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[54] **SNOWMOBILE WITH HYDRAULIC DEVICE**

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[52] **U.S. Cl.** .....**180/5 R,** 180/9.54, 180/66 R, 305/27

[51] **Int. Cl.** **B62m 27/02**

[58] **Field of Search**.....180/5, 6, 66 R, 6.48, 6.3; 115/1; 287/108

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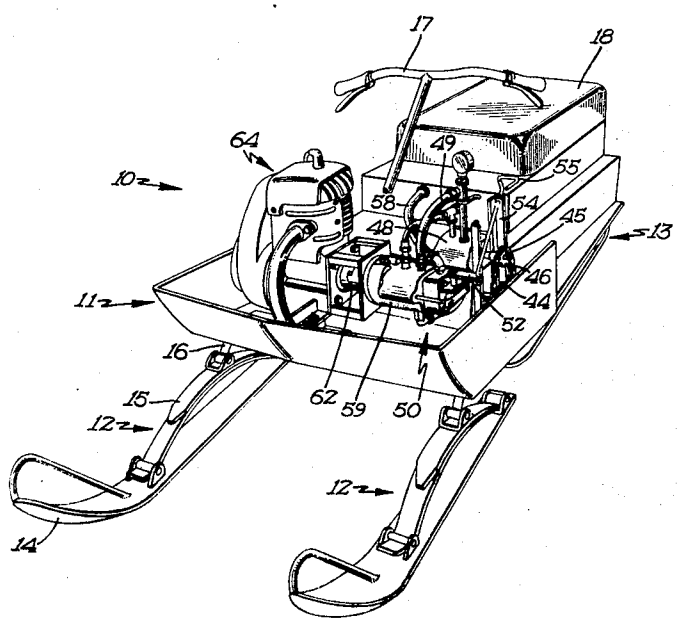
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[57] **ABSTRACT**

A snowmobile includes an internal combustion engine drivingly connected to the variable displacement rotary pump. The pump is disposed in controlling relation with respect to a variable displacement reversible rotary motor whose output shaft drives the chain and sprocket drive to the bogey wheel assembly. A control valve is provided and permits the rotary motor to be driven selectively in a reverse or forward direction, and also permits the flow of hydraulic fluid to bypass the motor when the valve is in a neutral position. The bogey wheel assembly includes a frame supporting the bogey wheels which assembly may be readily removed and replaced as a unit from the snowmobile body thereby facilitating maintenance of the bogey wheel assembly.

