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(54) IMPROVEMENTS IN THREAD FEEDERS PARTICULARLY FOR KNITTING MACHINES

(71) We, SOBREVIN SOCIETE DE BREVETS INDUSTRIELS, an Etablissement of Liechtenstein, of Aeulestrasse 151, Vaduz, Liechtenstein, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

5 In one kind of thread feeder, suitable for feeding thread, particularly elastic thread, to knitting machines for example, the thread is fed tangentially to a coil support drum on which a certain amount of thread is coiled in a single layer, the thread being delivered axially by pulling it off under a ring. The coil support drum is rotated at a speed which is controlled in dependence of the amount of thread coiled on the drum, usually in such a way that the number of turns of thread stored on the drum remains within a given range.

10 The part of the drum to which the thread is fed tangentially is a truncated cone and contiguous to this there is a cylindrical drum part on which the coil of thread is stored before axial delivery under the ring. The ring, mounted around the delivery end of the drum, is elastic and somewhat restrains the axial delivery of the thread, that is to say it acts as a restrainer ring, German Patent Specification No. 1,262,847 discloses a feeder of this kind.

15 Such feeders can be used for example when it is desired to measure lengths of thread or for feeding thread to weaver's looms or automatic weaving machines, as well as with knitting machines. However, they are particularly useful for feeding thread to the knitting machines, in the first place because

a constant but adjustable length of thread is stored on the coil support drum and, secondly, because the tension required to pull the thread off the delivery end of the thread feeder remains almost constant, even if the speed at which the thread is pulled off varies abruptly.

20 In the known thread feeders of this kind there is however an upper limit to the speed of rotation of the coil support drum. If the coil support drum rotates faster than the limiting speed, which depends among other things on the elasticity of the thread, the thread tends to be lifted from the surface of the drum by centrifugal force, with the result that the thread can no longer be depended on to slide correctly over the surface of the truncated cone. Difficulties are also encountered when feeding comparatively stiff kinds of thread, for example hemp, jute and thread made of comparatively stiff synthetic fibre. A further disadvantage of the known thread feeders is that the thread has to be supplied to the thread feeder under a certain amount of tension, to ensure that the thread lies properly on the truncated cone.

25 In accordance with the present invention; a thread feeder has a coil support for supporting a coil of thread, a thread lead for delivering thread tangentially to one end of the coil support, and a thrust surface at one end of the coil support for urging the delivered thread axially along the coil support towards the other end of the coil support from which the thread will, in use, be withdrawn, the coil support being formed by a number of separate parallel rods positioned at the corners of a polygon, the coil support and the thrust surface being rotatable relatively to

one another about the axis of the coil, and the radially outermost extent of the thrust surface being such that, upon the relative rotation, the thrust surface overlaps and engages the thread stretched between two adjacent rods but passes inwardly of the radially outermost surfaces of the rods.

With this arrangement, the storage coil of thread produced by supplying thread to the one end of the coil is pushed forwards reliably forwards without any need for the coil support to have an initial frusto-conical portion. The coil support can be uniform so that the circumference of each turn of the thread is unchanged during sliding along the support.

This construction allows a thread feeder to be made for continuously feeding thread, particularly high elastic or comparatively stiff thread and also thick thread. The thread need not be supplied to the surface of the coil support under tension, as is necessary in the previously known thread feeders in which tension is required to drive the thread along the conical surface of the coil support. The fact that the coil support need not rotate at high speed provides the considerable advantage that the thread can be supplied to the coil support at a very high linear velocity. The coil support may be stationary with the thrust surface rotating relative to it.

In one satisfactory arrangement, the thrust surface is an axially facing cam surface at the edge of a cylinder, and the rods have free ends at the one end of the coil support with radially inner cut-away portion through which the periphery of the cylinder passes.

There may be a circular disc mounted on a central shaft and provided at the other end of the coil support whereby, in use, the thread is drawn substantially axially from the coil support over the rim of the disc, the rods being carried by and projecting from the disc.

If the coil support polygon has a large number of corners, that is to say approaches the shape of a circle, the delivery of the thread becomes more constant, but a large number of polygon corners has a unfavourable effect on the intermittent pushing forward of the coil of thread on the coil support. It has been found advantageous to use a coil support polygon with comparatively few corners. Even delivery of thread can be ensured if the disc has, on its face facing the one end of the coil support and between each adjacent pair of rods, a cut-away surface sloping inwards from its periphery towards the coil support. The cut-away parts of the delivery head disc are arranged to conform with the coil support polygon in such a way that the thread is delivered, that is to say pulled off the delivery head, at as nearly as possible constant speed so as to prevent the occurrence of abrupt changes in tension.

