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CONTROL SYSTEM FOR CARDING MACHINE

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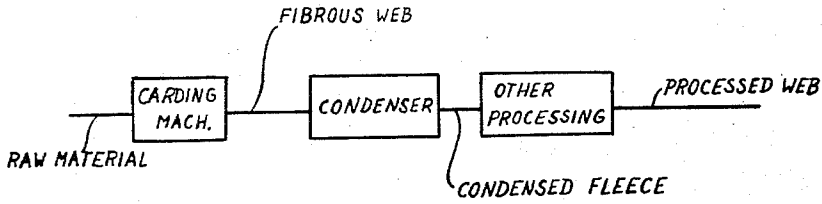


Fig. 1

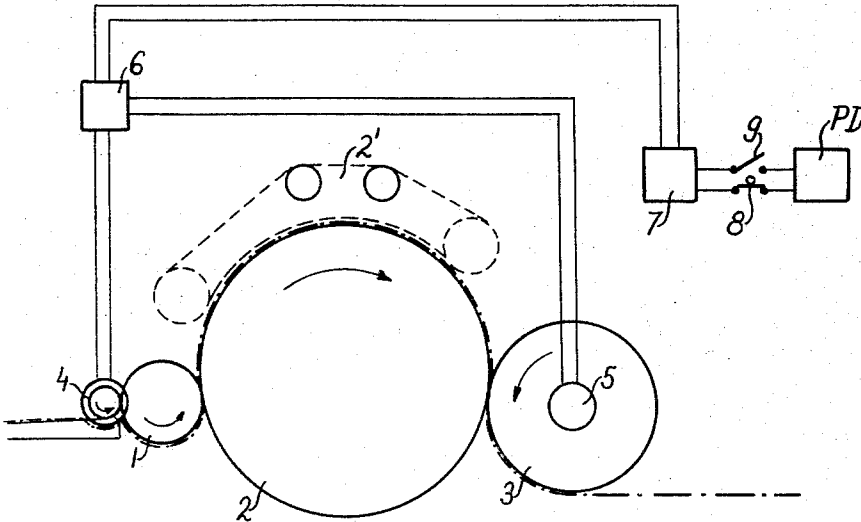


Fig. 2

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CONTROL SYSTEM FOR CARDING MACHINE
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ABSTRACT OF THE DISCLOSURE

A control system for carding machines which include a first rotary member for feeding a fibrous material, and a second rotary member spaced from the first rotary member and receiving the fibrous material therefrom. Drive means is provided for both of these rotary members and includes means for starting and stopping rotation of one of these members subsequent to starting and stopping of the other.

The present invention concerns a carding machine. More specifically, it concerns an arrangement for controlling stopping and starting of rotatable components of a carding machine.

Carding machines comprise, broadly speaking, a feed roller which advances a mass or "lap" of fibrous material to a licker-in which in turn plucks fibers from the lap and advances them to a main or carding roller which receives these fibers and, in conjunction with a so-called flats, transforms them into a loosely coherent mat or web of fibrous material, and a doffing roller which removes this mat or web of fibrous material from the carding roller and advances it for further processing. As a result of the construction of carding machines, in which particularly the carding roller has considerable inertial mass, a relatively long period of up to several minutes is required after start-up of the machine before the prescribed working speed is reached, whereas during stopping of the carding machine, particularly of the carding cylinder, considerable dynamic stresses are exerted on the machine parts. It is therefore desirable to avoid stoppage of the carding cylinder as much as possible. On the other hand it is frequently necessary, particularly in carding machines which form a part of an automatic production line, to shut down one or the other component of this production line, thus necessitating shut-down of the web production. Modern carding machines are therefore provided with independently controlled drives for the carding cylinder on the one hand, and for the feed means and the doffing cylinder on the other so that, if shut-down of production is necessary, only the feed means and the doffing cylinder need be stopped whereas the carding cylinder can continue to rotate. However, although this solution has eliminated the need for frequent stopping and starting of the carding cylinder, it has implications beyond this particular problem, implications which concern the quality of the final product produced with the help of the carding machine. With the feeding means and the doffing cylinder stopped and with the carding cylinder continuing to rotate, it will be understood that whatever fibrous material the carding cylinder has received from the feed means at the moment of stoppage of the latter will still be transferred to the doffing cylinder. Since the doffing cylinder is stopped, the material will be transferred thereto not in the form of a loosely coherent mat but in bunched-up form. It is clear that when the doffing cylinder is started up again, this must cause a local increase in the thickness of the web. On the other hand, when the feed means and doffing cylinder are started up together, the feeding mechanism only begins to re-fill the emptied carding cylinder so that for a period of time

