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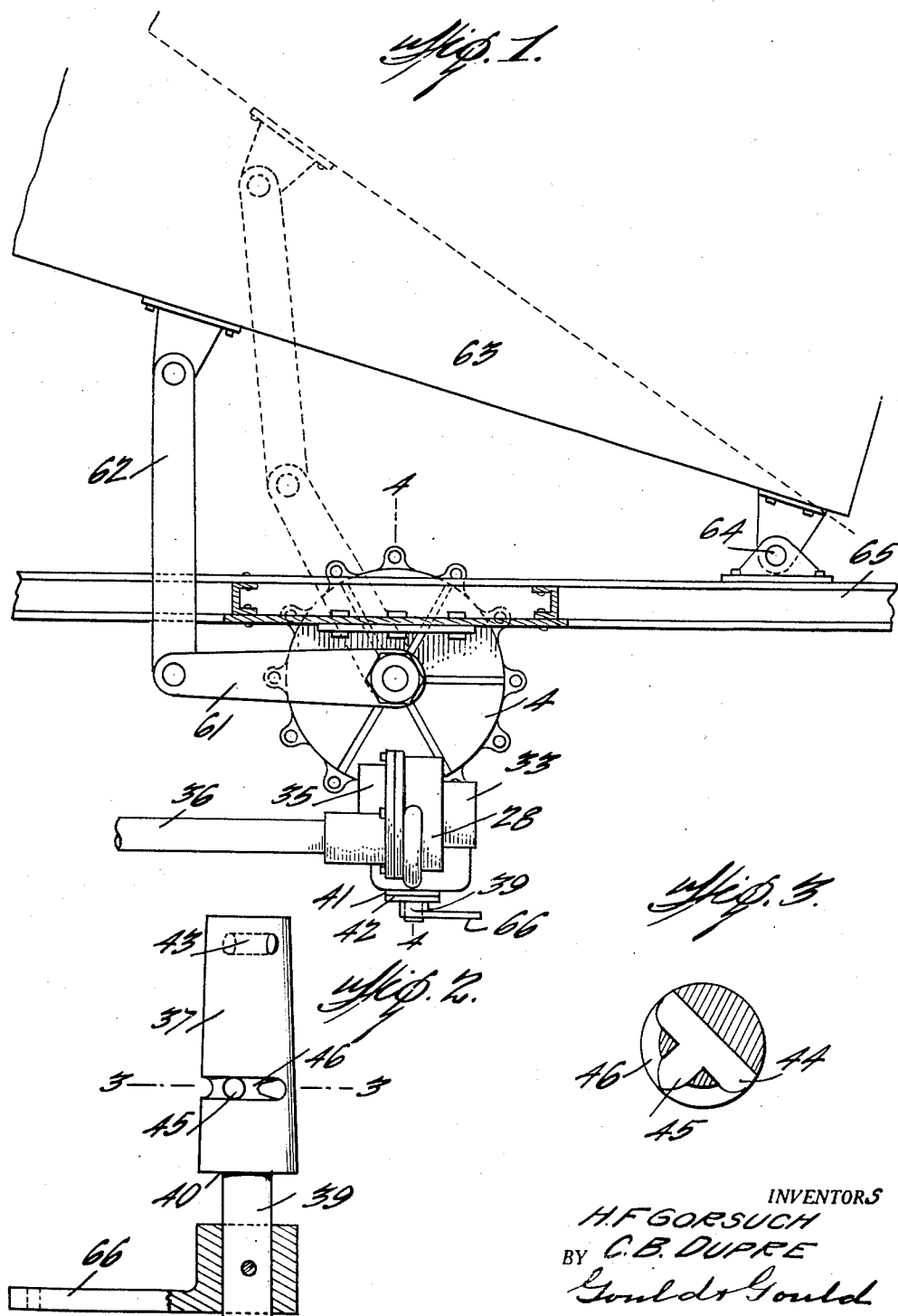
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1,974,775

