Jan. 2, 1940. A. H. CARSON ET AL 2,185,498

HOIST

Filed Oct. 18, 1935 5 Sheets-Sheet 1

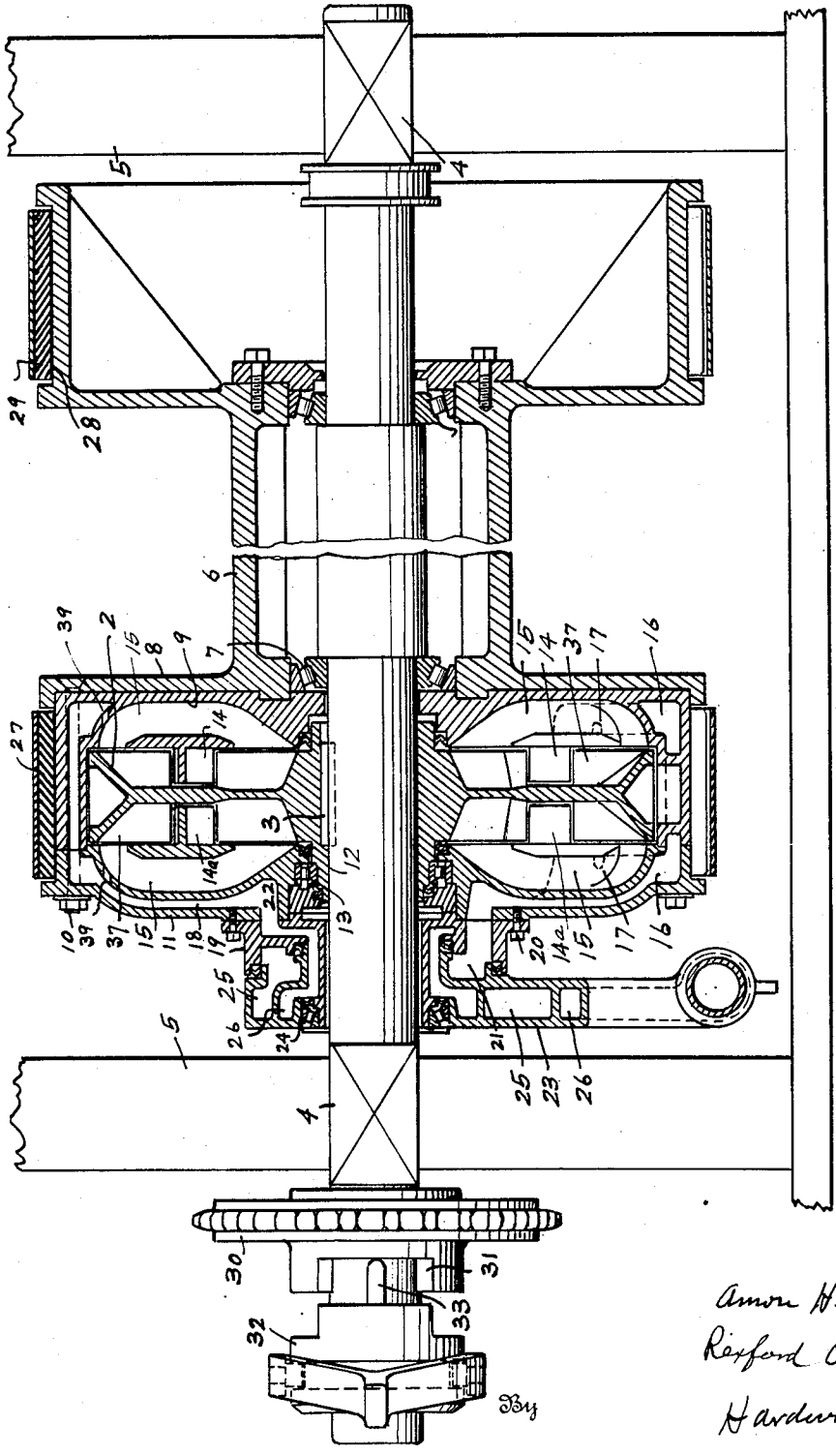

Fig. 1.

