April 16, 1929. F. WYSS 1,709,296

DRIVING DEVICE FOR PAPER MACHINES

Filed Sept. 15, 1927 3 Sheets-Sheet 1

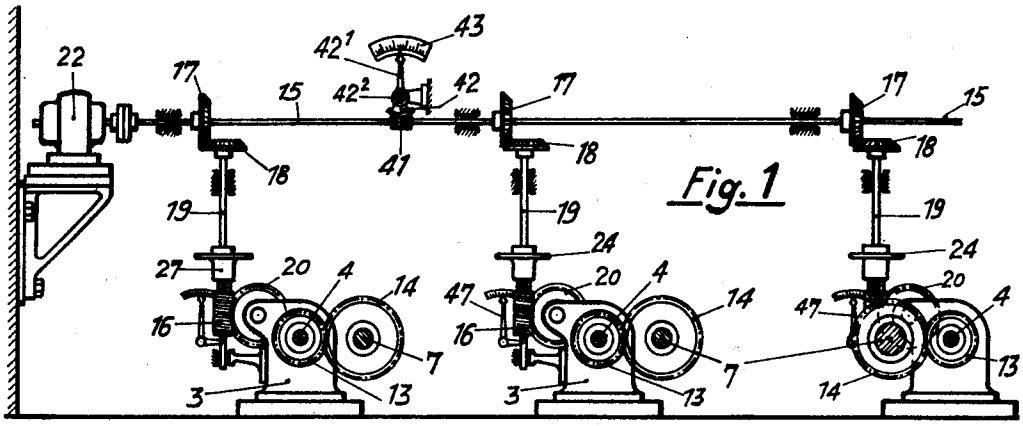


Fig. 1

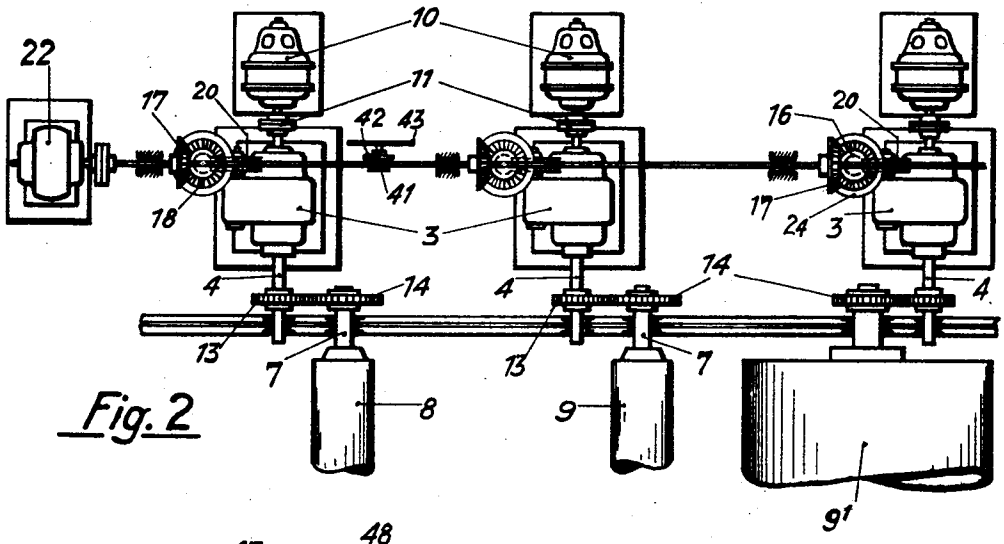


Fig. 2

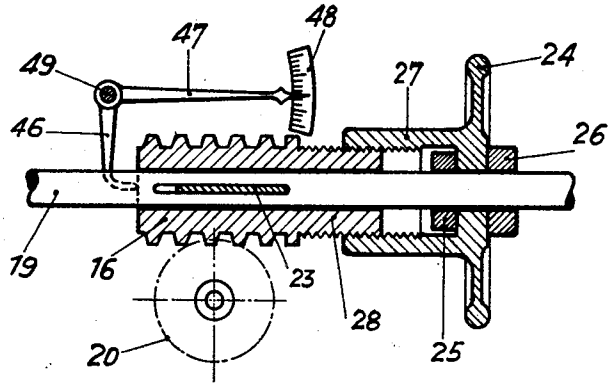


Fig. 3

