

Feb. 25, 1947.

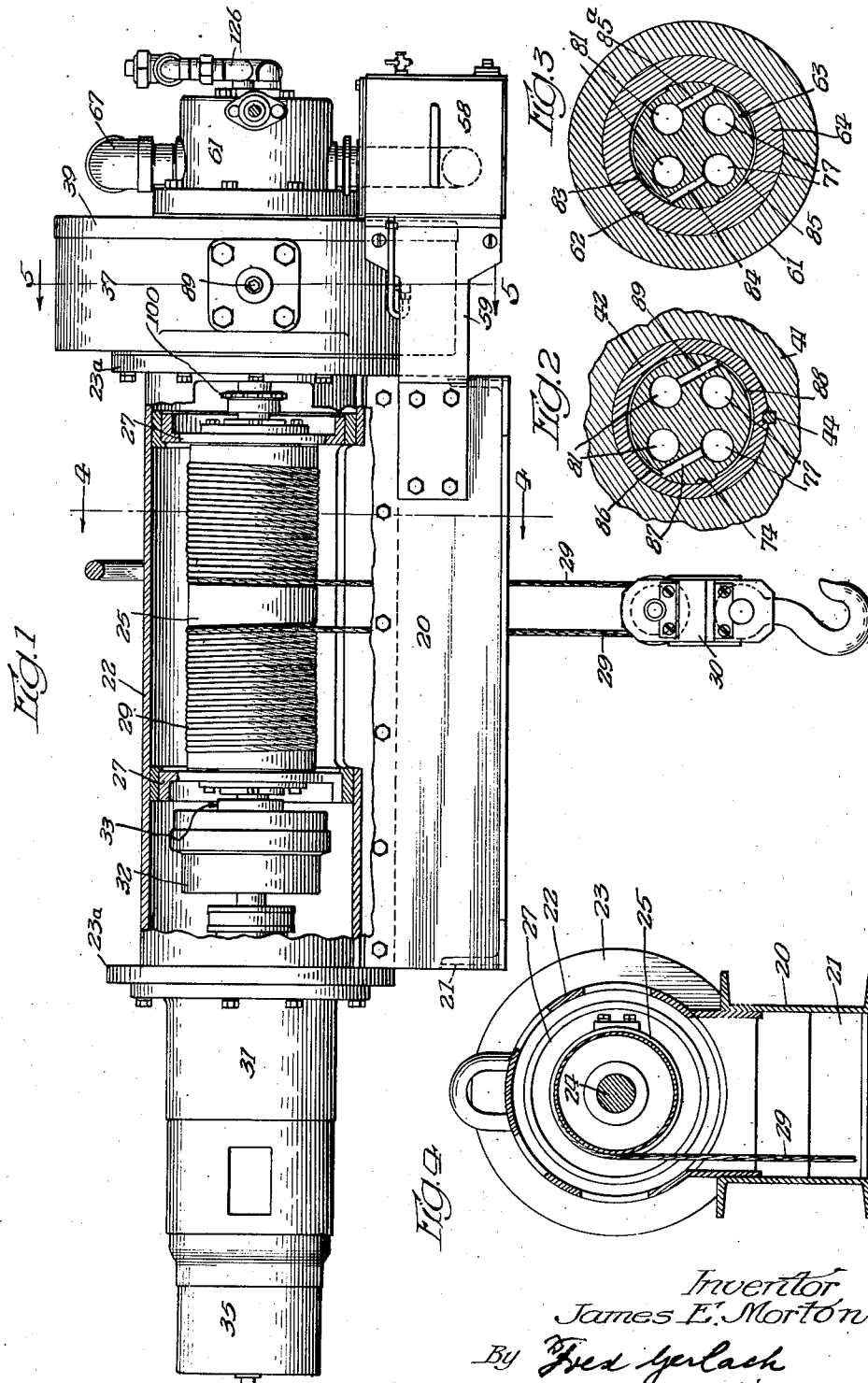
J. E. MORTON

2,416,638

HYDRAULIC BRAKE MECHANISM

Filed Aug. 3, 1944

4 Sheets-Sheet 1



Feb. 25, 1947.

