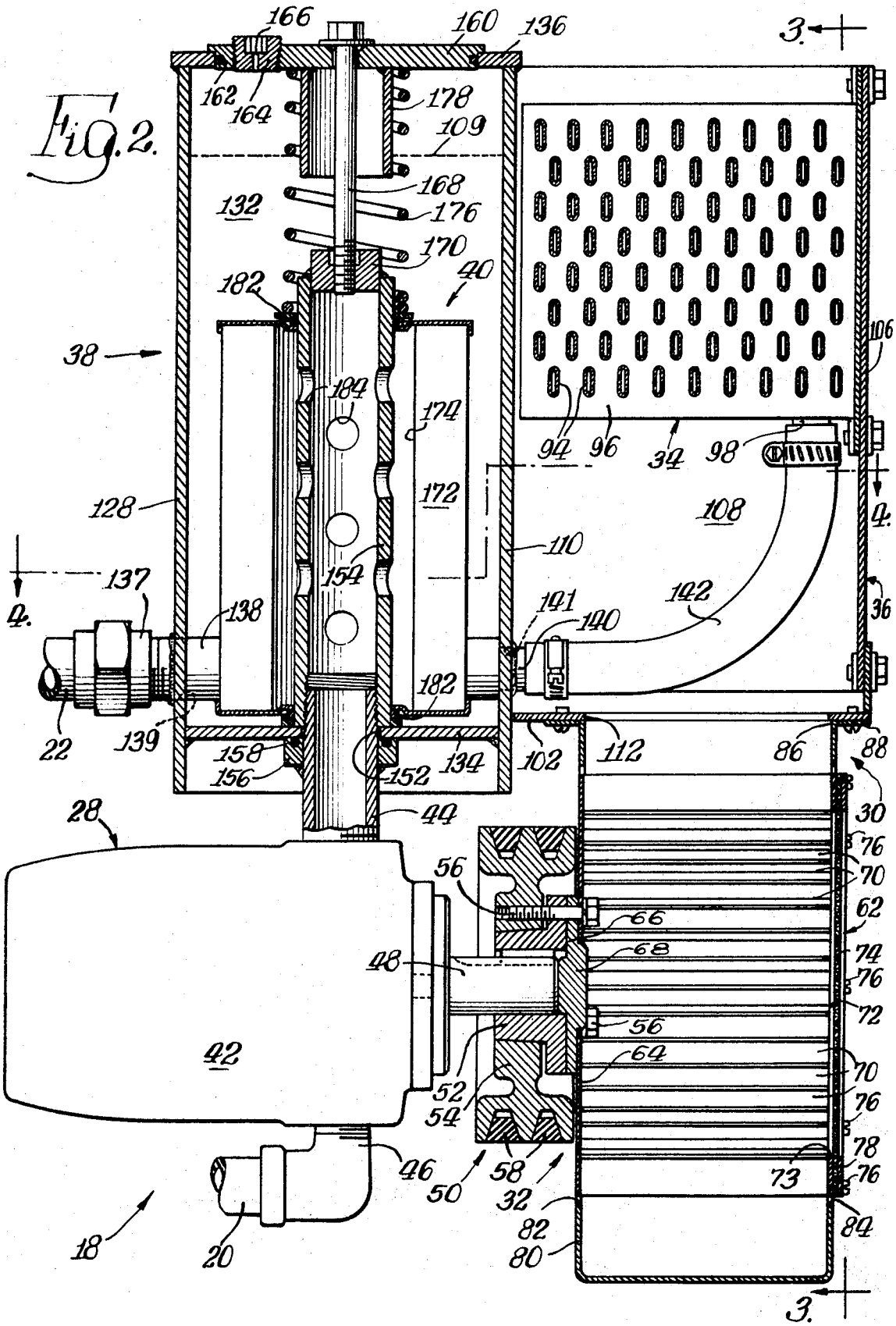

166
160
136
3
162
164
178
109
168
176
170
132
40
182
38
106
184
174
94
96
34
98
4
128
172
108
110
137
154
141
142
36
4
138
140
182
22
139
158
156
152
134
102
112
86
88
28
44
30
76
56
70
62
66
68
74
48
76
72
56
42
64
70
52
54
76
78
58
50
46
73
76
32
84
82
80
18
20
3

Fig. 5.

