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G. S. WITHAM, JR

PAPER MACHINE DRIVE

Filed Sept. 19, 1923 2 Sheets-Sheet 1

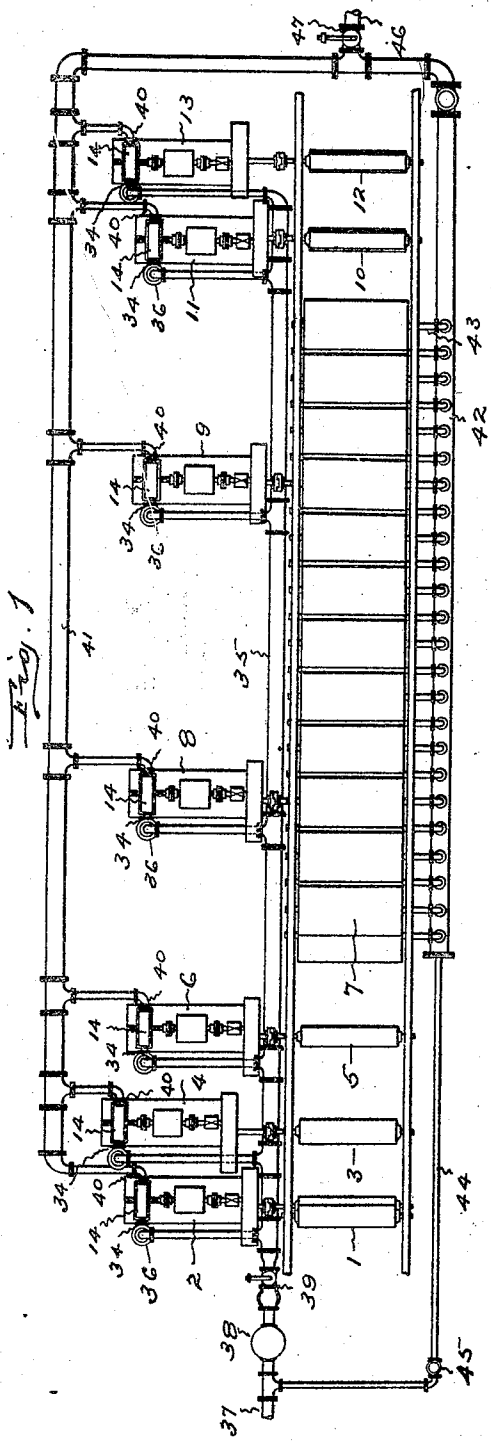


Fig. 1

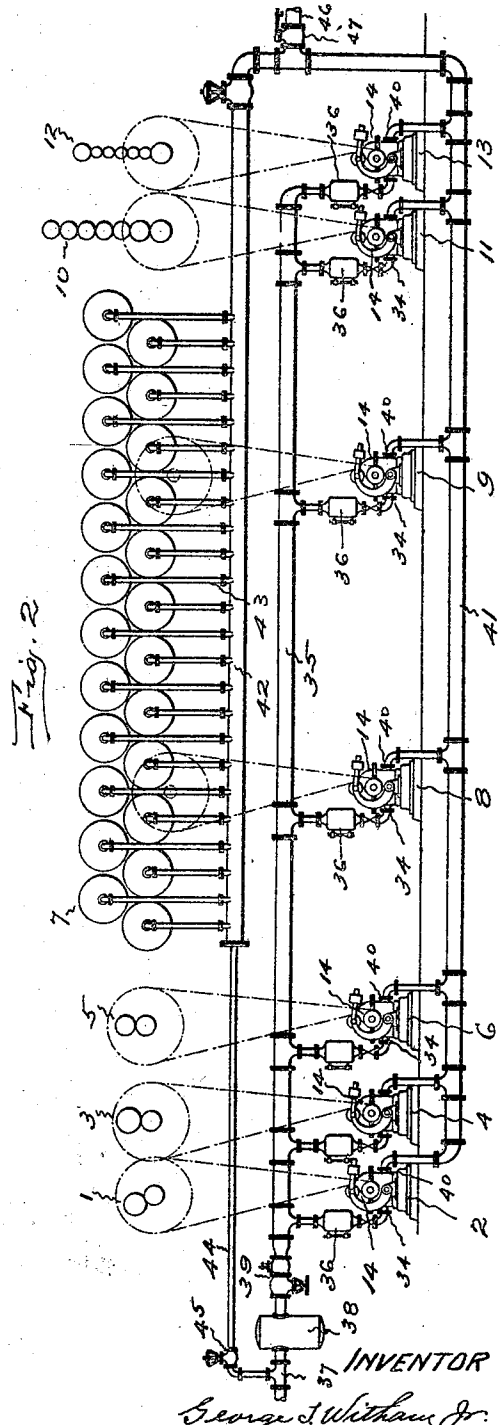