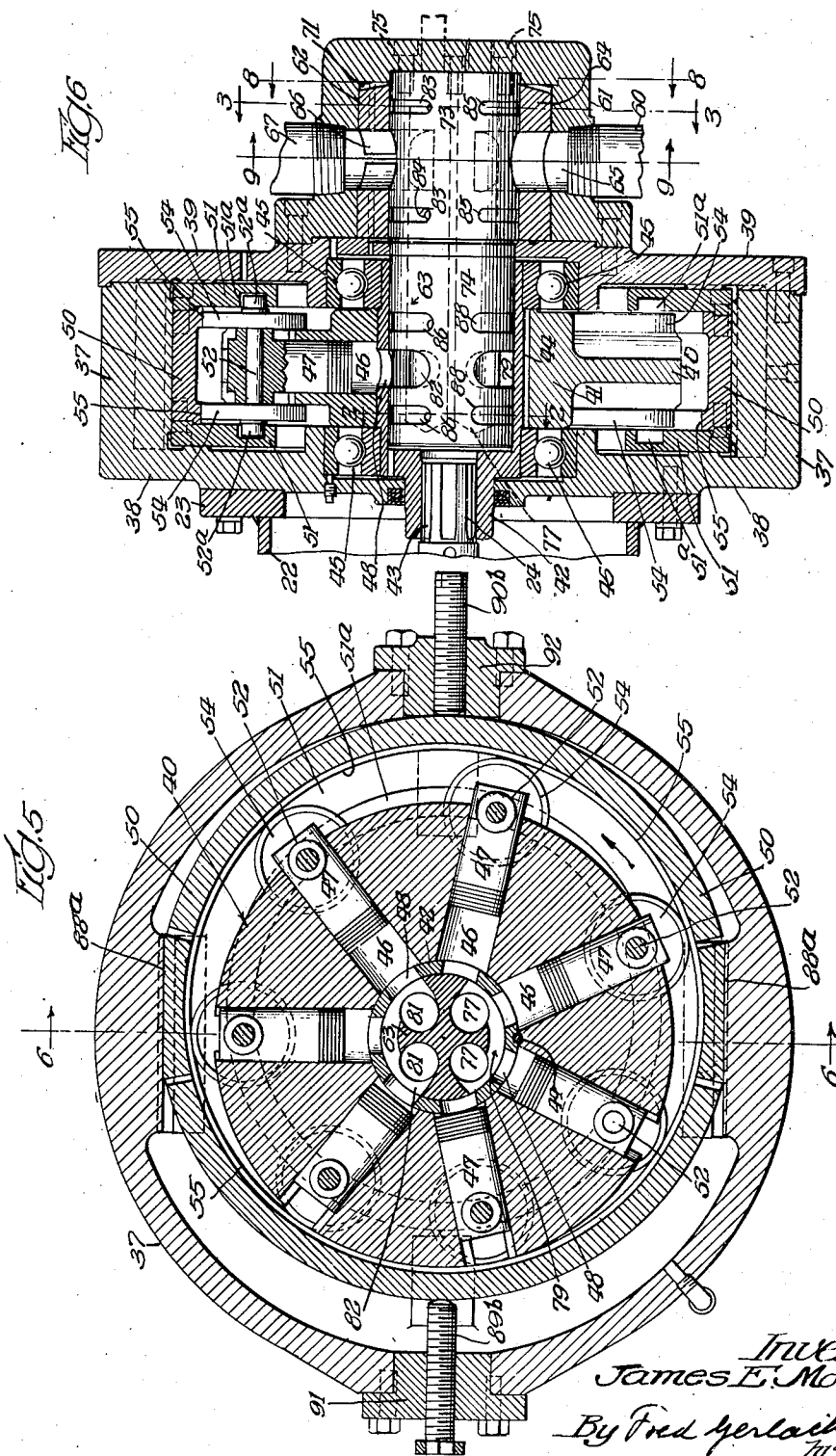
J. E. MORTON

2,416,638

HYDRAULIC BRAKE MECHANISM

Filed Aug. 3, 1944

4 Sheets-Sheet 2



Inventor
James E. Morton

By Fred Gerlach
Att'y

Feb. 25, 1947.

J. E. MORTON

2,416,638

HYDRAULIC BRAKE MECHANISM

Filed Aug. 3, 1944

4 Sheets-Sheet 3

FIG. 8

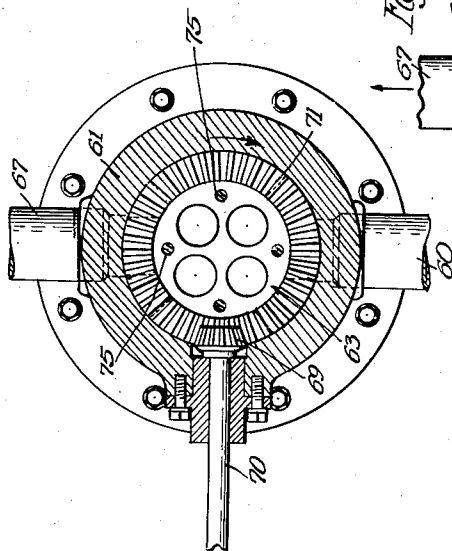


FIG. 9

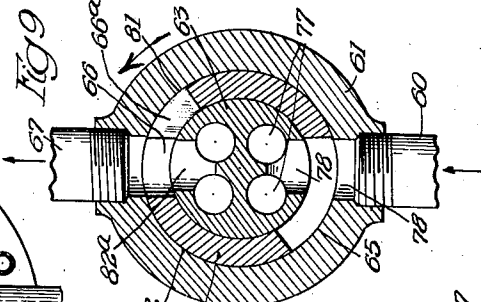


FIG. 10

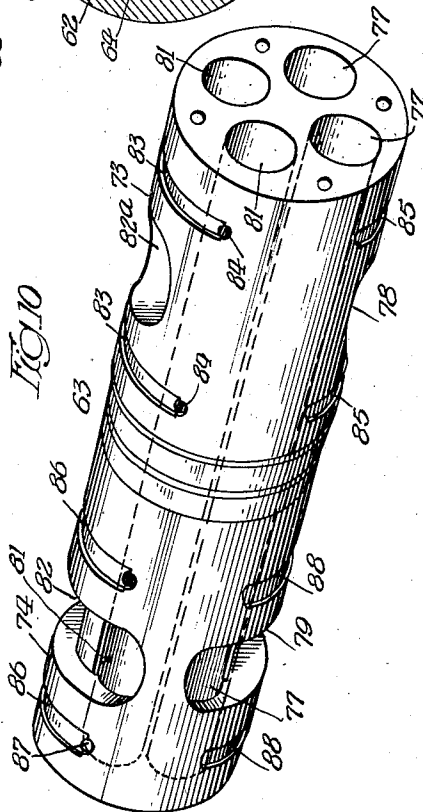
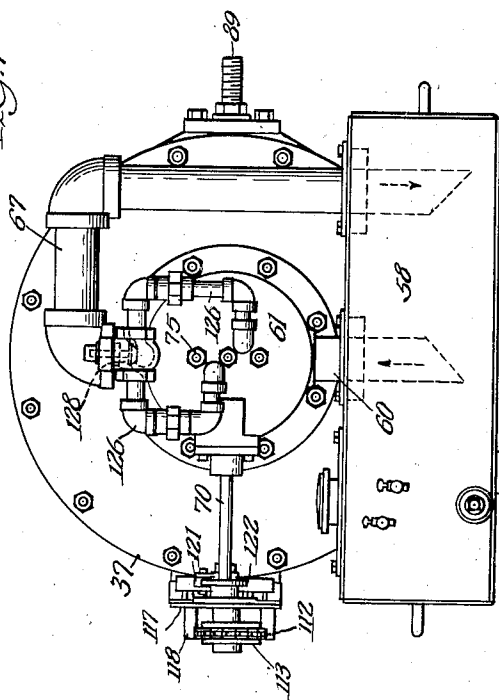


FIG. 11



Inventor:
James E. Morton
By Fred Gerlach
his Atty

Feb. 25, 1947.