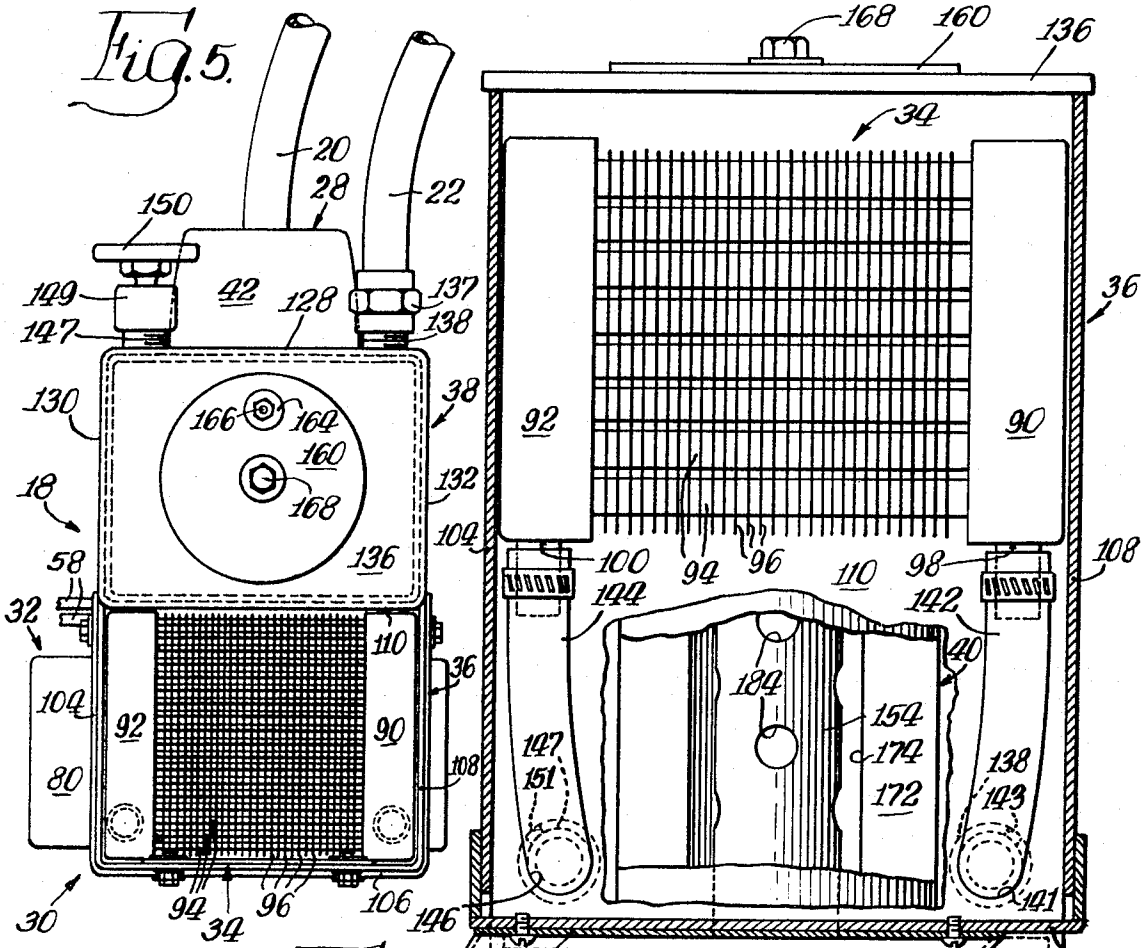