Inventors
Amon H. Carson
Rexford O. Anderson
By Hardway & Cathey
Attorneys

Jan. 2, 1940. A. H. CARSON ET AL 2,185,498

HOIST

Filed Oct. 18, 1935 5 Sheets-Sheet 2

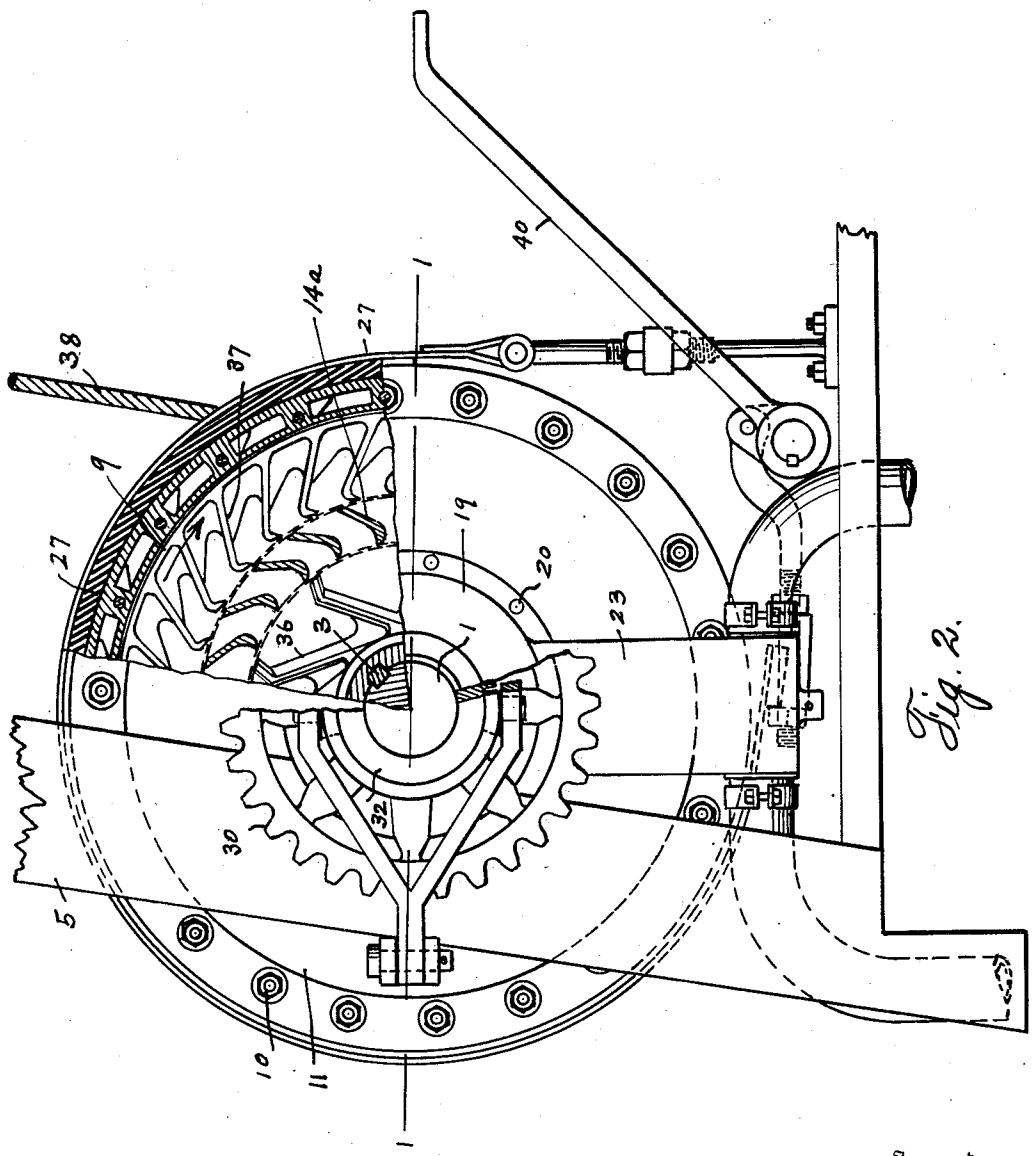

Fig. 2.

Inventors
Amon H. Carson
Reyford O. Anderson
By Hardway & Father
Attorneys

Jan. 2, 1940. A. H. CARSON ET AL 2,185,498

HOIST

Filed Oct. 18, 1935 5 Sheets-Sheet 3

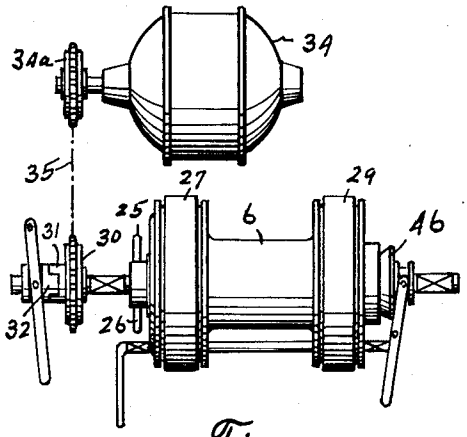

Fig. 3.

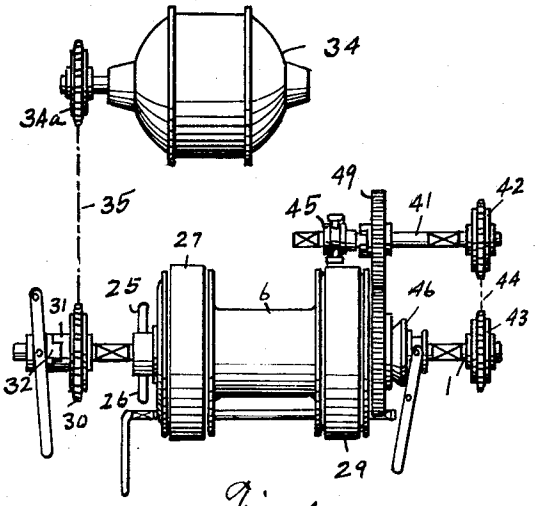

Fig. 4.

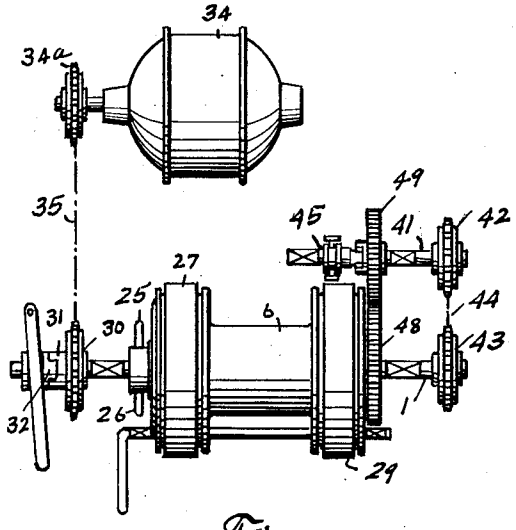

Fig. 5.