Fig. 2

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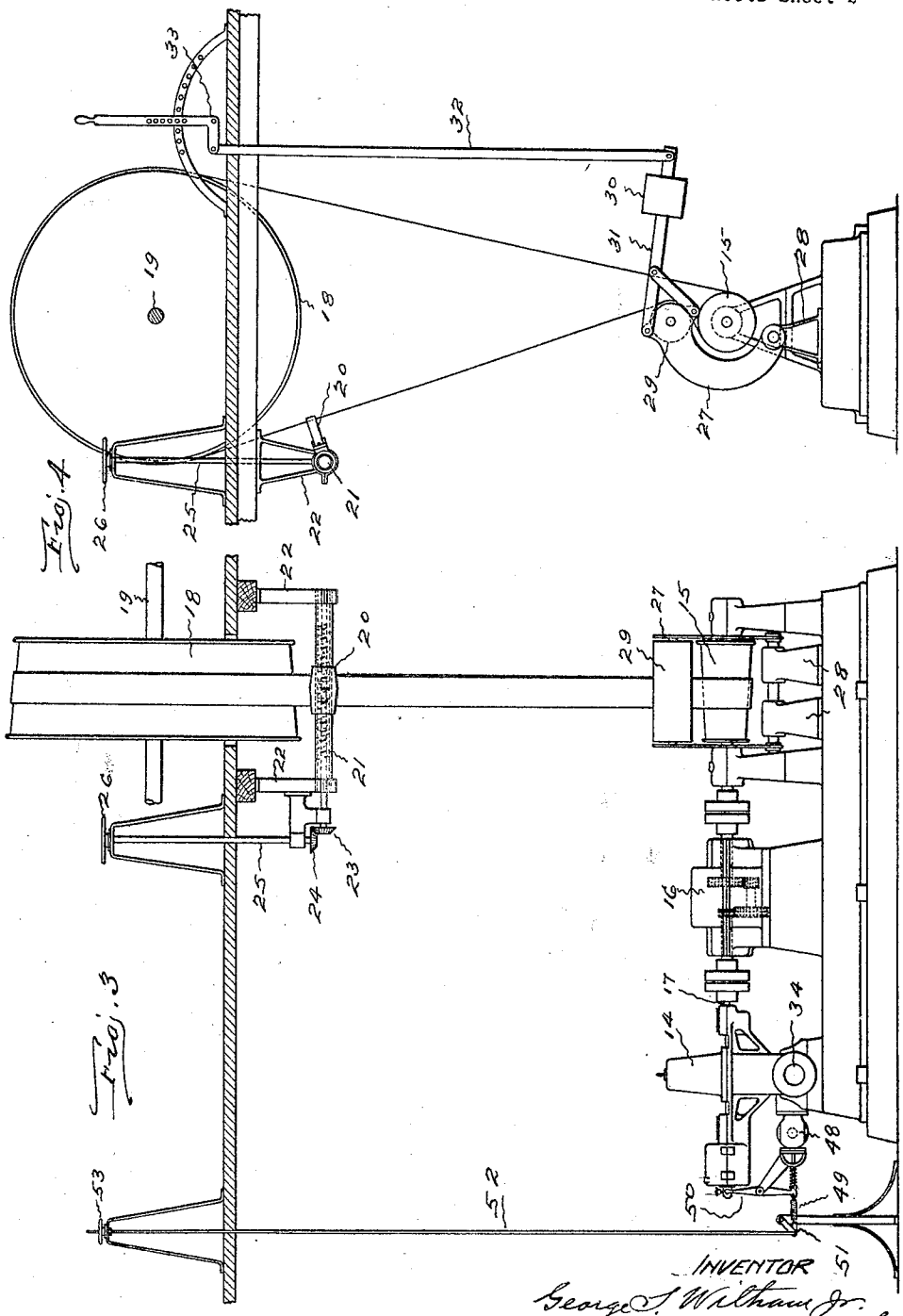
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UNITED STATES PATENT OFFICE.