HYDRAULIC MOTOR

Filed Nov. 8, 1930

3 Sheets-Sheet 1



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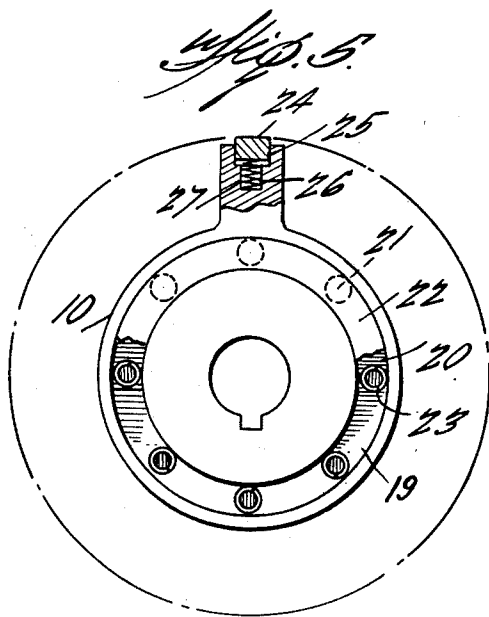
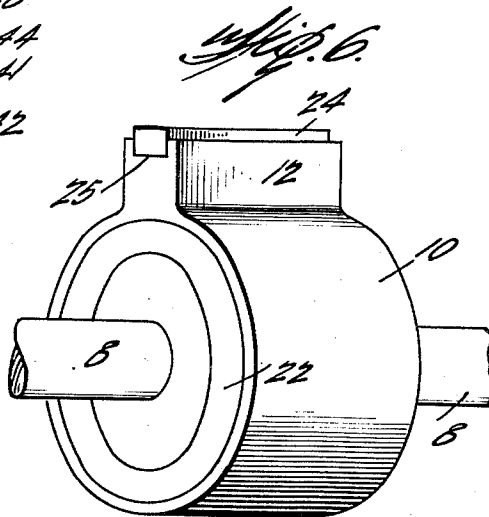
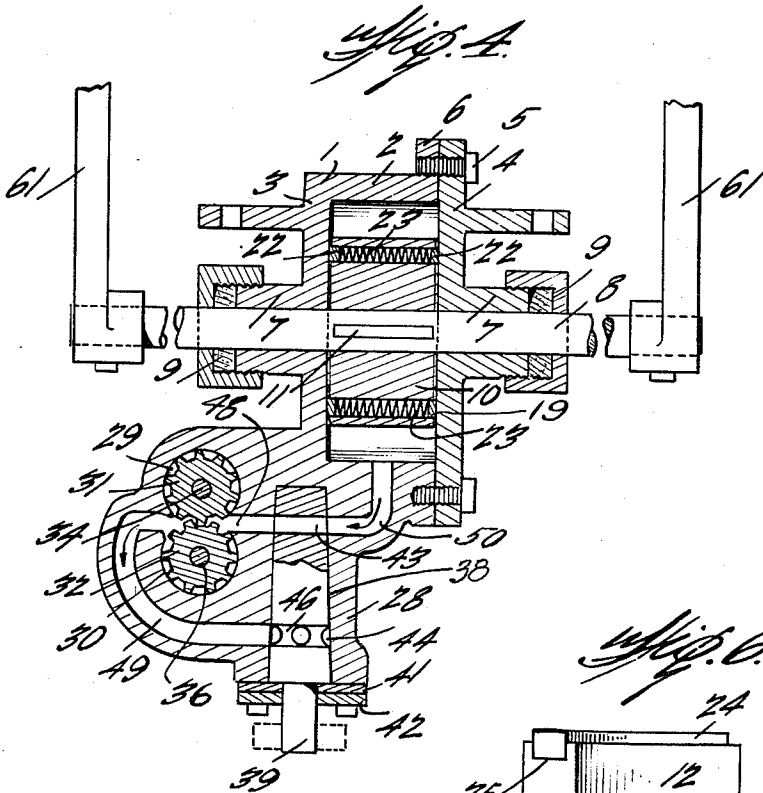
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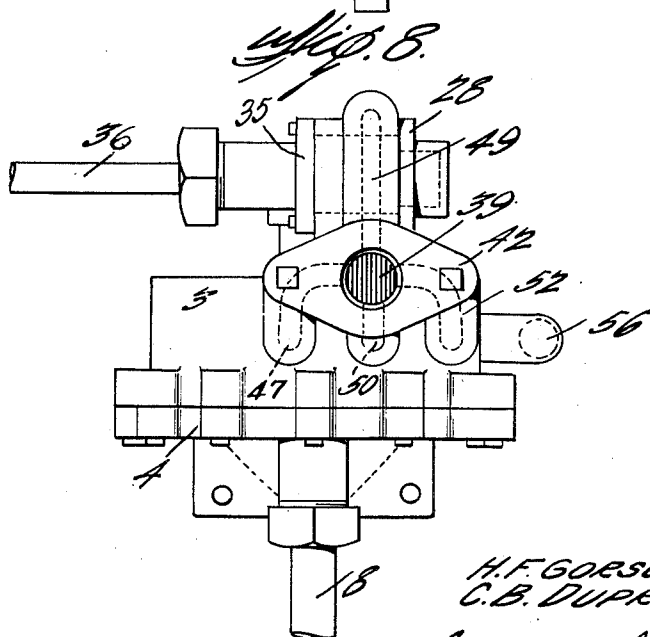
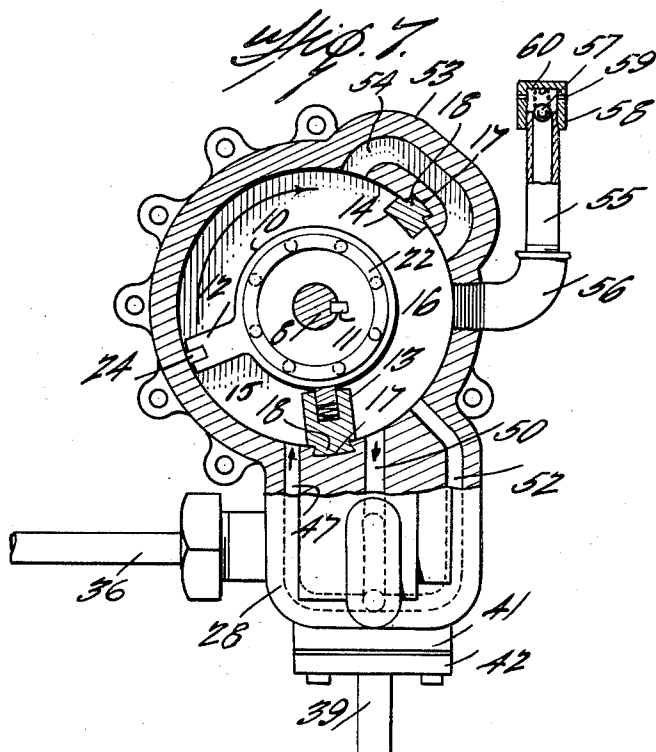
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