J. E. MORTON

2,416,638

HYDRAULIC BRAKE MECHANISM

Filed Aug. 3, 1944

4 Sheets-Sheet 4

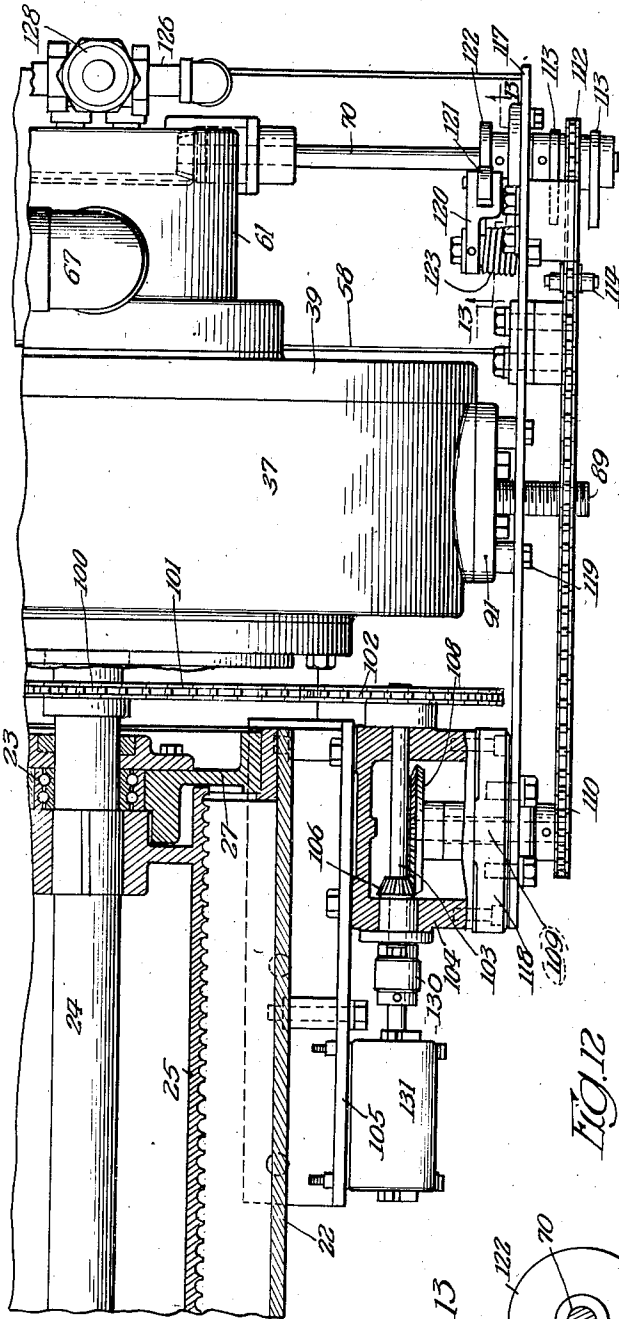


Fig. 11

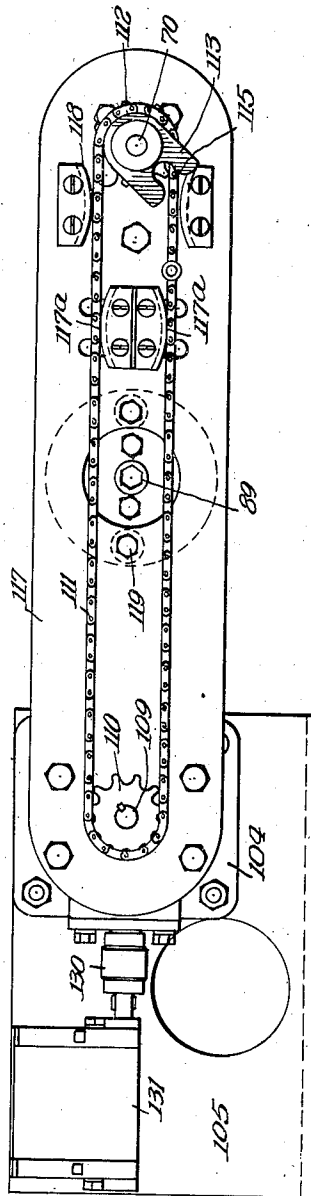


Fig. 12

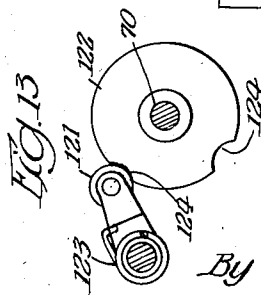


Fig. 13

Inventor
James E. Morton

By Fred Gerlach
his Atty.

UNITED STATES PATENT OFFICE

2,416,638

HYDRAULIC BRAKE MECHANISM

James E. Morton, Harvey, Ill.

Application August 3, 1944, Serial No. 547,881

11 Claims. (Cl. 188—91)

1

The invention relates to hydraulic brakes of the torque pressure type.

One object of the invention is to provide a hydraulic brake of the torque pressure type which is adapted for use in hoisting mechanism.

