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SEGREGATED DRIVE FOR PAPER MACHINES AND THE LIKE

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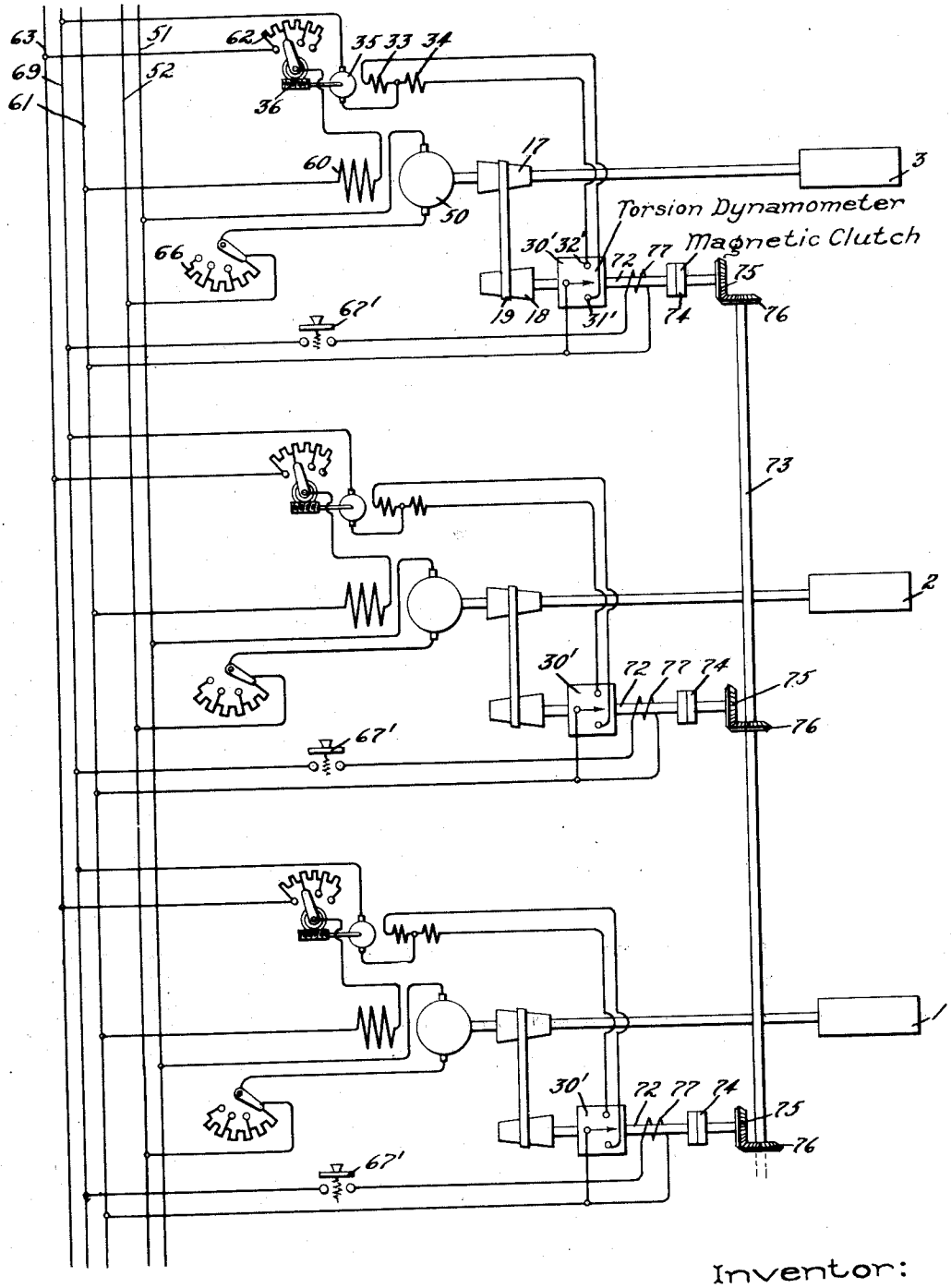

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UNITED STATES PATENT OFFICE.

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SEGREGATED DRIVE FOR PAPER MACHINES AND THE LIKE.

