May 8, 1928.

1,669,309

M. SPILLMANN

HYDRAULIC DRIVEN DRAINAGE PUMP SYSTEM

Filed June 22, 1926

5 Sheets-Sheet 1

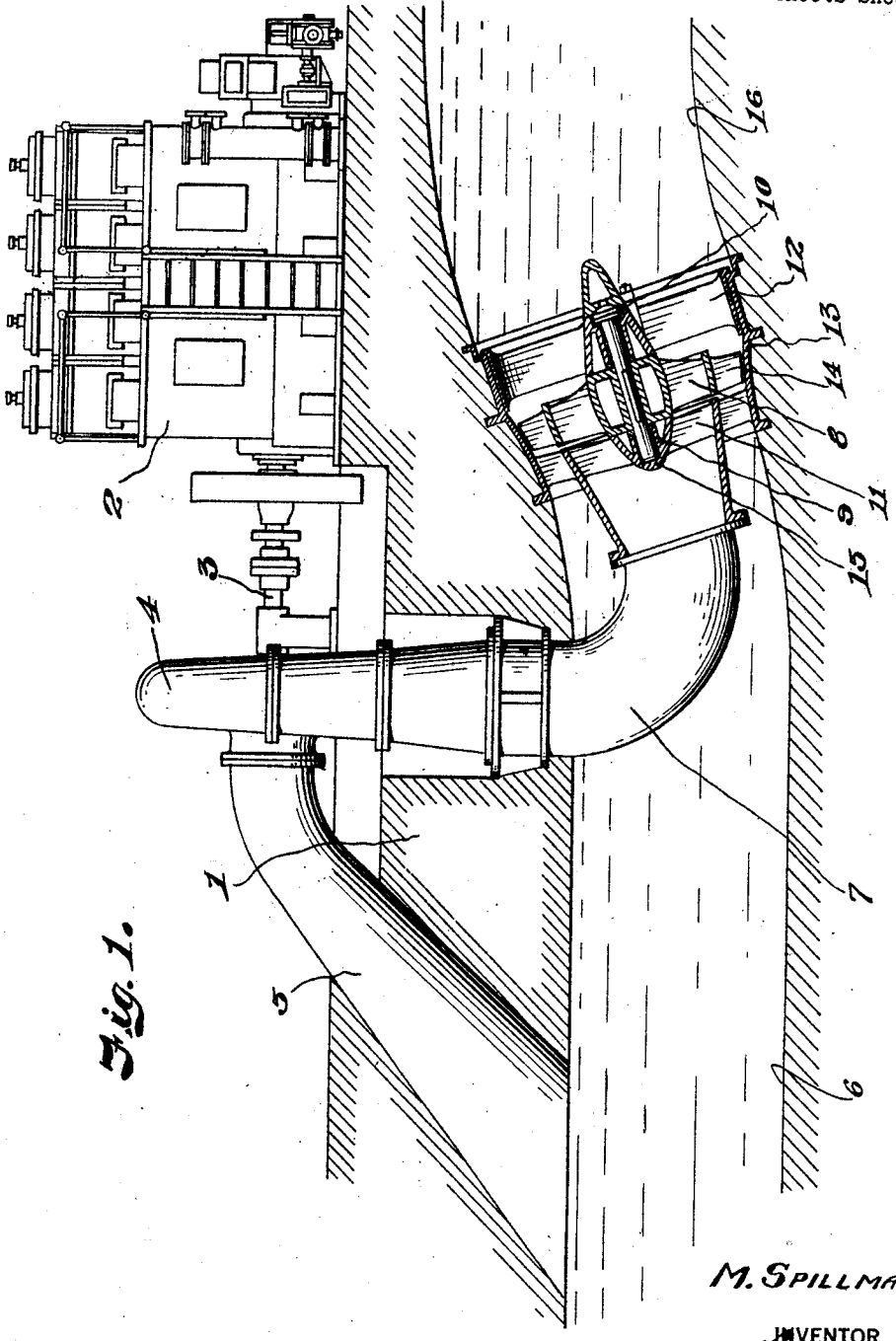


Fig. 1.