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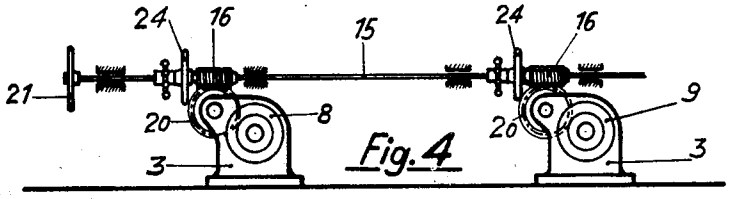


Fig. 4

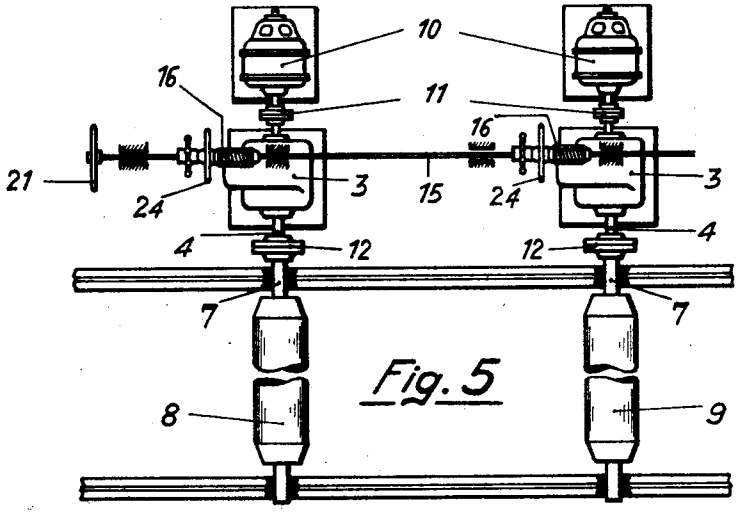


Fig. 5

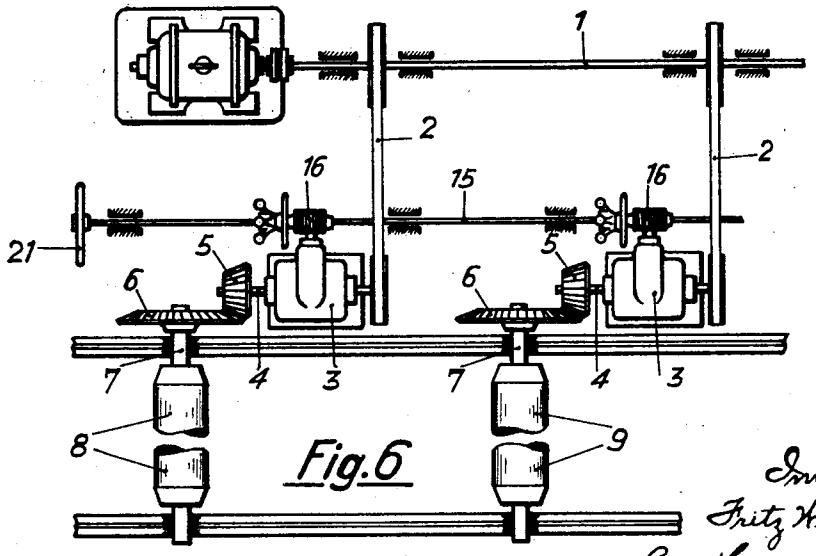


Fig. 6

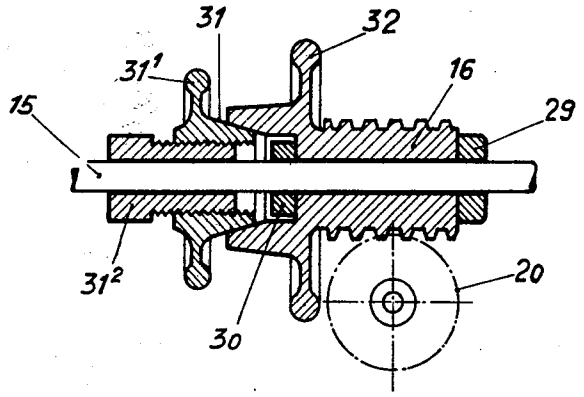
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DRIVING DEVICE FOR PAPER MACHINES