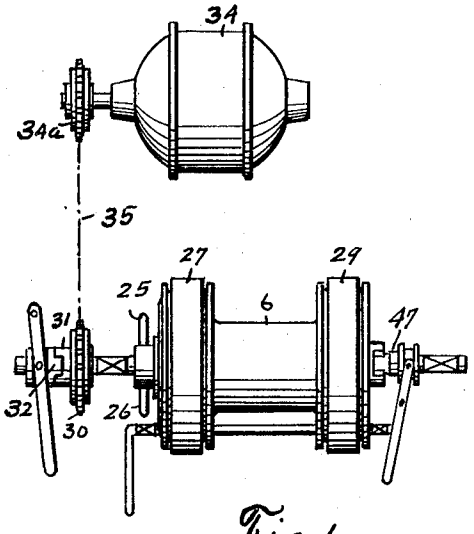

Fig. 6.

Inventors
Amon H. Carson
Rexford O. Anderson

By Hardway & Tathey
Attorneys

Jan. 2, 1940. A. H. CARSON ET AL 2,185,498

HOIST

Filed Oct. 18, 1935 5 Sheets-Sheet 4

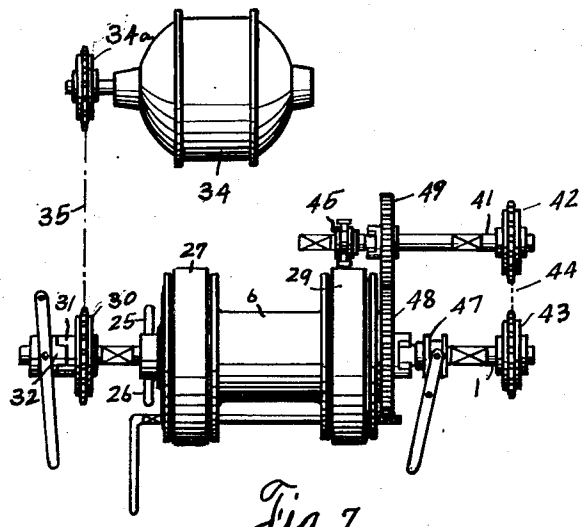

Fig. 7

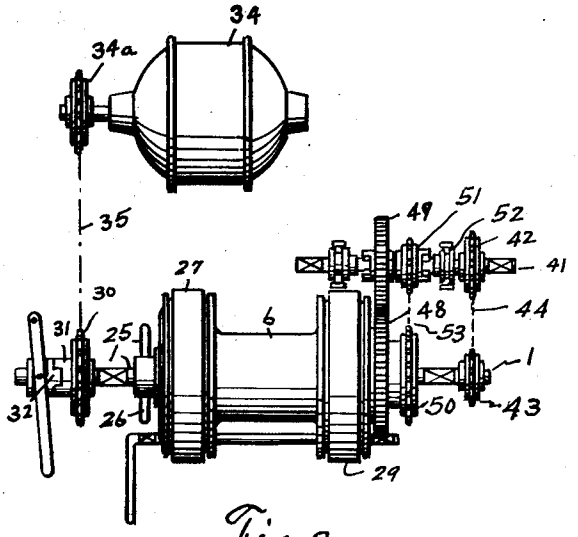

Fig. 8.