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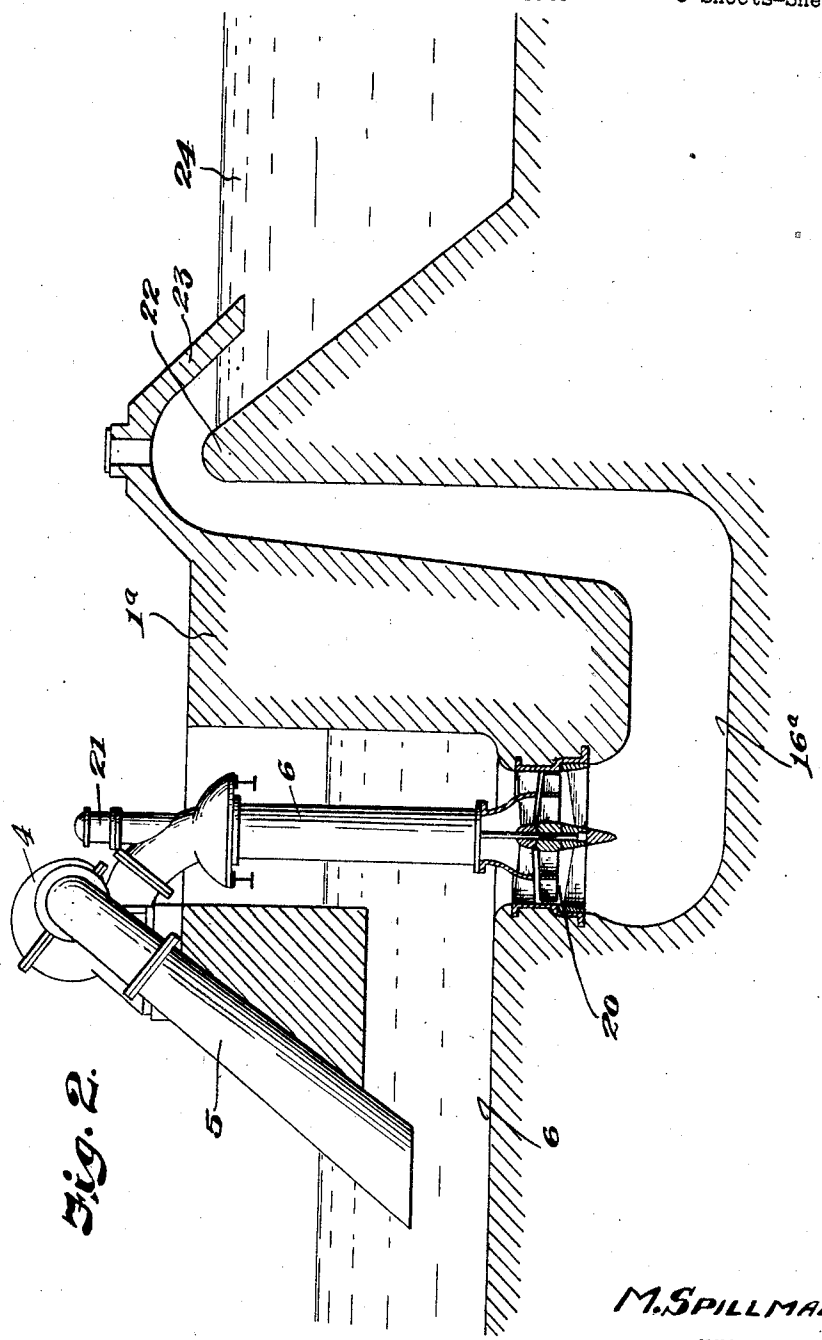


Fig. 2.