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Fig 7



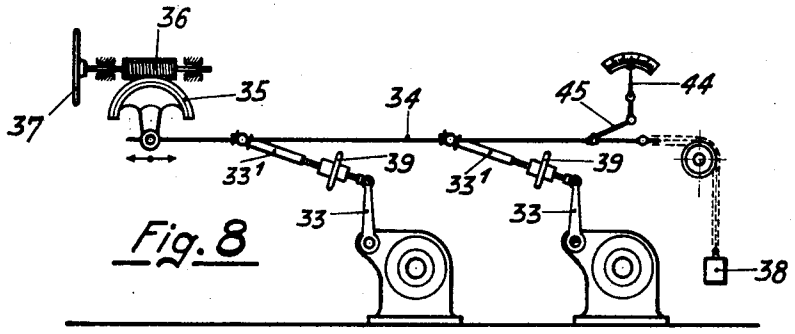


Fig. 8

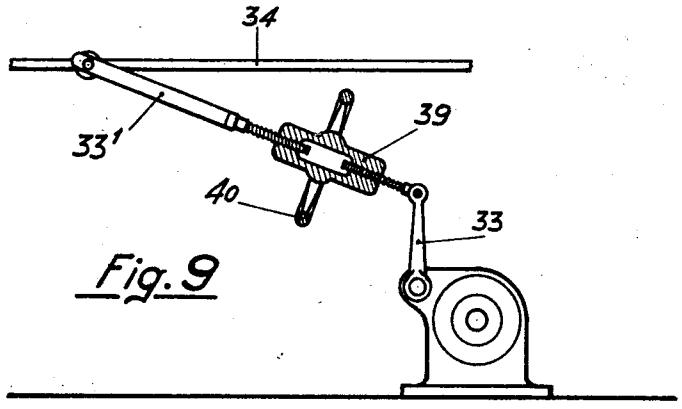


Fig. 9

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UNITED STATES PATENT OFFICE.

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DRIVING DEVICE FOR PAPER MACHINES.

Application filed September 15, 1927, Serial No. 219,693, and in Switzerland September 20, 1926.

Machines for manufacturing paper have parts which have to be driven with constant speed, such as stock chests, pulp strainers, pumps, shaking machines, and parts the speed of which must be variable, such as couch presses and wet presses, drying cylinders, calenders, reelers and so on. The driving device for parts of the last mentioned kind must permit of a simultaneous alteration of the speed of all such parts for the purpose of running the paper machine quicker or slower if lighter or heavier paper respectively has to be made.

The speed at which a paper machine runs is the so-called means speed. It must be variable within wide limits, for instance within 1:20. Furthermore the driving device of a paper machine must be so constructed that it permits of varying the speed of every single part within narrow limits, for instance up to 5% in order to take into account the shrinkage and the stretching of the paper; in other words the single "paper draws" should be adjustable by the so-called control of the draws. With the hitherto known driving devices for paper machines mechanical means such as interchangeable gear wheels, cone pulley drives or Reves-drives have been used for varying the mean speed if the machine is driven by a source of power having a constant speed. From these means different countershafts are driven by means of belts, or ropes, which transmit the mean speed by belt drives to the different shafts of the paper machine. With these driving arrangements the control of the draws is in most cases effected by shifting the belts running over conical pulleys and driving the single shafts of the paper machine.

These known means for varying the mean speed present many drawbacks. Interchangeable gear wheels give coarse steps only and require the machine to be stopped when changing from one step to another.

On the other hand cone pulley drives and Reves gears are limited as regards their speed ratios and the power transmitted and require much maintenance as the belts wear quickly; furthermore they require much space. Also the countershafts to be provided for the transmission of power from these devices to the different shafts of the paper machine require much space and high maintenance costs on account of the wear of the belts.