Inventors

Amon H. Carson

Retford O. Anderson

By Hardway & Cathey

Attorneys

Jan. 2, 1940. A. H. CARSON ET AL 2,185,498

HOIST

Filed Oct. 18, 1935 5 Sheets-Sheet 5

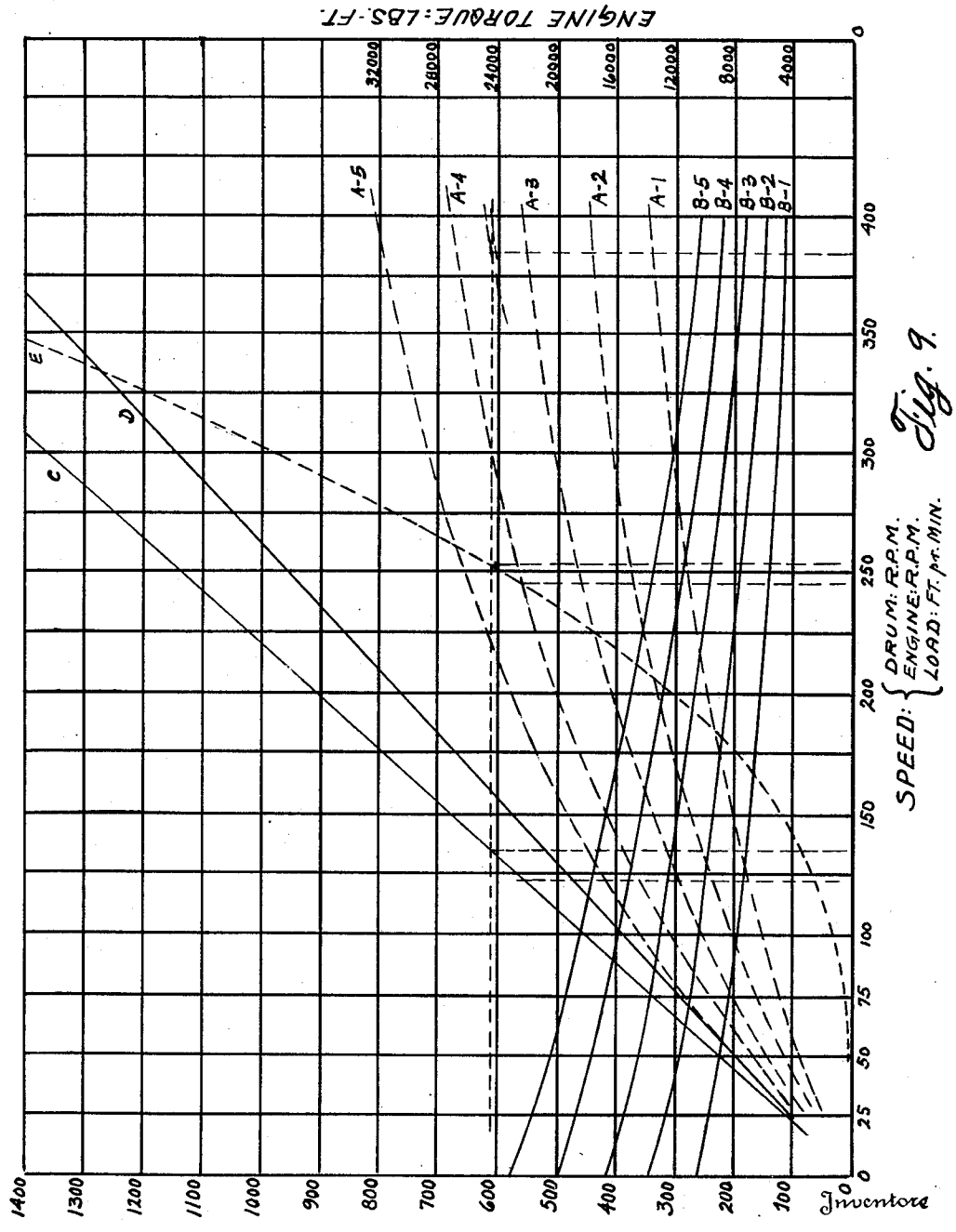

Fig. 9.

Inventors

Amon H. Carson

Rexford B. Anderson

By Hardaway & Cather

Attorneys

Patented Jan. 2, 1940 2,185,498

UNITED STATES PATENT OFFICE

2,185,498

HOIST

Amon H. Carson and Rexford O. Anderson,
Oklahoma City, Okla.

Application October 18, 1935, Serial No. 45,536

15 Claims. (Cl. 254—187)

This invention relates to a hoist.

An object of the invention is to provide a hoist for handling heavy loads wherein the initial torque load is of constantly changing magnitude such as is encoutered in well drilling, power excavating, and in the operation of power crane equipment.

The conventional hoist for the purposes abovementioned is equipped with means for obtaining different speed ratios which demands heavy and expensive equipment in the form of line shafts, jack shafts, sprockets, gears, clutches, and the like. In rotary drilling hoists, drag line ditchers, power shovels, and other equipment that must be transported from place to place and requires frequent installation, the item of bulk and weight are of great importance. Interrupted trips due to unexpected overloads are dangerous, especially in the drilling of oil wells where the drilling tools are liable to become stuck in the well bore.

With the conventional speed shift type of hoists, this overloading necessitates a temporary suspension of the upward movement of the load and sometimes requires that the load be slightly lowered in shifting to another speed. This interrupted, or suspended, movement of the load in the well is liable to cause the load, such as a string of pipe, to become stuck, sometimes resulting in the loss of a well, and in all events, causing delay and expense. Speed in handling the load is of great importance and the use of conventional chain driven devices, either greatly overloads the engine to obtain the maximum speed, or necessitates slower speed than necessary.

Our invention embodies a hydraulic power transmission that automatically balances the power of the prime mover with the load and speed, and vice versa. In the case of heavy initial torque loads, the power necessary to meet the torque requirements is comparatively high and is applied automatically by increasing the speed of the prime mover. The speed of the load conforms automatically to the power generated by the prime mover. The speed ratio available is of from zero up to the maximum speed of the driving unit. This speed ratio is automatic, depending on the weight of the load handled and the power available. In case of unexpected overloads, the speed of the load merely decreases, automatically building up the torque to conform to the constant power applied. The maximum torque is available for the load without in any way stopping the prime mover, or bringing the load to rest.

In use of hoists for lowering, as well as raising, heavy loads, as in the case of heavy cranes and oil well drilling equipment, the braking ability of the equipment is as important as the hoisting ability thereof. This is especially true where the load has to be lowered a great distance at a trip. Equipment of this character requires the use of manually operated friction brakes of the band, block, or disk type on the conventional hoist. Such brakes, especially in the rotary well drilling equipment as now developed, are greatly overtaxed, necessitating the introduction of extra large braking surfaces which are expensive, both as to cost of manufacture and material. The upkeep and replacement of these parts represents a large part of the cost of the equipment. Our invention, being automatic in its speed ratios, acts as a lowering device, dissipating the energy generated in lowering the load in the form of heat which raises the temperature of the liquid that is constantly being replaced through the natural operation of the apparatus, and the mechanical brakes referred to are thus in a large measure dispensed with.