1,974,775

HYDRAULIC MOTOR

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Application November 8, 1930, Serial No. 494,413

1 Claim. (Cl. 60—52)

This invention is directed to an improvement in hydraulic motors of the rotary type, wherein a self-contained unitary construction involving a pump and a rotary element are selectively operated and controlled to compel a power output particularly serviceable for numerous uses.

The invention is more particularly designed to construct a relatively small, compact and self-contained unit structure, necessitating the use of a comparatively small amount of the hydraulic medium, and involving a pump, preferably of the rotary type, a rotor operated through the pressure or hydraulic medium incident to the operation of the pump, and a single valve arranged for manual control and adapted in that control to utilize the power of the pump on the rotor, sustain the rotor in any relative fixed position under the pressure of the hydraulic medium, or relieve the rotor of that pressure to permit the parts to assume a normal position, with the entire control functioning regardless of the continuous operation of the pump.

The invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a broken view in elevation illustrating the application of the motor for use in moving the body of a dump wagon, the body being shown partly raised in full lines and fully raised in dotted lines.

Figure 2 is an enlarged elevation of the control valve of the motor.

Figure 3 is a section on the line 3—3 of Fig. 2.

Figure 4 is a vertical sectional view through the motor.

Figure 5 is a sectional view through the rotor.

Figure 6 is a perspective view of the rotor.

Figure 7 is a vertical sectional view through the motor, the line of section being at right angles to that shown in Figure 4.

Figure 8 is a bottom plan view of the motor.

The improved motor comprises a unit casting formed at one end to provide a hollow rotor casing and at the opposite end to provide a relatively offset pump casing, the casting being also formed to provide a valve casing for the reception of a valve, with the necessary ports and channels of communication between the rotor casing, valve casing and pump being cored in or otherwise formed directly as an integral structure with the unit casting.