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only a reduced quantity of fibrous material can be removed from the latter by the doffing cylinder. Naturally, this results in a local decrease in the thickness of the web, thus weakening the web or even interrupting it completely.

This is of particular importance in installations, such as automatic production lines, in which the carding machine supplies the web to subsequent processing machines. Since the web produced by the carding machine is the raw material for the production of many types of yarn, fleece, felt, non-woven textiles, laminated goods, etc., carding machines form a part of many such automatic production lines and the problem of preventing undesirable variations in the quality—i.e., thickness—of a web is very pressing.

One solution which has been proposed is to let the carding machine continue to operate and produce its web throughout the time for which the rest of the production line is shut down, provided that this involves only a short-time stoppage. The surplus web produced by the carding machine must then be routed into suitable depositories, must be guided and transported on its way thereto, and must be checked and controlled. From a point of view of space requirements this necessitates a long production line to accommodate the web depositories. It also requires very complicated control equipment, as will be obvious from the outline of the functions this equipment must perform.

Another known solution is to form the surplus web into a free-hanging loop between the carding machine and the next following processing machine. In this case the loop is allowed to attain a predetermined length; once it exceeds this length as a result of an overly long stoppage of the production line, a control device such as a photocell which measures the length of the loop, stops the carding machine and interrupts web production. Again, this device is relatively complicated and has the additional disadvantage of adversely affecting the quality of the web since the latter, which is not supported while hanging in loop shape, is subject to stretching and thereby suffers local decrease in its thickness.

Despite these known solutions industry is thus still searching for an arrangement whereby any or all processing machines of an automatic production line may be temporarily closed down without affecting the quality of web produced by the carding machine.

It is therefore a general object of the present invention to overcome the drawbacks of the above-mentioned previously known solutions.

A more specific object of the present invention is to provide a carding machine in which the quality of the web produced by the carding machine is not affected whenever the other processing machines cooperating with the carding machine are shut down.

A still more specific object of the present invention is to provide a carding machine in which the feed means and the doffing roller may be shut down at will without causing variations in the quality of the web, or breakage of the same during shut down or re-starting of the carding machine.

In accordance with one feature of our invention we have provided in a carding machine for processing an elongated web of fibrous material, the combination of feed means for feeding fibrous material, including a first rotary advancing member; a second rotary advancing member spaced from said first advancing member, each of said advancing members rotating in a predetermined direction so as to advance fibrous material from said first advancing member toward and around said second advancing member; and drive means for both of said advancing members, said drive means comprising means

for starting and stopping rotation of one of said advancing members subsequent to starting and stopping of the other of said advancing members, so as to prevent, during starting and stopping of said carding machine, rupture or weakening of said web of fibrous material.

The advantage of the inventive construction lies in the fact that in case of need of a short-time interruption of the web-producing process, the carding machine may be shut down by stopping the feed means and the doffing cylinder. However, this is accomplished not simultaneously, but in a predetermined order. Specifically, the feed means is stopped first whereas the doffing cylinder continues to rotate for a predetermined period of time so as to receive the residual amount of fibrous material from the carding cylinder which, it should be understood, is not shut down but continues to rotate. There is thus formed on the doffing cylinder at the moment of shut-down of the same an end portion of a loosely coherent fibrous mat or web whose forward portions lead to the next processing device, such as a condenser. When the production line, and accordingly the carding machine, is started up again, there is again a delaying action in that the feed means is started first, in order to refill the carding cylinder with fibrous material. When the doffing cylinder is re-started after a predetermined time delay the carding cylinder is so refilled with fibrous material that the doffing cylinder can remove from it during each rotation the quantity of fibers necessary to form a web of a thickness desired. This material joins up with the end portion of the web still held on the doffing cylinder, and the modified web which is now again being passed on to the processing device next in line, gives no appearance of ever having been interrupted and does not suffer from increases or decreases in its thickness.

