

C. M. MANLY.
POWER TRANSMITTING MECHANISM.
APPLICATION FILED MAR. 13, 1911.

1,179,737.

Patented Apr. 18, 1916.

2 SHEETS—SHEET 1.

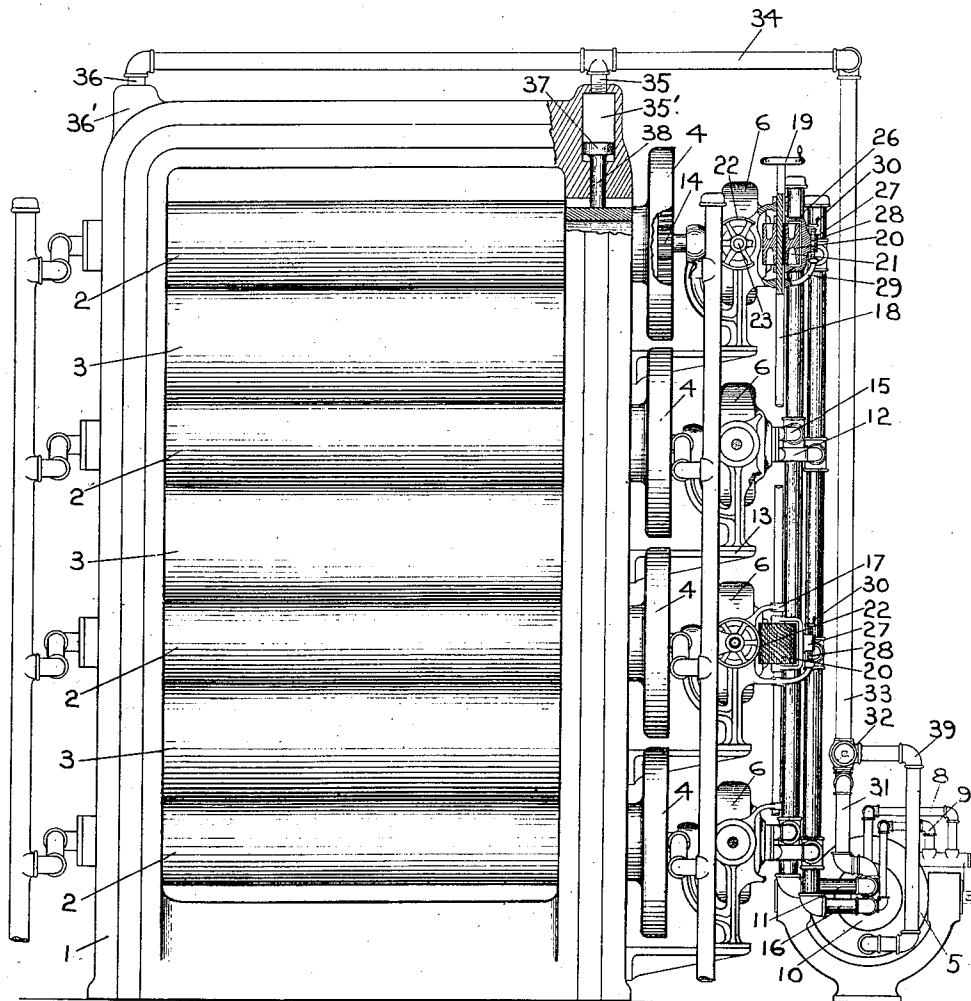


Fig. 1

Attest:
A. Newman
Ada J. Miller

Inventor:
Charles M. Manly,
by *W. B. Morton* Atty

C. M. MANLY.
POWER TRANSMITTING MECHANISM.
APPLICATION FILED MAR. 13, 1911.

1,179,737.

Patented Apr. 18, 1916.
2 SHEETS—SHEET 2.

