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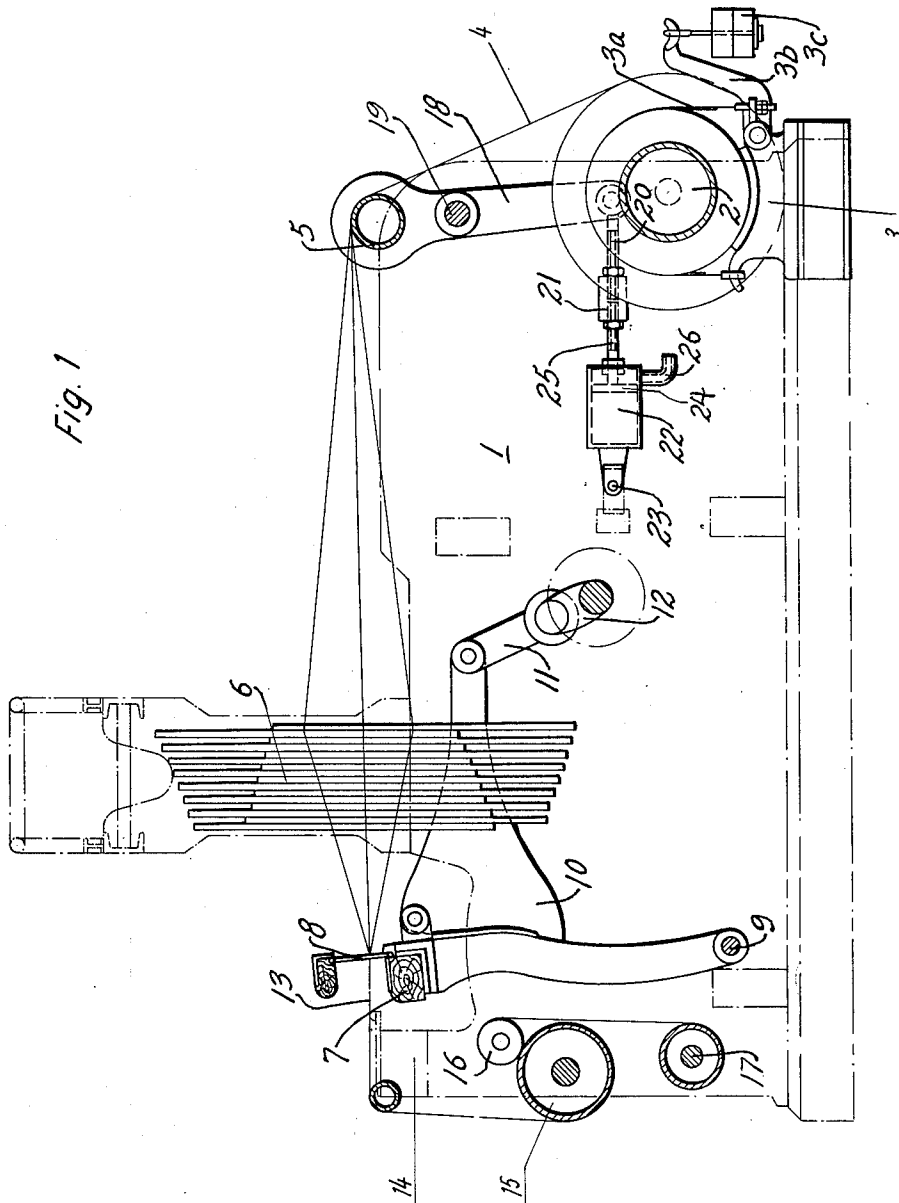
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PNEUMATIC WARP TENSIONING DEVICE FOR LOOMS

