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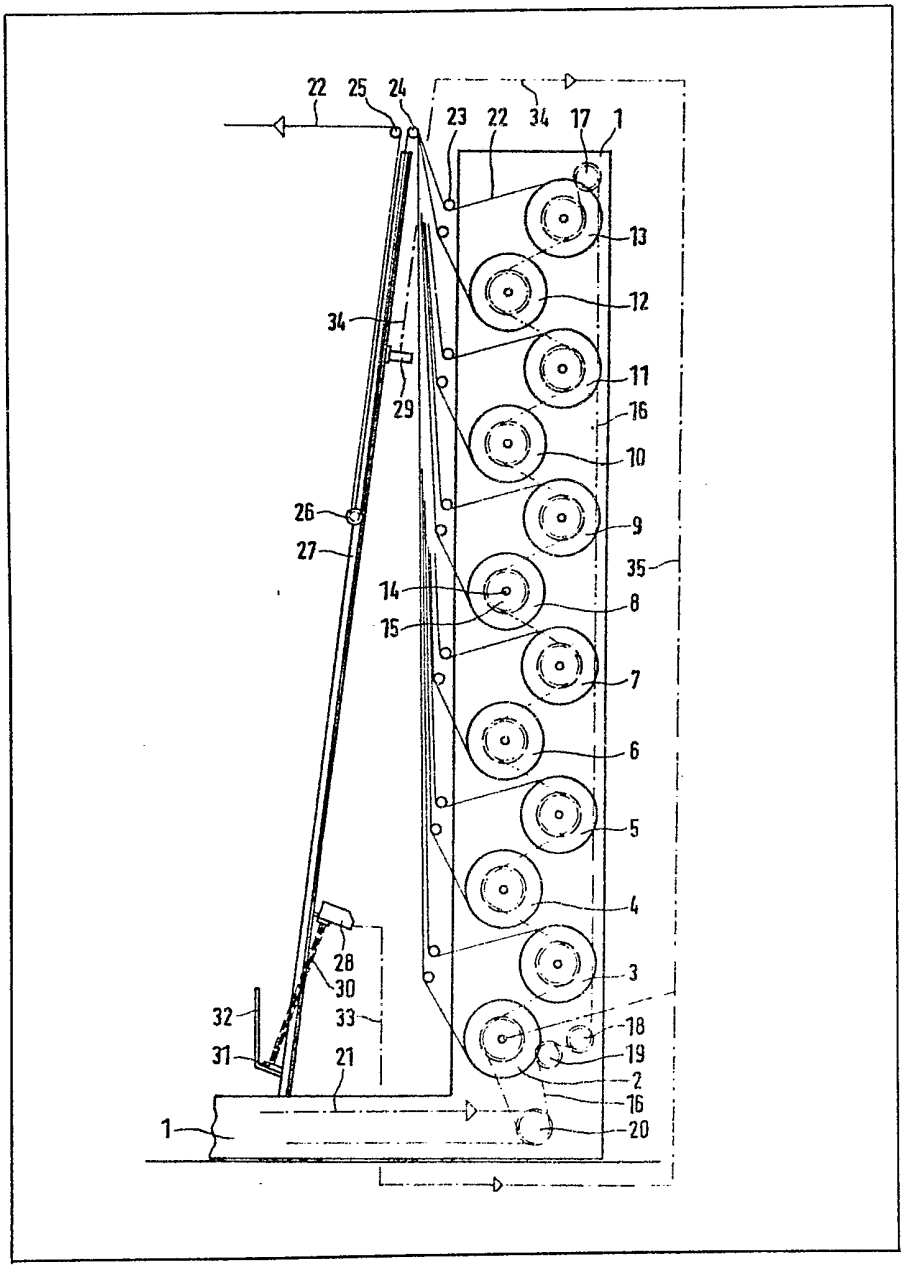
# (54) Thread feeding equipment for a weaving or knitting machine