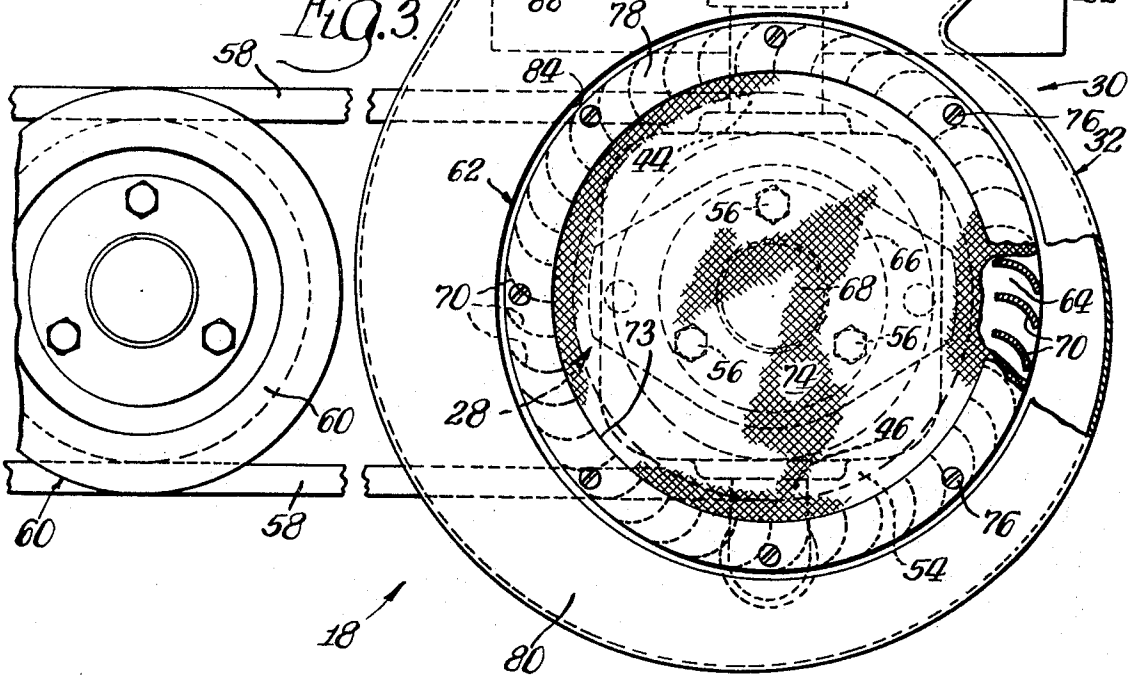