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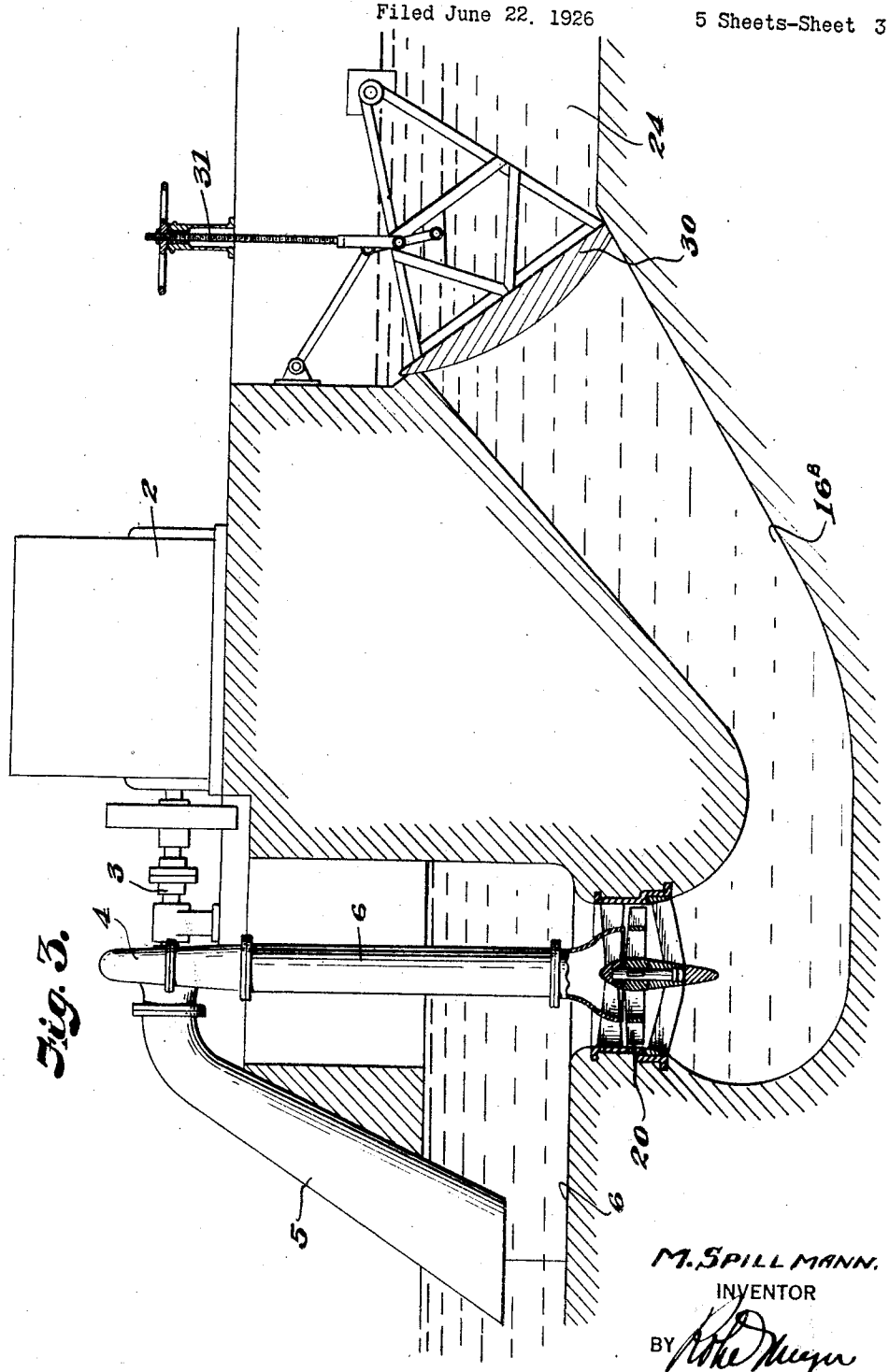


Fig. 3.