The rim of the disc may have a surrounding restrainer ring.

In order to ensure that the coil support is held stationary, by mechanically positive means, in spite of the fact that the thread is introduced into the thread feeder through a longitudinal channel, and in spite of the fact that the thread lead rotates constantly about a system of cantilever coil supports, the polygonal coil support may be fixed to a central, stationary axle on which a support carrying the thread lead rotates, the thread lead support having a longitudinal channel, and the stationary axle having at its rear end an eccentric axle stub mounted in a bearing in a rotary support plate which rotates synchronously with the thread lead support and which has an opening in line with the longitudinal channel.

This synchronous but non-coaxial rotation can be achieved by a pin projecting from the rear end of the thread lead support and working in a radial slot in the rotary support plate. Alternatively, the rotary support plate may be in the form of a gearwheel, both the thread lead support and the gearwheel having peripheral teeth which mesh with the teeth of a neighbouring gearwheel.

It is sometimes desirable to rotate the coil support, with its delivery disc, either in the same direction as the thread lead, or in the opposite direction. This allows the thread feeder to be adapted to suit different kinds of thread. For example jute thread has a tendency to get caught in such a way that the storage coil on the coil support becomes unevenly coiled, that is to say no longer regularly in a single layer. In this case the coil support is made to rotate in the same direction as the thread lead, the restrainer ring remaining stationary. This applies tension to the length of thread situated between the restrainer ring and the coil of thread on the coil support.

By making the coil support, with its delivery head disc, and with the restrainer ring, rotate in the opposite direction compared to the thread lead, extremely high outputs can be obtained from the thread feeder, provided that the thread is of a suitable nature. The coil support can be made to rotate in the same direction as the thread lead, or in the opposite direction, by means of a planetary drive interposed between the axle which supports the coil support and the thread lead support bush. The speed and the direction of rotation of the coil support can be changed by driving the outer wheel, whose internal teeth mesh with the teeth of the planetary wheels, through a variable speed drive. Alternatively the gear ratio can be varied between the planetary wheels which mesh the teeth on the thread lead support bush.

Four examples of thread feeders constructed in accordance with the invention are

illustrated in the accompanying drawings, in which:—

Figure 1 is a side view of the first example;

Figure 2 is a section taken along the line

5 II—II in Figure 1;

Figure 3 is a detail corresponding to Figure 1, but showing a thread lead after it has rotated into a further position;

10 Figure 4 is a view similar to Figure 1 but with part in axial section;

Figure 5 is a plan view, as seen in the direction of the arrow A in Figure 4;

15 Figure 6 corresponds to Figure 5, but with the thread lead rotated into a further position;

Figure 7 is a longitudinal section through part of the second example;

Figure 8 is a cross section taken along the line X—X in Figure 7;

20 Figure 9 is a side view of the third example;

Figure 10 is a longitudinal section through the third example;

25 Figure 11 is a plan view of the third example, seen in the direction of the arrow XIII of Figure 9;

Figure 12 is a longitudinal section drawn to a larger scale showing a detail, the section taken along the line XIV—XIV in Figure 9;

30 Figure 13 is a cross section taken along the line XV—XV in Figure 12;

Figure 14 is a longitudinal section through the fourth example; and

35 Figure 15 is a cross section taken along the line XVII—XVII in Figure 14.

In the first two examples the thread feeder has a stationary bearing housing 1 in which a stationary central axle 2 is mounted. The stationary bearing housing 1 also contains a thread lead support bush 3 which rotates about the stationary central axle 2. Fixed to the lower end (as seen in Figure 1) of the thread lead support bush 3 there is a thread lead support 4 on which is mounted a thread lead 5. Fixed to the lower end of the stationary central axle 2 there is a circular thread delivery headplate 6 to which are fixed four upwardly projecting coil support rods 7, 8, 9, 10, spaced at equal angles around the central axle 2. Each coil support rod is of circular cross section and together the rods form a square coil support. It will be observed that when the thread feeder is in operation the coil support is stationary.

