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SPEED REGULATING MECHANISM

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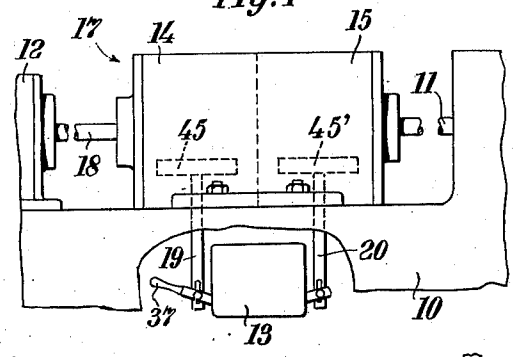
Fig. 1



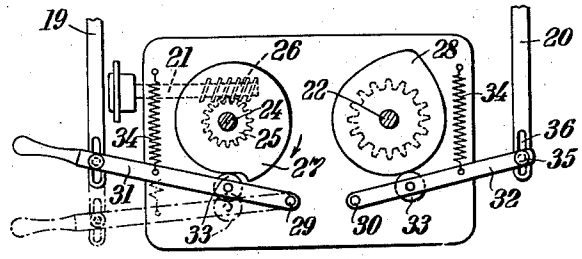


Fig. 2

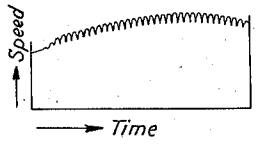


Fig. 3

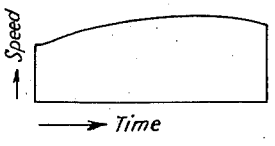


Fig. 4

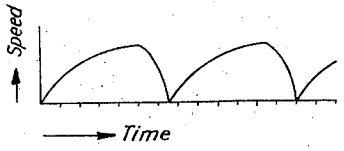


Fig. 5

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SPEED REGULATING MECHANISM

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Goppingen, Germany

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6 Claims. (Cl. 57—95)

The present invention relates to a speed regulating mechanism which is particularly adapted for spinning machines.

In numerous machines the requirement arises that the speed of a driven shaft should be continuously variable in accordance with the condition of operation of the machine which may be a function of two variable factors. This applies for instance to ring spinning or like machines in which the rotary speed of the spindles should be varied during the operation in accordance with two conditions:

(1) When the building of the cops is in its initial stage, the spindles should be driven at a lower speed and this speed should gradually increase as the cops are being built up. When the thread approaches the upper ends of the cops, the speed should be reduced again. This speed regulation is known as the basic variation of speed.

(2) The thread is wound on the spools layer by layer, the thread moving from the outer periphery of the spools towards the inner periphery and then back to the outer periphery and so on. When the thread is wound on the inner surface, the speed of the spindles should be reduced and it should be increased when the thread is wound on the outer surface of the spools. This additional speed control is called the cyclic variation.

The basic variation and the cyclic variation are combined to take place simultaneously. Their purpose is to keep the tension set up in the thread as constant as possible in order to minimize the liability of fracture of the thread.

The object of the present invention is to provide an improved speed regulating mechanism for spinning machines of this type in which the speed can be accurately and positively controlled in accordance with a predetermined characteristic. A further object of the present invention is the provision of a speed control mechanism in which the changes of the speed do not lag behind the adjustment of the regulating mechanism no matter how fast the regulating mechanism is adjusted. Further objects of the present invention will appear from the description of a preferred embodiment of the invention following hereinafter.

In the drawing illustrating this embodiment

Fig. 1 is a partial elevation of a spinning machine provided with the improved speed control mechanism,

Fig. 2 is the speed control mechanism shown on an enlarged scale,

Figs. 3, 4 and 5 show characteristics of the speed variation.

In Fig. 1, a spinning machine 10 is diagrammatically illustrated which is equipped with a spool driving shaft 11, a spool driving electric motor 12 and a speed control mechanism designated by 13 as a whole. The motor 12 may be of the constant speed type.

Fig. 3 illustrates the speed characteristic of the spools which is preferred in modern spinning machines. This characteristic is produced by the additive combination or superimposition of the two curves illustrated in Figs. 4 and 5, Fig. 5 being on an enlarged scale. Fig. 4 shows the basic variation and Fig. 5 the cyclic variation which is to be superimposed on the basic variation. From this superimposition the characteristic shown in Fig. 3 will result.

Prior to the present invention, the speed regulation of such spinning machines was effected by regulatable electric motors, more particularly, by alternating current commutator motors adapted to be controlled as to their speed by a displacement of their commutator brushes. This brush displacement was effected by the speed control mechanism. This speed control mechanism was operated from the ratchet wheel shaft providing for the basic variation and from the building motion shaft or heart cam shaft providing for the cyclic variation, the mechanism including means for combining the two adjustments producing motion of a single member transmitted to the brushes of the electric motor. In this manner, the brushes were adjusted in accordance with a characteristic substantially that shown in Fig. 3.