5 Claims, 11 Drawing Figures



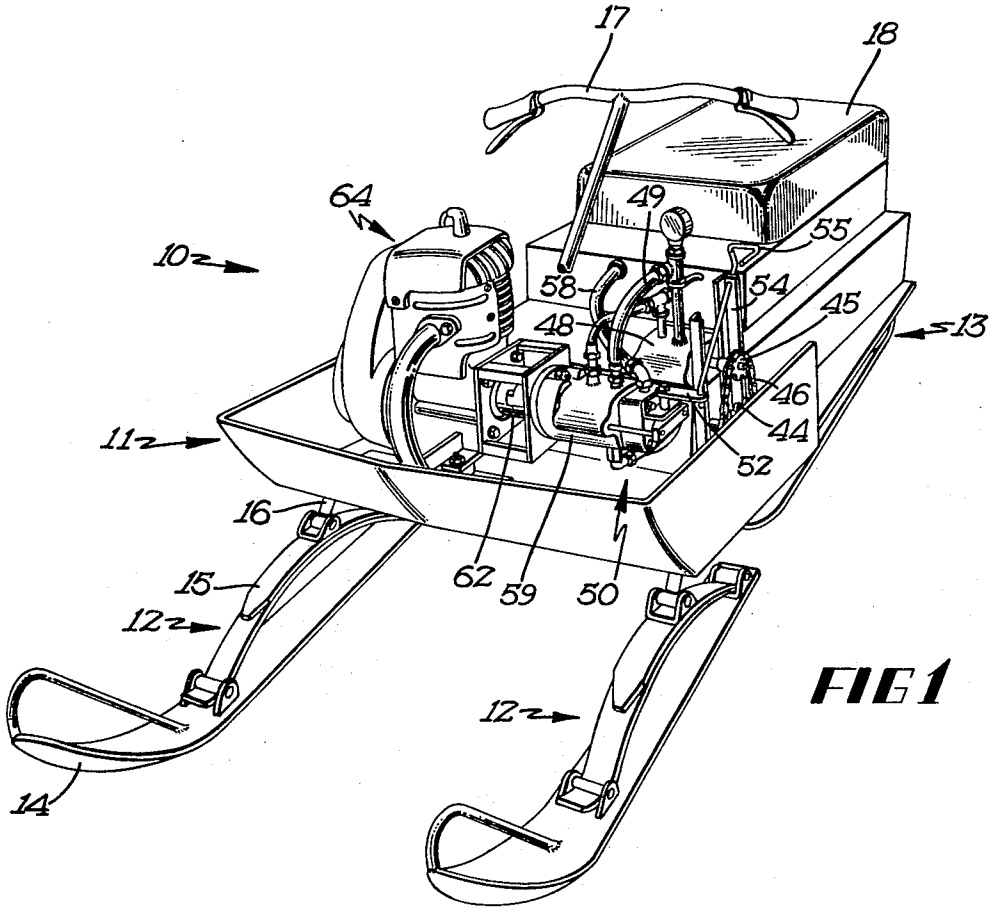


FIG 1

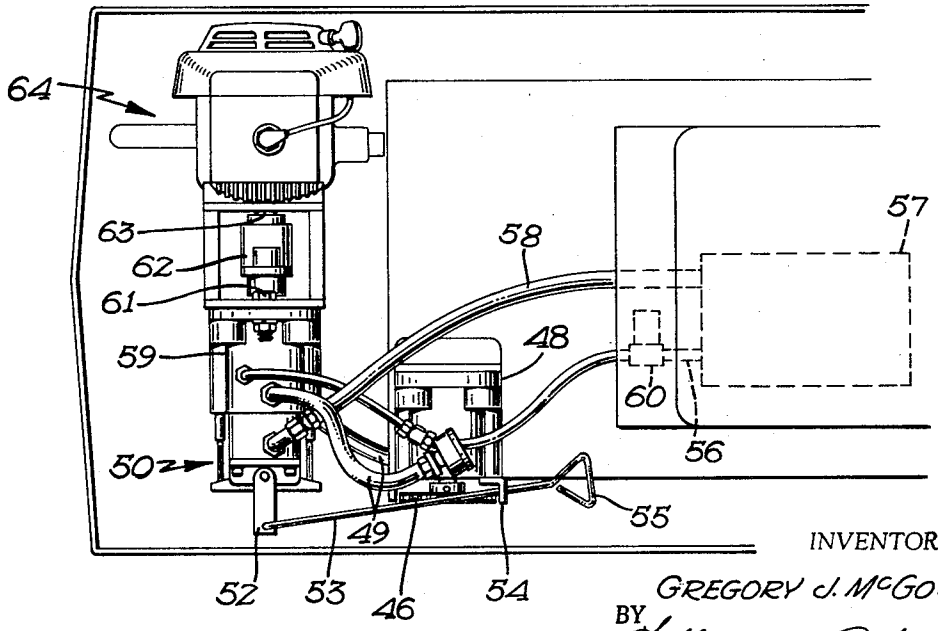


FIG 2

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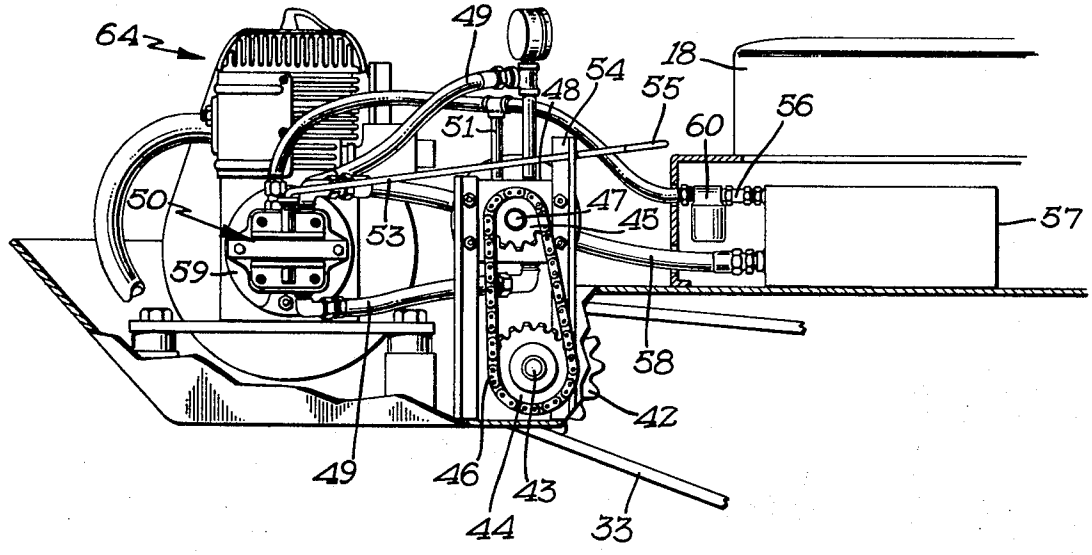