Another object of the invention is to provide hydraulic brake mechanism comprising radial cylinders in which movable pistons are operated for producing torque pressure and braking effect upon the load.

Another object of the invention is to provide automatic means for controlling the torque pressure of the fluid and the braking effect and automatically graduating the torque pressure in stopping the movement of the load.

Another object of the invention is to provide a hydraulic torque pressure brake of improved construction.

Other objects of the invention will appear from the detailed description.

The invention consists in the several novel features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a side elevation of the hydraulic torque pressure brake applied to a hoisting mechanism, parts being shown in section.

Fig. 2 is a section taken on line 2—2 of Fig. 6.

Fig. 3 is a section taken on line 3—3 of Fig. 6.

Fig. 4 is a section taken on line 4—4 of Fig. 1.

Fig. 5 is a section of the hydraulic brake-mechanism taken on line 5—5 of Fig. 1.

Fig. 6 is a section taken on line 6—6 of Fig. 5.

Fig. 7 is an end elevation.

Fig. 8 is a section taken on line 8—8 of Fig. 6.

Fig. 9 is a section through the torque-pressure controlling valve, taken on line 9—9 of Fig. 6.

Fig. 10 is a perspective of the stationary valve member through which the fluid flows to and from the radial cylinders of the hydraulic brake.

Fig. 11 is a plan illustrating the automatic means for controlling the torque pressure control valve.

Fig. 12 is a side elevation of said automatic control mechanism.

Fig. 13 is a section taken on line 13—13 of Fig. 11.

The invention is exemplified with hoisting mechanism which comprises: an overhead supporting structure which includes channel beams 20, rigidly connected at their ends by angle bars 21; a cylindrical drum-housing 22 which has welded to its ends heads 23, all secured together to provide a rigid supporting structure. The hoisting mechanism comprises a drum 25 fixed

2

to a shaft 24 which is journaled in bearings 23^a carried in the heads 27 in the housing 22; a hoisting cable 29 which has its ends rigidly fixed to the drum 25 and is adapted to be wound on and unwound from the drum by rotation of the drum; a pulley block 30 to which the load to be lifted is connected and which is suspended in a loop of cable 29 which depends from the drum; an electric motor 31 mounted on one end of the supporting structure; a magnetic clutch for driving the drum 25 from the motor 31 including a driving member 32 on the shaft of a reversible electric motor 31 and a driven member 33 fixed to the shaft 24 of the drum 25. A holding brake 35 of usual construction may be provided for the motor 31. The hoisting mechanism described is of the drum and cable type and may be of any suitable construction as well understood in the art. The magnetic clutch 32, 33 exemplifies a coupling between electric motor 31 and the hoisting drum 25 which, when current is interrupted, will release the drum 25 to permit the load on the block 30 to drop by gravity and unwind the cable 29 from the drum 25, cause said drum to rotate, and drive the rotor of the hydraulic torque pressure brake-mechanism hereinafter described, which is adapted to gradually arrest and then stop the drum when the load has dropped to the desired predetermined point.

The hydraulic brake mechanism comprises a non-rotatable cylindrical casing which includes an annular member 37 provided with an integral side 38 which is fixedly secured to one of the flanges 23 on the housing 22, and a head 39 which closes the opposite side of the casing; a rotor in said casing comprises a rotor-body 40 which is provided with a hub 41; a sleeve 42 which is splined at 43 to one end of the drum-shaft 24 and keyed as at 44 to the hub 41 of rotor-body 40, and is journaled in anti-friction bearings 45 mounted in the sides 38 and 39 of the casing; a series of radial cylinders 46 formed in the rotor-body; and a series of pistons 47 which are slidable in the cylinders 46, respectively. A ring 50 is slidable transversely and non-rotatably mounted in the casing member 37 which is provided with cylindrical tracks 55 on its inner periphery. Each piston 47 carries adjacent its outer end a cross shaft 52, the ends of which are provided with rollers 54 for engaging tracks 55. Ring 50 is provided with inwardly extending sides 51, which are provided with circular grooves 51^a concentric with tracks 55. The ends of cross shafts 52 are provided with rollers 52^a which extend into circular grooves 51^a in the sides 51 of the ring for

forcing the pistons outwardly toward the tracks 55 and moving the pistons 47 outwardly when the rotor travels at low speed, or when centrifugal force will not force the pistons outwardly. Fluid is conducted in continuous or overlapping rotative succession to the cylinders 46 and torque is produced by the inward radial movement of the pistons 47 imparted thereto by tracks 55. The exhaust of the fluid from the cylinder 46 during the inward radial movement of the pistons is controlled to vary the torque pressure produced, and the braking effect upon the rotor and the drum 25.

A tank 58 is suitably supported by brackets 59 from the beams 20 and contains a supply of hydraulic fluid not under pressure for circulation through the brake-mechanism. From tank 58 hydraulic fluid passes through an intake pipe 60 to a cup-shaped valve casing 61 which is secured to the casing-side 39 and provided with a cylindrical valve seat 62. A ring valve 64 (Figs. 6 and 9) fitting in the cylindrical seat 62, is provided with an arcuate intake port 65 through which the fluid flows to a stationary valve member 63 and the rotatable valve-sleeve 42 on the rotor to the cylinders 46. Valve 64 is provided with an arcuate outlet port 66 to which the fluid from said cylinders 46 is conducted via sleeve valve 42 and the stationary valve-member 63 to a pipe 67 which returns the fluid into the tank 58. Ring-valve 64 is rotatable to cause port 66 to variably limit and cut off the outflow of fluid from the cylinders 46 and produce the torque pressure in the fluid for braking the drum 25 against rotation in one direction. Ring-valve 64 is rotatable for this purpose by a bevel pinion 69 which is fixed to a shaft 70 which is journaled in the valve casing 61 and an annular series of gear teeth 71 (Fig. 8) formed on the outer end of said valve and meshing with pinion 69.