The use of an electric motor of the regulatable type involves the disadvantage, however, that the electric motor cannot be started under load thus requiring the interposition of a clutch between the motor and the spools. Moreover, for stopping the machine the spools must be brought to a stop by a braking mechanism. Furthermore, the speed of the electric motor lags behind the adjustment owing to the considerable momentum of the armature tending to maintain its speed. The object of the present invention is the elimination of these disadvantages.

To this end, a fluid transmission is interposed between the motor and the machine, the transmission including a variable pump provided with a pump regulating member and a variable fluid motor fed by said pump and provided with a motor regulating member. Both regulating members are capable of individual adjustment from

two different elements of the machine, more particularly, from the building motion shaft and from the ratchet wheel shaft of the spinning machine.

Therefore, the variable pump and the variable motor constitute two transmission elements one being adjusted in accordance with the basic variation characteristic of Fig. 4 and the other element being adjusted in accordance with the cyclic variation characteristic of Fig. 5.

The transmission, including the variable pump 14 and the variable fluid motor 15, is diagrammatically indicated in Fig. 1 and designated by 17 as a whole. Transmissions of this type are well known in the art and, therefore, need not be described in detail. Preferably, however, the transmission disclosed in the German Patent No. 519,686 to Erwin Sturm is employed to which reference may be had for a more detailed disclosure of the transmission.

The variable pump 14 is connected by a shaft 18 with the electric motor 12 whereas the variable fluid motor 15 is connected with the spool driving shaft 11. It will be understood that the fluid is circulated by the pump 14 through the motor 15. The resulting speed depends on the adjustment of the variable pump and on the adjustment of the variable motor.

In the German patent to Erwin Sturm above referred to there is shown a member 45 which is radially shiftable for adjustment of the pump and a similar member 45' which is radially shiftable for adjustment of the fluid motor. For the purposes of the present invention, the slide 43 of the prior patent cooperatively connecting the two members 45 and 45' has been omitted and a regulating member 19 in the form of a rod is attached to the member 45 and a similar rod 20 is attached to the member 45'. Both of these rods 19 and 20 are individually guided by suitable means, not shown, so as to be shiftable in radial direction relative to the transmission 17.

In this manner, both, the pump and the fluid motor, may be individually controlled by adjustment of the members 19 and 20. Thus, the speed of the spool driving shaft 11 may be varied by adjustment of the pump regulating member 19 as well as by adjustment of the fluid motor regulating member 20. The adjustment of these two members is effected by the speed control mechanism 13 illustrated in Fig. 2 on an enlarged scale. This regulating mechanism is operated from the ratchet wheel shaft 21 of the spinning machine and from the building motion shaft 22 of the spinning machine. Since the function and operation of these shafts in the spinning machine is well known in the spinning machine art, a detailed description thereof may be dispensed with herein. The building motion shaft extends through a bearing provided in the base plate 23 of the speed control mechanism. In another bearing provided for in this base plate there is journaled a shaft 24 carrying a worm wheel 25 rigidly attached thereto. This worm wheel is in mesh with a worm 26 mounted on the ratchet wheel shaft 21. Moreover, a cam 27 is fastened to the shaft 24. This is the basic cam of the speed regulating mechanism which performs one complete revolution while the cops are completely built up, whereas the building motion shaft 22 performs one revolution for every reciprocation of the ring frame of the spinning machine.

To the shaft 22 there is secured a cam 28 known as the "heart cam".

On pivots 29 and 30 attached to the base plate 23 there are pivotally mounted two arms 31 and 32 each carrying a follower 33 and subjected to the pull of a spring 34 whereby the follower is resiliently kept in engagement with its associated cam.

The free end of the arm 31 is connected to the pump regulating rod 19 whereas the free end of the arm 32 is connected to the motor regulating rod 20. Preferably, the connection is made adjustable. To this end, the connecting pin 35 is firmly but adjustably attached to the rod 20, or 19 respectively, engaging a slot 36 provided therein. By shifting the pin 35 in the slot 36, the speed allotted to any predetermined position of the cam 27, or 28 respectively, may be varied, as will be readily understood.

The profiles of the two cams 27 and 28 are so designed as to result in the speed characteristics illustrated in Figs. 4 and 5. As cams of this profile are well known in the art, a detailed description thereof need not be given herein.

The arm 31 is provided with a handle 37 enabling the operator to manually shift the pump regulating rod 19 from its operative position to its zero position indicated in Fig. 2 in dotted lines in which the feed of the pump is reduced to zero. When the pump assumes this position, the spool driving shaft 11 stops without requiring any brake even though the motor 12 is running at its normal speed. The machine may be started by gradually moving the arm 31 from its zero position until the follower 33 engages the cam 27. In its zero position, the arm 31 may be held against the tension of spring 34 by a suitable detent not shown.