168
160
136
34
20
28
22
150
149
42
128
137
147
138
36
130
38
92
90
166
164
160
132
18
168
104
136
58
100
94
96
110
98
108
32
144
142
110
40
36
184
104
92
90
154
174
147
151
172
138
143
108
80
101
30
94
34
96
106
146
88
102

Fig. 3.


58
78
84
30
76
32
62
44
56
66
70
68
64
73
56
56
70
28
96
60
76
60
58
54
18
80

HYDRAULIC PUMP AND COOLER UNIT

This invention relates to a hydrostatic drive mechanism having a compact hydraulic pump and cooler unit.

Heretofore, it has been known to use a hydrostatic drive mechanism to operate various types of equipment. Such a mechanism usually includes a hydraulic pump for supplying pressure fluid for driving a hydraulic motor. Frequently, because of the large amount of heat transferred to the hydraulic fluid, cooling means, usually in the form of a fan and radiator, are also provided for cooling the hydraulic fluid. Attempts have been made to achieve a compact assembly of these components, but such attempts have been only partially successful.

The present invention eliminates the foregoing disadvantages by providing a hydrostatic drive mechanism having a hydraulic pump and cooler unit with compactly arranged components. Such unit comprises hydraulic pump means and cooler means, and the cooler means further comprises duct means having heat exchanger means therein, and blower means for dissipating heat from the fluid. The hydraulic pump means and blower means are coaxially arranged and mounted on a single shaft, and drive means is provided for simultaneously driving the pump means and blower means. In addition, reservoir means having filter means therein, may be connected to the hydraulic pump means and heat exhanger means. The reservoir means and duct means are located side-by-side and may also be adjacent the coaxially arranged hydraulic pump means, drive means and blower means. Thus, the duct means extends radically from the blower means.

Accordingly, it is the primary object of the present invention to provide a hydrostatic drive mechanism having a compact hydraulic pump and cooler unit.

Another important object of the present invention is to provide a hydrostatic drive mechanism of the foregoing character suitable for being mounted on a vehicle for driving various types of equipment carried by the vehicle.

Still another object of the present invention is to provide a hydraulic pump and cooler unit having pump means and blower means coaxially aligned and having a common drive means, reservoir means attached to said pump means, and duct means extending radially from the blower means and arranged in side-by-side relation with said reservoir means and having a heat exchanger therein.

These and other objects of the present invention will become apparent from the following description and accompanying figures of the drawings in which:

FIG. 1 is a perspective view of a tractor equipped with three mowers, two of which are driven by two hydrostatic drive mechanisms each utilizing a hydraulic pump and cooler unit embodying the features of the present invention;

FIG. 2 is an enlarged vertical sectional view of one of the hydraulic pump and cooler units shown in FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2; and

FIG. 5 is a reduced, top plan view of the unit shown in FIG. 2.

In FIG. 1 a vehicle or tractor 10 is illustrated, to which are secured a rear mower 12 and two side mowers 14. The rear mower 12 is, in this instance, mechanically driven from the rear power take-off of the tractor 10. The side mowers 14 are pivotally mounted on the outer ends of a pair of frames 13, the inner ends of the frames 13 also being pivotally connected to the sides of the tractor 10. Thus, the side mowers 14 can be moved, upwardly or downwardly, from their illustrated horizontal position, and can be pivoted. Such movements may be effected by conventional hydraulic cylinders (not shown) which receive hydraulic fluid under pressure from the hydraulic system of the tractor under the control of a multi-section control valve 15. The mowers 12 and 14 have rotatable mower shafts 17 to which cutting elements 19 are secured.

For convenience of installation, reduction in size, and increased operating efficiency, a separate hydrostatic drive mechanism embodying the features of the present invention, is utilized to drive each side mower 14. It will be understood that the hydrostatic mechanism to be hereinafter described could be used to drive other types of associated devices while located either on or off a vehicle. The provision of a separate hydrostatic drive mechanism for each associated device to be driven results in smaller, more easily handled components, and eliminates the pressure losses due to division of the fluid to drive two or more devices.

Each hydrostatic drive mechanism, in this instance, comprises a hydraulic motor 16 secured to one of the mowers 14 and driving the shaft 17 thereof, and a hydraulic pump and cooler unit 18. The motor 16 and unit 18 are connected together by conduit means in the form of flexible hoses 20 and 22.

The two units 18 are preferably mounted on the respective sides of the tractor 10 and at one end thereof, preferably the front end. The units may thus be driven by a power take-off shaft at the front of the tractor. The units may be selectively connected to or disconnected from the power take-off shaft by manual controls 24.

As shown in FIG. 2, each hydraulic pump and cooler unit 18 comprises pump means, such as a hydraulic pump 28, and cooler means indicated generally at 30. The cooler means 30 includes a blower means 32, and a heat exchanger means 34 mounted within duct means 36. In this instance, reservoir means 38 having filtering means 40 therein, is also provided. The components are arranged with the pump means 28 closely adjacent and in coaxial alignment with the blower means 32, the duct means 36 extending radially from the blower means 32 and having the heat exchanger means 34 therein. The reservoir means 38 is arranged in close side-by-side relation with the duct means and adjacent the pump means 28.