FIG 3

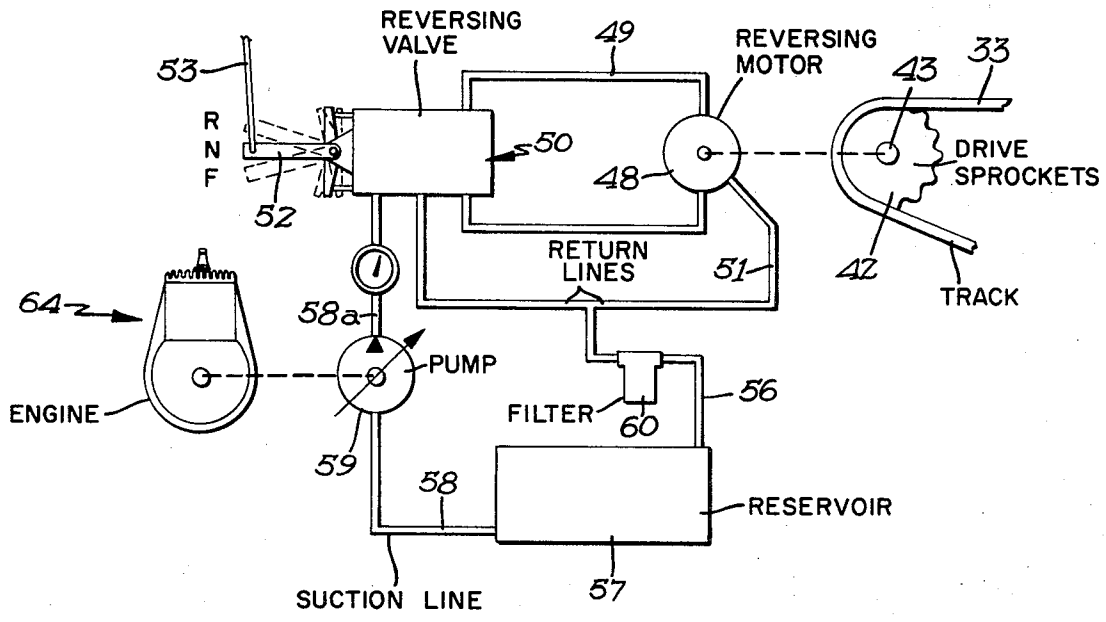


FIG 4

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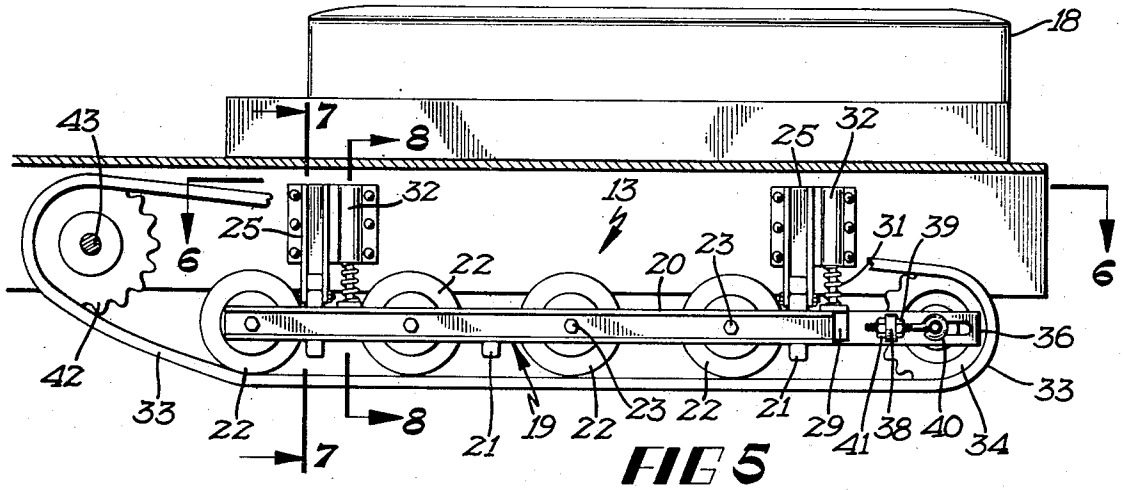
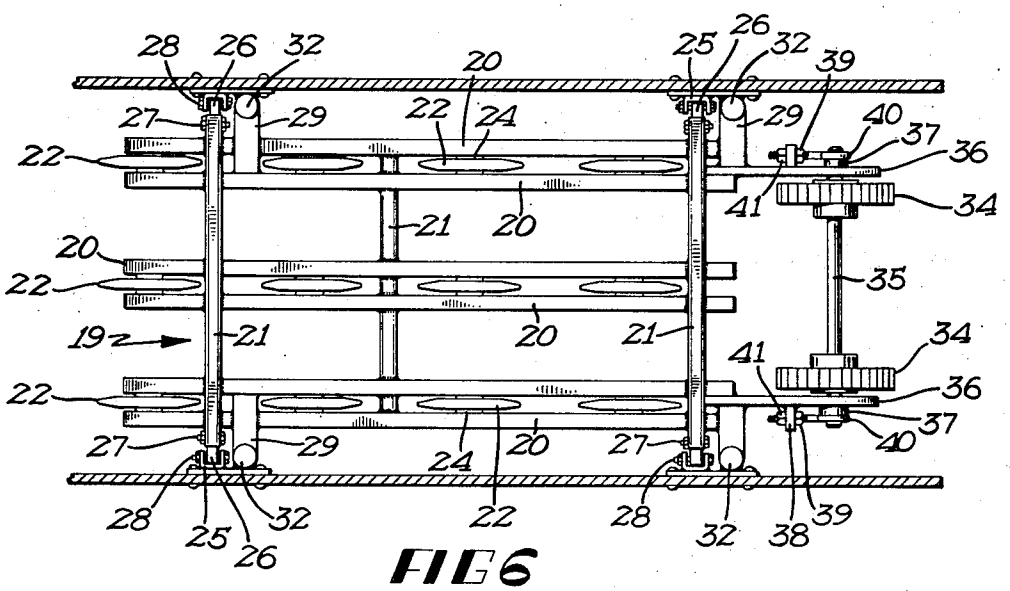
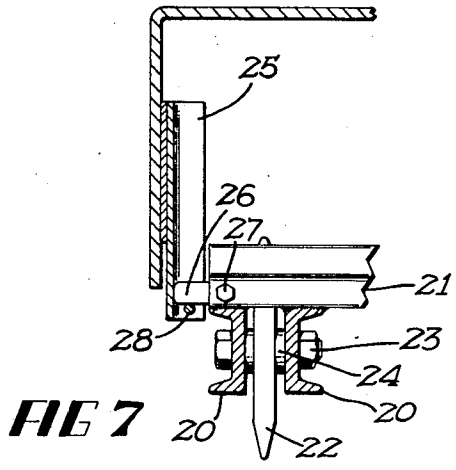
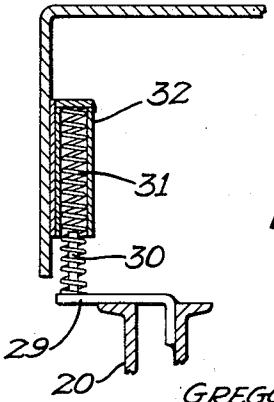