With the above and other objects in view, the invention has particular relation to certain novel features of construction, operation, and arrangement of parts, examples of which are given in this specification and illustrated in the accompanying drawings, wherein:

Fig. 1 shows a longitudinal sectional view of the hydraulic power transmitting apparatus taken on the line 1—1 of Fig. 2.

Fig. 2 shows an end elevation, partly in section.

Fig. 3 shows a modified form of the invention embodying a friction clutch mechanism.

Fig. 4 shows a modified form, as illustrated in Fig. 3, modified as hereinafter more specifically explained.

Fig. 5 shows a slightly modified form of the invention illustrated in Fig. 4.

Fig. 6 illustrates the invention as embodied in the disclosure of Fig. 3 wherein the jaw clutch is substituted for a friction clutch.

Fig. 7 illustrates the invention as embodied in a combination of Figs. 5 and 6.

Fig. 8 illustrates a slight modification of the form shown in Fig. 5, and

Fig. 9 shows a work characteristic chart of the invention.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates the rotor shaft whereon the

rotor 2 is rigidly mounted, said rotor being preferably keyed to the shaft by the key 3. The shaft 1 is supported by the bearings 4 which are fixed to the frame members 5. Rotatably mounted on the shaft 1 is a cable winding drum 6 which is mounted on the bearings 7. Rigidly attached to one flange 8 of the drum is the rotor shell 9, said shell being preferably connected to the flange by the bolts 10. This shell partly encloses the rotor 2. The shell embodies also a cover 11 which is attached to the shell also by means of the bolts 10. The cover 11 is rotatably mounted and supported on the rotor hub 12 by means of the bearings 13. The shell 9 and cover 11 contain the deflecting vanes 14 and 14a, respectively. The inner surfaces of the shell and shell cover are contoured to form the series of channels 15 which extended from the periphery of the shell cover to the centers thereof. These vanes 14, 14a also contain the inlet circulating ducts 16 which are connected to the channels 15 by means of the openings 17 and are also provided with the discharge circulating ducts 18. There is a header 19 attached to the shell cover by the bolts 20 and this header contains the circulating inlet ducts 21 and discharge ducts 22 which connect with the corresponding ducts 16 and 18, respectively. There is a manifold 23 which is supported on the header 19, said header being rotatable relative to the manifold and being mounted thereon by means of the bearing 24. The manifold contains the inlet channel 25 and the circulating discharge channel 26 which are connected with like channels in the header and shell cover and body, as shown. The outer periphery of the shell and cover is formed to act as braking surfaces to receive the band 27. The other drum is provided with a braking surface 28 to receive the brake band 29. Rotatably mounted on the shaft 1 is the sprocket wheel 30 which is provided with the clutch jaw 31 which is engageable by the clutch 32, feather-keyed on said shaft 1 by the key 33.

In operation, water, or a similar liquid, is admitted to the space inside the shell, and surrounding the rotor, through the circulating inlet channels 25, 21, and 16, and through the openings 17 until the space is completely filled. The prime mover 34 is connnected to, and drives the shaft 1 and rotor 2 in the direction indicated by the arrow in Fig. 2 by means of the sprocket chain 35 which operates over the sprocket wheel 34a on the prime mover shaft, as well as over the sprocket wheel 30, the clutch 32, of course, being engaged. The rotation of the rotor in this direction circulates the liquid by means of its runner vanes 36 in an outward radial direction, imparting energy to the liquid in the form of velocity, transforming it into kinetic energy. This liquid strikes the deflecting vanes 14, 14a, imparting its energy to them and tending to rotate the shell and shell cover in the same direction as the rotor. The liquid spent of most of its energy passes from the deflecting vanes to the outer runner vanes 37, located on the rotor 2 adjoining its outer rim, and whose inner ends are contoured at an obtuse angle with the radius, forming a radial component outwardly to give the liquid velocity in an outward radial direction, and whose outer ends are contoured at an acute angle with the plane of rotation both tangentially and radially, giving a lateral component outwardly from said plane to impart a tangential and lateral velocity to the liquid proportional to their contours and velocities, again instilling energy into the liquid. The liquid is discharged laterally into the channels 15, the sides of which are contoured at an acute angle with the plane of rotation toward the axis and an acute angle with the radius, forming a radial component toward the axis of rotation, to change the direction of flow of the liquid into a direction opposite that of rotation of the rotor and toward the rotor hub. In doing this the shell absorbs the energy imparted by the outer rotor vanes 37. This energy is also effective to rotate the shell in the direction of the rotor. When the liquid reaches the rotor hub, the runner vanes 36 again give it velocity outwardly, and the cycle is repeated. In this manner, power is transmitted from the prime mover to the rotor by mechanical means, and from the rotor to the shell through the liquid as a medium, and thence to the cable winding drum and to the load suspended by the cable 38 which is wound on the drum, but which is shown only in Fig. 2.

The total power transmitted by the rotor to the drum varies approximately as the cube of the difference between the velocity of the rotor and the velocity of the shell. A portion of the energy is dissipated in the form of heat which raises the temperature of the liquid. A portion of the liquid is ejected by the circulation of the liquid from the shell channels 15 and through the openings 39 into the circulating discharge channels 18, 22, 26. Sufficient cool liquid is admitted through the inlet channels 25 to replace that discharged, and to maintain the required temperature.