The stationary valve member 63 is cylindrical, has a portion 73 fitting the inner periphery of ring valve 64, and a cylindrical portion 74 fitting the inner periphery of the rotatable valve-sleeve 42. Member 63 has its outer end fitting against and fixedly secured, by bolts 75, to the outer side of valve-casing 61. Stationary valve member 63 is provided with a pair of longitudinally extending inlet ducts 77 which are communicatively connected by a port 78 with the inlet port 65 in ring-valve 64. The outer ends of ducts 77 are closed by the outer end of valve-casing 61 and their inner ends terminate inwardly of the inner end of valve member 63. Ducts 77 are communicatively connected to a common duct 79 in portion 74 of the valve member 63. A series of ports 48 in valve-sleeve 42 conduct fluid from duct 79 into the inner ends of cylinders 46 in rotative succession. The fluid is drawn into cylinders 46 by the radial outward movement of pistons 47. A pair of cylindrical exhaust ducts 81 extend from the inner portion 74 of valve member 63, are closed at their outer ends by a valve casing 61, and are communicatively connected to a common port 82. Fluid is forced from the cylinders 46 through the ports 48 in rotative succession into the duct 82 from which the fluid is conducted under pressure via ducts 81 to a port 82^a which is formed in valve member 63 and communicates with the outlet port 66 in ring-valve 64. The valve 64 controls the outflow of the fluid from valve member 63 to the pipe 67 which returns the fluid without pressure to the reservoir 58.

A pair of arcuate grooves 83 in the periphery of portion 73 of stationary valve-member 63 are

communicatively connected by ports 84 to one of the inlet ducts 77. A pair of arcuate ducts 85 in the periphery at the opposite side of portion 73 of valve member 63 are communicatively connected by ports 85^a to one of the return ducts 81. By means of these arcuate ducts the fluid pressure exerted on the ring-valve 64 is balanced to permit the free rotation of ring-valve 64. Arcuate grooves 86 in the portion 74 of stationary valve member 63 are communicatively connected by ports 87 to one of the inlet ducts 77. Arcuate grooves 88^a disposed oppositely to the grooves 86 are provided in the opposite portion of the periphery of the portion 74 of valve member 63 and are communicatively connected by ports 89 to one of the exhaust ducts 81. Fluid in grooves 87, 88 cause the transverse pressure between the rotor and the valve member 63 to be balanced against the transverse pressure produced on the opposite sides of valve member 63 due to the pressure of the fluid exerted on one side of the rotor.

The ring 50, which is provided with tracks 55 for the rollers 54 carried by the pistons 47, is mounted to slide transversely in the casing 37 to vary its eccentricity and the length of the piston strokes for volumetric variation of the fluid flowing to and exhausted from the radial cylinders 46. Ring 50 is provided with rectilinear surfaces which are slidably fitted to rectilinear surfaces 33^a formed on the ring 37. A pair of screws 89^b, 90^b, which are threaded to caps 91, 92, respectively, and disposed on opposite sides of ring 50, are adapted to adjust said ring into positions of different eccentricity for varying the length of the piston strokes.

In some instances it is desirable to use the hoisting mechanism without using the hydraulic braking mechanism and in other instances it is desirable to vary the volumetric flow of the hydraulic fluid. By adjustment of screws 89^b, 90^b, the ring 50 may be slidably shifted into concentric relation with the rotor so that the pistons 47 will not move radially for the circulation of fluid from tank 58 when no braking effect is desired or the eccentricity may be varied to correspondingly vary the volume of flow of the fluid through the brake mechanism.

In the operation of hoisting mechanism of the type described, it is desirable to permit the load to be quickly lowered by gravity and the reversible drum to run freely until the load is to be arrested. The invention provides mechanism for automatically controlling the torque pressure of the fluid in the braking mechanism for stopping the load and drum after a predetermined drop of the load, and progressively increase said pressure as the load approaches its predetermined position. This mechanism is controlled by the rotation of the winding drum 25 and operates the ring-valve 64 to control the torque pressure of the fluid in the cylinders 46 which retards the rotation of the drum during the lowering of the load. This mechanism comprises a sprocket wheel 100 which is fixed to the shaft 24 of the drum 25 and is rotatable therewith; a chain 101 driven by sprocket 100; a sprocket wheel 102 driven by chain 101 and fixed to a shaft 103; a gear casing 104 in which shaft 103 is journaled, through which said shaft extends, and which is supported on an angle plate 105 which is secured to the supporting structure for the hoisting mechanism; a bevel pinion 106 fixed to the shaft 103 in gear case 104; a bevel gear 108 meshing with pinion 106; a shaft 109 fixed to gear 108 and jour-

naled in gear case 104; a sprocket wheel 110 fixed to the outer end of shaft 109; a sprocket chain 111 driven by sprocket wheel 110; a sprocket wheel 112 which is driven by chain 111 and rotatably mounted on the shaft 70; a pair of forked arms 113 which are fixed to shaft 70 at the sides of sprocket 112, respectively; and a pair of studs 114 carried by chain 111 which are adapted to enter the recesses 115 in the outer ends of arms 113 and intermittently to oscillate said arms to rotate shaft 70 which, through pinion 69 and gear 71, rotates the arcuate port 66 in the ring-valve 64 to gradually reduce the exhaust of hydraulic fluid from the cylinders 46 through valve sleeve 42, ducts 82, 81, port 82^a, to the ring-valve 64 for gradually increasing the torque pressure in cylinders 46 and for entirely cutting off the exhaust of fluid from the cylinders and locking the drum and its load when the load has reached its predetermined lowered position.