FIG 5







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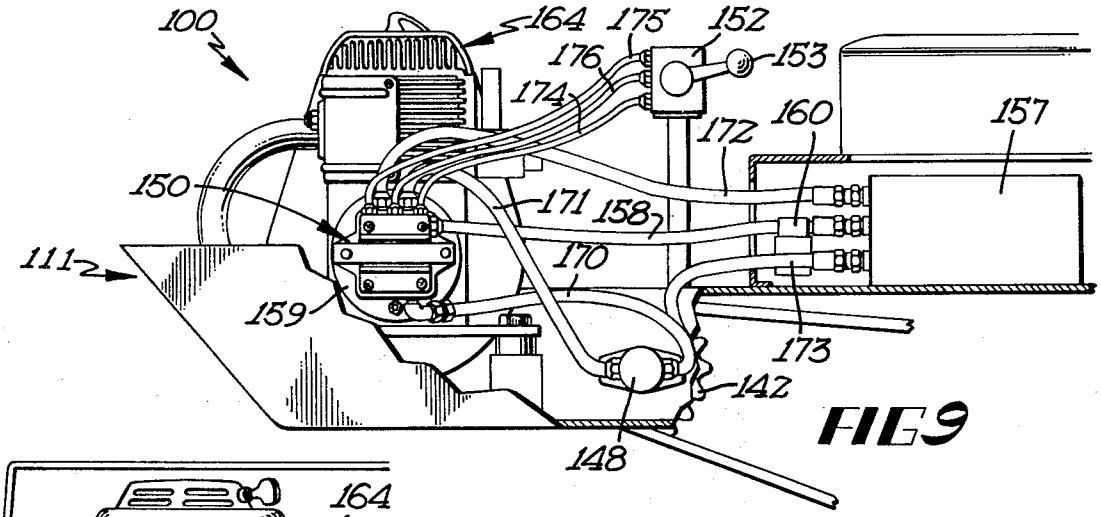