(57) In order to compensate for variations in the rates of utilisation of individual threads being fed to a weaving or knitting machine (without providing individual speed-controlled drives for each spool) and for variations in delivery from the spools themselves, each spool has an associated thread reservoir formed by training the thread around a compensation pulley (26) which travels up and down over an almost vertical path (27), there being a signal generating device (28) at the bottom of the path actuated by the presence there of the pulley to effect declutching of a clutch/brake coupling between the spool and its drive to retard the spool, and a second signal generating device (29) effecting reconnection of the drive when the pulley has travelled a distance up its path.

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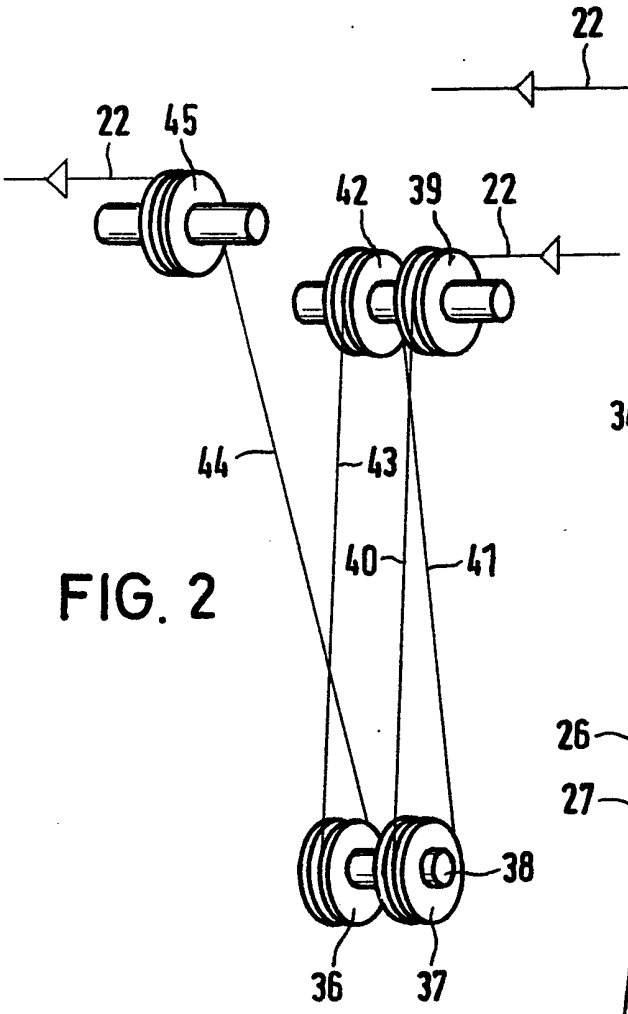


FIG. 2

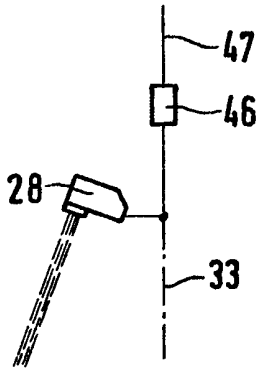


FIG. 3




FIG. 1

SPECIFICATION

**Thread feeding equipment for a weaving or knitting machine**

The invention relates to thread feeding equipment for a weaving or knitting machine and provides equipment for compensating for variations of the speeds of delivery of threads from driven spools to a weaving or knitting machine.

Normally the threads for working in such machines are drawn off endwise, that is to say over one free end of a spool, the spool not being rotated so that in withdrawal of one complete turn of thread it has itself to rotate once about its axis. When such twisting is not desired the threads must be withdrawn tangentially from the spools, for which purpose the spool must rotate. If now the threads are worked at different speeds by the machine, either the spools must be driven with correspondingly different speeds, which would necessitate an expensive drive system in which the drive to each spool is varied automatically, or speed-compensation equipment must be provided.