In order to obtain a larger range of regulation the use of hydraulic transmission gears permitting a speed regulation has been proposed. Such gears are however of a complicated design, further they do not work without slip and have a low efficiency. Moreover as countershafts for transmitting the power to the single shafts cannot be dispensed with the drawbacks inherent to the use of such countershafts still exist.

Another known manner for varying the mean speed consists in the use of sources of power running at variable speeds, such as regulable steam engines or electric motors, in the latter case preferably direct current motors with Leonard-connection, or three-phase collector motors with shunt regulation have been used. Such machines permit the omission of some or of all the countershafts or gears for varying the mean speed; however, the transmission of the drive to the paper machine has still to be effected by means of countershafts with belts or ropes. Sources of power which run with variable speed are furthermore expensive and of a complicated design. The efficiency is low particularly when alternating current has to be converted into direct current. The space required and the wear of the belts are still high as the countershafts remain.

For these reasons it has already been proposed to drive each part of the paper machine by its own electric motor whereby the arrangement is so made that the speed of all the motors may be simultaneously varied within the same limits and separate devices for controlling the draws have been utilized. In practice this is however only possible by the use of direct current motors and complicated connections and controlling means. Such drives are therefore expensive and have a low efficiency if alternating current has to be converted into direct current. Furthermore such devices require well trained operators and they are only applicable to paper machines of large output.

In order to overcome the various drawbacks of the aforementioned known driving devices in a paper machine having a plurality of shafts to be driven at variable speeds according to the present invention a separate mechanical change speed gear driven at constant speed is used for the drive of each of these shafts. The range of the speed variation of all these gears, which are independent of each other as regards power transmission,

is such that it is sufficient for the simultaneous regulation of the speed of all the shafts, that is to say for the change of the mean speed, as well as for the control of the draws of the respective shaft. The actuating mechanism for all the change speed gears is so designed that in a manner known per se the mean speed of the different shafts to be driven is simultaneously varied by the same amount, whilst the speed taking into account the control of the draws of every shaft is singly adjustable. The drive of the change speed gears may be effected from a common shaft, driven by a source of power running at a constant speed and which may at the same time serve for driving the parts of the paper machine which run at a constant speed. If desired each shaft of the parts of the paper machine which have to run at variable speeds may be driven by a change speed gear which in its turn is driven from a motor of its own running at constant speed, for instance a synchronous electric motor, whereby multiphase or single phase current of constant frequency may serve as source of current. In such a case all belts may be dispensed with and motors of the simplest design and of best efficiency may be used.

Several constructional examples of the subject matter of the present invention are illustrated on the accompanying drawings, in which:

Fig. 1 shows in elevation a part of a paper machine in which every change speed gear connected to a shaft of the machine to be driven receives its drive by a motor running at a constant speed;

Fig. 2 is a plan view of Fig. 1,

Fig. 3 shows on a larger scale a detail of this constructional example.

Figs. 4 and 5 illustrate in elevation and in plan view respectively a constructional example which differs from that shown in Figs. 1 and 2 by a different design of the controlling mechanism for changing the speed ratio.

Fig. 6 shows in a plan view a part of a paper machine in which the driving power is transmitted from a source of power common to all the parts to be driven through the intermediary of a transmission shaft running at constant speed to the change speed gears connected to the parts to be driven of the paper machine.

Fig. 7 shows on a larger scale a modified construction of controlling means for adjusting the mean speed and the speed of the draw of the parts to be driven.

Fig. 8 is an elevation of a further constructional example and

Fig. 9 shows a detail thereof on a larger scale.

In Fig. 2 8 denotes the first and 9 the second wet press and 9^1 a drying cylinder of a paper machine, which presses have been omitted in the elevation view for sake of clearness. The drive of each of these parts, which have to run with variable speed, is effected by a separate motor 10 and a separate change speed mechanism 3. Every mechanism 3 is directly connected to its respective motor 10 by means of a coupling 11. Any source of power, which runs at a constant speed, may be used as motor, for instance synchronous motors, multiphase or single phase motors may be used.