The present invention is capable of numerous modifications which will readily occur to anyone skilled in the art. Thus, the heart cam 28 may control the variable pump while the basic cam 27 may control the fluid motor.

Moreover, fluid transmissions of a type other than that of the patent to Sturm may be employed provided that the pump and the fluid-motor constituting the transmission are individually adjustable.

From the foregoing description it will appear that the present invention offers the advantage of an elimination of a special linkage for superimposing or combining the two adjusting motions produced by the heart cam and the basic cam. Moreover, the speed of the spinning shaft 11 is more positively and accurately controlled since the speed of this shaft depends solely on the adjustment of the members 19 and 20 and responds immediately without any lag to any change in such adjustment. Therefore, any desired speed characteristic such as that shown in Fig. 3 may be accurately produced to meet the requirements of the spinning process. As the contours of the basic cam 27 and the heart cam 28 correspond positively and directly to the characteristics shown in Figs. 4 and 5, it is very easy to so design these cams as to produce the desired variations in speed.

The spinning machine may be started and stopped without requiring the engagement of any interposed clutch or the operation of a brake. All that is required for starting and stopping the machine is a variation of the pump feed from zero to a predetermined amount or vice versa. When the pump feed is changed to zero, the spinning shaft 11 is positively stopped and prevented from continuing its rotation under its momentum.

When the machine is to be started, first the

motor 12 is put in operation so that it may attain full speed while the pump is adjusted to zero. In this manner, the motor is free from any load while gathering speed.

After the motor 12 has attained its full speed, the handle 37 is gradually moved from its zero position to the operative position in which the follower 33 engages the cam 27. Then it is oscillated thereby so as to change the speed in accordance with the desired characteristic while the cop is being built up.

What we claim is:

1. A machine including a driving shaft, a driven shaft, a hydraulic transmission interposed between said shafts, said transmission including a variable pump provided with a pump regulating member and a variable fluid motor provided with a motor regulating member, two speed control elements and means connecting one element with said pump regulating member and the other one of said elements with said motor regulating member.

2. In a spinning machine the combination comprising a motor, a spool driving shaft, a hydraulic transmission interposed therebetween, said transmission including a variable pump provided with a pump regulating member and a variable fluid motor provided with a motor regulating member, a ratchet wheel shaft, a basic cam operated thereby, a building motion shaft, a cyclic cam operated thereby, means operated by one of said cams and acting on said pump regulating member, and means operated by the other one of said cams and acting on said motor regulating member, whereby the speed of said spool driving shaft is varied under the combined control from said ratchet wheel shaft and said building motion shaft.

3. In a spinning machine the combination comprising a motor, a spool driving shaft, a hydraulic transmission interposed therebetween, said transmission including a variable pump provided with a pump regulating member and a variable fluid motor provided with a motor regulating member, a ratchet wheel shaft, a basic cam operated thereby, a building motion shaft, a cyclic cam operated thereby, means operated by one of said cams and acting on said pump regulating member, means operated by the other one of said cams and acting on said motor regulating member, whereby the speed of said spool driving shaft is varied under the combined control from said ratchet wheel shaft and said building motion shaft, and manual means adapted to move said pump regulating member from its operative position to its zero position and vice versa.

4. In a spinning machine the combination comprising a motor, a spool driving shaft, a hydraulic transmission interposed therebetween, said transmission including a variable pump provided with a pump regulating member and a variable fluid motor provided with a motor regulating member, a ratchet wheel shaft, a basic cam operated thereby, a building motion shaft, a cyclic cam operated thereby, adjustable means operated by one of said cams and acting on said pump regulating member, and adjustable means operated by the other one of said cams and acting on said motor regulating member, whereby the speed of said spool driving shaft is varied under the combined control from said ratchet wheel shaft and said building motion shaft.

5. In a spinning machine the combination comprising a motor, a spool driving shaft, a hydraulic transmission interposed therebetween, said transmission including a variable pump provided with a pump regulating member and a variable fluid motor provided with a motor regulating member, a ratchet wheel shaft, a building motion shaft, means operated by one of said shafts and acting on said pump regulating member, and means operated by the other one of said shafts and acting on said motor regulating member, whereby the speed of said spool driving shaft is varied under the combined control from said ratchet wheel shaft and said building motion shaft.

6. In a spinning machine the combination comprising a motor, a spool driving shaft, a hydraulic transmission interposed therebetween, said transmission including a variable pump provided with a pump regulating member and connected with said motor and a fluid motor fed by said pump and connected with said spool driving shaft, a ratchet wheel shaft, a building motion shaft, means operated by said shafts and controlling said hydraulic transmission, the range of adjustability of said pump regulating member extending to the zero position thereof in which the feed of the pump is reduced to zero for the purpose of stopping and starting the spools of said spinning machine.

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