In the preferred embodiment of specific detail as illustrated, the motor includes a unit casting formed to provide a rotor casing 1, in the form of a hollow cylindrical body, the peripheral wall 2 of which is integral with one side wall 3. The open end of the casing 1 opposite the side wall 3 is designed to be closed by a cover 4 removably secured by bolts 5 to a flange extension 6 of the peripheral wall 2 of the casing. The wall 3 and cover 4 are formed with integral bearing exten-

sions 7 in which is rotatably supported a power shaft 8, suitable packing glands 9 being provided to prevent lubrication leakage.

A rotor 10 is mounted within the rotor casing, being keyed at 11 on the power shaft 8. The rotor 10 has a diameter somewhat less than the similar dimension of the rotor casing and an axial length substantially equal to that of the rotor casing. A power vane 12 extends radially from the peripheral edge of the rotor, the free end of which vane is designed to provide a substantially non-leaking cooperation with the inner surface of the peripheral wall 2 of the rotor casing.

The peripheral wall 2 of the rotor casing 1 is interiorly provided with relatively fixed abutments, that is, a pressure abutment 13 and a limit abutment 14. The pressure abutment 13 is arranged substantially at the lower end of the vertical diametric line of the casing, while the limit abutment is offset from this vertical line. As the power vane 12 moves from the pressure abutment 13 toward and into contact with the limit abutment 14 in a power stroke and does not move in the power direction beyond the limit abutment 14, it will be apparent that the abutments 13 and 14 divide the rotor casing into two chambers, that within which the power vane moves, being hereafter referred to as the pressure chamber 15, and that between the abutments 13 and 14 beyond the path of movement of the power vane being referred to as a reservoir 16.

In order that the inner surface of the peripheral wall of the rotor casing can be accurately and easily machined to insure a non-leaking cooperation of the power vane therewith, it is preferred that the pressure abutment 13 and the limit abutment 14 be removably engaged with this wall, for which purpose the wall at the appropriate points is provided with an undercut channel 17 and the respective abutments formed with corresponding projections 18 to slidably seat in the channel. Thus the abutments, while having the capability of convenient removal, may be placed in position after the machining of the peripheral wall of the rotor casing and held against longitudinal movement by the fixed wall 3 of the casing and the cover 4.

In providing sealing means for the rotor proper, the side walls of such rotor, preferably adjacent the peripheral edge, are formed with annular channels 19, which at determinate points circumferentially of the rotor are in communication through bores 21 of small diameter. Sealing rings 22, having their outer surfaces machined for accurate sealing contact with the walls of the rotor casing, seat in the respective channels 20, while coiled springs 23 of the compression type are seated in the bores 21 and bear at the respective ends against the rings 22. These sealing rings are, therefore, held as compensat-

ing pressure in sealing contact with the respective walls of the rotor casing, the arrangement facilitating the removal or replacement of the rings or springs in a simple, convenient manner when necessary.

The power vane 12 and the pressure abutment 13 are formed at their free end edges with sealing means to cooperate respectively with the peripheral wall of the rotor casing and with the peripheral surface of the rotor. The sealing means in these instances is identical, involving a bar 24 seating in a recess 25 formed in the free end of the particular element, pressure springs 26 being seated in shallow depth recesses 27 formed in the element to exert an outward influence on the respective sealing bars. The outer surfaces of the bars are accurately machined to correspond with and fit the curvature of the respective parts with which they cooperate, and the springs serve to maintain a sealing contact of the bar and, therefore, of the element in which the bar is mounted with respect to the surface relative to which it is moving.

The integral casting of the unit construction is formed below and preferably laterally offset with respect to the rotor casing and with the body 28 in which are formed the pump casing, the valve casing and the various channels for the flow of the hydraulic medium. This body is cored in a direction at right angles to the plane of the axial line of the rotor, with vertically aligned circular openings 29 and 30, in which are mounted cooperating gear bodies 31 and 32 intermeshing to form a conventional gear pump. The openings for the gears do not extend in one direction entirely through the body, providing end extensions 33 in which one end of the shafts 34 of the respective gears may be mounted. The opposite end of the openings are closed by a removable cover plate 35 formed to provide a bearing for the opposite end of the shaft of one gear, the shaft of the other gear being extended through its bearing at 36 and connected to any suitable conventional or required instrumentalities, with a conventional take-off from the power shaft of the motor of the vehicle. This detail is not illustrated, as it is contemplated that any convenient means may be provided for selectively operating the pump from the power of the vehicle motor and any and all necessary details for such drive are to be included within the spirit of this invention. The primary object is the continuous operation of the pump after connection with the take-off is had, which, of course, is a selective one, in order that the hydraulic medium may be delivered under pressure from the pump for the operation of the power vane of the rotor.