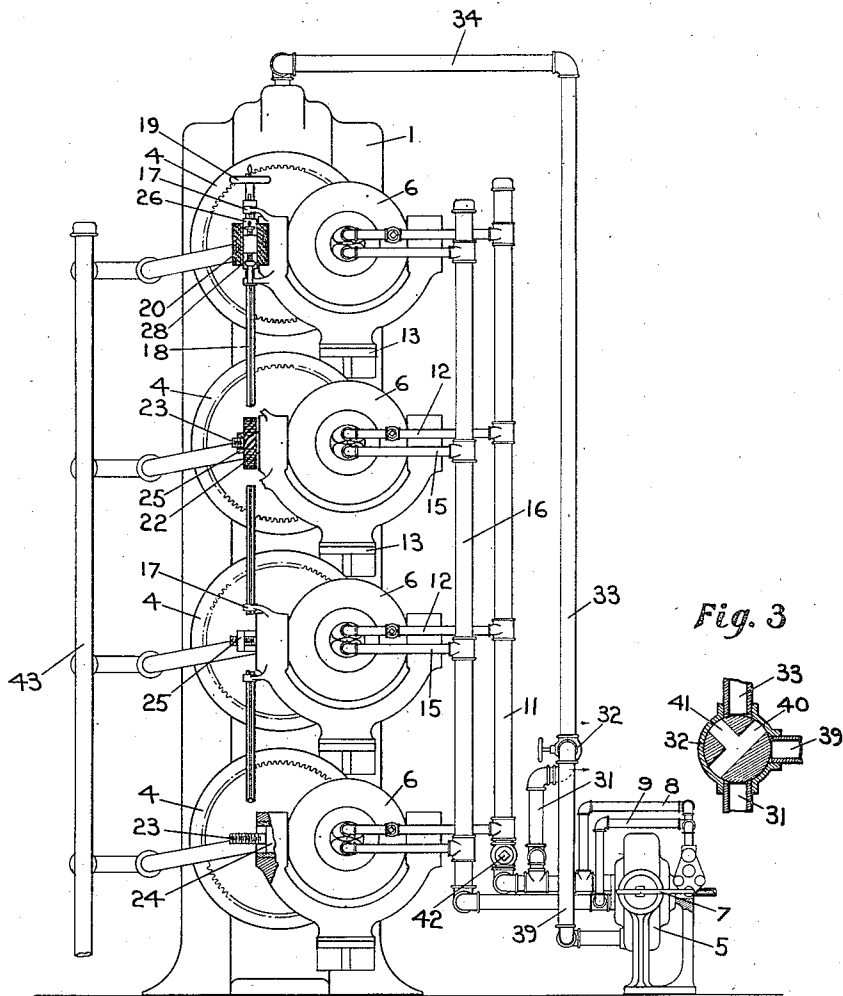


Fig. 2

Fig. 3

Attest:
S. Krummer
W. J. Miller

by

W. B. Morton

Inventor:
Charles M. Manly

Atty

UNITED STATES PATENT OFFICE.

CHARLES M. MANLY, OF BROOKLYN, NEW YORK.

POWER-TRANSMITTING MECHANISM.

1,179,737.

Specification of Letters Patent.

Patented Apr. 18, 1916.

Application filed March 13, 1911. Serial No. 614,128.

To all whom it may concern:

Be it known that I, CHARLES M. MANLY, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Power-Transmitting Mechanism, of which the following is a specification.

My invention relates to power transmitting mechanism and more particularly to mechanism for driving the rolls of machines in which material of any kind is passed between rolls turning in conjunction with each other and forced together by pressure, such as for instance, machines for calendering or finishing paper. Heretofore the rolls of machines of this type have been driven by directly driving the first roll only, all the other rolls being driven by the frictional contact between the rolls, the rolls being held together with high pressure. This method results in the loss of considerable power since the efficiency of transmission between two frictionally engaging rolls is very low and when there are a number of successive friction drives the efficiency of the driving power transmitted from the first roll to the last roll may be less than ten per cent. Further, to start a machine of this character requires a very large amount of torque on account of the starting friction resulting from the high pressure with which the rolls are held together and it is not desirable to reduce the pressure on the rolls when starting for the reason that to do so results in a loss of material.

The objects of my invention are to provide a driving mechanism for machines of this character in which very little power will be lost from the frictional engagement of the rolls and which will be capable of exerting a large driving torque when desired so that the machine may be started without reducing the pressure on the rolls.

A further object of the invention is to provide a driving mechanism for a machine of the character described which is simple in construction and efficient in operation.

In the accompanying drawings and annexed specification I have disclosed a preferred embodiment of my invention as applied to a calendering machine. It is however to be understood that my invention is not limited to this application or to the details of construction disclosed, but covers all

modifications of the same which fall within the scope of the appended claims.