The hydraulic pump 28 is conventional and has an outer housing 42, a fluid inlet pipe 44, a fluid outlet pipe 46, and a shaft 48 rotatably mounted in the housing 42 and extending from one end thereof. When driven, the pump 28 draws hydraulic fluid from the reservoir 38 and supplies hydraulic fluid under pressure to the motor 16.

Drive means is secured to the shaft 48 and, in this instance, comprises a pulley 50 having an inner or hub portion 52 keyed to the shaft 48, and an outer portion 54 secured to the hub portion 52 as by bolts 56. The pulley 50, in the present instance, is driven by two V-belts 58 which extend around another pulley 60 (FIG. 1) mounted on the front power take-off shaft of the tractor 10. Since the blower 32 and pump 28 are con-

nected to a single shaft **48**, both may utilize the same drive means, i.e., the pulley **50**.

The blower means **32**, preferably comprises a squirrel cage rotor **62**, and an enclosing housing **80**. The rotor **62** includes a rear disk or plate **64** secured to the hub portion **52** of the pulley **50** by the bolts **56**. An adapter **66** is located between the plate **64** and hub portion **52** so that the pulley **50** clears the rotor **62**. The rear plate **64** is piloted on a portion **68** of the adapter **66** which serves to align the rotor **62** with the bore in the hub **52**. Blades **70** are carried by the rear plate **64** and an annular front disk **72** forming part of the rotor. The axial center opening **73** of the front disk **72** forms the blower inlet and is covered by a screen **74** held in place on the rotor **62** by screws **76** and an outer annular disk **78**. The screen **74** thus rotates with the rotor.

The rotor **62** rotates in the blower housing **80** which, except for an opening **82** in its rear wall, an opening **84** in its front wall, and a blower outlet or opening **86** at its top and connected to the heat exchanger **34**, is completely closed. The housing **80** has a flange **88** surrounding the opening **86** and is secured to the lower end of the duct **36** surrounding the heat exchanger. The front opening **84** and, in this instance, the rear opening **82**, are larger than the diameter of the rotor **62** so that some of the air delivered by the rotor bleeds out through the annular clearances between the housing **80** and the rotor **62** constituting positions of the opening **82** and **84**. This air bleed eliminates the need for seals or the like, and insures that all air enters the blower through the screen **74** covering the blower inlet. The air bleed also prevents debris or other material from entering the blower or from accumulating on the portion of the unit adjacent the blower. Debris and other materials are also centrifully prevented from accumulating on the screen **74**.

The heat exchanger **34** comprises two headers **90** and **92** connected by a plurality of transverse tubes **94** having thin heat transfer fins **96** secured thereto. The header **90** has an inlet **98**, and the header **92** has an outlet **100**. The heat exchanger **34** is mounted in the duct **36** provided by a bottom wall **102**, side walls **104**, **106**, **108**, and a side wall **110** which also forms part of the reservoir **38**, the top of the duct **36** being open. An opening **112** in the lower wall **102** aligns with the opening **86** in the blower housing **80** and permits passage of air from the blower **32** through the duct **36** to the heat exchanger **34**.

The reservoir **38** is in side-by-side relation with the duct **36** and is also directly above the pump means **28**. The reservoir **38** comprises the wall **110** which is common to the duct **36**, side walls **128**, **130** and **132**, a bottom wall **134**, and a top wall **136**. The reservoir **38** is adapted to be filled with hydraulic fluid to a surface or level indicated by the broken line **109** in FIG. **2**.