FIG 9

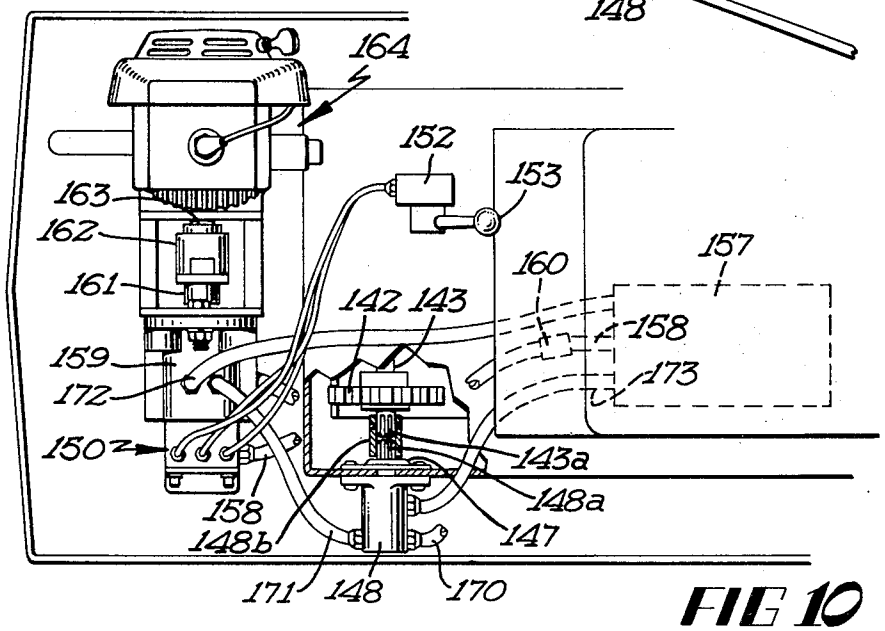


FIG 10

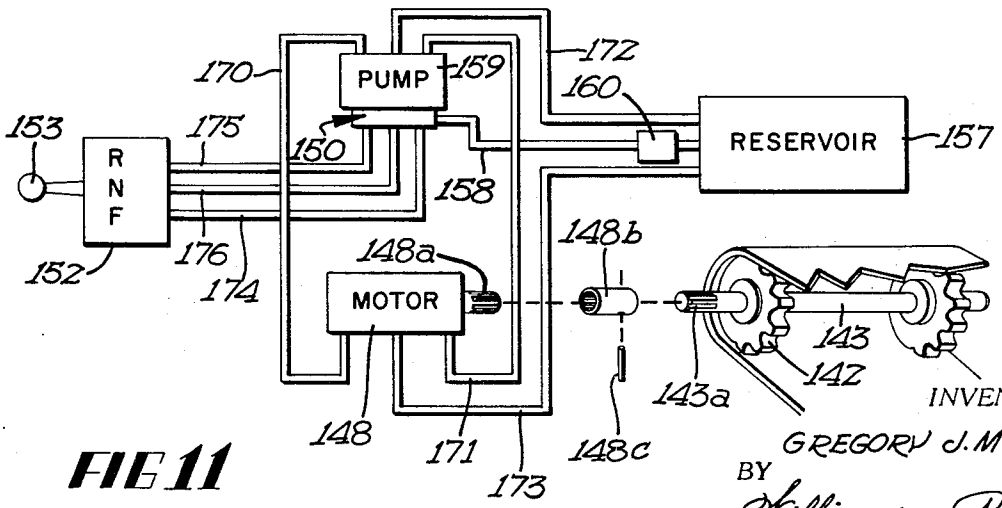


FIG 11

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SNOWMOBILE WITH HYDRAULIC DEVICE

SUMMARY OF THE INVENTION

An object of this invention is to provide a snowmobile with a variable displacement fluid pressure drive from the conventional internal combustion engine to the bogey wheel assembly. This fluid pressure drive is accomplished by means of a variable displacement hydraulic pump and a variable displacement reversing rotary hydraulic motor which is connected directly to the chain and sprocket drive of the bogey wheel assembly.

A control valve is provided which is readily shiftable between reverse, forward and neutral positions thus permitting the snowmobile to be operated effectively over a wide range of speeds but under positive effective control. The fluid pressure drive not only permits the smooth efficient operation of the snowmobile, but there is little if any wear with respect to the components constituting the drive as compared to the conventional mechanical drive systems now utilized in snowmobiles.

The novel bogey wheel suspension system permits the bogey wheel assembly to be readily removed as a unit by merely removing four retaining elements thereby facilitating maintenance of the bogey wheel assembly. These and other objects and advantages of this invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views.

BRIEF DESCRIPTION OF THE FIGURES OF THE DRAWINGS

FIG. 1 is a perspective view of the snowmobile with the hood removed to illustrate the components of the fluid pressure drive;

FIG. 2 is a plan view of the fluid pressure drive;

FIG. 3 is a side elevational view illustrating the various components of the fluid pressure drive;

FIG. 4 is a diagrammatic view of the fluid pressure drive illustrating the relationship of the various components;

FIG. 5 is a cross-sectional view of the rear portion of the snowmobile illustrating certain features of the bogey wheel assembly;

FIG. 6 is a cross-sectional view taken approximately along line 6—6 of FIG. 5 and looking in the direction of the arrows;

FIG. 7 is a cross-sectional view taken approximately along line 7—7 of FIG. 5 and looking in the direction of the arrows;

FIG. 8 is a cross-sectional view taken approximately along line 8—8 of FIG. 5 and looking in the direction of the arrows;

FIG. 9 is a side elevational view similar to FIG. 3 but illustrating a modified form of the invention;

FIG. 10 is a top plan view of the embodiment of FIG. 9; and

FIG. 11 is a diagrammatic view of the fluid pressure drive of the embodiment of FIG. 9.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings and more specifically to FIG. 1, it will be seen that a snowmobile type vehicle, designated generally by the reference numeral 10, is there shown. The snowmobile 10 includes a body 11 having a pair of ground engaging front ski assemblies 12 and having a driven ground engaging bogey wheel assembly 13. The front ski assemblies are of conventional construction and each includes a ski or runner 14 secured to a leaf spring 15 which in turn is connected to the lower end of a standard 16. The standard 16 of each ski assembly is connected in a well-known manner by suitable steering linkage (not shown) to the steering handle bars 17. The handle bars 17 will be positioned adjacent the seat 18 of the snowmobile which accommodates the user.