Thus, with the present invention there is no need to provide receptacles for surplus web produced during shut-down of the production line, there is no need for special devices for depositing, guiding and checking the surplus web, and there is no impairment in the quality of the web and no breakage occurs which would require manual re-linking by an operator, a time-consuming and expensive process.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a flow diagram showing the flow of fibrous raw material through an automatic production line incorporating a carding machine;

FIG. 2 is a schematic representation of the carding machine according to the present invention.

As indicated in FIG. 1, the fibrous raw material is fed into the carding machine and leaves the same in the form of a loosely coherent fibrous web. This web then passes into a condenser, where it is condensed into fleece which in turn passes on to one or more other processing machines, the last of which it leaves as a processed web or other commodity. It will be clear from this flow chart that whenever either the condenser or one of the other processing devices must be shut down, be it for repair, inspection or any other reason, it is either necessary to somehow store surplus web produced by the carding machine, or to interrupt the production of web by the carding machine. As will be evident from the introductory comments we have chosen the second approach and have directed our invention thereto.

Turning now to FIG. 2, the carding machine incorporating an invention will be seen to comprise advancing means 1, a carding roller 2 cooperating with flat 2', whose exact construction forms no part of the present invention, and a doffing roller 3. The carding roller 2 is driven

by a drive means which is not shown. Advancing means 1, which may also be considered as a first advancing member, and doffing cylinder 3, which may be considered as the second advancing member, with the carding roller 2 constituting a transfer member for transferring material from the advancing means to the doffing roller, are driven by a common drive means which is also not shown since it may be of any well-known construction. Advancing means 1 is connected to the drive means by a suitable expedient, such as an electromagnetic clutch 4, and the doffing roller 3 is similarly connected to the drive means by an electromagnetic clutch 5. The flow of fibrous raw material through the carding machine is indicated in dot-dash lines.

Electromagnetic clutches 4 and 5 are both connected to a time delay means, such as a timing relay 6, and the latter is in turn connected to an auxiliary relay 7 inserted into the electrical circuit of a processing device PD following next in line after the carding machine. Reference numeral 8 designates an automatic switch arranged in the circuit between the processing device PD and the auxiliary relay 7 so that, if breakdown of the processing device PD occurs, the switch 8 will automatically open in response to operation of a well-known automatic stop-motion arrangement in the device PD, thereby interrupting the circuit and causing the auxiliary relay 7 to issue a shut-down impulse to the timing device 6. This impulse reaches the electromagnetic clutch 4 of the advancing means 1 immediately and the advancing means 1 is stopped at once by being disconnected from its drive. The impulse is, however, delayed in the timing device 6 on its way to the electromagnetic clutch 5 of doffing roller 3, and timing device 6 will pass the impulse on to clutch 5 only after a predetermined period of time. Reference numeral 9 indicates a manually operable switch which is also inserted in the circuit intermediate the processing device PD and the auxiliary relay 7 so as to give the operator of the processing device PD the possibility of switching off the carding machine at will. The results of interrupting the circuit with the switch 9 are similar to those which occur upon interruption of the circuit by automatic switch 8.

As has been pointed out before, when the electromagnetic clutch 4 stops the operation of the advancing means 1, the doffing roller 3 continues to operate for a predetermined period of time. This period is so selected that the doffing roller 3 is enabled to remove the residual fibrous raw material from the carding roller 2. After the predetermined period of time has passed, the timing device 6 disengages the electromagnetic clutch 5 and thereby stops the doffing roller 3. The carding roller 2 which, as has been pointed out before, is provided with an independent drive, continues to rotate.