GEORGE S. WITHAM, JR., OF HUDSON FALLS, NEW YORK.

PAPER-MACHINE DRIVE.

Application filed September 19, 1923. Serial No. 663,699.

To all whom it may concern:

Be it known that I, GEORGE S. WITHAM, Jr., a citizen of the United States, residing at Hudson Falls, in the county of Washington and State of New York, have invented a new and useful Improvement in Paper-Machine Drives, of which the following is a specification.

Paper making machines of the common types, and other machines utilizing both heat and power, such, for instance, as calico printing machines, which are composed of a plurality of independently controllable units, each performing its own function but all sequentially co-operating to produce the finished product, have, heretofore, been operated by two distinct forms of drive, the first having a single water power or steam or electrical driving unit connected through a train of shafts and gears or pulleys and belts to the several machine units, and the second, now recognized to be the more satisfactory but more expensive, having a plurality of electric motors, each connected directly to a unit of the machine.

The present invention relates to driving means for such machines, of the class having a plurality of motive means, each directly connected to and driving a unit of the machine independently of, but in proper co-ordination with the other units.

In the operation of machines of this character, particularly large Fourdrinier paper making machines, coal or other heat producing fuel is a predominant factor, for even with sufficient and convenient water or electric power for driving, a steam plant must be provided for heating and drying purposes. Owing to the varying character, quality, consistency and wetness of the stock manipulated and to climatic conditions, the several units of such machines must be capable of being run at different necessary rates of speed to produce the required feet per minute or output of the desired grades and at the same time maintain a constant speed relationship to each other. The several units must also, to accommodate the variations in draw resulting from stretching, shrinking and other actions of the stock, be capable of being adjusted independently so as to operate at different relative speeds. Furthermore, the units must be maintained at the same predetermined relative speeds regardless of variations of power required to operate the different units, such variation for instance as results from increased or decreased pressure on the couches, presses, etc., increased tensions of the wires and belts, faulty adjustments, frictional resistance and resistance offered by various characters of stock.

The object of the invention is to provide machines of the character set forth with comparatively simple and efficient individually connected, independently adjustable, easily controlled, driving means for each unit, which means are actuated by the medium necessarily generated for heating the units of the machines, preferably before the heating medium is conducted to the parts to be heated, and by such use of the heating medium reduce its pressure to a degree suitable for properly performing its drying function, thereby effecting economy of plant, installation and operation, and permitting the necessary regulation for various output speeds,—variation for draw or relative unit speeds, and for changes of power or resistance to operation in the different units,—and thus ensuring correct co-ordination of the several units and a maximum output.

This object is attained by providing a steam turbine of requisite power for driving each segregable unit of the machine, and preferably connecting the turbine intakes with a header that is in communication with a source of steam supply and connecting the turbine discharges with a header that is in communication with the parts of the machine to be heated. Each turbine is provided with its own governing mechanism whereby its speed may be maintained constant at the desired rate, regardless of the speeds of the other turbines, and each turbine is, in a simple form of the invention, connected by properly proportioned pulleys and belt, with the driving shaft of the unit it is to operate, the pulleys desirably being cones to facilitate adjustment for variations of speed, and the belts preferably being tensioned by a common form of tightener which can be readily adjusted to give the belt the proper traction, or quickly thrown to release the traction, thus eliminating mechanical clutches.

The invention is illustrated and described in connection with a Fourdrinier paper making machine, for which it is particularly adapted although it is applicable without the exercise of further invention to other

classes of multiple, co-ordinated unit machines requiring heat and power in their operation.