Fluid conducting structure is provided to supply hydraulic fluid to the heat exchanger **34** and to transmit the fluid from the heat exchanger to the reservoir. To this end the one means, i.e., the heat exchanger **34** is interposed in the fluid conducting structure. The fluid conducting structure includes an inlet connection **137** which at one end is connected to the hose **22**, an inlet pipe **138** which extends into the reservoir through an opening **139** (FIG. **4**) in the reservoir wall **128**, a pipe **140** extending into the duct **36** through an opening **141** (FIG. **3**) in the common wall **110**, and a hose **142** extending from the pipe **140** to the inlet **98** of the heat exchanger **34**. A portion of the fluid flow is bypassed to the reservoir **38** through several openings **143** (FIG. **4**) provided in the pipe **138** which is upstream of the heat exchanger. The remainder of the flow through the pipe **138** continues on to the heat exchanger **34**. The bypass openings **143** are oriented in the pipe **138** so as to direct hydraulic fluid away from the hydraulic fluid level **109** in the reservoir **38**, so that aeration of the fluid in the reservoir is minimized.

For flow from the heat exchanger **34** to the reservoir **38**, the fluid conducting structure includes a hose **144** extending from the outlet **100** of the heat exchanger **34**, a pipe **145** located in a second opening **146** (FIG. **3**) in the common wall **110**, and a transfer pipe **147**. The transfer pipe **147** extends through a second opening **148** (FIG. **4**) in the reservoir wall **128**, and the end of the pipe **147** is closed by a pipe cap **149** which may be fitted with a gauge, such as a temperature gauge **150**. The pipe **147** has openings **151** within the reservoir downstream of the heat exchanger which are also oriented so that hydraulic fluid discharging through these openings is directed away from the upper surface **109** of the hydraulic fluid in the reservoir to likewise minimize aeration. All of the fluid flowing through the heat exchanger is discharged into the reservoir through the openings **151**.

The pump inlet pipe **44** extends from the pump **28** through an opening **152** in the lower wall **134** of the reservoir **38** and is threaded into the lower end of a larger diameter pipe **154** positioned within the reservoir. The lower wall **134** of the reservoir **38** is clamped between the end of the pipe **154** and an annular boss **156** secured to the inlet pipe **44**, as by welding, to retain and support the reservoir **38** above the pump **28**. An O-ring **158** is provided in a groove in the boss **156** to form a seal. In this instance, a removable cover **160** has been provided in the top wall **136** of the reservoir. The cover **160** has a groove and O-ring **162** on its outer edge to seal the cover **160** to the wall **136**. A removable filler plug **164** having a vent opening **166** therein, is threaded into the cover **160**. The cover **160** is held in place by a single center bolt **168** which engages a threaded member **170** welded to the upper end of the pipe **154**, the member **170** closing the upper end of the pipe **154**. The cover **160** permits replacement

The filter means **40** is contained within the reservoir **38**, is placed directly above and connected to the pump **28** through the pipe **154** and the inlet pipe **44**, and comprises a conventional cylindrical filter element **172** having a center passage **174**. The filter element **172** is held in place by a spring **176** which abuts the cover **160** and the element, and is centered by the pipe **154**. The spring **176** is positioned by a tube **178** secured to the cover **160**. The ends of the filter element **172** are sealed by engagement with seal washers **182**. Openings **184** in the pipe **154** permit fluid to flow from the reservoir **38** through the filter element **172** to the pump **28**.

In operation of the hydraulic pump and cooler unit, the drive means i.e., the pulley **50** is driven by a tractor power take off shaft, and in turn drives the pump **28** and blower rotor **62**. Hydraulic fluid is pumped from the reservoir **38** by the pump **28**, through the outlet pipe **46**, and the hose **20**, to the hydraulic motor **16**, which drives the mower **14**. The hydraulic fluid returns from the motor **16** through the hose **22** and the pipe **138**. A portion of this fluid flows directly into the reser-

voir 38 through the bypass openings 143 in the pipe 138 to be recirculated by the pump. The remainder of the fluid flows through the pipe 138 and enters the heat exchanger 34, is cooled therein, and is returned to the reservoir through the hose 144 and the holes 151 in the transfer pipe 147. Fluid from the reservoir 38 is then drawn through the filter element 172 and the pipe 154 and the inlet pipe 44 by the pump 28 to again be supplied to the motor 16.