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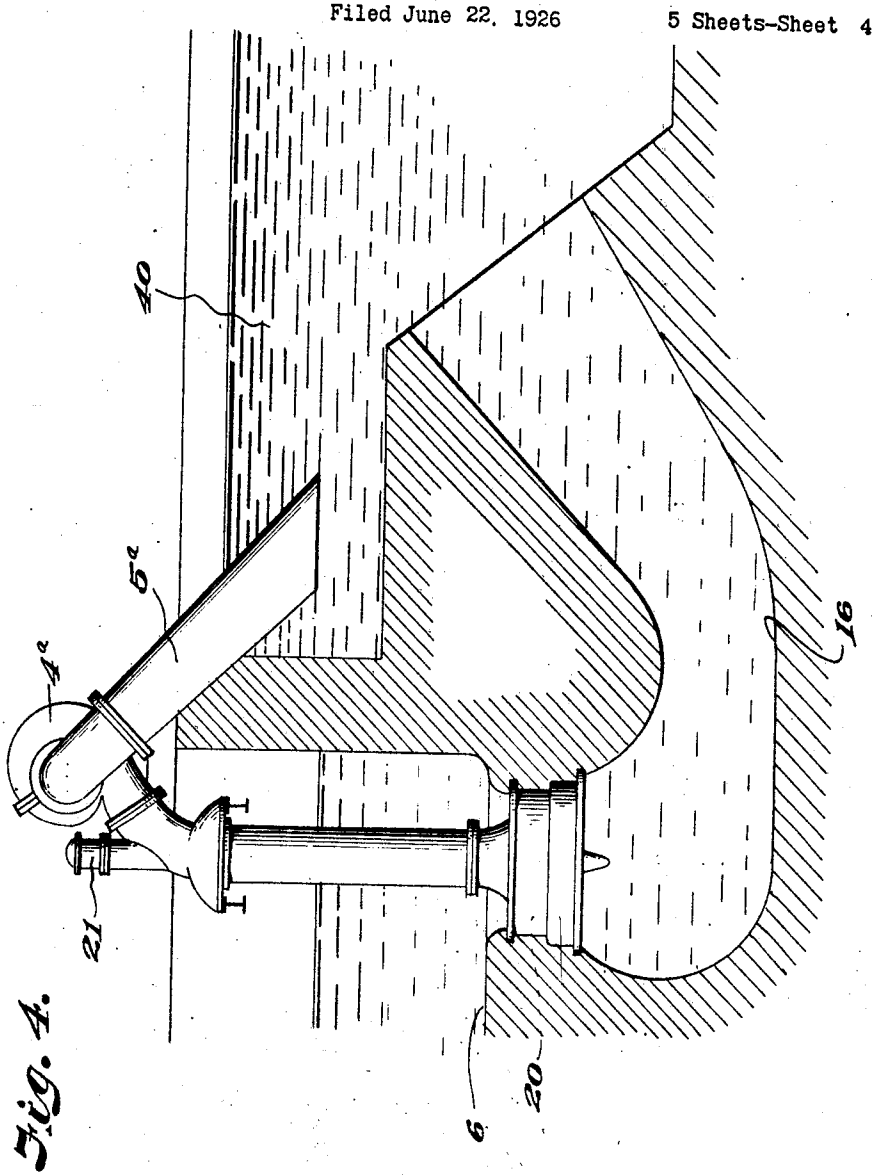


Fig. 4.

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HYDRAULIC DRIVEN DRAINAGE PUMP SYSTEM