When the relative velocities of the rotor and shell have increased to such an extent that sufficient power is transmitted to the shell and drum to overcome the initial torque load placed on it, the drum will start to rotate and wind the cable, lifting the load at a speed commensurate with the further increase in the rotor speed and the load.

Referring to Fig. 9, showing the work chart and the curves A—1, A—2, A—3, A—4, and A—5, representing the power generated by a typical 12" x 12" twin steam engine, with steam pressure of 150 pounds, 200 pounds, 250 pounds, 300 pounds, and 350 pounds, respectively, the curves B—1, B—2, B—3, B—4, B—5 show a torque in pounds-feet delivered by the engine using steam at 150 pounds, 200 pounds, 250 pounds, 300 pounds, and 350 pounds, respectively. Curve C represents the work done in raising a string of 6⅝ inch drill pipe 6,000 feet long, and the curve D represents the work done in lifting a string of 6⅝ inch drill pipe 5,000 feet long. Curve E represents the work transmitted by the invention of standard size. Noting the curves further, it is seen that for the engine directly connected to the load of 6,000 feet of pipe, to overcome the initial torque of 24,000 pounds, the engine would have to work with over 350 pounds of steam pressure. This would impart tremendous strain to the engine since an engine of this type does not develop power until first gaining speed. Since the load curve C lies outside of the work curve A—5, the engine must have a speed reduction in its connection with the drum. Considering a speed reduction of three to one, with a maximum speed of 400 R. P. M., the initial torque of the engine would be 8,000 pounds, which would necessitate 110 pounds of steam pressure to start the load, with resulting heavy strains on the engine and transmitting mechanism. When the engine has attained full speed of 400 R. P. M., the drum is

rotating at 133 R. P. M., and the load is being raised 133 feet per minute, necessitating 610 H. P. and requires 270 pounds steam pressure.

With the same engine directly connected to the hydraulic power transmission, as shown in Figs. 1 and 2, it is noted that to start the load of 24,000 pounds with the drum 6 rotating at 1 R. P. M. would require 4.6 H. P. From the curve it is seen that with a relative speed of 50 R. P. M., the invention develops the 4.6 H. P. and at this speed and power the engine is using 7 pounds of steam pressure (M. E. P.). This puts no great strain on the engine or parts. As the engine speed further increases, the power transmitted increases until at 385 R. P. M. of the engine, 610 H. P. is delivered, there being 252 R. P. M. relative speed, plus 133 R. P. M. on the drum. This power at 385 R. P. M. requires 272 pounds of steam pressure, as compared with the engine directly connected to the load with three to one speed reduction mechanism using 270 pounds steam pressure. It will thus be seen that the same work can be accomplished by the use of the invention disclosed in Figs. 1 and 2 without the use of bulky and expensive equipment and speed reduction apparatus and requiring no greater steam pressure than would be required by such equipment and with no excessive initial starting overloads or strains on the parts.

When the load is raised, the drum is held stationary by the brakes 27, 29, which may be actuated by the brake lever 40. In order to lower the load with the conventional hoisting equipment with only friction brakes, the brakes would have to be released gradually, allowing the load to attain speed, and generating power in proportion to the speed. This power has to be absorbed by the brake surfaces generating heat which goes to destroy the braking surfaces and the drum surfaces. By utilizing the hydraulic transmitting mechanism illustrated in Figs. 1 and 2, when it is desired to lower the load, it is only necessary to cause a relative rotative speed between the rotor in the normal raising direction of rotation and the drum 6 in the opposite direction. This can be accomplished either by the use of the engine to rotate the rotor, as shown in Figs. 1, 3, and 6, or by the use of the back-geared shaft. or transmission shaft, 41 as shown in Figs. 4, 5, 7, and 8. In the first case, with the load suspended, the engine would be speeded up to, say 50 R. P. M., where the load would be balanced by the power transmitted, and the brakes 27, 29, released. As the cable drum attains speed, the engine would be further speeded up to maintain the relative speed commensurate with the power generated by the descent speed of the load. In case the load is to be lowered at 133 feet per minute, generating 610 H. P., the engine would be speeded at 252 R. P. M. minus 133 R. P. M., or 119 R. P. M. In the case of the back-geared shaft, the gear 48, fixed to the drum 6, meshes with the spur gear 49 which is loosely mounted on the shaft 41, but which may be clutched therewith by means of the conventional jaw clutch 45. The shaft 1 is connected with the back-geared shaft 41 by the sprockets 42, 43, fixed, respectively, on the shafts 41 and 1, and over which the sprocket chain 44 operates. This arrangement causes the rotor shaft to rotate in its normal raising direction, and opposite to that of the drum when it is being unwound by the load.

With the proper speed ratio between the drum and rotor shaft, any desired speed of descent can be attained. For example, assuming the ratio between the rotor and drum is unity, or 1; when it is desired to lower the load the clutch 32 is disengaged and the clutch 45 is engaged. Then the brakes 27 and 29 are released, and as the drum speed reaches 25 R. P. M., lowering the load at 25 feet per minute, it is generating 115 H. P. while the relative speed is 25 plus 25, or 50 R. P. M. with the hydraulic power transmission generating 4.6 H. P. The drum, therefore, increases in speed until it attains 122.5 R. P. M., lowering the load at 122.5 feet per minute and generating 560 H. P., the rotor rotating 122.5 R. P. M. in the opposite direction, causing a relative speed of 245 R. P. M. and generating 560 H. P. This balances the power generated by the load and maintains that speed for the duration of the trip. In this way the action of the load automatically governs its descent.