The power transmission from the driving shaft 4 of every mechanism 3 to the parts 8 or 9 respectively of the paper machine is effected by means of spur gears 13, 14. In order to permit a simultaneous alteration of the mean speed of the parts, 8, 9 by the same amount a controlling shaft 15 common to all the mechanisms 3 is provided which is rotated by an electromotor 22 provided with a remote control. On the controlling shaft 15 a bevel gear wheel 17 is provided for every mechanism 3 and is fixed to the shaft and cooperates with a bevel gear 18 fixed to the shaft 19. On every shaft 19 a worm 16 is slidable in the axial direction but secured against rotation relatively to the shaft by a key 23 (see also Fig. 3 in which the shaft 19 has been shown horizontally instead of vertically in order to save space). Every worm 16 cooperates with a worm wheel 20 which directly acts on the mechanism by which the speed ratio is changed. The worms 16 are provided with threaded elongations 28 on which the interiorly threaded boss 27 of a hand wheel 24 is screwed, the latter being secured against axial displacement relatively to the shaft 19 by collars 25 and 26. By turning the hand wheel 24 on the non-rotating shaft 19 the respective worm 16 may be axially displaced and thereby the worm wheel 20 cooperating with the worm may be angularly displaced through an amount necessary for causing the change of the speed required by the control of the draws. The change speed mechanisms 3 are so constructed that their speed range is sufficient for the speed regulation of the presses 8, 9 as well as for the control of the draws.

Further on the controlling shaft 15 a worm 41 is fixed cooperating with a worm wheel segment 42 carrying a hand 42^1. The segment 42 is turnable about a stationary pin 42^2. The hand 42^1, which is turned more or less in dependency on the turning movement imparted to the shaft 15, cooperates with a scale 43 on which the mean speed at any moment may be read. In order to make the control of the draws visible a lever 46 (Fig. 3) is provided rigidly fixed to a hand 4 and turnable about a stationary pin 49. Upon a displacement of the worm 16 the lever 46 is turned whereby the deflection of the hand 47 read on the scale 48 gives a measure of the control of the draws.

Instead of causing the turning of the shaft

15 to be effected by a motor 22 a hand wheel may be provided for this purpose as is the case in the constructional example illustrated in Figs. 4 and 5 in which 21 designates the hand wheel. The constructional example illustrated in Figs. 4 and 5 differs from that described above in that the driving shaft 4 of the change speed mechanisms 3 drives the shafts 7 of the presses 8 and 9 respectively through the intermediary of an elastic coupling 12 instead of by spur gearings and that the controlling mechanism for influencing the mean speed and the control of the draws and which includes a worm 16 and a hand wheel 24 is directly arranged on the shaft 15 so that the shafts 19 of the first described constructional example are dispensed with. Instead of an elastic coupling 12 a disengageable clutch may be used.

With the embodiment of the invention illustrated in Fig. 6 the single change speed mechanisms 3 are driven from a shafting 1 running at constant speed by means of belt drives 2. The driving shaft 4 of every mechanism 3 drives by means of bevel gear wheels 5, 6 the shafts 7 of the presses 8 and 9 respectively. 21 and 16 designate again parts of the controlling mechanism.

A further possibility of changing the control of the draws is provided by the arrangement shown in Fig. 7, which comprises a worm 16, secured against axial displacement relatively to the controlling shaft 15 by collars 29, 30, and a conical sleeve 31 with hand wheel 31^1. The latter is screwed on a sleeve 31^2 rigidly fixed to the controlling shaft 15 so that in turning the shaft 15 the worm 16 is normally also turned. After withdrawing the conical sleeve 31 the worm 16 may be turned by means of the hand wheel 32 relatively to the controlling shaft 15 whereby the worm wheel 20 is turned through an amount necessary in adjusting the draws.