The invention provides means for solving the problem of the compensating for variations in the thread speeds and for avoiding the need to provide individual speed-controlled drives for each spool.

According to the invention, equipment for compensating for variations in the speeds of delivery to a weaving or knitting machine of threads drawn tangentially from driven spools comprises for each thread a compensating pulley over which in use the thread is trained, which pulley is arranged due to its weight and in dependence on the rate of yarn feed to travel up and down over a prescribed path, and means actuable by the pulley in its travel to effect retardation of the spool at the lower end of the path and to restore the spool drive at the top of the path.

In operation, the compensating pulley for each thread moves up and down over a specific range of travel so producing a reservoir of thread which can constantly adapt itself to the speed of thread withdrawal required in each case by the working machine.

According to a feature of the invention each compensating pulley has associated with it a first signal emitter at the lower end of the prescribed path, which emitter is effective in response to the presence of the pulley at the lower end of the path to produce a signal initiating retardation of the spool drive, and a second emitter to produce a signal to restore the drive.

The second signal emitter may be positioned at the upper end of the prescribed path, or may be actuated by the first emitter and arranged to emit a drive-restoring signal after a time delay.

The second signal emitter when including a time delay is set so that, taking consideration of the mean speed of withdrawal of the working machine, the retardation of the spool drive is eliminated before the compensating pulley has reached the upper end of its maximum range of travel. Thus in this case the timing means must be set in dependence upon the mean speed of thread withdrawal.

The speed-compensating equipment finds preferred utilisation in warp knitting machines to which transversely extending weft threads are fed in order for example to reduce the possibility of transverse stretching of the knitted fabric. These weft threads are laid by a weft carriage moving to and fro over the width of the machine. The weft threads are fed to the weft carriage from above approximately in the middle of the machine width, so that even in the case of substantially constant speed of the weft carriage (apart from the reversing and acceleration at the ends of its travel) a varying thread withdrawal speed results. The thread withdrawal speed here varies periodically from a value close to zero up to a maximum speed.

The retardation of the spool drive can be taken so far that the drive system is switched off entirely, so that the relevant spool may remain stationary. In this case the signal from the first signal emitter disconnects the relevant spool drive and brakes the spool. When the spool drive is re-engaged, in the response of the second signal emitter, the braking action is eliminated.

The capacity of the thread reservoir can be increased by the compensating pulley comprising multiple pulley wheels around which the thread is trained in the manner of a tackle block.

For the guidance of the compensating pulleys two rails are expediently provided per pulley, between which the compensating pulley is guided, resting on the rails, the rails being slightly inclined in relation to the vertical in such a way that the weight of the compensating pulleys just presses them against the rails. In this case the force of gravity acts upon the compensating pulleys practically fully as regards their upward and downward movement, without the possibility of excessive friction being exerted by the rails upon the compensating pulleys. Consequently the compensating pulleys can adapt themselves immediately to quick variations of speed of withdrawal.

Some embodiments of the invention are illustrated by the accompanying drawings, in which:—

Fig. 1 shows the arrangement of twelve spools with rails in front for a compensating pulley,

Fig. 2 shows a modified form of compensating pulley, and

Fig. 3 shows a modified spool-drive control.

As illustrated in Fig. 1, the thread feed equipment with speed-compensating arrangement comprises a frame 1 on which spools 2 to 13 are mounted. Each spool is pushed on to a rotatably-mounted spindle 14 (as indicated by spool 8) which carries a chain wheel 15 (as indicated by spool 8) by means of which the spindle 14 is driven and thus also the spool. An endless chain 16 is trained over the chain wheels 15 and over idler chain wheels 17, 18 and 19. Also the chain 16 is looped around the double chain wheel 20 around which the further chain 21

is trained leading to a drive source (not shown). Thus when chain 21 is driven all the chain wheels 15 and thus the spools 2 to 13 are set in rotation.