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5 Sheets-Sheet 5

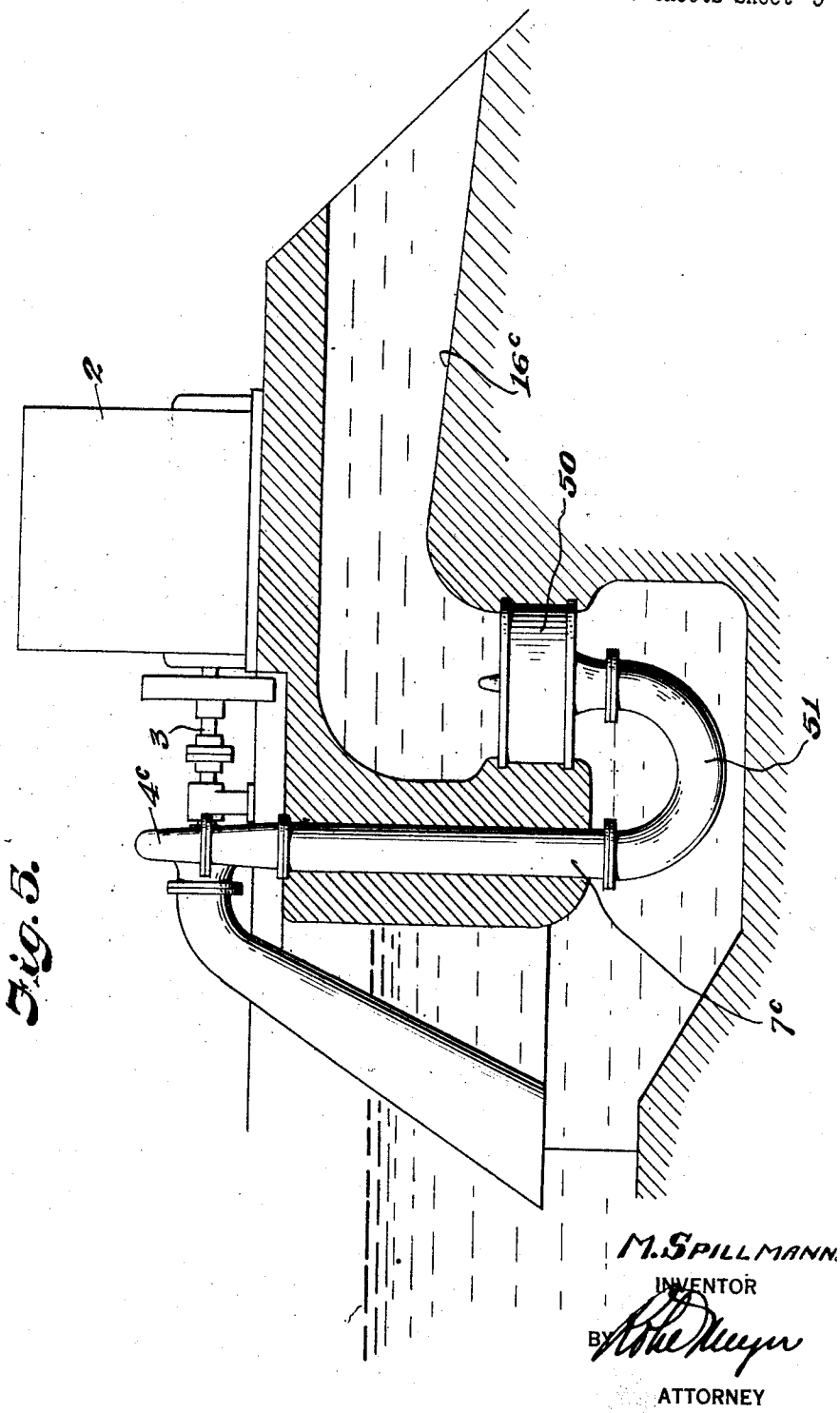


Fig. 5.

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Patented May 8, 1928. 1,669,309

UNITED STATES PATENT OFFICE.

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HYDRAULIC DRIVEN DRAINAGE PUMP SYSTEM.

Application filed June 22, 1926. Serial No. 117,692.

This invention relates to pumping systems and more particularly to a hydraulic driven drainage pump system.

An object of the present invention is to overcome several inconveniences now found in the drainage of swamp lands and in analogous pumping of water. It is desirable to confine the cost of such pumping systems within a pre-determined amount and to provide a system which will give maximum pumping efficiency and require a minimum expenditure in upkeep at as low an initial or installation cost as is contingent with the requirements to be met. Owing to the fact that the initial cost of prime movers is regulated by their horse-power it is desirable to utilize all of the power of the prime mover and this is particularly difficult in drainage systems owing to the fact that the load or head of water varies from day to day, sometimes varying fully fifty per cent which is hard on a pump driven at substantially uniform speed, from the prime mover, such as is necessary to obtain an efficient and effective operation of the pump. Where the prime mover is connected for direct drive of the drainage or low head pump it is necessary either to drive the pump at a uniform speed, regardless of the head of water, with detrimental effects on the pump, or else reduce the speed of operation of the prime mover for reducing its horse-power and consequently reducing the pumping capacity of the pump, thereby causing considerable unnecessary expense in the provision of a high horse-power prime mover which operates for approximately one-half of the time at one-half of its capacity.

An object of the present invention is to provide a pumping system which embodies a hydraulic drive of the low head or drainage pump through the medium of a medium head pump and turbine which will permit the medium head pump of the hydraulic transmission system to be operated at a uniform rate of speed and utilize the maximum power of the prime mover regardless of the head to be pumped against.

With these objects in view, the invention consists in various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a hydraulic driven drainage pump system of the preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings—

Figure 1 is a view partly in section illustrating the improved drainage pump system.

Figure 2 is a view similar to Figure 1 illustrating the low head or drainage pump and its driving medium positioned vertically.

Figure 3 is a view similar to Figure 2 showing a prime mover and transmission in side elevation in lieu of end elevation and showing a gate to prevent back-flow of the head water to the pump.

Figure 4 is a view showing a modification of the pumping system and

Figure 5 is a diagrammatic view showing still a further modification of the pumping system.