The bogey wheel assembly 13 includes a bogey wheel frame 19 which includes a plurality of longitudinal frame members 20. These frame members are of channel shaped configuration and are arranged in spaced apart parallel pairs as best seen in FIG. 6. Three such pairs are provided and are rigidly interconnected by transverse frame members 21.

A plurality of longitudinally spaced apart bogey wheels 22 are positioned between and journalled on each pair of longitudinal frame members by axles 23. Spacers 24 are provided for spacing each bogey wheel from the associated longitudinal frame member.

The snowmobile body 11 has a pair of longitudinally spaced apart vertical channel-shaped guides 25 secured to each side thereof as best seen in FIGS. 5, 6 and 7. It will be noted that each rear and front transverse frame member, which are of rectangular cross-sectional configuration, has a pair of rectangular slide blocks 26 preferably formed of nylon or the like, projecting longitudinally therefrom and engaging in a pair of opposed guides 25. These nylon slide blocks are secured to the end portion of the associated transverse frame members 21 by suitable nut and bolt assemblies 27. Thus the bogey wheel frame 19 is mounted on the snowmobile body for vertical translation relative thereto.

Downward movement of the bogey wheel frame is limited by nut and keeper bolt assemblies 28 which, as best seen in FIGS. 6 and 7, are each secured to the lower end portion of one of the guides 25. Means are also provided for resisting upward movement of the bogey wheel frame, and to this end, it will be seen that a pair of longitudinally spaced apart angle brackets 29 are rigidly affixed to opposite sides of the bogey wheel frame.

It will be noted that these angle brackets are actually secured to certain longitudinal frame members and each has an elongate stud or post 30 rigidly affixed thereto and projecting upwardly therefrom. A helical or coil spring 31 is positioned around each post 30 and projects interiorly of a vertically oriented tube 32, each tube being secured to the snowmobile body 11. The tube 32 for each spring has a closed upper end and an open lower end and each is positioned closely adjacent one of the channel-shaped guides.

With this arrangement upward vertical movement of the bogey wheel assembly is resisted by the helical spring 31. It will also be noted that the bogey wheel frame may be readily removed from attached relation with respect to the snowmobile body by merely removing the nut and keeper bolt assemblies 28. Since there are only four such nut and keeper bolt assemblies, removal of the frame may be readily and easily accomplished.

A flexible endless ground engaging track **33** is trained about the bogey wheels **22** and is also trained about a pair of idler sprockets **34** which are located adjacent the rear of the bogey wheel frame. These idler sprockets are journalled on an elongate transverse shaft which has its outer end portions projecting through elongate slotted supporting members which actually constitute extensions of certain of the longitudinal frame members **20**.

Suitable spaces **37** are interposed between the sprockets and the associated supporting members **36** as best seen in FIG. **6**. It will also be noted that each supporting member **36** has a bracket **38** affixed to the outer surface thereof. These brackets are apertured for accommodating an end portion of an elongate bolt **39** which has an eyelet **40** at its other end. The eyelet of each bolt is positioned around one end of the shaft **35** and suitable nuts **41** engage the threaded end of each bolt **39**. With this arrangement, the shaft **35** may be moved longitudinally in the slots of the slotted support members **36** to thereby permit the track **33** to be tensioned as desired. A plurality of driven sprockets **42** are mounted on a driven shaft **43** which is journalled on the snowmobile body in a well-known manner. The endless track **33** is trained about the driven sprockets **42** as best seen in FIG. **5**. The shaft **43** also has a sprocket **44** keyed thereto for rotation therewith and an endless chain **46** is trained about the sprocket **44** and a smaller driven sprocket **45**. The small sprocket **45** is keyed to a shaft **47** as best seen in FIGS. **1** and **3**. The shaft **47** constitutes the output shaft of a variable displacement reversing rotary hydraulic motor **48**.

The variable displacement motor **48** has a pair of supply conduits **49** connected in communicating relation therewith and the respective other ends of the supply conduits are connected in communicating relation to a control valve **50**. A return conduit **51** has one end thereof connected in communicating relation with the control valve **50** and has the other end thereof connected in communicating relation to the variable displacement rotary motor **48**. The control valve **50** is provided with an actuator arm **52** for controlling operation of the control valve, and the actuator arm is pivotally connected to one end of an elongate actuator rod **53**. It will be noted that the actuator rod **53** projects through an opening in a bracket **54** secured to the snowmobile body, as best seen in FIGS. **1** and **2**. The free end of the actuator rod has a hand grip member **55** integrally formed therewith which is disposed adjacent the seat **18** of the snowmobile.

A conduit **56** has one end thereof connected to the return conduit **51** and has the other end thereof connected in communicating relation to a reservoir **57** which contains a predetermined amount of hydraulic fluid. One end of an elongate conduit **58** is also connected in communicating relation to the reservoir **57** and the other end of this conduit **58** is connected in communicating relation to a variable displacement rotary pump **59**.