Fig. 1 is a diagrammatic plan of a paper making machine provided with driving means arranged and connected in conformity with this invention. Fig. 2 is a diagrammatic front elevation of the same. Fig. 3 is a side elevation of one of the driving units. Fig. 4 is an end elevation of one of the driving units.

In the machine chosen to illustrate the invention the couch rolls 1 are driven by a motive unit 2; the first press rolls 3 are driven by a motive unit 4; and the second press rolls 5 are driven by a motive unit 6. The double deck drying cylinders 7 are divided into two sections, one being driven by a motive unit 8 and the other by a motive unit 9. The first stack of calender rolls 10 is driven by a motive unit 11 and the second stack of calender rolls 12 is driven by a motive unit 13. The driving element of each of these motive units is a steam turbine 14 of the necessary power to drive the machine unit to which it is connected.

The connections between the turbines and the driving shafts of the machine units driven thereby are preferably similar. Each may consist of a cone pulley 15 driven directly or through reduction gears 16 by the rotor shaft 17 of the turbine, which cone pulley is belted to a cone pulley 18 on the driving shaft 19 of the driven machine unit. Fig. 4. The pulleys are proportioned to transmit the required power over the desired range of speed, and are tapered or stepped so that the speed transmitted may be accurately adjusted. A belt shifter 20 mounted on a threaded shaft 21 supported by bracket 22, and provided with a bevel gear 23 meshing with a bevel gear 24 at the lower end of a shaft 25 having a conveniently located hand wheel 26, Figs. 3, 4, are illustrated as a means for adjustably locating the belt on the pulleys. For the purpose of giving the belt the necessary tension, and traction on the smaller turbine pulleys, a so-called "Lenix" tightener may be employed. Such a device consists of a frame 27 pivoted at one end to supporting brackets 28, and at the other end provided with a roller 29 that is adapted to be swung away from the belt or pressed against the belt, by the action of a weight 30 on lever 31 or pull of a rod 32 connected between the weight-lever and a bell-crank hand-lever 33 mounted in convenient position to be manipulated by the mill operatives. Figs. 3, 4. By turning the hand wheel the operating speed of the driven unit may be finely adjusted, and by moving the lever the tractive power of the belt may be altered to suit the conditions, or may be entirely released.

The intake 34 of each turbine is connected by ordinary fittings with a header pipe 35 common to all, a separator 36 usually being interposed in the connection between the turbine intake and this header. This header is connected with a pipe line 37 leading from the source of live steam, which line may be provided with separator 38 and control valves 39, as desired.

The discharge 40 of each turbine is connected by ordinary fittings with a header 41 common to all, which header is connected with a manifold pipe 42 from which pipes lead to the several drying cylinders in the usual manner. A connection 44 may be made directly from the live steam supply pipe to the manifold, which connection may include a reducing valve 45. A pipe 46 may be led from the turbine exhaust header to the atmosphere, which pipe can be provided with an ordinary back pressure valve 47. By means of these connections all of the turbines may be run with live steam for driving the several machine units and this steam after passing through the turbines and having its pressure reduced may be used for heating the required machine parts. If there is not sufficient steam for the required purpose passing through the turbines or where it is desired to heat the machine parts before starting the turbines, steam may be admitted directly to the dryer manifold 42. Should there be too much steam passing through the turbines for heating purposes, the excess may be vented to the atmosphere, or used for any other desired purpose.

Each of the turbines is equipped with the usual governing valve 48 which may be automatically controlled by the spring 49 and link 50, from the turbine shaft, as regulated by the segment 51 and rod 52 provided with hand wheel 53 located in convenient position, Fig. 3. This governing mechanism being well known is not illustrated in detail. By means of the governing mechanism with or without the belt and pulley adjustment each of the motive units may be regulated independently of the other so that the relative speeds of the machine units may be made such as to compensate for variations of draw which result from stretching, shrinking and quality of the stock.

The motive means described are cheaper to install and less liable to disarrangement than the individual electric motor drives in use at the present time, and yet this simpler means is easily and independently adjusted so that each machine unit can run at the most advantageous relative speed to enable the entire machine to be operated at a rapid speed and produce a satisfactory product. Furthermore, by the use of individual steam turbines not only can the individual machine units be correctly co-ordinated with each other, but there is no sub-

stantial fuel waste, as it is necessary anyway to produce steam for drying and heating purposes.