In the installation of drainage plants or pumping systems for draining swamp lands or any analogous pumping systems, suitable concrete structures as indicated at 1 are built for providing support for the prime mover and pumps and to provide the desired water passageways to and from the pumping station. In Figure 1 of the drawings, the improved pumping system or station embodies the prime mover 2 which is illustrated as an internal combustion engine. The engine 2 is connected by a direct driving connection 3 to a medium head centrifugal pump 4. The suction of the medium head centrifugal pump 4 is through a suitable conduit 5 which has communication with the inlet water passageway to the pumping station and the operation of the pump 4 will draw water from the passageway 6 and discharge it through the conduit 7 against the turbine 8. The turbine 8 may be of any approved construction and is supported by bearings 9 and 10, carried by suitable supports 11 and 12, the former of which is illustrated as connected to the conduit 7 while the latter, or support 12 is carried by a suitable casing 13 mounted in the structure 1. The casing 13 also serves as a housing or casing for the low head or drainage pump 14 which is formed on or suitably connected to the turbine 8, to be rotated by rotation of the turbine 8. A suitable stream-line housing 15 is provided for enclosing the bearings 9 and 10 and to present as little resistance as possible to the outgoing water.

The water from the medium head pump 4 flows through the conduit 7, operates the turbine 8, passing from the discharge of the turbine into the discharge passageway 16 of the pumping station. The operation of the pump 14 draws the water from the inlet passageway 6 through the housing or casing 13 into the passageway 16, from which it is discharged to any suitable basin or outlet.

The prime mover 2 is illustrated as an internal combustion engine since in numerous localities where drainage is necessary the fuel most readily available is oil and consequently the oil engine is the most logical and most convenient prime mover for use under such conditions, but owing to its relatively high initial cost per horse-power and due to the varying conditions in the head water to be pumped against, it has been practically prohibitive in competition; however, with the present hydraulic transmission system the full or maximum power of the engine may be utilized permitting the installation of an engine of much less horsepower than would be required under the present known systems of transmission.

In operation of the present system, the engine 2 operating at a uniform speed and maximum power will operate the medium head pump 4 at the same speed all of the time and it will pump water from the passageway 6 in constant uniform quantity which will, in turn, drive the turbine 8 and the low head or drainage pump 14 and thus when there is an exceptionally low head of water, against the low head pump, because of either high water on the suction side or low water on the discharge side, the turbine and low head pump will have a tendency to race or operate at a high speed and will, consequently, pump a large quantity of water. As the water head increases, the resistance against the turbine 8 and low head pump 14 increases which slows down the speed of the low head pump 14 and turbine 8 and, consequently, decreases the quantity of water pumped, which makes the low head pump practically automatic in its speed and pumping capacity regardless of the speed of operation of the engine or prime mover 2 and the centrifugal or medium head pump 4; thus causing the low head or drainage pump 14 to pump water from the inlet passageway 6 in quantities substantially inversely proportionate to the discharge head.

The substantial automatic control of the speed of operation of the low head pump, in other words the regulating of the speed of the low head pump will be controlled by the net head and the operation of the improved hydraulic driven drainage pump system will be equally affected whether the low head pump is discharging into a basin, river, irrigation ditch, or the like, variances in the head being provided by variances in the water level on the suction side of the pump and also by variances of water level on the discharge side.

In Figure 1 of the drawings, the drainage pump 14 and turbine 8 are shown as completely submerged and placed in a substantially horizontal position in the water passageways; however, in Figures 2, 3 and 4 of the drawings, the combined drainage pump and turbine or drainage unit 20 are positioned with their axis vertically, which permits the positioning of the thrust bearing above the water and permits ready and convenient access to the thrust bearing 21 for repair or replacement. This is particularly desirable since it has been found that considerable trouble is occasioned by thrust bearings positioned under water.

In Figure 2 of the drawings, the concrete construction 1^a and the passageways for the water are different from those illustrated in Figure 1 of the drawings, dam 22 is provided together with an apron 23 to prevent back-flow of the water from the discharge basin or outlet 24 into the discharge passageway 16^a when the pumping system is not working. In other respects, except those above mentioned, the modified form of system illustrated in Figure 2 is similar to the system illustrated in Figure 1.