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3 Sheets-Sheet 1



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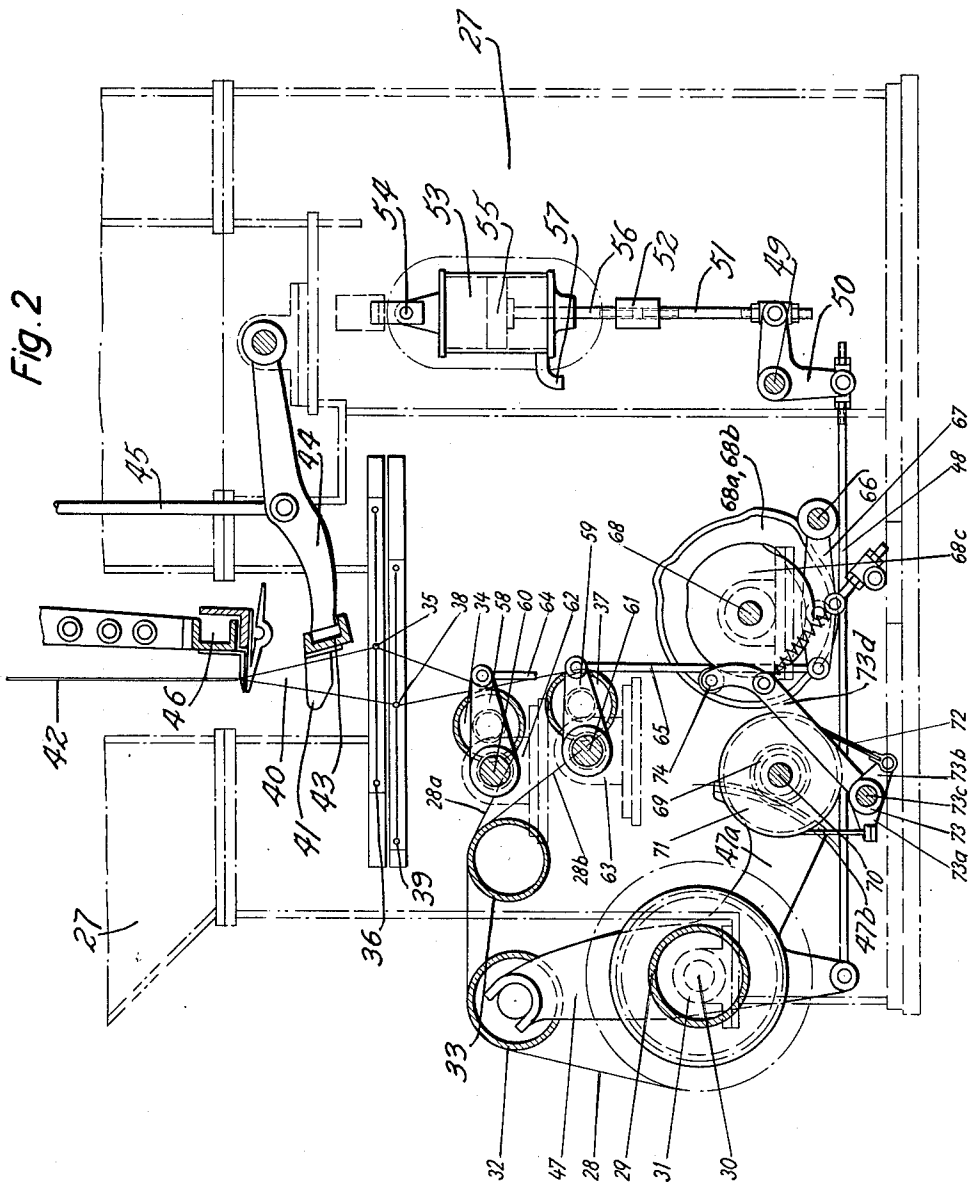
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3 Sheets-Sheet 2