Fig. 3 shows a modified form of the invention in which a friction clutch 46 is used to connect the drum 6 to the shaft 1. This form is desirable where light loads are to be handled, or where loads vary from heavy initial to comparatively light over long runs, at which time the friction clutch is thrown in after maximum speed of the load possible, through the speed differential of the hydraulic power transmission is reached, bringing the engine speed down to that of the drum without affecting the power, and further increasing the drum speed along with any increase in the engine speed.

Fig. 4 shows a modified form of the invention embodying the clutch 46 along with the back-geared transmission shaft 41 for automatically lowering the load, as hereinafter described. Fig. 5 shows a modified form of the invention with the back-geared transmission shaft 41 geared to the drum by means of the gears 48, 49, the latter of which may be clutched with the shaft 41 by the clutch 45. In Fig. 6 there is shown a modified form of the invention in which the jaw clutch 47 is employed for connecting the drum 6 with the shaft 1 to be utilized for handling light loads at maximum speeds.

In Fig. 7 there is shown another modification wherein the jaw clutch 47 is utilized, as shown in Fig. 6, in combination with the back-geared transmission shaft 41, for automatically governing the speed of the descent of the load.

Fig. 8 illustrates another modification of the invention in which there is a sprocket wheel 50 attached to the drum 6. A sprocket wheel 51 is loosely mounted on the back-geared transmission shaft 41 and may be clutched therewith and declutched therefrom by means of the clutch 52. Operating over the sprocket wheels 50 and 51, there is a sprocket chain 53. The speed ratio between the shaft 41 and the drum shaft 1 is such as to allow the sprocket 51 to synchronize with the shaft 41 at predetermined load speeds. This allows the handling of loads of diminishing intensity to be synchronized to direct drive by the rotor shaft, and also allows light loads to be handled direct at starting while by-passing the hydraulic transmission. The spur gear connections 48, 49, are also available to be used to automatically lower the load, as hereinabove explained and as explained in connection with the description of Figure 5 below.

The operation of the modified form of the invention shown in Figure 4, is the same as that described of the form shown in Figure 3 up to the point where the load is raised and the manual brakes 27 and 29 are set, at which time the drum

and load are held stationary. When it is desired to lower the load, causing the drum 6 to rotate in the opposite direction to that when the load was lifted, the clutch 46 is thrown out, disengaging the shaft 1 from the drum 6, the clutch 32 is also thrown out disengaging the prime mover 34 from the shaft 1. The clutch 45 is thrown in, engaging the spur gear 49, (in mesh with spur gear 48) with the shaft 41. The drum 6 is thus engaged with the shaft 1 by means of the spur gears 48 and 49, the shaft 41, the sprocket wheels 43 and 42, and the sprocket chain 44 in such manner that when the drum 6 is rotated to lower the load, the shaft 41 is rotated in the opposite direction, and by means of the sprocket wheels 42, and 43, and the chain 44, the rotor shaft 1 is simultaneously rotated in the direction for raising the load. Release of the brakes 27 and 29 allows the load to rotate the drum 6 and simultaneously rotates the rotor shaft 1 the opposite direction in a speed relation commensurate with the ratios of the spur gears 48 and 49, and the sprocket wheels 42 and 43, giving a relative speed between the drum 6 and the rotor 2, equal to the sum of the speeds of the two. When the work generated by the rotor 2 operating in the shell 9 at the relative speed of the two balances that done by the descending load, the speed of the load will be held constant and further speed on the part of the load will become impossible as aforedescribed. When the load is completely lowered, the brakes 27 and 29 are set to stop the rotation of the drum 6. The clutch 45 is disengaged, the clutch 32 is engaged and the equipment is again ready to raise the load.

The operation of the modified form shown in Figure 5 is the same as that shown in Figure 4, excepting the operation of the clutch 46, of which there is none in Figure 5.

The operation of the modified form shown in Figure 7 is the same as that described of Figure 4, excepting that the clutch 47 takes the place of clutch 46 in Figure 4.

The drawings and description are illustrative of the principle of the invention, although mechanical modifications may be made within the scope of the appended claims.

What we claim is:

1. Hoisting equipment comprising a driving member, a prime mover, means for operatively connecting the prime mover with, and disconnecting it from the driving member, a load-handling member, hydraulic transmission means for transmitting power from the driving member to the load handling member, a clutch for connecting the driving member with, and for disconnecting it from, the load handling member, a transmission shaft directly connected with the driving member, gearing connecting the shaft with the load-handling member and clutch means for operatively connecting the gearing with and disconnecting it from said shaft.

2. Hoisting equipment comprising a driving member, a prime mover, means for operatively connecting the prime mover with, and disconnecting it from the driving member, a load-handling member, hydraulic transmission means for transmitting power from the driving member to the load-handling member, a transmission shaft directly connected with and driving the driving member, gearing connecting the shaft with the load-handling member and clutch means for operatively connecting the gearing with and disconnecting it from said shaft.

3. Hoisting equipment comprising a driving member, a prime mover, means for operatively connecting the prime mover with, and disconnecting it from the driving member, a load-handling member, hydraulic transmission means for transmitting power from the driving member to the load handling member, a clutch for connecting the driving member with, and for disconnecting it from, the load handling member, a transmission shaft directly connected with, and driven from, the driving member, gearing connecting the shaft with the load-handling member and clutch means for operatively connecting the driving member with and disconnecting it from said shaft.