It is pointed out that the rotary pump **59** is a swash plate type inline piston pump in which reciprocation of the pistons therein is caused by a swash plate that the pistons run against as the drive shaft is revolved. Similarly, the variable displacement hydraulic motor **48** is an inline piston type motor and torque is developed by the pressure drop through the motor, the pressure exerting a force on the ends of the pistons which is translated into shaft rotation. Shaft rotation is reversed at will by reversing the directional flow of hydraulic fluid.

A conduit **58***a* interconnects the variable displacement pump **59** with the control valve **50**. A filter **60** is interposed in flow controlling relation with respect to the conduit **56** so that the hydraulic fluid which is returned to the reservoir **57** is constantly filtered.

The input shaft **61** of the variable displacement rotary hydraulic pump is connected by a coupling **62** to the output shaft **63** of an internal combustion engine **64**. The internal combustion engine **64** is of conventional construction but it will be noted that the input shaft of the displacement pump is disposed in axial alignment with the output shaft **63** of the engine.

During operation of the snowmobile, the actuator arm **52** of the control valve **50** will be disposed in a neutral position. In this regard, the actuator arm is shiftable between reverse, neutral and forward positions with respect to the control of the hydraulic motor **48**. When the actuator arm for the control valve is in the forward position, hydraulic fluid is supplied from the pump **58** to the valve **50** and to the motor **48** so that the output shaft of the motor **48** will be driven in a direction to drive the bogey wheel assembly track in a forward direction. However, when the actuator arm **52** is in the reverse position, the flow of hydraulic fluid from the valve **50** to the reversing motor **48** will be reversed and the output shaft of the motor **48** will be driven in a reverse direction thereby driving the bogey wheel assembly in a reverse direction. When the actuator **52** for the control valve is in a neutral position, fluid from the control valve will bypass the motor **48** so that the pump may be operated without requiring the motor **48** to be driven.

With this arrangement, the engine **64** may be allowed to warm up or idle by merely shifting the valve to the neutral position. The present variable displacement fluid pressure drive allows the drive transmitted from the engine to the bogey wheel assembly to be accomplished smoothly without the attendant problems of wear associated with the conventional mechanical drive system used with snow-mobiles. The drive to the bogey wheel assembly can be readily changed from one direction to another without the attendant strains and stresses associated with mechanical transmission and drive systems. Thus it will be seen that we have provided not only a novel and improved variable displacement fluid pressure drive system for a snowmobile, but also have provided a novel suspension system for a snowmobile.

Referring now to FIGS. **9**, **10** and **11**, it will be seen that a different embodiment of the snowmobile is there shown and is designated generally by the reference numeral **100**. Although only fragmentarily illustrated in these drawings, the snowmobile **100** is substantially identical to that disclosed in the embodiment of FIGS. **1** through **8** with the exception of the drive system. In this regard, the drive system includes a variable displacement motor **148** mounted on the body **111** and is connected directly to the driven shaft **143** of the bogey wheel assembly. The shaft **143** has a plurality of driven sprockets **142** mounted thereon and shaft **143** corresponds to shaft **43** of the embodiment of FIGS. **1** to **8**.

The variable displacement motor **148** has an output shaft **148***a* which is externally splined and which is received within an internally splined sleeve **148***b*. The internally splined sleeve **148***b* also telescopically receives the splined end portion **143***a* of the shaft **143**. A pin **148***c* extends through openings in the sleeve **148***b* and the splined end portion **143***a* of the shaft **143** to secure the sleeve to the shaft **143**. Thus when the motor **148** is energized, the shaft **143** will be rotated to drive the bogey wheel assembly. The shaft **148***a* is journaled in a self-aligning bearing assembly **147**.

The variable displacement rotary motor **148** is controlled by a variable displacement rotary pump **159** which is similar in construction and operation to pump **59**. A valve **150** controls operation of the pump **159** and the valve **150** is hydraulically controlled by a control valve **152**. This control valve **152** is provided with an actuating handle **153** which is shiftable between a reverse, neutral and forward position.

One end of an elongate supply conduit **158** is connected in communicating relation to the valve **150** and the other end of the conduit is connected in communicating relation to the reservoir **157**. A filter **160** is interposed in flow controlling relation in the conduit **158**. Conduits **170** and **171** each has one end thereof connected in communicating relation to the pump **159** and each has the other end thereof connected in communicating relation to the motor **148**. A relatively small diameter bleeder conduit **172** intercommunicates the pump **159** with a reservoir **157**, and a small diameter bleeder conduit **173** intercommunicates with the reservoir **157**.

A conduit **174** has one end thereof connected to the control valve **152** and has the other end thereof connected in communicating relation to the valve **150**. The second conduit **175** intercommunicates the control valve **152** with the valve **150** and a third or neutral conduit **176** intercommunicates the control valve **152** with the valve **150**.