Original application filed February 9, 1920, Serial No. 357,219. Divided and this application filed November 1, 1922, Serial No. 598,405. Renewed October 22, 1924.

My invention relates to a segregated drive for paper machines and the like in which a plurality of the driven elements are normally required to operate in fixed speed relation and in which it is essential that the speed of any individual element of the machine, as well as of the machine as a whole, be readily adjustable.

This application is a division of my former application, Serial No. 357,219, filed February 9, 1920, for segregated drives for paper making machines and the like, in which I have described and broadly claimed the segregated drive of this application and specifically claimed a type of drive employing electrically tied in synchronous motors for effecting the automatic speed control of a plurality of separate driving units.

An object of my invention is to provide an efficient form of segregated drive in which the speed relation of the various machine elements is maintained absolutely fixed, while at the same time this fixed speed relation may be readily adjusted and this accomplished without the use of speed adjusting devices transmitting large amounts of power.

A further object of my invention is to provide an apparatus which from the source of power to the winders is rugged and substantial and in which no complicated or delicate governing or regulating machine is employed, whereby the apparatus may be adjusted and operated by the ordinary mill force and without the attention of skilled electricians.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

The requirements for a satisfactory segregated drive for this type of machine are very severe. There are two separate and distinct conditions of operation imposing different requirements upon the segregated drive. One, a condition of operation and adjustment when the machine is not making paper, but is being adjusted to eliminate the "broke"; and the other, the condition of normal operation after the web has been passed through the elements or sections of the machine and paper is being made. After the machine has been started and brought approximately to the speed desired for making paper and the stock put on the wire, it is necessary that means be provided, whereby each section of the machine may be adjusted from the approximate speed at which it is running to the exact speed necessary to convey the paper from the preceding section to the section under adjustment without stretching sufficiently to break the paper or retardation sufficient to allow the sheet to accumulate at the section in question. After the sheet has been properly adjusted through all of the elements or sections of the machine, it is essential that the speed relation of the various elements be maintained fixed regardless of changes in the load or other changes which tend to disturb the speed at which the driving motor for any individual element tends to run. It is also essential that the controlling means for maintaining the fixed speed relation in question shall operate upon any tendency of an individual element of the machine to vary its speed relation to the remaining elements, as distinguished from operating to correct a departure in speed which has taken place, since otherwise, the paper must in many cases be broken. In other words, the means controlling the fixed speed relation must anticipate the changes for which it must correct. If each element of the paper machine were provided with a regulator which required some change in the speed of the individual element to set it into operation the regulators of all of the machines would be required to be in almost continual operation. If a variation in load should occur on an individual element or section of the machine, this change in load would change the total load required to drive the paper machine as well as the load on the individual element. This would cause an operation of the governor of the steam unit or other source of power for the generator supplying the various motors, where electric motors are used to drive the individual elements of the machine, and consequently, each individual regulator would function. Not only would all of the regulators be in practically continuous operation, but if each of the various regulators did not function in absolute synchronism, one or several breaks in the paper might occur.

According to my invention, all of the mo-

tors driving the various elements of the paper machine are not only maintained in fixed speed relation while the machine is making paper, but the variation in angular movement of any given motor is so slight as to produce the same effect as would be produced if each of the sections of the machine were geared directly from one shaft. Means are also provided whereby the speed of any individual element of the machine, as well as the speed of the machine as a whole, may be readily adjusted. According to my invention, moreover, this speed adjustment of the individual elements of the machine is accomplished without the transmission of large amounts of power as distinguished from an arrangement in which the full torque required to operate each element of the machine is transmitted through an adjustable speed mechanism such for example as the well known belt and cone pulley drive.