4. Hoisting equipment comprising a driving member, a prime mover, means for operatively connecting the prime mover with, and disconnecting it from the driving member, a load handling member, hydraulic transmission means for transmitting power from the driving member to the load-handling member, a transmission shaft directly connected with, and driven from, the driving member, gearing connecting the shaft with the load-handling member and clutch means for operatively connecting the driving member with, and disconnecting it from the said shaft.

5. Hoisting equipment comprising a driving member, a prime mover, means for operatively connecting the prime mover with the driving member, a load-handling member, hydraulic transmission means for transmitting power from the driving member to the load-handling member, a transmission shaft, means for transmitting rotation from the driving member to said shaft, means arranged to be clutched with and declutched from the shaft for transmitting rotation from the shaft to the load-handling member.

6. Hoisting equipment comprising a driving member, a motor, means for operatively connecting the motor with and disconnecting it from the driving member, a load handling member, hydraulic transmission means for transmitting power from the driving member to the load handling member, a transmission shaft, means for transmitting rotation from the driving member to said shaft, means for connecting the driving member with the load handling member for rotating said member in one direction, gearing for connecting the shaft with the load handling member to induce its rotation in the opposite direction and clutch means for operatively connecting the gearing with and disconnecting it from said shaft.

7. A hydraulic hoist comprising a shaft, a rotor rigidly mounted thereon, and a rotatable drum loosely mounted thereon, the rotor and the drum being arranged to form a chamber between them for containing a liquid, means whereby co-action between the rotor and the liquid will induce a transmission of energy from the shaft to the drum, clutch means between the shaft and the drum for the locking of said shaft to said drum, brake means on said drum for retarding rotation of said drum.

8. A hydraulic hoist comprising a drive shaft, a rotor rigidly mounted thereon, a rotatable drum loosely mounted on said shaft, the rotor and drum being arranged to form a chamber between them for containing a liquid, means whereby the co-action of the rotor and liquid will be rendered effective to transmit energy from said drive shaft to said drum, brake means on the drum effective to govern the rotation of said drum, a line shaft

rotatably connected to said drive shaft, a gear on said drum, and a co-meshing gear mounted on and selectively connected with said line shaft, making said line shaft a means for transmitting motion between the drum and drive shaft in opposite directions.

9. A hydraulic hoist comprising a drive shaft, a rotor rigidly mounted thereon, a rotatable drum loosely mounted on said drive shaft, the rotor and drum being arranged to form a chamber between them for containing a liquid, means through which co-action of the rotor and liquid will transmit energy from said shaft to said drum, clutch means between said shaft and said drum for selectively transmitting energy from said shaft to said drum, brake means on the drum effective to govern the rotation of said drum, a line shaft rotatably connected to said drive shaft, a gear on said drum, a co-meshing gear mounted on and selectively connected with said line shaft, making said line shaft a means for transmitting motion between the drum and the drive shaft in opposite directions.

10. A hoist comprising a drive shaft, an impeller fixedly mounted thereon, a shell rotatively mounted thereon, and adjacent said impeller and forming a chamber between them for containing a fluid energy transmitting medium, a load handling drum attached to said shell, friction braking surface on said drum to control the rotation of the drum, braking means for contact with said friction braking surface, impeller vanes on the impeller, and turbine blades on the shell, all arranged to co-act upon rotation of the shaft to transmit energy from the shaft to the drum.

11. A hoist comprising a drive shaft, a rotatable, load handling drum, a hydraulic transmission adapted to contain an energy transmitting liquid, and including a driving member which is attached to said shaft, and a driven member which is attached to said drum, friction braking surface on said drum, braking means for contact with said friction braking surface, all arranged to co-act for the transmission of energy from said drive shaft to said drum and for the control of the rotation of said drum.

12. A hoist comprising a prime mover, a driving member, means for operatively connecting the prime mover with, or disconnecting the same from, the driving member, a load handling member, hydraulic transmission means for transmitting power from the driving member to the load handling member, operative means whereby the load handling member may be clutched with the driving member to produce rotation of said driving member in the opposite direction to that of the load handling member.

13. Hoisting equipment comprising a driving member, a prime mover, means for operatively connecting the prime mover with, and disconnecting it from, the driving member, a load-handling member, hydraulic transmission means for transmitting power from the driving member to the load-handling member, clutch means for connecting the driving member with, and for disengaging it from, the load-handling member, a transmission member directly connected with the driving member, gearing connecting the transmission member with the load-handling member and clutch means for operatively connecting the gearing with, and disconnecting it from, said transmission member.

14. Hoisting equipment comprising a driving member, a prime mover, means for operatively connecting the prime mover with, and for disconnecting it from, the driving member, a load-handling member, hydraulic transmission means for transmitting power from the driving member to the load-handling member, a transmitting member directly connected with, and driven from, the driving member, gearing connecting said transmitting member with the load-handling member and means for operatively connecting the gearing with, and disconnecting it from, said transmitting member.

15. Hoisting equipment comprising a driving member, a motor, means for operatively connecting the motor with the driving member, a load-handling member, hydraulic transmission means for transmitting power from the driving member to the load-handling member, a transmission shaft, means for transmitting rotation from the driving member to said shaft, clutch means for connecting the driving member with the load-handling member, gearing connecting the shaft with the load-handling member, and clutch means for operatively connecting the gearing with and disconnecting it from said shaft.

AMON H. CARSON.
REXFORD O. ANDERSON.