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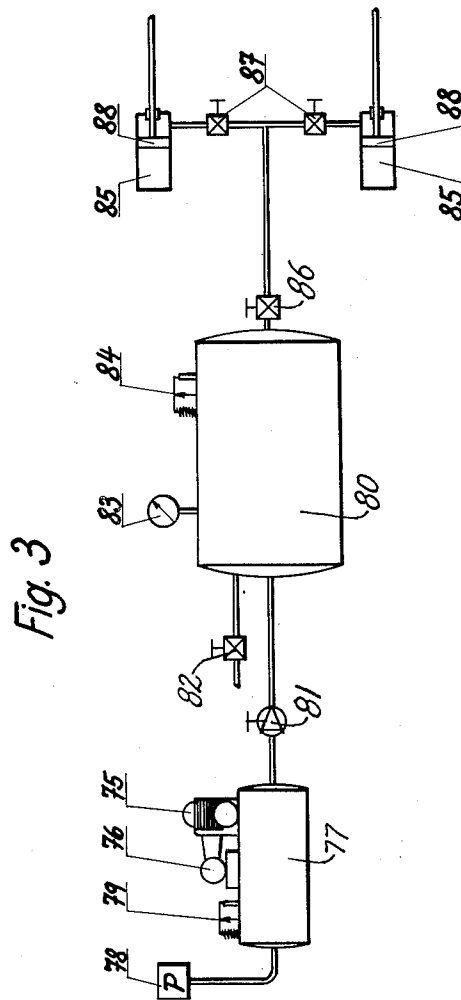
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3 Sheets-Sheet 3



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1

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PNEUMATIC WARP TENSIONING DEVICE FOR LOOMS

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In looms it is necessary to keep constant the tension of the warp threads or of the different warp-thread groups during certain periods in weaving. This aim is generally attained by the use of oscillating back beams (back rests) whose movement is mechanically and positively controlled by the crank shaft.

In the manufacture of staircase carpets, carpets etc., the tension of the warp threads must be kept constant on the knotting loom during certain periods of one cycle of operation; during other periods of one cycle of operation the one or the other group of warp threads must be slackened temporarily in order to enable the correct formation of the desired knots of the pile.

The present invention is characterized by the fact that the required warp tension, or the required warp tensions of several warp-thread systems through which the different operations are performed, are maintained pneumatically whereby the adjustment of the required warp tension is made by the operation of one or more electric and pneumatic adjusting or control members. For this purpose, one or more whip rollers, freely movable along a guide, are connected by means of suitable rods with the working pistons in compressed air cylinders, and all compressed air cylinders of a unit or all compressed air cylinders acting on the oscillating whip roller in operation, are connected with one pressure chamber or the corresponding pressure chamber. If the weaving loom is fitted with one or more warp-beam regulators, the position of one or more whip rollers freely movable along a guide, can be used for the control of the advance of one or more warp-beam regulators of the weaving machine. The adjustment and maintaining of the working pressure necessary for a certain operation, can be made f.i. by means of one or more pressure reducing valves or by means of electric pressure switches (pressostats).

In order to prevent the machine from working or being set to work at a too low pressure in the pressure chamber or pressure chambers, there is connected with the compressed air cylinders of the machine a further pressure responsive switch (safety pressostat) arranged in the control circuit for the electric drive motors.

The enclosed figures serve to illustrate the invention, i.e. two execution forms given as an example.

FIG. 1 is a section view of a weaving machine with pneumatic warp tension device;

FIG. 2 is the section view of a carpet knotting machine with a pneumatic warp tension device of similar design;

FIG. 3 is a schematic view of the compressed air piping, including one compressor set as a compressed air generator for a pneumatic warp tension device.

The FIGURES 1 and 2 show a device in which only one pneumatic working cylinder is visible. As a matter of fact, the devices shown in the figures must be arranged at least at both sides of a machine, and on heavy machines more than two devices of this kind can be installed on the machine width. In FIG. 3 two pneumatic working cylinders are shown; their number may be easily increased if heavy machines are concerned, by coupling in parallel further cylinders.

In FIG. 1, 1 is shown the left side frame of the loom. At the rear of the machine, the warp beam 2 is carried

2

on concave surfaces of the friction block 3 and braked f.i. by the brake band 3a, lever 3b and weights 3c.

The warp 4 coming from the warp beam 2 passes first over the oscillating whip rollers 5 and is then conducted through the healds (heddles) of the heald frames 6 and through the reed 8 carried by the lay 7. The movement of the lay 7, carried in the footstep 9, is effected by the crank shaft 12 by means of the lay angles 10 and the crank connecting links 11.