Each thread, as shown for the thread 22 from spool 13, is withdrawn tangentially and is trained over individual sets of idler pulleys 23, 24 and 25, over compensating pulley 26 between pulleys 24 and 25, and from pulley 25 to the working machine (not shown).

As may be seen from Fig. 1, the compensating pulley 26 holds the thread 22 under tension by reason of its weight. The compensating pulley 26 is guided between two rails, of which only the rear rail 27 is shown, which rails are slightly inclined to the vertical so that the compensating pulley 26 constantly rests lightly on the rails 27 under the weight of the compensating pulley 26. By reason of the slight obliquity of the rails 27 to the vertical, the friction between the compensating pulley 26 and the rails 27 is substantially negligible so that in the movement of the compensating pulley 26, apart from the tension of the thread 22, practically only gravity is effective. Consequently the compensating pulley 26 can respond rapidly to quickly varying speeds of, and tensions in, the thread 22.

The speed-compensating arrangement for each thread also comprises an associated first signal emitter 28 and an associated second signal emitter 29. The first signal emitter 28 is for example a light barrier control device in which a light beam 30 is emitted by the first signal emitter 28 and reflected by the mirror 31 back to the emitter. The mirror 31 is arranged within the guard plate 32 serving to catch any compensating pulley 26 which may fall on breakage of a thread. The first signal emitter 28 when the compensating pulley 26 runs through its light beam 30 generates a signal which is fed through the lead 33 (as shown in dot-and-dash lines for spool 2) to a clutch/brake coupling (not shown) between the spool and its driving chain wheel 15. This signal actuates the clutch/brake coupling to retard or stop rotation of the spool. As a result thread 22 is either withdrawn from the spool 2 at a very low speed or not withdrawn at all, so that under the pull from the machine being supplied the thread 22 is drawn off over the pulley 25 without thread being fed over pulley 24 at the same speed. Consequently the compensating pulley 26 is caused to run up on the rails 27.

The light beam 30 is directed to cross the path of the pulley 26 over such a relatively great length that the pulley 26 remains in the light beam 30 long enough for signal from the emitter 28 to cause braking of the spool. Thus false operation will not occur due to the compensating pulley 26 passing through the light beam 30 before braking can occur and consequent ascent of the compensating pulley 26 through the light beam 30.

The compensating pulley 26 continues to travel up the rails 27 until the compensating pulley 26 comes into the region of the second signal emitter 29, which for example is a proximity switch in which an electric or magnetic field is disturbed by the entry of the compensating pulley 26, and causes the signal emitter 29 to generate a signal. This signal is fed through lead 34 to the clutch/brake coupling between chain wheel and spool to re-establish the drive to the spool so that the spool 2 again delivers thread 22 at a greater speed than the speed of thread withdrawal of the working machine. Consequently the compensating pulley 26 travels down the rails 27 so that the thread reservoir constituted by the loop between pulleys 24, 25 fills again until the compensating pulley 26 enters the light beam 30 whereupon the operation as described above is repeated by reason of the response of the first signal emitter 28. It should here be pointed out that an individual second signal emitter 29 is provided for each of the spools 2 to 13. The relevant signal leads 33 and 34 are assembled in symbolic representation into the bundle 35 of signal leads.

It will be clear that with the described control the thread reservoirs are constantly filled and emptied again by travel of the compensating pulleys 26 up and down the rails 27.