In the drawings, Figure 1 is a front elevation of a calendering machine embodying my invention. Fig 2 is a side elevation of the machine. Fig. 3 is a detail view hereinafter referred to.

Referring to the drawings, in which the same reference characters indicate the same parts throughout the several views, 1 represents the frame of the machine which may be of any desired form suitable to support the desired number of superposed rolls, forming the so-called "stack", and my improved driving mechanism, the stack shown consisting of four hollow steel rolls 2 and three intermediate paper rolls 3, arranged one above the other with their surfaces contacting in the usual manner. All of the rolls are mounted in sliding bearings and are, by a mechanism which will be hereinafter described, held together under high pressure. Each of the steel rolls 2 is provided at one end with an internally toothed gear wheel 4 whereby driving power may be applied separately to each of said steel rolls.

For driving the rolls I have provided a hydraulic transmission system embodying a single variable stroke pump 5 for the stack and a separate variable stroke motor 6 for each roll driven, the pump and motors being preferably of the character disclosed in my application, Serial No. 525,925 filed November 2, 1909. As the pump and motor mechanism *per se* form no part of my present invention I have not shown the details of their construction in the drawings of this application, but I will describe so much of their construction and operation as is necessary for an understanding of this invention. The pump comprises a plurality of radially arranged cylinders rotated from a common driving shaft and each provided with a piston adapted to engage a surrounding ring, held against rotation but capable of adjustment transversely of the shaft whereby it may be positioned either concentric with the center of rotation or eccentric thereto to any desired degree within the limits of movement permitted. When the ring is in its concentric position there is no relative movement between the pistons and their cylinders and consequently no fluid will be circulated by the pump and when the ring

is shifted to an eccentric position the pistons will be reciprocated on each revolution an amount proportionate to the eccentricity of the ring and a corresponding amount of fluid will be circulated. The position of the ring is controlled by a hand lever 7 which controls a fluid pressure shifting mechanism operated by fluid received from the main circuit of the transmission through the pipes 8 and 9.

The fluid under pressure from the pump is delivered from a port in the central valve 10 into pipe 11 which is connected by means of pipes 12 to each of the motors 6. The motors are of substantially the same construction as the pump except that the position of the piston operating ring is preferably controlled by a screw operated mechanism to be hereinafter described. The motors are supported on brackets 13 adjacent the steel rolls and are provided with spur gears 14 engaging the internal gears 4 of the steel rolls. The fluid from the motors is returned to the pump through pipes 15 connected to the main return pipe 16 which is connected to the low pressure port of the control valve 10.

For shifting the piston operating rings of the motors, the following mechanism is provided: Rotatably mounted in bearings 17 formed on each motor frame is a vertical shaft 18 provided on its upper end with a hand wheel 19. Slidably mounted on the shaft 18 are a plurality of spiral gears 20, one for each motor, the gears being held against rotation relatively to the shaft by suitable keys 21, only one of which is shown. Each of the gears 20 meshes respectively with a corresponding spiral gear 22 having a screw threaded engagement with a pin 23 projecting from the end of the bearing 24 of the piston operating ring and held against bodily movement between the end of the motor frame and a bracket 25 formed thereon, so that rotary movement of the spiral gears 22 shifts the piston operating rings and consequently varies the strokes of the pistons of all the motors simultaneously. In order to separately control the several motors, the spiral gears 20 on the vertical shaft 18 are each provided with means whereby they may be independently shifted longitudinally of shaft 18, which movement also causes rotation of the spiral gears 22, as is obvious. These means comprise yokes 26, slidable on the shaft 18 and embracing the gears 22 and provided with screw threaded bores 27. Working in the bores 27 are screw shafts 28 rotatably supported on brackets 29 formed on or attached to the motor frames and provided with crank handles 30 whereby they may be manually adjusted.