The outer end of shaft 70 for rotating valve 64 is supported in a plate 117 which is secured by bolts to the cover 118 of the gear case 104 and is also secured to the cap 91 on the hydraulic brake casing. Adjustable shoes 117^a are provided for guiding the inner faces of chain 111 adjacent the sprocket 112. Shoes 118 are also provided for guiding the chain 111 into the notches 115 in arms 113. An arm 120 is pivoted to the back of plate 117, carries a roller 121 which engages a disk 122 which is fixed to the shaft 70 and is engaged by a torsion spring 123 to press the roller 121 on arm 120 into notches 124 in disk 122 to prevent overthrow of the shaft 70 and arms 113 when the studs 114 pass out of the notches 115 in arms 113. The movement imparted to shaft 70 during a full cycle of movement of the arms 113 is sufficient to rotate the ring valve 64 to completely cut off communication between exhaust ports 81 in the stationary valve member 63 and the pipe 67 and lock the fluid in the cylinders. Chain 101, sprocket 102, pinion 106 and gear 108 exemplify speed-reducing gearing, operable from the drum shaft 24, for intermittently and automatically operating the ring-valve 64 for causing a gradual increase of the torque pressure in the hydraulic cylinders 46 produced by the pistons 47 in rotative succession, as the load descends, and to cut off the exhaust of fluid, when the load has dropped to, the predetermined point at which it is to be stopped. The outlet port 66 in ring-valve 64 terminates in a constricted portion 66^a, for more gradually cutting off the discharge of fluid, as the load nears the point where it is to be stopped by the full closure of port 82^a.

During the operation of the drum 25 in the direction necessary for lifting the load, the rotor 40 and the pistons carried thereby will be rotated in the reverse direction from that in which the drum is rotated when the load is dropped and automatic braking occurs, the rotor of the hydraulic brake mechanism will be driven in the reverse direction with the drum, and no braking is desired. This reversal of the rotor will reverse the circulation of fluid through ducts 81 and 77. Provision is made for preventing the braking of the rotor by this reversed circulation. For this purpose, the fluid which is discharged from the cylinders into one of the ducts 77 in the stationary valve member 63 is by-passed from said ducts into one of the ducts 81 through which fluid is drawn into the cylinders, by means of a loop of pipe 126. The ends of pipe 126 are connected to the outer end of the valve housing 61 communi-

catively with said ducts 77 and 81, respectively. A check valve 128 is included in the pipe 126 to prevent this by-pass of the fluid during the operation of the drum and brake mechanism in lowering the load. During this reverse operation of the rotor of the hydraulic brake mechanism, the fluid will be freely circulated from the cylinders via ports 77, pipe 126 in which check valve 128 is included, a duct 81 to the cylinders in rotative succession so that there will be no torque pressure in the brake mechanism and it will be automatically ineffective for braking during lifting operations of the drum, until the valve 64 is automatically rotated into its open position to permit the exhaust of fluid from cylinder 46.

The operation of the hydraulic braking mechanism will be as follows: Assuming the load carried by the hoisting block 30 to have been raised, the cable will be wound on the drum 25. When the load is to be dropped, the current to the magnetic clutch 32, 33 will be cut off and the drum 25 and the rotor of the hydraulic brake mechanism will be free to be driven by the gravitation of the load on the block 30. The rotor-body of the hydraulic brake mechanism will be rotated in the direction of the arrow indicated in Fig. 5. The centrifugal force on the pistons 47 will tend to move them outwardly in the cylinders 46 and the rollers 54 will engage the eccentric tracks 55 on ring 50. The outward movement of the pistons will draw fluid into the cylinders in rotative succession through the ports 48 in the valve sleeve 42. During the inward movements of the pistons 47 in the cylinders 46 by the eccentric tracks 55, the fluid in the cylinders will be forced outwardly therefrom in rotative succession through ports 48 in the valve-sleeve 42 to produce a torque pressure in the cylinders against the pistons. When the ring valve 64 is in the position illustrated in Fig. 9, the maximum volume of hydraulic fluid will be drawn into cylinders 46 in rotative succession from the reservoir 58 via intake pipe 60, duct 65 in ring-valve 64, ducts 78, 77 and 79, and the ports 48 in valve sleeve 42, and an equal volume of fluid will be discharged from the cylinders 46 in rotative succession by the inward movement of pistons 47 into the reservoir 58 via ports 48 in valve sleeve 42, ducts 82, 81 and 82^a in stationary valve member 63, ports 66 in valve 64, and pipe 67. The hydraulic brake mechanism will then produce no substantial braking effect upon the drum and its load. This condition will continue until ring-valve 64 commences to close to produce torque pressure in the cylinders 46 and against the pistons 47 and retard the sliding movement of the pistons and rotation of the rotor by the eccentric tracks 55. When the chain 111, which is continuously driven from the drum shaft 24, has been operated to move studs 114, which are carried by said chain, into the recesses 115 in the outer ends of arms 113, the continued movement of said studs around sprocket 112 on shaft 70 will impart movement to said shaft and operate the pinion 69 to rotate gear 71 on the valve-ring 64 to progressively close the duct 82^a in stationary valve member 63, and restrict the exhaust of fluid from the cylinders, via ports 48 in valve sleeve 42, ducts 82, 81 and 82^a in stationary valve member 63, duct 66, and pipe 67 to the reservoir 48. As port 82^a is progressively closed by the valve-ring 64, the torque pressure in the cylinders will be progressively increased until the exhaust of fluid is completely cut off, and then the fluid in the cylinders in which the pistons have

been shifted outwardly blocks the inward movement of the pistons and prevents the rotation of the rotor.