This form of thread reservoir has the advantage that no separate expense has to be incurred in providing drive systems for individually controlling the speeds of rotation of the spools 2 to 13 to correspond to the speed of thread withdrawal. If in fact it were intended to keep the reservoir constantly in a middle position, it would have to be ensured by means of a special expensive regulating system that the drive systems of the spools 2 to 13 constantly run exactly at the correct speed, which would have to correspond to the mean speed of withdrawal. Since thread is wound on spools in a manner such that thread withdrawal speeds fluctuate from spool to spool, individually controlled drives for the spools would have to be provided, and this is achieved in a simple way by the invention by the thread reservoir arrangements in which the pulleys 26 travel up or down faster or slower according to the rate of yarn delivery from the respective spools. A further advantageous effect achieved is that the tension in the threads 22 is kept constant, since the tension in a thread is dependent substantially solely upon the weight of the individual compensating pulley 26, and since these are of equal weight the tensions in all the threads are the same.

In Fig. 2 a form of compensating pulley is shown comprising a number of pulley wheels. In this instance there are two pulley wheels 36 and 37 each freely rotatably mounted on spindle 38. The thread 22 is looped around the pulley wheels 36 and 37 as in a tackle block so that the following thread course results.

The thread 22 from the spool runs firstly over the pulley 39 and then as length 40 to and over pulley 37, as length 41 to and over pulley 42, as length 43 to and over pulley 36 and from the latter as thread length 44 to and over pulley 45 to the working machine.

In the thread reservoir as illustrated in Fig. 2

there is a double storage capacity compared with the individual looping of a compensating pulley 26 according to Fig. 1. This can naturally be increased still further by the provision of further single pulleys and correspondingly reversing pulleys, as in a tackle block.

In Fig. 3, another form of embodiment of the two signal emitters is provided. The signal emitter 28 is illustrated and works in the same manner as described with reference to Fig. 1. The signal emitter 28 through its signal lead 33 now not only controls the coupling between the chain wheel 15 and the spool 2, but furthermore on delivery of a signal it also actuates the timing member 46 which on actuation emits with delay a signal through output lead 47. This signal is used to act like the output signal of the second signal emitter 29 of Fig. 1. The delay set in the timing member 46 is such that, taking consideration of the mean speed of withdrawal of the working machine, the compensating pulley has again ascended so far that it is approaching the end of the range of travel (that is to say approximately at the level of the second signal emitter 29 according to Fig. 1). At this moment the timing emitter 46 emits its signal which then through the signal leads 47 and 34 acts in the manner as described with reference to Fig. 1, in that again it eliminates the braking of the drive of the relevant spool, whereupon the compensating pulley 26 travels downwards again.

CLAIMS

1. Equipment for compensating for variations in the speeds of delivery to a weaving or knitting machine of threads drawn tangentially from driven spools characterised by comprising for each thread a compensating pulley over which in use the thread is trained, which pulley is arranged due to its weight and in dependence on the rate of yarn feed to travel up and down over a prescribed path, and means actuable by the pulley in its travel to effect retardation of the spool at the lower end of the path and to restore the spool drive at the top of the path.

2. Equipment according to claim 1, wherein the pulley comprises a number of pulley wheels around which the thread can be trained in the manner of a tackle block.

3. Equipment according to claim 1 or claim 2, wherein the pulley rests under its weight on and is guided by rails which are for this purpose slightly inclined to the vertical.

4. Equipment according to any of claims 1 to 3, comprising for the pulley a first signal emitter at the lower end of the prescribed path, which emitter is effective in response to the presence of the pulley at the lower end of the path to produce a signal initiating retardation of the spool drive, and a second emitter to produce a signal to restore the drive.

5. Equipment according to claim 4, wherein the second emitter is positioned at the upper end of the path.

6. Equipment according to claim 4, the second emitter being actuated by the first emitter and arranged to emit a drive-restoring signal after a time delay.

7. Equipment according to any of claims 1 to 6 wherein each spool drive comprises a clutch/brake coupling arranged to retard the spool by declutching the drive and braking the spool and to restore the drive by releasing the brake and clutching the spool to the drive.

8. Equipment for compensating for variations in the speed of delivery to a weaving or knitting machine of threads drawn tangentially from spools, the equipment being constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in Fig. 1 or Fig. 2 or Fig. 3 of the drawings.

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