The pump **159** has a revolvable input shaft **161** which is connected by a coupling **162** to the output shaft **163** of an internal combustion engine **164**. This internal combustion engine **164** is also of conventional construction and it will be noted that the output shaft of the internal combustion engine is disposed in coaxial relation with the input shaft of the rotary displacement pump.

With this arrangement, the pump **159** will be driven by the internal combustion engine **164**. If it is desirable to drive the snowmobile in a forward direction, an operator will shift the actuating lever **153** to the forward position (F) and the hydraulic fluid will be circulated from the reservoir through the conduit **158** to the valve **150**, then to the pump **149** through the conduit **170** to the variable displacement motor **148**. Ordinarily, during normal operation of the drive system, the conduit **172** serves to permit bleeding of fluid from the pump to the reservoir. Similarly, conduit **173** also serves to permit bleeding of fluid to the reservoir from the motor **148**. Again it is pointed out that conduits **172** and **173** are substantially smaller in size than the conduits **158**, **170** and **171**. Thus fluid is circulated through conduit **170** from the pump to the motor and returned by conduit **171** to revolve the shaft **148***a* and shaft **143** in a forward direction.

The handle **153** for the control valve **152** will be in the forward position so that the fluid will circulate through the conduit **176** and be returned through conduit **174** to hydraulically adjust the valve **150** so that the hydraulic fluid from conduit **158** flows outwardly through conduit **170**. In this regard, the valve **150** is preferably a spool valve and is adjustable in response to adjustment of the control valve **152**.

When it is desirable to operate the snowmobile in a reverse direction, the handle **153** is shifted to the R position so that hydraulic fluid is circulated from conduit **176** outwardly through conduit **175** to hydraulically adjust the valve **150**. This intercommunicates the hydraulic fluid from the conduit **158** with the conduit **171** so that fluid is circulated through conduit **171** to the motor **148** and is returned through the conduit **170** to the pump **159**. This revolves the shaft **148** in a reverse direction.

When the handle **153** is in the neutral position, the spool valve **150** is conditioned so that the supply line to the pump is closed and fluid may bleed off from the pump and motor respectively through conduits **172** and **173** respectively. With this bleed off arrangement, the motor **148** will not creep and the snowmobile will remain stationary.

By utilizing a fluid pressure system which directly drives the bogey wheel assembly, a very simple, yet highly effective system is provided. There is no appreciable wear of parts as is the case with the conventional mechanical drives used in most snowmobile drive systems. Further, not only is maintenance reduced, but compact components may be used in the drive system such as the relatively small motor **148**. The use of small components is important when it is desirable to conserve space.

The present drive system (variable displacement pump and variable displacement motor as well as the control valve) is not only a relatively simple and inexpensive system, but this fluid pressure drive system is a more efficient drive system for snowmobiles than any heretofore known comparable system.

What is claimed:

1. In a snowmobile comprising a body having a pair of ground engaging skis at the front end portion thereof,

a bogey wheel track assembly including a bogey wheel frame, a plurality of bogey wheels journalled on said frame, a plurality of sprockets, at least one of which is driven, a ground engaging endless flexible track trained about said bogey wheels and sprockets, an internal combustion engine having an output shaft,

a variable displacement rotary hydraulic pump having an input shaft,

drive means interconnecting said output shaft of the engine with the input shaft of the hydraulic pump,

a reservoir containing hydraulic fluid,

a supply conduit interconnecting said reservoir and pump in communicating relation with each other,

a pump bleeder conduit having an internal diameter less than the diameter of said supply conduit and interconnecting said pump in communicating relation with said reservoir,

a variable displacement reversing rotary hydraulic motor having an output shaft, means connecting

the output shaft of said variable displacement motor with the driven sprocket of the bogey wheel assembly, a pair of conduits connecting said pump and motor in communicating relation with each other to permit hydraulic fluid to flow therebetween,

a motor bleeder conduit connecting said hydraulic motor in communicating relation with said reservoir and having a diameter smaller than the diameter of conduits connecting the pump with said motor, and

a control valve connected in communicating relation with respect to said conduits, said valve controlling the volume and direction of flow of the hydraulic fluid between said pump and motor, and being adjustable between forward, reverse and neutral positions, said valve when in the forward position controlling the flow of hydraulic fluid to said motor to cause the bogey wheel assembly to be driven in a forward direction, and when in a reverse position controlling the flow of fluid to the motor to drive the bogey wheel assembly in the reverse direction, and when in the neutral position permitting the flow of fluid to bypass said motor and be returned to the reservoir through said bleeder conduit.

2. The snowmobile as defined in claim 1 and an elongate actuating handle for actuating said control valve.

3. The snowmobile as defined in claim 1 wherein said hydraulic pump is positioned closely adjacent said engine so that the output shaft of the engine is disposed in substantial axial alignment with the input shaft of the pump.

4. The snowmobile as defined in claim 3 wherein said variable displacement hydraulic motor has an output shaft

a coupling member interconnecting said output shaft of the motor directly with the bogey wheel assembly.

5. The snowmobile as defined in claim 4 wherein said coupling comprises a sleeve.

* * * * *