Assuming, for example, a load weighing 300 pounds is suspended from the block 30 and a predetermined drop of 33 feet is desired, and the current has been cut off from the magnetic clutch 32, 33, the released load will continue to drop and rotate the drum 25 while ring-valve 64 remains in its fully open position (Fig. 9) and the hydraulic torque pressure in the brake will be approximately zero. During this operation, sprocket wheel 100, chain 101, sprocket wheel 102, pinion 106, gear 108 will operate the sprocket 110 to drive the chain 111 so that the studs 114 will travel without shifting the ring-valve 64 until the load has dropped, for example, approximately 27 feet. The studs 114 will then enter the notches 115 in arms 113 and commence to rotate shaft 70 which through pinion 69 and gear 71, will rotate ring-valve 64 in the direction indicated by the arrow in Fig. 8, and progressively close duct 82^a as this occurs. The restriction of the outflow of hydraulic fluid from the cylinders in rotative succession causes the pressure to be built up in cylinders 46 by the radial inward movement of the pistons 47. During an additional drop of approximately six feet, ring-valve 64 will completely cut off the outflow of fluid from ducts 81 and the torque pressure in the cylinders will be increased to cause the drum to stop at the end of a 33 foot drop. During this closing cycle of the duct 82^a the torque pressure in the cylinders gradually decelerates the dropping of the load without shock until it is automatically and definitely arrested at the predetermined point.

During the load lifting operations, the drum 25 will be reversely rotated through clutch 32 and 33 from the reversible motor 31 and the rotor of the hydraulic brake mechanism will be rotated with the drum. This reversal of the rotor will reverse the flow of fluid through the valve member 63 and it will be drawn into the cylinders 46 through ducts 81 and exhausted through ducts 77. The fluid circulated by the rotor will circulate from the outer end of one of the ducts 77 through pipe 126 in which check valve 128 is included, to one of the ducts 81 so that the block 30 and load can be raised without any braking effect on the rotor until port 82^a opens, after which pipe 67 functions as an intake and pipe 60 as an exhaust during the remainder of the lifting operation. During the initial portion of the lifting operation, studs 114 on chain 111 will be shifted in the reverse direction and return arms 113 and ring-valve 64 to their normal positions. The automatic brake control mechanism will then again be effective to control the ring-valve 64 for producing torque pressure in the cylinders 46 during the succeeding lowering operation of the load.

When no braking of the load is required for extended periods, screws 89, 90 can be adjusted to set ring 50 into concentricity with the rotor so that no radial movement will be imparted to the pistons 47 and no circulation of the oil will occur. The screws 89, 90 may also be adjusted to vary the eccentricity of ring 50 for varying the length of the piston strokes and the volume of the fluid displaced from the cylinders by the pistons. Usually the drum 25 and rotor of the brake are operated at a sufficiently high speed to exert centrifugal force on the pistons 47 for moving them radially outward, but when the drum is operated

at an unusually low speed the circular grooves 51^a in the ring-sides 51 will effect this outward radial movement of the pistons through the rollers 52^a on the shafts 52 which are carried by the pistons 47.

Shaft 103 which is driven from the drum shaft 24 may be connected by a coupling 130 to operate a suitable limit switch 131 for the electric motor 31.

The invention exemplifies hydraulic braking mechanism of the pressure torque type which is efficient in operation to gradually control the braking of the load. The invention also exemplifies a simple construction in which a ring-valve around a stationary valve member is utilized to control the torque pressure. The invention also exemplifies mechanism for automatically controlling the ring-valve for progressively increasing this torque pressure to gradually decelerate the dropping of the load and positively stop the load at a predetermined point without shock. The invention also exemplifies a brake in which the volume controlling ring is non-rotatable and adjustable for volumetric variation of the fluid circulated. The invention also exemplifies hydraulic brake mechanism of the pressure torque type which is efficient in operation and makes it possible to expedite the dropping of the load under control of the brake.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. Hydraulic brake mechanism comprising a driven rotor provided with radial cylinders and pistons slidable in the cylinders, a casing provided with an eccentric track for operating the pistons to produce torque pressure in the fluid in the cylinders, valve means for controlling the flow to and the exhaust of fluid from the cylinders in continuous rotative succession, means for controlling the outflow of fluid from the exhaust-control means and producing torque pressure in the cylinders for braking the rotor, and means controlled by the operation of the rotor for automatically shifting the outflow control means and progressively increasing the torque pressure in the cylinders, said last named means including an element rotated by the rotor and speed-reducing gearing between said element and the outflow control means.

2. Hydraulic brake mechanism comprising a driven rotor provided with radial cylinders and pistons slidable in the cylinders, a casing provided with an eccentric track for operating the pistons to produce torque pressure in the fluid in the cylinders, valve means for controlling the flow to and the exhaust of fluid from the cylinders in continuous rotative succession, means for controlling the outflow of fluid from the exhaust-control means and producing torque pressure in the cylinders for braking the rotor, and means controlled and intermittently operable by the rotor for automatically shifting the outflow control means and progressively increasing the torque pressure in the cylinders, said last named means including an endless element having a constant driving connection with the rotor and a lost-motion connection between said endless element and the outflow control means.

3. Hydraulic brake mechanism comprising a

driven rotor provided with radial cylinders and pistons slidable in the cylinders, a casing provided with an eccentric track for operating the pistons to produce torque pressure in the fluid in the cylinders, valve means for controlling the flow of fluid to and the exhaust of fluid from the cylinders in continuous rotative succession, rotary means for controlling the outflow of fluid from the exhaust control means and producing torque pressure in the cylinders for braking the rotor, and means controlled by the operation of the rotor for automatically shifting the outflow control means and progressively increasing the torque pressure in the cylinders, said last mentioned means comprising speed reduction gearing having a constant driving connection with the rotor intermittently acting mechanism and speed-reducing gearing between said intermittently acting mechanism and the outflow control means.