The blower rotor 62 draws air through the rotating screen 74. A small portion of this air is bled off through the clearances between the rotor 62 and the opening 82 and 84 of the blower housing 80. Most of the air, however, passes through the duct 36 and then passes through the heat exchanger 34 to the hydraulic fluid.

It is apparent from the foregoing that a hydrostatic drive mechanism having a compact hydraulic pump and cooler unit has been provided, wherein a hydraulic pump means and blower means are closely adjacent to each other and in coaxial alignment, duct means having a heat exchanger means therein is so as to extend radically from the blower means. Reservoir means may be located in close side-by-side relation with said duct means and adjacent said pump means, and filter means may be located within said reservoir means.

We claim:

1. A hydraulic pump and cooler unit, comprising hydraulic pump means, cooler means comprising blower means, duct means connected to and extending radially from said blower means for receiving air discharged from said blower means, and heat exchanger means in said duct means, said heat exchanger means being operable to cool hydraulic fluid pumped by said pump means, and reservoir means communicating with said heat exchanger means and said pump means and adapted to contain hydraulic fluid pumped by said pump means, said pump means and said blower means being arranged in coaxial relation with and close to each other and said reservoir means being located adjacent said pump means and arranged in side-by-side contiguous relation with said duct means, whereby the components of said unit are compactly arranged and the overall size of said unit is minimized.

2. The combination of claim 1, wherein drive means is provided for driving said pump means and said blower means, and said reservoir means is adapted to receive hydraulic fluid from said heat exchanger means and to supply hydraulic fluid to said pump means.

3. The combination of claim 2, in which said pump means includes a shaft, said blower means includes a rotor mounted on said shaft, and said drive means is connected to said rotor for effecting rotation thereof and of said shaft.

4. The combination of claim 2, in which said drive means comprises a pulley, and said pulley is mounted on one end of said rotor.

5. The combination of claim 2, wherein filter means is provided in said reservoir means for filtering hydraulic fluid flowing from said reservoir means into said pump means.

6. The combination of claim 1, in which said reservoir means and said duct means are elongated and have a common wall, said pump means is connected to one end of said reservoir means, and said blower means is connected to the corresponding end of said duct means.

7. The combination of claim 6, in which said reservoir means and said duct means are arranged in an upright position, and said pump means and said blower means are respectively connected to the lower ends of said reservoir means and said duct means.

8. The combination of claim 7, in which said duct means is open at its upper end, said blower means including a rotor having an axial inlet and a housing having an upwardly opening outlet, and said blower outlet is connected to the lower end of said duct means.

9. In a hydraulic pump and cooler unit including reservoir means adapted to contain a supply of hydraulic fluid and heat exchanger means adapted to cool hydraulic fluid, the improvement comprising fluid conducting structure having spaced ends, one of said ends being adapted to be connected to a source of hydraulic fluid, said heat exchanger means being interposed between said ends of said structure, said structure having at least one opening therein upstream from said heat exchanger means for discharging hydraulic fluid into said reservoir means, and said structure downstream from said heat exchanger means communicating with said reservoir means.

10. The combination of claim 9, wherein said opening in said structure directs hydraulic fluid flowing therethrough away from the surface of hydraulic fluid in said reservoir means to minimize aeration thereof.

11. The combination of claim 9, wherein said structure is closed at its other end, and said structure downstream of said heat exchanger means has at least one other opening therein for discharging hydraulic fluid into said reservoir means.

12. The combination of claim 11, wherein said other opening directs hydraulic fluid flowing therethrough away from the surface of hydraulic fluid in said reservoir means to minimize aeration.

* * * * *

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,751,191 Dated August 7, 1973

Inventor(s) Carl W. Mott, Jr., et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 1, line 33, "radically" should read "radially".
Col. 3, line 29, "positions" should read "portions"; line 36, "centrifully" should read "centrifugally".
Col. 5, line 12, "opening" should read "openings"; line 22, after "is" should appear --located--; line 23, "radically" should read "radially".

Signed and sealed this 27th day of November 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents