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SPEED CONTROL FOR TEXTILE MACHINES.

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1,192,704. Patented July 25, 1916.

Fig. 1.

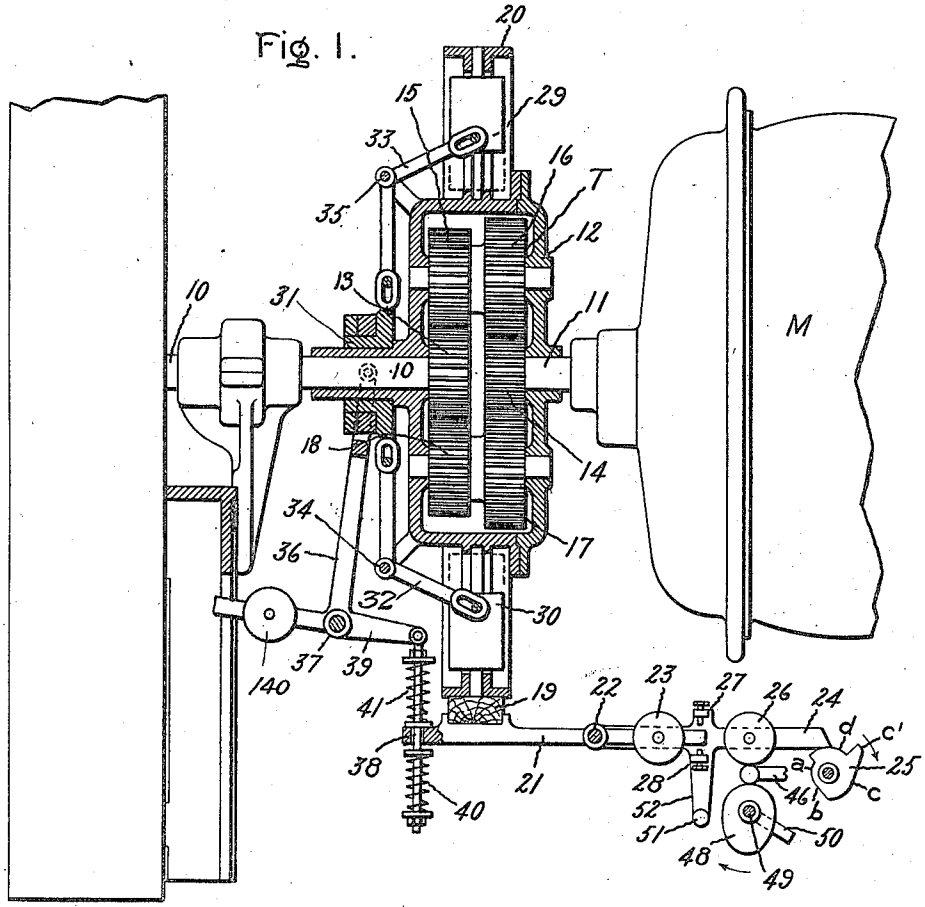
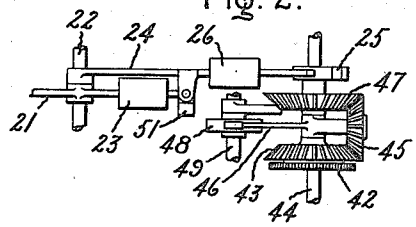


Fig. 2.



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SPEED CONTROL FOR TEXTILE-MACHINES.

1,192,704. Specification of Letters Patent. Patented July 25, 1916.

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To all whom it may concern:

Be it known that I, OTTO STÖBE, a subject of the Emperor of Germany, residing at Berlin, Germany, have invented certain new and useful Improvements in Speed Control for Textile-Machines, of which the following is a specification.

This invention relates to the control of textile machinery such as spinning frames and the like, and has for its object the provision of a control in which the speed of the spinning machinery is varied without varying the speed of the driving machine.

This invention relates more specifically to the control of spinning machinery in which each spinning frame is driven by an electric motor.

It is a well known fact that the yarn tension of a ring spinning machine varies continuously. This variation in tension is due principally to two causes, one of which results from the varying diameter of the bobbin while the other results from the varying length of the balloon during the rise and fall of the ring rail. The tension on the yarn varies inversely with the diameter of the bobbin and varies directly with the length of the balloon. In the "filling wind" (as distinguished from the "warp wind") as the ring rail moves from the small end or "peak" of the cone to the large end or hip and back, the tension of the thread gradually decreases in the downward movement toward the hip, and then increases on the upward movement toward the "peak". With each advance of the ring rail after the downward and return movement is completed, the balloon is permanently shortened by a decrement and the tension on the yarn proportionately decreased. Ordinarily the spinning frame is driven at a constant speed, which speed is so adjusted that the tension on the thread will never exceed a safe value. It has long been recognized that spinning at a constant speed does not produce the best results, mainly for the reason that at the constant speed which must be employed the machine is not worked to its fullest capacity. Various attempts have been made to vary the speed of the machine to keep a constant tension on the yarn, since it was early recognized that with such a variation the average speed of operation could be greater than the highest constant speed at which the machine could be safely operated. These attempts have generally met with indifferent success, although systems which are more or less satisfactory have been devised in which an electric motor has been employed and the motor caused to vary in speed.

In carrying out my invention I avoid varying the speed of the motor or other driving machine. The speed of the motor is kept constant and the speed of the spinning machine is caused to vary by varying the speed ratio of the driving connection between the motor and the spinning machine. The driving connection is caused to change automatically so as to vary the speed of the spinning machine in accordance with the movement of the ring rail of the spinning machine.

In one particular embodiment of my invention the driving connection between the motor and the spinning machine consists of a differential gear mechanism, means being provided whereby one member of the mechanism is automatically retarded more or less during the movement of the ring rail to vary the speed ratio, and hence the speed of the spinning machine.

My invention is shown embodied in concrete form.

Figure 1 shows the essential parts of my improved speed control and Fig. 2 is a detail of certain of the parts.

Referring to Fig. 1 this represents the spinning machine having main driving shaft 10 and M represents the motor for driving the spinning machine and having a driving shaft 11; T represents the differential gear transmission between the motor and the spinning machine, and consists of a casing 12 mounted to rotate upon the two shafts 10 and 11. Within the casing 12 and mounted upon the shafts 10 and 11 respectively are the gears 13 and 14. Two gears 15 and 16 which are rigidly secured together and have bearings in the upper side of the casing mesh with the gears 13 and 14 respectively, as well as gears 17 and 18 also rigidly connected and having bearings in the lower side of the casing. It is, of course, obvious that if free to do so the casing 12 will simply rotate about the shaft 10 and the spinning machine will not move. It is also obvious that if the casing 12 is held stationary the spinning machine will be driven at a constant speed which will de-

pend upon the ratio of the driving gears. Between these two extremes,—that is, on the one hand, leaving the casing free to rotate, and, on the other hand, holding the casing stationary,—a wide range of speeds may be obtained by varying the speed at which the casing is permitted to rotate.

In the present embodiment of my invention, I cause the movement of the ring rail to retard the casing 12 more or less so as to vary the speed ratio between the motor and the spinning machine.

19 represents a brake shoe acting upon a brake ring or disk 20 which is concentric with the periphery of the casing 12. The brake shoe 19 is mounted upon a lever 21 pivoted at 22 and having on the opposite side of the pivot a weight 23 which tends to turn the lever on its pivot to force the brake shoe into engagement with the brake disk and retard the speed of the gear casing. Another lever 24 is likewise pivoted on the shaft 22 and has its end engaging with a cam 25. Mounted upon this lever 24 is another weight 26 arranged between the shaft 22 and the cam 25. This lever is provided with the projections 27 and 28 having adjusting screws arranged to engage the end of the lever 21. The arrangement is such that by moving the lever 24 either up or down a small amount on its pivot the end of lever 21 will be engaged so as to turn the latter on its pivot and either increase or decrease the pressure of the brake on the brake disk. The mechanism thus far described provides for three principal constant braking pressure conditions,—one with the brake shoe 19 applied by the weights 23 and 26 together, one with it applied by the weight 23 alone, and one with it altogether out of contact. The pressure of the brake shoe is likewise affected by the speed of the gear casing so that as the gear casing speeds up the braking effect of the brake shoe will be decreased, and as the speed of the casing decreases the braking effect will be increased. The purpose of this arrangement will hereinafter appear. The particular structure by which this result is obtained consists of centrifugal weights 29, 30 mounted within the brake disk 20 so as to slide in and out from the center depending upon the speed of the gear casing. The movement of these weights in and out from the center causes the collar 31 to slide on the shaft through a pair of bell crank levers 32, 33, pivoted at 34 and 35 respectively, and having slot connection with the weights and collar. Pivoted to a loose ring on the collar is another bell crank lever 36 having a pivotal point at 37. Bolt 38 passes through the end of lever 21 and is pivoted to the end of bell crank lever 39. Upon this bolt on each side of the lever 21 are springs 40 and 41. This arrangement is such that when their centrifugal force is sufficient the weights 29, 30 will move outward from the center, the collar 31 will be moved inward toward the gear casing, and hence the bell crank lever 36 will be turned on its pivot 37 so as to force the spring 41 against the end of the lever 21 and decrease the pressure of the brake shoe against the brake disk. On the other hand, when their centrifugal force is so small that under the influence of the counterweight 140 the weights 29, 30 move inward toward the center the collar 31 will be moved along the shaft away from the casing and the bolt 38 will be moved upward so as to put the spring 40 under compression and force the brake shoe against the brake disk. The decrease in speed of the gear casing tends to increase the speed of the spinning machine.

It will be seen that if the application of the brake shoe 19 to the brake disk 20 and its pressure thereon were controlled entirely by the levers 21 and 24 and the cam 25, it would practically always be zero or else either that due to the weight 23 plus the whole of the weight 26 or that due to the weight 23 alone; for at the critical moment a very slight lowering or lifting of the left-hand end of the lever 21 would almost instantly apply the brake shoe 19 with the full force of the weight 23 or throw it entirely out of contact, and a very slight lowering or lifting of the lever 24 would almost instantly add the full force of the weight 26 to that of the weight 23 or vice-versa. The result of such sudden changes in the braking pressure would be a more sudden change of the spinning frame speed than is usually desirable. The auxiliary control of the braking pressure by the casing speed as above described, however, makes the variations of braking pressure and frame speed less sudden and so brings them into compensatory correspondence with the tendency toward variation of the tension in the yarn as it is wound from hip to peak and vice-versa. For suppose the parts to be in the positions shown in Fig. 1. If the lever 24 is lowered till the screw 27 strikes the lever 21 and the whole weight 26 is imposed on the lever so as to increase the braking pressure *pro tanto*, the speed of the casing 12 will decrease. As the speed of the casing 12 gradually decreases the centrifugal force of the weights 29 and 30 acting through the spring 41 on the brake shoe 19 in opposition to the weights 23 and 26 will diminish and the actual effective braking pressure will be reinforced or supplemented,—at first directly by the diminution of the downward push on it due to centrifugal force, and then indirectly by the upward pull due to the counterweight 140 acting through the spring 40. As this supplemental increase of braking pressure depends on the actual reduction of casing speed while the momentum of the

casing 12 is being used up in friction at the brake shoe 19, it will be gradual. This supplemental augmenting of the braking pressure and consequent decrease of casing speed will go on cumulatively until the centrifugal weights 29 and 30 have been forced inward to the inner limit of their travel (shown in dotted lines in Fig. 1),—after which the pressure will remain uniform and the casing speed will ultimately become constant. If, subsequently, the lever 24 is raised, the centrifugal weights 29 and 30 will supplement the decrease in braking pressure due to the lifting of the weight 26 and cause a gradual decrease of braking pressure which will be just the reverse of that described. As decrease in casing speed means increase in spinning frame speed and vice-versa, it will be seen that the centrifugal weights 29 and 30 can be made to regulate the spinning frame speed so that its variation shall be more gradual over a given range than it would be without them and more effective in securing uniformity of yarn tension. Thus the supplementary action of the centrifugal weights 29 and 30 in changing the casing speed is always in the same sense as that of the lever 24, by way of reinforcement, instead of in the opposite sense, like an ordinary speed governor.