In order that the rotor may be controlled, particularly in the application of the hydraulic motor with a dump body proper, it is essential that this control provide for several operations or conditions of the rotor. That is to say, there must be a power operation in which the rotor is moved from the pressure abutment into contact with the limit abutment, during which operation the dump body is elevated to the desired inclination. Following this operation of the dump body, the rotor must be held under the pressure of the hydraulic medium in its then position to permit the load to be discharged by gravity from the inclined dump body. Following the discharge of the load, or at other selected interval, the power medium must be controlled to permit the dump

body to return to normal position, this movement being accomplished by relieving the pressure on the rotor and utilizing the weight of the body to restore the parts to normal position. Obviously, as the dump body is of considerable weight, this return movement should be more or less cushioned in order to avoid undue noise and jar.

An important characteristic of the present invention is the means by which this control is provided, such means involving a single manually operable valve capable in its various positions of permitting and maintaining the necessary conditions and operations of the rotor to insure the desired relations of the dump body. The valve proper, indicated at 37, is of slight conical form and designed to be rotatively mounted in a casing formed by an appropriate coring 38 in the body 28. The valve casing opens through the lower end of the body and the valve proper has a reduced extension 39 providing an annular shoulder 40 at the lower end of the valve which bears against a wear plate 41 held by a cover plate 42 removably secured to the body, this wear plate and cover plate being formed with an opening to permit the passage of the extension 39 therethrough, while at the same time holding the valve proper rotatively in its casing 38. The valve 37 is formed at its upper end with a transverse channel 43 and near its lower end with a transverse channel 44 having a right angled communicating channel 45 leading to and through the periphery of the valve, a semi-annular channel 46 in the surface of the valve providing communication between the respective ends of the channels 44 and 45 inwardly of the surface of the valve proper.

In order to provide for the control of the rotor by the hydraulic medium under pressure in the operation of the pump, the rotor casing and valve ports are arranged for control communication through the medium of channels cored or otherwise formed in the body 28. The body 28 is thus formed with what may be termed a pressure channel 47 which opens into the rotor casing immediately adjacent the pressure abutment 13 and between such abutment and the power vane when the latter is in inoperative or normal position, that is, with its rotor connected end in contact with the rotor contact end of the pressure abutment. Owing to the relatively different inclinations radially of the power vane and the pressure abutment, the power vane when in normal position or in contact with the pressure abutment presents a space between it and the pressure abutment on the peripheral wall of the rotor casing, into which space the pressure channel opens so that the hydraulic medium under pressure will act at all times against the power vane. The pressure channel 47 continues through the body in a plane including the plane of movement of the lower port 44 of the valve and continues beyond the valve casing, as at 49, to the pump and beyond the pump, as at 48, into the plane of movement of the upper port 43 of the valve.

A supply channel 50 formed in the body 28 opens into the reservoir chamber 16 of the rotor casing on the side of the pressure abutment opposite that of the pressure channel and extends through the body into the plane of the upper port 43 of the valve. The body 28 is further formed with a relief channel 52 which opens into the reservoir chamber 16 of the rotor casing

adjacent the supply channel and extends through the body into the plane of the lower ports 44 and 45 of the valve, this relief channel being extended at right angles to the similar end of the supply channel 50.

With the valve set in the position shown in Figure 4, the hydraulic medium, such as oil, with which the rotor casing and channels are filled will, by the operation of the pump, be drawn through the service channel 50 from the reservoir 16, through the port 43 of the valve, through the pressure channel section 48, through the pump, through the pressure channel 49, through the valve port 44, through channel 47 into the rotor casing. The pressure of this medium under the action of the pump resisted by the pressure abutment 13 acts to move the power vane 12 and thereby the rotor until the latter contacts with the limit abutment 14, it being apparent that the oil withdrawn from the reservoir by the action of the pump and forced into the pressure chamber is in circulation as the oil ahead of the power vane is carried in the movement of that vane into the reservoir. After the rotor has been moved to its limit position, the valve 37 is slightly turned to cut off communication between the service channel 50 and the pump intake channel 48.