The fabric 13 passes first over the front rest or breast beam 14 and then over the take-up roller or sand beam 15 driven by the take-up motion not shown in the figure. After having turned round the pressure beam 16, the fabric is finally wound up on the cloth beam 17 or carried to a separate wind-up frame (not shown in the figure).

According to the invention, the whip roller or tension roller 5 is carried by the top arm of the double-armed lever 18 the latter pivoting on the shaft 19 mounted on the frame 1. To the bottom arm of the lever 18 the connecting rod 20 is linked whose effective length can be varied by means of an adjustable intermediate member 21 with righthand and lefthand threads. The frame 1, carries on pivot 23 the compressed air cylinder 22 with the piston 24 whose piston rod 25 is linked, by means of the intermediate member 21, to the connecting rod 20. The compressed air cylinder 22 has an inlet socket 26 serving to admit compressed air by means of a flexible pipe (not shown in the figure). The devices shown in FIG. 1 are provided on both sides of the loom.

FIG. 2 shows, in dot-and-dash pattern, the bottom machine side 27 of a carpet knotting loom for making carpets with a tufted pile. The warp threads 28 into which the pile thread parts are tied pass from a warp beam 29 whose gudgeons are rotating in bearings 31 on the machine sides and which is controlled by a warp-beam regulator not shown in the figure. The warp 28 coming from the warp beam 29, passes first over the oscillating whip roller 32 and then over a fixed back rest 33. After having passed this fixed back rest 33, the warp 28 is distributed in groups, group 28a which, after the distribution, is carried, over a second upper oscillating whip roller 34, through the healds (heddles) 35 of the top heald frame 36, and in the group 28b which first passes a further lower oscillating whip roller 37 and then goes through the healds (heddles) 38 of the bottom heald frame 39. The two heald frames 36 and 39 are actuated to form a shed 40 through which a shuttle (not shown in the figure) is picked in well-known manner. The shuttle runs on the reed 41 and inserts a weft thread into the shed 40; the weft thread is then beaten-up tightly to the fell of the cloth 42 by means of the reed 41. The fabric 42 passes then over a take-up beam (not shown in the figure) and finally is wound to a cloth beam (not shown in the figure).

The reed 41 is fitted in well-known way to the lay 43. The lay 43 has lay swords 44 which are actuated by means of the connecting rods 45 which are driven in the usual manner.

According to the type of fabric, after a certain number of wefts forming a woven base with the warps, a row of pile-thread tufts are tied into the warp threads 28. This is done by means of the device 46 which, however, is not subject of the present invention so that no specification thereof is given.

To obtain a constant tension of the warp 28 during the insertion of the base wefts between the tying into warp of two rows of pile-thread tufts, the oscillating whip roller 32 is arranged, according to the invention, in the top-arm of the three-armed lever 47 which is pivoted on the gudgeon 30 of the warp beam 29. To the bottom arm of the lever 47 a horizontal connecting rod 48 is linked to one arm of the angle lever 50 pivoting

on pivot 49. A further, vertical connecting rod 51 is linked to the other arm of said angle lever 50. The effective length of this connecting rod 31 can be varied f.i. by means of a lefthand and righthand threaded intermediate adjustable link 52.

To the frame 27, the compressed air cylinder 53 is fitted, on swivel 54. The piston 55 with its piston rod 56 is linked to the vertical connecting rod 51 by means of the intermediate member 52. The compressed air cylinder 53 carries the inlet socket 57 which serves to admit the compressed air by means of a flexible pipe (not shown in the figure).

Whilst the pile thread tufts are tied into the warp groups by means of the device 46, it will be necessary to slacken or let-off from time to time the warp thread group 28a or the group 28b, and this is performed by a corresponding control of the oscillating back-rests 34 and 37. Both additional oscillating whip rollers 34 and 37, carried in the levers 58 and 59 are pivotally mounted at points 60 and 61. in the bearings 62 and 63 on the frame, and are controlled for instance by means of the connecting rods 64 and 65, which are connected to the levers 67 pivoting at points 66, and the grooved cams 68a on shaft 68, which are superimposed in FIG. 2.