The modified form of system illustrated in Figure 3 is the same as that illustrated in Figure 2 in so far as the pumping unit itself is concerned, differing from the form shown in Figure 2 only in the arrangement of the various passageways for the water and in the provision of a gate 30 which is positioned at the outlet of the discharge passageway 18^b. The gate 30 may be of any approved construction and while a manually operable mechanism 31 is illustrated for opening and closing the gate, it is to be understood that any approved mechanism may be provided for this purpose. The gate 30 is provided to prevent backflow of water from the basin or oulet 24 of the pumping station into the discharge passageway 16^b and to or through the pump unit 20.

In Figure 4 of the drawings the medium head centrifugal pump 4^a is shown with its suction conduit 5^a extending into the discharge basin or outlet 40 so that the water for operating the turbine of the pumping unit 20 is taken from the head water or the discharge outlet of the pumping system.

In Figures 2, 3, and 4 of the drawings, the pumping unit 20 is illustrated with its discharge downwardly into the respective outlet passageways while in the further modified form illustrated in Figure 5 of the drawings, still another arrangement of the drainage pumping unit is illustrated. In this

form, the drainage pumping unit 50 is positioned with its axis vertical; however, it discharges upwardly into the discharge passageway 16[c] and the conduit 7[c], which leads from the medium head centrifugal pump 4[c] and has a curved portion 51 therein so as to lead the water from the pump 4[c] to the pumping unit 50 for operating the latter.

While in the foregoing description and in the drawings, the prime mover has been referred to and is illustrated as an internal combustion engine it is to be understood that any suitable type of prime mover may be employed, and this is also true of the medium head pump 4 in that any suitable type of pump, whether centrifugal, rotary or reciprocatory, may be employed without departing from the spirit of this invention, the invention comprehending essentially the provision of the pumping system in which the pump is connected direct to the prime mover and pumps fluid as the operating medium for the low head or drainage pump.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that these may be modified widely within the invention defined by the claims.

What is claimed is:

1. In a pumping system, the combination, of a pump, a prime mover having a constant speed and torque, and a hydraulic transmission connecting said prime mover and pump and having a common final discharge with the pump whereby the pump will operate at a speed and capacity substantially inversely proportionate with the discharge head, irrespective of the speed of operation of the prime mover.

2. In a pumping system, the combination, of a pump, a turbine for driving said pump, an internal combustion engine, a second pump connected direct to said internal combustion engine for pumping water to said turbine for operating it, the discharge from said turbine and the discharge from said turbine driven pump being against the same head whereby the turbine driven pump will operate at a speed and capacity substantially inversely proportionate with the water head irrespective of the speed of operation of the internal combustion engine.

3. In a pumping system, a pump, a hydraulic transmission for driving said pump including a second pump, said pumps having a common suction source, the final discharge of said pumps being against a common head whereby the first named pump will operate at a speed and capacity substantially inversely proportionate with the water head.

4. In a pumping system, a pump, a hydraulic transmission for driving said pump including a second pump and a prime mover connected direct to said second pump, said pumps having a common suction source, the final discharge of said pumps being against a common head whereby the first named pump will operate at a speed and capacity substantially inversely proportionate with the head irrespective of the speed of operation of the prime mover.

5. In a pumping system embodying a water passageway, a low-head pump submerged in said passageway, a prime mover, a hydraulic transmission for driving said low-head pump and including a pump connected direct to said prime mover and discharging against the same head as said low-head pump, said second pump having its suction from the water supply forwardly of the discharge of the low-head pump.

6. In a pumping system, a pump, a turbine for driving said pump, a prime mover, a second pump connected direct to said turbine for operating it, the discharge from said turbine and the discharge from said turbine driven pump being against the same head whereby the turbine driven pump will operate at a speed and capacity substantially inversely proportionate with the discharge head irrespective of the speed of operation of the prime mover, and means to prevent back-flow of water to said turbine.

7. In a pumping system embodying a water passageway, a pumping unit submerged in the passageway and including a turbine and a pump connected to and positioned outwardly to said turbine, a thrust bearing for said turbine and pump positioned above the water level in said passageway, a prime mover, a second pump connected direct to said prime mover and having its discharge to said turbine for operating the turbine the final discharge from said second pump being through the turbine and against the head water against which the turbine driven pump discharges whereby the turbine driven pump will operate at a speed and capacity substantially inversely proportionate to the discharge head irrespective of the speed of operation of the prime mover.

In testimony whereof I affix my signature.

MAX SPILLMANN.