By reason of the vertical offsetting of the service ends of the upper and lower ports, this movement of the valve will cut off the service channel connection slightly before completely interrupting communication between the sections 49 and 47 of the power channel. Thus the pump, which, of course, continues in operation, will force additional oil or at least create additional pressure in the rotor casing without withdrawing oil from the reservoir, that is, the pump will step up the pressure so that as the valve is turned to finally cut off communication between the sections 50 and 48 of the supply channel, the power vane, and thereby the rotor, will be held in operative position, with the power vane against the limit abutment 14. This represents the dumping position of the dump body, as will later appear.

After the dumping operation or at any desired interval, the valve is further rotated to arrange the port 44 in position to establish communication between the valve ends of the pressure channel 47 and relief channel 52. As these channels communicate respectively with the pressure chamber and with the reservoir of the rotor casing, it is apparent that a by-pass circulation is established between the pressure chamber and reservoir through the valve, and as the oil in the pressure chamber is thus relieved of its pressure, the weight of the dump body tends to return the power vane to normal or inoperative position. In this movement, the oil in the pressure chamber behind the power vane is delivered through the channel 47, valve port 44 and channel 52 to the reservoir, permitting the rotor to move to normal or inoperative position, cushioned by the gradual displacement of the oil from the pressure chamber.

In order to provide for necessary relief of the pressure flow of the hydraulic medium as the power vane reaches its limit position in contact with the limit abutment 14, the rotor casing is provided with an offset 53 in which is formed a by-pass channel 54 opening into the rotor casing on the respective sides of the limit abutment 14. Thus when the power vane reaches the limit abutment under the continued pressure operation of the pump, the oil forced by this pressure into the pressure chamber will by-pass around the power

vane into the reservoir to maintain the circulation necessary to avoid breakage of parts or cessation of movement of the pump under resistances of extreme pressure.

As the limit abutment 14 is primarily to limit operative position of the power vane, this abutment need not contact with the rotor 10 and, therefore, is preferably of restricted projection inwardly of the peripheral wall of the rotor casing, as indicated in Figure 7 of the drawings. To facilitate charging of the system with the hydraulic medium and also to provide for the escape of accumulated air, a pipe section 55 is provided which, through a suitable elbow connection 56, opens into the reservoir of the rotor casing. This pipe connection is terminally provided with a ball valve 57 opening under pressure from within the rotor casing and provided with a cap 58 having air vents 59 and means, such as a spring 60, to insure the seating of the valve in the absence of operating pressure.

The power shaft 8 extends in both directions beyond the rotor casing and is provided on each end with a removable, relatively fixed arm 61 connected by links 62 to a conventional dump body 63 swingingly supported at 64 on a chassis 65. Obviously, in the rotation of the power shaft 8, the arms 61 are operated and through the links the dump body is swung on its pivotal mounting to the desired inclination for dumping purposes. Of course, the arms 61 and links 62 may be of such relative size as to secure practically any desired inclination of the dump body during the operative movement of the rotor, and as the arm and link are duplicated at the respective ends of the power shaft, the power applied to the dump body is at transversely separated points to insure uniform movement of the body.

The valve projection 39 is provided with an operating arm 66 preferably pinned thereto and designed to be connected by a rod (not shown) to a suitable lever (not shown) arranged in the cab in a position convenient to the driver so that the various operations of the valve may be readily and easily carried out.

We claim:—

A hydraulic motor unit including an integral casting formed to provide a rotor casing and a pump casing, a rotor operative in the rotor casing, the rotor and rotor casing providing a pressure chamber and a reservoir, a pump operative in the pump casing, the pump casing being formed with a supply channel opening into the reservoir of the rotor casing and leading through the pump casing to one side of the pump and a pressure channel leading from the opposite side of the pump through the pump casing and opening into the pressure chamber of the rotor casing, a relief channel opening from the reservoir of the rotor casing and leading into the pressure channel, a valve having an upper port to control the supply channel between the intake side of the pump and the rotor casing, and a lower port to control the pressure channel between the discharge side of the pump and the rotor casing, the lower port of the valve controlling communication between the relief channel and that portion of the pressure channel between such lower port of the valve and the rotor casing, the valve operating in one movement to simultaneously cut off the communication between the pump and the supply channel and establish communication between the pressure channel and relief channel.

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