In order to make sure a slackening or letting-off of the warp-thread groups 28a and 28b for the tie-in process, it will be necessary to stop by braking the oscillating whip roller 32 when the pile-thread tufts are tied-in. For this purpose, the lever 47 has a third arm 47a which carries at its outer end a toothed sector 47b in gear with the spur wheel 69.

The same shaft 70 with the spur wheel 69 carries the brake pulley 71 of a differential brake; 72 is the brake band. The ends of this brake band 72 are fitted to the arms 73a and 73b of the three-armed lever 73, pivoting at point 73c in the frame 27. The third arm 73b of the lever 73 carries at its outer end a follower roller 74 guided in the cam groove of a cam 68c which for instance is mounted, together with the grooved cams 68a, on the same shaft 68.

According to the position of follower 74, the brake pulley 71 of the differential brake is either braked or not braked, which means that the whip roller 32 is either fixed or free to oscillate. The devices shown in FIG. 2 are provided at both sides of the loom.

The pneumatic connection of the compressed air plant is shown by the compressed air piping scheme in FIG. 3. 75 is the air compressor, driven by the electro-motor 76, which carries the compressed air to the compressed air chamber 77. The air chamber 77 has a pressure responsive switch (pressostat) 78 and a safety valve 79, and is also connected, by means of a piping, with a larger compressed air chamber 80 which is fitted with an adjustable pressure reducing valve 81. The larger compressed air chamber 80 is fitted with a hand operated shut-off valve 82 which is opened to reduce the pressure in container 80, a manometer 83 and a safety valve 84; the piping fitted to the air chamber 80 brings the compressed air to the compressed air cylinders 85, and has two hand operated shut-off valves 86 and 87. The piston rods of the pistons 88 in the compressed air cylinders are connected by suitable rods with the two ends of an oscillating whip roll (not shown in the drawing).

Motor 76 of compressor 75 is automatically switched on by the pressure responsive switch 78 when the pressure in container 77 has dropped below a predetermined minimum value, and the motor is automatically disconnected when a previously set maximum pressure is obtained in container 77. Due to the operation of pressure responsive switch 78, the air pressure in container 77 fluctuates within a selected range of pressures. The required working pressure in the larger air chamber of the second container 80 is automatically maintained by means of the pressure reducing valve 81 at a level below the minimum pressure in container 77. The pres-

sure is observed on the manometer 83, and when it is desired to adjust the pressure in container 80 to lower pressure, the pressure therein is relieved by opening valve 82 until the desired lower pressure is indicated on manometer 83, and valve 81 is correspondingly adjusted. Since the pressure in the large container 80 is automatically maintained at a selected constant level, the power transmitted to the oscillating whip roller through the cylinder and piston means 85, 88 is kept constant.

If the power transmitted to the whip roller is insufficient, regulation of the pressure reducing valve 81 to a higher value will suffice to increase the pressure in container 80 and the transmitted power. If the power acting on the whip roller must be decreased, the pressure reducing valve 81 is set to a lower pressure, and the relief valve 82 is opened to let out a certain quantity of air from container 80 until the lower pressure set on the pressure reducing valve 81 will prevail in the air chamber of container 80.

The pistons 88 in FIG. 3 correspond to piston 24 in FIG. 1, and to piston 55 in FIG. 2.

Besides the extremely simple and most precise regulation possibilities a particular advantage of the device is the fact that the powers transmitted by the two or more compressed air cylinders to the oscillating whip roller are synchronous as all working cylinders are fed with compressed air by a common piping which must be of sufficient diameter in order to avoid essential losses or pressure. It is desirable to prevent a pressure increase in the cylinders 85 during the compression stroke of the pistons 88 in order to maintain the force exerted by pistons 88 on the whip roller constant. A slight increase of the pressure cannot be entirely prevented but it is possible to maintain as low as desired the increase of pressure during the compression stroke, by choosing a suitable volume of the larger compressed air chamber. As clearly shown in FIG. 3, the volume of container 80 is substantially larger than the volume of cylinder 85, and the volume of container 80 is selected in the illustrated embodiment in order to achieve a very small increase of the pressure in the cylinders 85 during the compression stroke. All the before mentioned advantages which are of highest importance in weaving, could not be realized by the use of the devices so far known.