In the accompanying drawing, the machine elements 1, 2 and 3 are represented as driven by direct current motors 50 provided with field windings 60. The armatures of the motors are shown connected across mains 51, 52 through the adjustable resistances 66 and the field windings 60 are supplied from the excitation mains 61 and 63. Adjustable resistances 62 are arranged in the circuits of the field windings 60, and these resistances are arranged to be operated by pilot motors 35. The means for causing the elements 1, 2 and 3 to run in fixed speed relation comprises a member represented as a shaft 72, connected to be driven positively from the shaft of each machine element through speed adjusting means including cone pulleys 17 and 18 with belt 19. The members 72 are arranged to be coupled together to run in synchronism by means of the shaft 73. Each shaft 72 is adapted to be connected in positive driving relation to the shaft 73 through a clutch 74 and bevel-gears 75 and 76. It is apparent that any mechanical equivalent of the shaft 73 may be substituted in the combination shown. The clutch 74 is represented as a magnetic clutch controlled by the coil 77 supplied from mains 61 and 69 through the circuit controller 67', although any suitable form of clutch may be used. A torsion dynamometer 30' is shown arranged in the shaft 72 to measure the torque transmitted through this shaft. This dynamometer, which may be of any well known construction, performs the function of a wattmeter. That is to say, these dynamometers indicate whether power is being transmitted to or from the corresponding machine element. The torsion dynamometers are represented as provided with contacts 31' 32' connected respectively to the field windings 33 and 34 of the pilot motors 35.

The operation of the arrangement shown is as follows: During normal operation, the clutches 74 are engaged and the shaft 73 for synchronizing the shafts 72 causes the machine elements 1, 2 and 3 to run in absolutely fixed speed relation. The angular variation in the position of any rotating machine element with respect to the synchronizing shaft 73 is merely that permitted by the corresponding torsion dynamometer and this variation can be reduced to a negligible value. When any torsion dynamometer indicates that the torque being transmitted therethrough is above any desired amount the resistance 62 may be adjusted, either at will, or automaticaly by the dynamometer.

While I have represented a torsion dynamometer interposed in each of the shafts 72, it is apparent that this instrument may be omitted with its function if desired. When an electric drive is used a careful observation of the instruments in the circuits of the driving motors 50 will enable a rough determination to be made of the amount and direction of energy transfer through the synchronizing means.

It is obvious that the various elements of the machine may be started into operation either simultaneously or in succession. To start the machines simultaneously the switches 67' are closed to engage the clutches 74 where magnetic clutches are employed. The resistances 66 will be cut out and the voltage applied to the motor armatures and fields. To operate any machine individually it is merely necessary to disconnect the clutch 74. When any machine is to be started individually the motor 50 is first brought up to speed by cutting out the resistances 66 and, when the speed of the individual element of the machine corresponds approximately to that of the shaft 73, the clutch 74 is engaged.

It is apparent that the arrangement shown in the drawing possesses advantages since the amount of power transmitted through the speed adjusting means and the synchronizing means is but a fraction of the power transmitted from each driving motor 50 to the corresponding machine element. This synchronizing energy is merely that necessary to take care of small variations in the load of the respective machine elements.

While I have described a particular embodiment of my invention with considerable detail, it is obvious that many variations and modifications may be made within the scope of my invention and I aim to cover all such changes in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In a segregated drive for a paper making machine or the like wherein a plurality of units of the machine are required to run in a fixed but adjustable speed relation, a

separate driving motor connected in fixed driving relation with each of said units, mechanical connections between the units through which the power of said motors is exchanged between the units to preserve the predetermined speed relation of the units, and adjusting means included in said connections for permitting the alteration of the speed relation of said driving motors.

2. In a segregated drive for a paper making machine or the like wherein a plurality of units of the machine are required to run in a fixed but adjustable speed relation, a separate driving motor connected in fixed driving relation with each of said units, a shaft mechanically connected to each of said units through which the power of said motors is exchanged between the units for the purpose of preserving the predetermined speed relation of the units, and adjusting means interposed between a portion of said units and said shaft for permitting the alteration of the speed relation of said driving motors.

3. In a segregated drive for a paper making machine or the like wherein a plurality of units of the machine are required to run in a fixed but adjustable speed relation, a separate electric driving motor for each of said units, mechanical connections between the units through which power is exchanged between the units to preserve a predetermined speed relation of the units, adjusting means included in said connections for permitting the alteration of the speed relation of said driving motors, and speed controlling means for certain of said motors, the said means being connected to be automatically operated responsively to the exchange of power through said adjusting means for controlling the speed of the driving motor of the corresponding unit to reduce the amount of power taken from or given to the unit through said connections.

In witness whereof, I have hereunto set my hand this 31st day of October, 1922.

WILBUR L. MERRILL.