4. Hydraulic brake mechanism comprising a driven rotor provided with radial cylinders and pistons slidable in the cylinders, a casing provided with an eccentric track for operating the pistons to produce torque pressure in the fluid in the cylinders, valve means for controlling the flow of fluid to and the exhaust of fluid from the cylinders in continuous rotative succession, rotary means for controlling the outflow of fluid from the exhaust control means and producing torque pressure in the cylinders for braking the rotor, and means controlled by the operation of the rotor for automatically shifting the outflow control means and progressively increasing the torque pressure in the cylinders, said last mentioned means comprising gearing driven by the rotor, an endless element driven by said gearing, variable intermittently acting mechanism operated by said endless element for rotating said outflow control means.

5. Hydraulic brake mechanism comprising a driven rotor provided with radial cylinders and piston slidable in the cylinders, a non-rotatable casing provided with an eccentric track for operating the pistons to produce torque pressure in the cylinders, valve means including a sleeve in the rotor and a centrally disposed non-rotatable member secured in the casing, for controlling the flow of fluid to and from the cylinders in continuous rotative succession, an inlet for fluid in the casing, an outlet for fluid in the casing, and a rotary valve around said stationary member for controlling the output of fluid from the stationary member to said outlet for producing torque pressure in the cylinders and braking the rotor.

6. Hydraulic brake mechanism comprising a driven rotor provided with radial cylinders and pistons slidable in the cylinders, a non-rotatable casing provided with an eccentric track for operating the pistons to produce torque pressure in the cylinders, valve means including a sleeve in the rotor and a centrally disposed non-rotatable member secured in the casing, for controlling the flow of fluid to and from the cylinders in continuous rotative succession, an inlet for fluid in the casing, an outlet for fluid in the casing, and a ring-valve rotatable around said stationary member for controlling the outflow of fluid from the stationary member to said outlet for producing torque pressure in the cylinders and braking the rotor.

7. Hydraulic brake mechanism comprising a driven rotor provided with radial cylinders and piston slidable in the cylinders, a non-rotatable casing provided with an eccentric track for operating the pistons to produce torque pressure in

the cylinders, valve means including a sleeve in the rotor and a centrally disposed non-rotatable member secured in the casing and provided with ducts for delivering fluid to and from the cylinders through said sleeve for controlling fluid to and from the cylinders in continuous rotative succession, fluid ducts between the sleeve and stationary members for balancing the off-center pressure on the rotor, and means for controlling the outflow of fluid from the stationary member to said outlet for producing torque pressure in the cylinders and braking the rotor.

8. Hydraulic brake mechanism comprising a driven rotor provided with radial cylinders and pistons slidable in the cylinders, rollers on the outer ends of the pistons, respectively, a non-rotatable casing around the rotor, a ring transversely slidable and non-rotatably confined in the casing, and having a circular track engaging said rollers for operating the pistons to produce torque pressure in the cylinders, means for slidably adjusting the ring to vary its eccentricity and into coaxial relation with the rotor, valve means for controlling the flow of fluid to and from the cylinders in continuous rotative succession, and means for controlling the outflow of fluid from the cylinders and producing torque pressure therein for braking the rotor.

9. Hydraulic brake mechanism for a reversible hoisting drum comprising: a supporting structure for the drum, a rotor driven by and coaxial with the drum and provided with radial cylinders and pistons slidable in the cylinders, a casing fixedly secured to the structure and provided with an eccentric track for operating the pistons to produce torque pressure in the fluid in the cylinders, a reservoir for the fluid carried by said structure, said casing being provided with an inlet and an outlet communicatively connected to the reservoir, means in the casing for conducting fluid from said inlet to the cylinders and from the cylinders to said outlet in continuous rotative succession, means in the casing for controlling the flow of fluid from said conducting means to said outlet for producing torque pressure in the cylinders for braking the rotor and the drum when the drum and rotor are driven in one direction, and means for by-passing the fluid from the inlet to the outlet when the rotor is driven in the reverse direction.

10. Hydraulic brake mechanism for a hoisting drum comprising: a supporting structure for the drum, a rotor driven by and coaxial with the drum and provided with radial cylinders and pistons slidable in the cylinders, a casing fixedly secured to the structure and provided with an eccentric track for operating the pistons to produce torque pressure in the fluid in the cylinders, means for adjusting the eccentric ring to vary its eccentricity for varying the volumetric flow of the hydraulic fluid by the pistons in the cylinders, a reservoir for the fluid carried by said structure, said casing being provided with an inlet and an outlet for fluid communicatively connected to the reservoir, a stationary member in the casing for conducting fluid from said inlet to the cylinders and from the cylinders to said outlet in continuous rotative succession, a rotary valve in the casing around said stationary member for controlling the flow of fluid from said conducting means to said outlet for producing torque pressure in the cylinders for braking the rotor and drum, and mechanism operable from the drum for intermittently rotating said valve to progres-

sively increase the torque pressure in the cylinders.

11. Hydraulic brake mechanism comprising a driven reversible rotor provided with radial cylinders and pistons slidable in the cylinders, a casing provided with an eccentric track for operating the pistons in the cylinders, a reservoir for fluid, valve means for controlling the flow of fluid from the reservoir to the cylinders and from the cylinders in continuous rotative succession, means for controlling the outflow of fluid from the valve means to the reservoir and producing torque pressure in the cylinders for braking the motor when it is driven in one direction, and means for automatically by-passing the fluid around the outflow control means when the rotor is driven in the opposite direction.

JAMES E. MORTON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

	Number	Name	Date
	1,476,170	Morlan	Dec. 4, 1923
	2,062,670	Luebkert	Dec. 1, 1936
5	2,154,690	McFarland	Apr. 18, 1939
	1,843,793	Wagner	Feb. 2, 1932
	2,246,923	Meunier	June 24, 1941
	1,282,438	Lamb	Oct. 22, 1918
	560,210	Herdman	May 19, 1896
15	1,695,289	Lee	Dec. 18, 1928