When the production line is to be re-started, that is when the processing device PD is re-activated by closing of the switches 8 or 9, the auxiliary relay 7 issues a starting impulse to the timing device 6. The impulse passes from timing device 6 immediately to electromagnetic clutch 4 which at once restarts the advancing means 1. The advancing means then begins to refill the carding roller 2 with fibrous raw material. The time required for this is known and the timing device 6 is accordingly preset for a delay corresponding to this time period. After expiration of the preset time period the timing device 6 actuates the electromagnetic clutch 5 of doffing roller 3 which now begins to rotate and removes or "doffs" fibrous raw material from the carding roller 2 at the operational rate of the carding machine. In other words, the fibrous raw material available on carding roller 2 for doffing corresponds in quantity to that which was available prior to stoppage of the carding machine so that the raw material being newly doffed simply joins up with the trailing end of the web which is still on the doffing roller 3, whereupon the web is then again fed to the processing device

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PD without any interruption or impairment of quality whatever.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of carding machine, differing from the types described above.

While the invention has been illustrated and described as embodied in carding machines, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that from the standpoint of prior art, fairly constitute essential characteristics of the specific and generic aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a carding machine for processing an elongated web of fibrous material, the combination of advancing means including a first advancing member adapted to advance fibrous material; a second advancing member spaced from said first advancing member; a transfer member for transferring fibrous material from said first advancing member to said second advancing member; first drive means for operating said first advancing member so as to advance said fibrous material from said first advancing member into contact with said transfer member and second drive means for operating said second advancing member so as to advance the material from said transfer member to said second advancing member; a pair of electromagnetic clutches operatively associated with the respective advancing members and arranged to effect and terminate driving connection thereof with said drive means; and electrically operable delaying means operatively connected with the respective electromagnetic clutches and arranged to actuate the same for starting operation of said second advancing member with a predetermined delay following starting of operation of said first advancing member, and for stopping operation of said second advancing member with a predetermined delay following stopping of operation of said first advancing member.

2. In a carding machine for processing an elongated web of fibrous material, the combination of advancing means including a rotatable feed roller adapted to advance fibrous material; a rotatable doffing roller spaced from said advancing roller; carding means cooperating with said advancing roller and said doffing roller for receiving fibrous material advanced by said advancing roller, processing said fibrous material and transferring the same to said doffing roller in the form of a web; first drive means for rotating said advancing roller in a direction to advance fibrous material into contact with said carding means, and second drive means for rotating said doffing roller in a direction to remove said web from said carding means and to further advance it for additional processing; a pair of electromagnetic clutches each associated

with a respective one of said drive means and with one of said rollers and operative for effecting and terminating driving connection of the respective rollers with their respective drive means; and electrically operable time delay means operatively connected with the respective electromagnetic clutches and arranged to actuate the same for starting rotation of said doffing roller with a predetermined delay following starting of rotation of said advancing roller, and for stopping rotation of said doffing roller with a predetermined delay following stopping of said advancing roller whereby interruption of the web being advanced by said doffing roller for further processing is prevented.

3. In a carding machine for processing an elongated web of fibrous material, the combination of advancing means including a first rotary advancing member adapted to advance fibrous material; a second rotary advancing member spaced from said first advancing member; a transfer member for transferring fibrous material from said first advancing member to said second advancing member; drive means for rotating said first and second advancing members in a direction to advance said fibrous material from said first advancing member into contact with said transfer member and from there around said second advancing member; a pair of electromagnetic clutches each associated with a respective one of said advancing members and operative for effecting and terminating driving connection of the respective advancing member with said drive means; and time delay means including relay means operatively connected with the respective electromagnetic clutches and arranged to actuate the same for starting rotation of said second advancing member with a predetermined delay following starting of rotation of said first advancing member, and for stopping rotation of said second advancing member with a predetermined delay following stopping of rotation of said first advancing member whereby, when said first advancing member is stopped, said second advancing member will receive residual fibrous material carried by said transfer member before said second advancing member is stopped, thereby substantially removing fibrous material from said transfer member, whereas, when said first advancing member is started, fibrous material will be fed thereby to said transfer member and will be carried by said transfer member into contact with said second advancing member before the latter is started so that no interruption occurs in the flow of fibrous material reaching said second advancing member during operation thereof.

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