The execution forms of the invention described and illustrated by the enclosed figures are preferred embodiments to obtain the results aimed at. As a matter of fact, various details of the devices can be designed in different ways. For instance, in lieu of a warp beam, a creel with introduction frame could be provided; the piston rods could act directly upon the oscillating whip roller i.e. without intermediate rods; the air compressor can supply several larger air chambers for several weaving looms; if a compressed air system is existing, the air compressor can be omitted, as the larger air chamber the larger air chambers then can be connected directly with this system, with insertion or pressure reducing valves.

Finally it is emphasized that the device is not only for use on the two weaving machine types as per description and figures, but also for use on all other machines in which systems of threads must be kept under certain tensions, f.i. knotting machines for making nets.

I claim:

1. In a loom, in combination, a tension control device comprising at least one whip roller means adapted to support warp threads and being movable for adjusting the tension of the warp threads; a compressor including an electric motor; a first air container connected to said compressor; a pressure responsive switch means controlled by the pressure of air in said first container and being connected to said motor for starting and stopping the same at a minimum and maximum pressure, respectively; a second container of large volume; a conduit connecting said containers; an adjustable pressure re-

5

ducing valve in said conduit for maintaining in said second container a selected pressure lower than said minimum pressure; a manually controlled relief valve on said second container for reducing the pressure therein until a selected lower pressure to which said adjustable pressure reducing valve is set prevails in said second container; pneumatic cylinder and piston means connected to said second container, and including a reciprocable member directly connected, said cylinder having a volume smaller than said large volume of said second container, said large volume of said second container being chosen so that the pressure increase in said cylinder during the compression stroke of said reciprocable member is maintained low whereby the pressure in said cylinder substantially corresponds to the adjusted pressure in said second container so that said second container, the tension of the warp threads is adjusted.

2. In a loom, in combination, a tension control device comprising at least one main whip roller means adapted to support warp threads and being movable for adjusting the tension of the warp threads; two additional whip rollers respectively supporting groups of warp threads; cam means for oscillating said additional whip rollers; a source of compressed air; at least one container means for compressed air connected to said source having a comparatively large volume; adjusting means for adjusting the pressure of said container means; pneumatic cylinder and piston means including a reciprocable member directly connected to said whip roller means, said cylinder having a volume smaller than said large volume of said container means, said large volume of said container means being chosen so as to absorb the pressure created by said reciprocable member in said cylinder so that there is substantially no pressure increase in said cylinder during the compression stroke of said reciprocable member whereby the pressure in said cylinder substantially corresponds to the pressure in said container means so that by adjustment of the pressure of said container means, the tension of the warp threads is adjusted.

3. In a loom, in combination, a tension control device

6

comprising at least one main whip roller means adapted to support warp threads and being movable for adjusting the tension of the warp threads; two additional whip rollers respectively supporting groups of warp threads; cam means for oscillating said additional whip rollers; a compressor including an electric motor; a first air container connected to said compressor; a pressure responsive switch means controlled by the pressure of air in said first container and being connected to said motor for starting and stopping the same at a minimum and maximum pressure, respectively; a second container of large volume; a conduit connecting said containers; an adjustable pressure reducing valve in said conduit for maintaining in said second container a selected pressure lower than said minimum pressure; a manually controlled relief valve on said second container for reducing the pressure therein to a selected lower pressure; pneumatic cylinder and piston means connected to said second container, and including a reciprocable member directly connected to said whip roller means, said cylinder having a volume smaller than said large volume of said second container, said large volume of said second container being chosen so as to absorb the pressure created by said reciprocable member in said cylinder so that there is substantially no pressure increase in said cylinder during the compression stroke of said reciprocable member whereby the pressure in said cylinder substantially corresponds to the pressure in said second container so that by adjustment of the pressure in said second container, by said relief valve, the tension of the warp threads is adjusted.

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