With the constructional example illustrated in Figs. 8 and 9 instead of the worms 16 and worm wheels 20 of the above described examples levers 33 are provided and are connected by links 33^1 with a controlling rod 34. Every link 33^1 has two parts connected to each other by means of a sleeve 39 provided with right and left hand thread and a hand wheel 40. A worm 36 with worm wheel 37 permits by the cooperation of a worm wheel segment 35 to simultaneously vary the mean speed of all the shafts 7 in the same degree, whilst by displacing the sleeves 39 an adjustment of the draws of the single shafts may be caused. In order to prevent the controlling shaft 34 from being subjected to lateral flexure a counter weight 38 is provided at its right hand end. 44 and 45 designate a device which indicates the means speed.

I claim:

1. In a paper machine, an arrangement for driving a plurality of shafts which have to run at variable speeds, comprising a separate mechanical change speed mechanism for driving every one of these shafts and adapted to effect a change of the speed of every single shaft to control the draws, means adapted to drive said change speed gears, and a mechanism adapted to influence the speed ratio of all of said change speed mechanisms to simultaneously vary the mean speed of all of said shafts, said mechanism comprising a shaft common to all the change speed mechanisms, further shafts interposed between said common shaft and each change speed gear, a worm on every further shaft and axially displaceable but not rotatable relatively to said further shaft, said worm cooperating with means to change the speed ratio in said change-speed mechanism, whereby a turning of said common shaft causes a turning of said worms and thereby a change of the mean speed of all the shafts whilst an axial displacement of a worm causes a change of the speed of the respective shaft driven by the change speed mechanism and influences the control of the draws.

2. In a paper machine, an arrangement for driving a plurality of shafts which have to run at variable speeds, comprising a separate mechanical change speed mechanism for driving every one of these shafts and adapted to effect a change of the speed of every single shaft to control the draws, means adapted to drive said change speed mechanisms, and a mechanism adapted to influence the speed ratio of all of said change speed mechanisms to simultaneously vary the mean speed of all of said shafts, said mechanism comprising a shaft displaceably arranged and common to all the change speed mechanisms, a worm for every change speed mechanism disengageably arranged on said shaft and in operative connection with means to change the speed ratio in the respective change speed mechanism, said worm, after having been disengaged from said shaft permits to influence the speed ratio of said transmission gear and thereby the control of the draws.

3. In a paper machine, an arrangement for driving a plurality of shafts which have to run at variable speeds, comprising a separate mechanical change speed gear for driving every one of these shafts and adapted to effect a change of the speed of every single shaft to control the draws, means adapted to drive said change speed gears, a mechanism adapted to influence the speed ratio of all of said change speed gears to simultaneously vary the mean speed of all of said shafts, means to indicate the mean speed of all the shafts, and means to indicate the adjustment of the draws of every single shaft.

4. In a paper machine, an arrangement for driving a plurality of shafts which have to turn at variable speeds, comprising a sep-

arate mechanical change speed gear for driving each shaft, means adapted to effect a change of speed of each shaft to control the draws, driving means running at constant speed for each change speed mechanism, each of the latter being arranged with respect to the transmission of power wholly independent of the remaining change speed mechanisms, and a mechanism adapted to simultaneously influence a speed ratio of all of said change speed gears, to vary the mean speed of all of said shafts.

5. In a paper machine, an arrangement for driving a plurality of shafts which have to run at variable speeds, comprising a separate mechanical change speed mechanism for driving separately these shafts, means adapted to effect a change of the speed of each shaft to control the draws, a separate driving motor running at a constant speed in connection with each of said change speed gears, and a mechanism adapted to collectively influence the speed ratio of all of said change speed mechanisms to simultaneously vary the mean speed of all of said shafts.

6. In a paper machine, an arrangement for driving a plurality of draw roll shafts; comprising a separate motor and change speed mechanism associated with each shaft, regulating means associated with each change speed mechanism to individually change the speeds of said mechanisms, and means connected to and common to all of said regulating means to collectively operate the regulating means and therethrough the speeds of said shafts.

7. In a paper machine, an arrangement for driving a plurality of draw roll shafts, comprising a separate constant speed motor for each shaft and a change speed mechanism included between each shaft and its associated motor, means common to all the change speed mechanisms to collectively adjust said mechanisms and means including a worm and worm gear for individually adjusting the mechanism.

In testimony whereof, I have signed my name to this specification.

FRITZ WYSS.