In order to utilize this variable speed gearing to give to the spinning frame its proper variations in speed, I provide the following mechanism to control the application of the brake with greater or less force. The cam 25 rotates in the direction of the arrow, being driven by a sprocket wheel 42 connected by a chain belt to the cam shaft which actuates the ring rail, and in such a manner that said cam 25 rotates synchronously with said cam shaft, making one revolution to each complete up or down traverse of said ring rail. The sprocket wheel is connected to the cam through a differential gearing, being secured to the hub of the bevel gear 43, which rotates freely on its shaft 44 and meshes with a bevel gear 45 rotatably journaled on an axis perpendicular to that of the gear 43 and mounted on an arm 46 pivoted on the shaft 44. Another bevel gear 47 rotates freely on the shaft 44 and meshes with the intermediate gear 45. The cam 25 is secured to the hub of the gear 47. The rotation of the sprocket wheel is communicated to the cam through the three bevel gears, but if the arm carrying the intermediate gear is rocked on the shaft it alters the phase of the gear 43 with reference to the gear 47, advancing it if the intermediate gear 45 is depressed, and retarding it when raised. In order to effect this result, a cam 48 is provided, mounted on a shaft 49, which rotates once during the building up of the complete bobbin, and acts to lift and lower the arm 46 carrying the intermediate gear 45. This shaft 49 also have a finger 50 adapted to engage with a lug 51 on an arm 52 of the lever 24 and temporarily lift the same. The cam 25 has four faces, *a*, *b*, *c*, *d*, for actuating the lever 24.

The operation is as follows:—When the ring rail goes down, the part *a* of the cam 25 comes under the tip of the lever. This lets the lever drop, so that the weight 26 causes the set screw in the upper lug 27 to press down the lever 21 and thus exert a greater pressure on the brake 19 to slow down the revolutions of the casing 12 and thereby accelerate the speed of the spinning machine. The centrifugal weights 29, 30 slide inwardly as the speed of the casing lessens, and operate through the springs 41 and 40 (with the co-action of the counterweight 140) to regulate the pressure of the brake as above described, finally allowing a uniform reduced rate of revolution of the driving gear to be established. This constant number of revolutions of the casing, and also of the spinning machine, (the latter running at its highest speed) exists only a short time, beginning just before the ring rail reaches its lowest position, and ending shortly after that time. With the rise of the ring rail, the part *b* of the cam 25 lifts the lever 24 and relieves the lever 21 of the weight 26. This lets the speed of the casing increase, and conversely the speed of the machine drops. The lever 24 then rides idly on the part *c* of the cam 25 and the speed of the spinning machine or frame tends toward (or even reaches) a constant value until the part *c'* of the cam causes the lower adjusting screw on the lever 24 to positively lift the lever 21, and thus remove the brake shoe from the wheel 20. The speed of the spinning machine drops still further, until the lever 24 rides upon part *d* of the cam 25, which allows the weight 23 to reapply the brake. The centrifugal weights again regulate the casing speed and a constant but higher rate of revolution of the spinning machine is established. This lasts during the final rise of the ring rail and for a short period after it commences to fall, the spinning machine running steadily at a low speed. This action is repeated regularly with each rise and fall of the ring rail. It thus appears that the cam 25 regulates the speed of the spinning machine by adding the weight 26 to the weight 23 and thus running up said machine to its highest speed, then taking off the weight 26 and letting the machine slow down, then lifting the weight 23 and reducing the speed to its lowest point, and then letting the weight 23 act again and so increasing the speed. The action of these weights is modified by the centrifugal weights 29, 30, which make the speed changes more gradual and allow the speed to remain constant at its highest and lowest values for