As stated above the bearings of the rolls are all slidingly mounted in the frame so that the rolls may be held in contact with

the proper pressure and I have provided means which will now be described whereby the fluid pressure generated by the pump may be utilized for this purpose. Connected to the delivery pipe 11 of the pump is a pipe 31 leading to a 3-port valve 32, shown in cross section in Fig. 3. Leading from the valve 32 is a vertical pipe 33 connected to a horizontal pipe 34 extending across the top of the frame and connected at 35 and 36 respectively to cylinders 35', 36' formed in the frame above the bearings of the top roll of the stack. Mounted in each of the cylinders is a piston 37 only one of which is shown, having a depending stem 38 engaging respectively the upper sides of the two bearings of the top roll. The third port of the valve 32 is connected by a pipe 39 to the lower part of the pump casing, to permit the fluid to return to the pump when the pressure is relieved. The valve body of the 3-port valve is provided with a transverse bore 40 extending diametrically through the same and with a branch bore 41 at right angles to the main bore and extending therefrom through one side only of the valve body. In the position shown in the drawings the valve is set to prevent communication between any of the pipes, but it is obvious that an eighth of a revolution in a counter clockwise direction will connect the pipe 31 from the high pressure pipe 11 of the fluid circuit to the pipe 33 leading to the pressure cylinders 35', 36' for the bearings of the rolls, whereas a movement of the same extent in the opposite direction will connect the pipe 33 with the pipe 39 leading to the pump casing, to permit the pressure to be relieved. A stop cock 42 is provided in the pressure pipe 11 so that the motors may be cut off from the pump, for a purpose which will be hereinafter described. The steel rolls 2 are provided with the usual fluid connections 43, at each end, whereby a heating or cooling fluid may be circulated through them if desired.

The operation of the mechanism described is as follows: Assuming the pump and motors all to be in their "no-stroke" positions and no pressure on the fluid in the pipe 33 leading to the pressure cylinders 35', 36', the operator sets the stop-cock 42 to cut off communication between the pump and motors and turns the 3-port valve 32 to connect the pipe 31 to the pipe 33. He then adjusts all the motors by means of the hand wheel 19 to have the desired speed when the pump is running at the preferred stroke for normal operation, and then by means of the crank-handles 30 adjusts all the motors except the first or lowermost one to have a speed slightly less than the first motor so that a small portion of the power will be transmitted from roll to roll by the friction

of their contacting surfaces, this being necessary to give the proper finish to the paper. The operator now starts the fluid in circulation by shifting the piston operating ring of the pump to a slightly eccentric position so that the pump delivers fluid under pressure to the cylinders 35' 36'. When the pressure on the rolls is sufficiently high the operator returns the pump to its "no-stroke" position and turns the 3-port valve to cut off the pipe 33 from communication with either the pipe 31 or the pipe 39 and thereby hold the rolls under pressure. The machine is now ready to be started. The stop-cock 42 is opened to establish communication between the pump and motors and the pump stroke control lever slowly shifted out of its "no-stroke" position to start the motors gradually with a very slowly increasing speed. As the torque exertable by the motors varies inversely as the speed, it is obvious that the amount of torque obtainable is limited only by the strength of the parts, and as the motors are capable of any speed between zero and their maximum speed, their speed may be increased by imperceptible degrees thereby bringing the parts up to normal speed without putting injurious strain on the paper.

It will be readily seen that the amount of power saved by my improved driving mechanism is very large. There are no successive friction drives. Each steel roll drives but one paper roll, the upper steel rolls deriving substantially all their power from their individual motors, sufficient power only being transmitted frictionally from the preceding paper roll to give the desired finish to the paper. Further with my improved driving mechanism the number of rolls may be increased indefinitely without increasing the power beyond a corresponding amount whereas with the friction drive now used the power applied to drive the first roll has to be increased much more than an amount proportionate to the number of rolls added to provide for the increased loss in transmission.

By means of the independent adjusting devices with which each motor is equipped as described above, the motors may be caused to tend to revolve at any speed desired with reference to each other so that variations in relative frictional resistances encountered may be compensated for as well as any desired tendency of the rolls to slip on each other may be brought about so that the finish given to the paper may be varied as desired.

It is a well known fact that in the process of calendering the paper changes somewhat in length and as the motors all receive their fluid pressure from the same pipe they will automatically differentiate their relative speeds to accommodate the alterations and

at the same time maintain the proper tension on the paper.

What I claim is,

1. In a machine of the character described, the combination with a plurality of cooperating rolls, of a driving mechanism therefor comprising separate variable speed hydraulic motors for certain of said rolls and means for simultaneously controlling the speeds of all said motors, substantially as described.

2. In a machine of the character described, the combination with a plurality of cooperating rolls, of a driving mechanism therefor comprising separate variable speed hydraulic motors for certain of said rolls and means for simultaneously and separately controlling the speeds of said motors, substantially as described.