As a result of this invention a paper mill having machines that are now driven at a relatively slow speed by a single unit can at but comparatively small expense be equipped with these simple individually adjustable turbine drives and thereby their output of product increased.

The invention claimed is:—

1. The combination with a machine comprised of a plurality of co-operating but independently driven units, of means for supplying a heated fluid under pressure to parts of the machine for heating the same, and a motive unit connected to and adapted to drive each of said machine units, said motive units being actuated by and reducing the pressure of said heating fluid before it is conducted to the machine and used for heating purposes.

2. The combination with a machine comprised of a plurality of co-operating but independently driven units, of means for supplying a heated fluid under pressure to parts of the machine for heating the same, a plurality of motive units, and means connecting each motive motive unit to a unit of the machine, said connecting means being adjustable whereby the effective action of each machine unit may be regulated independently of the other, and said motive units being actuated by and reducing the pressure of said fluid before it is conducted to the machine and used for heating purposes.

3. The combination with a machine comprised of a plurality of co-operating but independently driven units, of means for supplying a heated fluid under pressure to parts of the machine for heating the same, a plurality of motive units, and means including cone pulleys and belt, connecting each motive unit to a unit of the machine, said motive units being actuated by and reducing the pressure of said fluid before it is conducted to the machine and used for heating purposes.

4. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, each connected to a machine unit, and means for supplying steam to said turbines for driving the same and for supplying steam to units of the machine for heating the same.

5. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, a governor for controlling the speed of each turbine independently of the other, means directly connecting each turbine with a machine unit, and means for supplying steam to said turbines for driving the same and to machine units for heating the same.

6. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, variable speed mechanism connecting each turbine with a machine unit, and means for supplying driving steam to the turbines, and heating steam to the machine units.

7. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, a governor for controlling the speed of each turbine, variable speed mechanism connecting each turbine with a machine unit, and means for supplying driving steam to the turbine and heating steam to machine units.

8. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, a belt and pulley drive connecting each turbine directly with a machine unit, and means for supplying driving steam to the turbines and heating steam to machine units.

9. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, and driving means connecting each turbine directly with a machine unit, said driving means including a cone pulley driven by the turbine, a cone pulley on the machine unit drive shaft, a belt connecting the pulleys, means for shifting the belt on the pulleys, and means for adjusting the tractive tension of the belt on the pulleys.

10. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, and driving means connecting each turbine directly with a machine unit, said driving means including a pulley driven by the turbine, a pulley on the machine unit drive shaft, a belt connecting the pulleys, and means adapted to regulate the tension of the belt on the pulleys and relieve the tractive effort of the belt from one of the pulleys.

11. The combination with a machine comprised of co-operating but independently driven units of a plurality of steam turbines, driving means connecting each turbine directly with a machine unit, means for conducting steam to the turbines and means for conducting steam from the turbines to a machine unit.

12. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, a direct driving connection from each turbine to a machine unit, means for conducting steam to a machine

unit, means for conducting steam to the turbines, and means for conducting steam from the turbines to a machine unit.

13. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, a direct power transmission from each turbine to a machine unit, means for adjusting the speed of each turbine independently, means for adjusting the power of said transmission, means for conducting steam to the turbines, and means for conducting steam from the turbines to a machine unit.

14. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, governors for regulating the speed of each turbine independently, a direct transmission connection from each turbine to a machine unit, means for varying the speed of said transmission, means for conducting steam to the turbines, and means for conducting steam from the turbines to a machine unit.

15. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, and a belt and pulley drive connecting each turbine directly with a machine unit.

16. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, a direct power transmission from each turbine to a machine unit, means adapted to regulate the speed of each turbine independently of the other turbines, and means adapted to adjust the traction of and speed of transmission of each direct connection from each turbine to a machine unit independently of the other connections.

17. The combination with a machine comprised of a plurality of co-operating but independently driven units, of a plurality of steam turbines, a driving connection from each turbine to a machine unit, means for conducting steam to the turbines, and means for conducting steam from a turbine to a machine unit.

GEORGE S. WITHAM, JR.