a short interval while the ring rail is in its lowest and highest positions respectively. In addition, however, to this periodical variation of speed in different portions of the traverse of the ring rail, there is another feature of operation to be cared for. This is the fact that during the formation of the bobbin it is necessary that the spinning machine shall run slower during the first part of the building; that then the above described periodical variation in speed shall occur during the greater part of the bobbin building, and that then during the "spinning off" portion of the process the machine shall be slowed down. These results are accomplished by the cam 48 and the finger 50. The cam slowly lifts the arm 46 during a quarter of its revolutions, and thereby depresses the intermediate gear 45, advancing the phase of the gear 47 and the cam 25 and thus causing the latter to act sooner than it otherwise would in the travel of the ring rail. During the next quarter revolution of the cam 48 it lowers the arm 46 and retards the phase of the cam 25. During the next half revolution it does not move the arm 46 or affect in any way the operation of the cam 25. The finger 50, revolving with the arrow in Fig. 1, lifts the lug 51 and its lever 24 during about an eighth of its path of revolution, during part of the time that the cam 48 is lifting the arm 46. During the time that the finger 50 thus engages the lug 51 it prevents the lever 24 from dropping on the several faces of the cam 25 as it would otherwise do, so that said cam 25 and lever 24 will not influence the lever 21 or affect the casing or the machine speed as above described excepting when the cam projection c' lifts the levers 24 and 21 and momentarily relieves the brake pressure. As this action of the cam projection c' occurs when the ring rail is at almost its highest position, it follows that during the action of the finger 50 on the lug 51 the spinning frame will run at a low constant speed with no variation save a temporary retardation at this position of the ring rail. It thus appears that during the beginning of the bobbin building, the finger 50 will prevent the cam 25 from influencing the lever 24 and the speed of the machine except at the highest position of the ring rail, and during this time the machine will run at low speeds. At length, however, the finger 50 will pass out from under the lug 51, and the lever 24 will drop upon the cam 25, and the periodic variations in speed during each traverse of the ring rail will begin. At about the time this occurs, the widest part of the cam 48 is under the ends of the arm 46, so that the cam 25 is extremely advanced in phase. The continued rotation of the cam 48 causes a steady retardation in phase, so that during perhaps a quarter revolution of the cam 48 the several parts of the cam 25 act more and more tardily, or in other words the periods of high and low speeds of the spinning machine occur later in the cycle of movement of the ring rail. As this retardation of phase is continuous, it involves a continual lengthening of the intervals between the successive actuations of the levers 24 and 21 and a consequent prolongation of the periods of deceleration and acceleration of both the casing 12 and the spinning machine; but the effect of the prolonged acceleration of the spinning machine so far predominates that both the maximum and the minimum spinning machine speeds are increased, as well as the difference between them. Hence the average speed is increased as the winding of the bobbin progresses. This action continues during all the time that the arm 46 rests upon the concentric portion of the cam 48, which covers about half the building of the bobbin; that is, the entire principal spinning period. During the finishing of the bobbin, the cam 48 slowly lifts the arm 46, which advances the operation of the cam 25, and causes the periods of high and low speeds to occur earlier in the stroke of the ring rail.

The various weights are all adjusted in position, the springs are adjustable in tension, the set screws in the lugs 27, 28 can be adjusted, the arm 50 and the cams 25 and 48 can be shifted angularly on their shafts, so that all working conditions of the spinning machine can be provided for.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

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

1. The combination with a ring spinning machine, of a constant speed motor for driving it, planetary gearing connecting said motor and machine, a brake lever for controlling the revolutions of said gearing, centrifugal weights driven by said gearing and having a yielding connection with said lever, and a cam rotating with the ring rail and acting upon said lever.

2. The combination with a ring spinning machine, of a constant speed motor for driving it, planetary gearing connecting them, a weighted brake lever for controlling the revolutions of said gearing, an auxiliary weight, and a cam actuated and controlled in accordance with the movement of the ring-rail for adding said auxiliary weight to the weighted lever and withdrawing it therefrom at regular periods.

3. The combination with a ring spinning machine, of a constant speed motor for driving it, planetary gearing connecting them, a weighted brake lever for controlling the revolutions of said gearing, an auxiliary weight, a cam actuated and controlled in accordance with the movement of the ring-rail for adding said auxiliary weight to the weighted lever and withdrawing it therefrom at regular periods, and means for advancing and retarding the phase of said cam with respect to the movement of the ring rail.

4. The combination with a ring spinning machine, of a constant speed motor for driving it, planetary gearing connecting them, a weighted brake lever for controlling the revolutions of said gearing, an auxiliary weight, a cam actuated and controlled in accordance with the movement of the ring-rail for adding said auxiliary weight to the weighted lever and withdrawing it therefrom at regular periods, and means for suspending the action of said cam during the initial portion of the bobbin building.

5. The combination with a ring spinning machine, of a constant speed motor for driving it, planetary gearing connecting said motor and said machine, a rotatable casing containing said gearing, brake mechanism for controlling the speed of revolution of said casing, means for automatically varying the braking pressure in accordance with the movements of the ring rail, and means responsive to variation in the speed of revolution of said casing for supplementing and reinforcing the action of the aforesaid means in varying the braking pressure.

In witness whereof, I have hereunto set my hand this 29 October, 1913.

OTTO STÖBE.

Witnesses:
ALFRED EISNER,
HERMANN KÜNZE.