3. In a machine of the character described, the combination with a plurality of cooperating rolls, of a driving mechanism therefor comprising separate hydraulic motors for certain of said rolls and a variable capacity pump for supplying fluid under pressure to said motors, substantially as described.

4. In a machine embodying a plurality of rolls, the combination of a plurality of motors each independently connected to a roll, means for independently varying the relative speeds of the said motors, means operating on the said motors for conjointly varying the speed of said motors from an unchanged source of power, means for furnishing driving power to said motors and means acting on said power furnishing means for conjointly varying the power supplied to the said motors, substantially as described.

5. In a machine of the character described, the combination with a plurality of rolls arranged with their axes parallel and in the same plane and having means for holding them pressed toward each other, of a driving mechanism therefor comprising a plurality of variable stroke hydraulic motors and means for simultaneously varying the strokes of said motors, substantially as described.

6. In a machine of the character described, the combination with a plurality of rolls arranged in a series with the curved surface of the intermediate rolls adjacent the curved surfaces of the preceding and succeeding rolls of the series, for the passage of material therebetween, of means for driving said rolls comprising separate hydraulic motors for certain of said rolls and a variable capacity pump for supplying fluid under pressure to said motors, substantially as described.

7. In a machine of the character described, the combination with a plurality of rolls arranged with their curved surfaces adjacent for the passage of material there-

between, of a hydraulic driving mechanism therefor and means operated by the fluid from said driving mechanism for pressing said rolls toward each other, substantially as described.

8. In a machine of the character described, the combination with a plurality of rolls, having their curved surfaces adjacent for the passage of material therebetween, of a driving mechanism therefor comprising separate variable stroke hydraulic motors for certain of said rolls and a variable capacity pump for supplying fluid under pressure to said motors, substantially as described.

9. In a machine of the character described, the combination with a plurality of rolls having their curved surfaces adjacent for the passage of material therebetween, of a driving mechanism therefor comprising separate variable stroke hydraulic motors for certain of said rolls, a variable capacity pump for supplying fluid under pressure to said motors and means for separately controlling the strokes of said motors, substantially as described.

10. In a machine of the character described, the combination with a plurality of rolls having their curved surfaces adjacent for the passage of material therebetween, of a driving mechanism for said rolls comprising separate variable stroke hydraulic motors for certain of said rolls, a variable capacity pump for supplying fluid under pressure to said motors and means for simultaneously and separately controlling the strokes of said motors, substantially as described.

11. In a calendering machine, the combination with a stack of calendering rolls embodying alternate steel and paper rolls, of a driving mechanism therefor comprising a separate hydraulic motor for each of said steel rolls, substantially as described.

12. In a calendering machine, the combination with a stack of calendering rolls embodying alternate steel and paper rolls, of a driving mechanism therefor comprising a separate variable stroke hydraulic motor for each of said steel rolls and a variable capacity pump for supplying fluid under pressure to said motors, substantially as described.

13. In a calendering machine, the combination with a stack of calendering rolls embodying alternate steel and paper rolls, of a driving mechanism therefor comprising a separate variable stroke hydraulic motor for each of said steel rolls, a variable capacity pump for supplying fluid under pressure to said motors, and means for simultaneously and separately controlling the strokes of said motors, substantially as described.

14. In a mechanism of the class described, the combination with a plurality of cooperating driven elements, of a driving mechanism therefor comprising separate hydraulic motors for said elements, means for simultaneously varying the speed of all said motors and means for independently varying the speed of said motors.

15. In a mechanism of the class described, the combination with a plurality of cooperating driven elements, of a driving mechanism therefor comprising separate variable capacity hydraulic motors for said elements, means for independently varying the capacity of said motors, and means for simultaneously varying their capacity.

16. In a mechanism of the class described, the combination with a plurality of cooperating driven elements, of a driving mechanism therefor comprising separate variable speed hydraulic motors for said elements, means for separately and simultaneously varying the speeds of said motors, and a variable capacity pump for supplying fluid under pressure to said motors.

17. In a mechanism of the character described, the combination with a plurality of cooperating driven elements having engaging moving surfaces, of a driving mechanism therefor comprising separate hydraulic motors for certain of said elements and means for simultaneously and separately varying the speeds of said motors.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses, this 11th day of March, 1911.

CHARLES M. MANLY.

Witnesses:

SIGMUND NEWMAN,
ADA L. MILLER.