60 A cam cylinder 11, whose lower edge forms a cam surface 12, is fixed to the lower face of the thread lead support 4. The cam cylinder 11 rotates with the thread lead support 4 and the thread lead support bush 3. The cam surface 12 has a peak 12' which projects axially beyond the plane x—x (Figure 3) containing the exit from the thread lead 5. The shape of the cam surface 12 is such that the axial length of the cam cylinder

11 increases gradually up to the peak 12', which extends around a certain angle, and then decreases gradually to a trough 12". The cam peak 12' is positioned at an angle with respect to the thread lead 5, so that the leading edge of the peak 12' follows along after the thread lead 5. The outer diameter of the cam cylinder 11 is such that its surface 11' projects radially outwards to beyond the planes tangential to the outer surface of neighbouring coil support rods 7, 8 and 8, 9 and 9, 10 and 10, 7, that is to say it projects outwards to beyond the lengths of thread F extending between the coil support rods, as shown in particular in Figure 2.

The free ends of the coil support rods, 7, 8, 9, 10 have cut-away parts, cut away from the inside, leaving projecting external ends 13 surrounding the lower part of the cam cylinder 11 as shown in Figures 2 and 3. The headplate 6 can have around its edge a flexible restrainer ring 14 cooperating with the edge 6' of the headplate. The restrainer ring 14 can if desired have internal brushes 14' thrusting resiliently against the edge surface 6'. The thread F is delivered, with a certain amount of restraint, between the surfaces 14 and 6'.

The arrangement for preventing the central axle 2 from rotating is as follows. The upper end of the central axle 2 has an eccentric, axially projecting, axle stub 15 which is contained by a bearing in a rotary support plate 16 which rotates in a circular opening 17 positioned eccentric in the top 18 of the stationary housing 1. The rotary support plate has at least one opening 60. The support plate 16 rotates with the thread lead support bush 3, these two parts being connected together by a driver pin 19 which works in a radial slot 20 in the support plate 16, as shown in Figures 4 to 6. The thread lead support bush 3 has a longitudinal channel 21, for passage of the thread, terminating in a lower thread outlet lead 22, these two passages being preferably approximately in the same plane as the thread lead 5 of the thread lead support 4. The opening 60 in the rotary support plate 16 is in line with the longitudinal channel 21. When the thread feeder is in operation the thread enters through the opening 60 in the rotary support plate 16, passes along the longitudinal channel 21, in the direction of the arrow y, leaves the thread lead support bush 3 through the thread outlet lead 22 and passes through the thread lead 5. The arrangement allows the thread to enter through the top of the housing 1 and pass through the rotating thread lead support bush 3, in spite of the fact that the central axle 2 and the coil support are stationary.

In the second example, shown in Figures 7 and 8, a different arrangement is used for holding the central axle stationary. Instead

of the driver pin 19 there is a system of gearwheels. The upper end of the thread lead support bush 3 has peripheral teeth 61 which engage with the teeth of a neighbouring gearwheel 63, which can if desired be used as the driving wheel for driving the thread lead support bush 3. Above the upper end of the thread lead support bush 3 but not directly connected to it there is a gearwheel 16' mounted eccentrically with respect to the thread lead support bush 3 in bearings in the housing 1. The gearwheel 16' has a central drilling containing a bearing which supports an eccentric terminal stub axle 15 of the stationary central axle 2, the gearwheel 16' rotating about the eccentric stub axle 15 and also engaging the teeth of the neighbouring gearwheel 63. To ensure a good engagement of the gearwheel teeth the axis M1 of the neighbouring gearwheel 63 is centred on a perpendicular which bisects the straight line between the centres of the axis M2 of the eccentric stub axle 15 and the axis M3 of the thread lead support bush 3, this being the axis around which the thread lead rotates.

In the third example, shown in Figures 9 to 13, the central axle 2' is a rotating part. The coil support rods therefore rotate. This is arranged as follows. The thread lead support bush 3 is mounted to rotate in the stationary bearing housing 1. The central axle 2 is mounted to rotate in bearings in the thread lead support bush 3.

To the lower end of the central axle 2' there is fixed a circular headplate 6 which has an outer rim 6'. When the thread feeder is in operation the thread is delivered from the polygonal coil support over this circular edge 6'. The coil support rods 7,8,9,10 project upwards from the upper surface of the headplate 6. The upper part of the headplate 6 has cut-away sloping surfaces 33 extending between the corners 34 of the polygon formed by the coil support rods.

The circular edge 6' of the headplate 6 has a peripheral groove 35 accommodating the restrainer ring 36 made of flexible material. When the thread feeder is in operation the thread is delivered with a certain amount of restraint, between the surfaces of the circular edge 6' and the restrainer ring 36.

Alternatively however if desired, as shown in chain lines in Figure 9, the thread can be delivered between the circular edge 6' and a restrainer ring 37 fixed to the headplate 6, provided that the headplate 6 rotates in the same direction as the thread lead.

The coil support, with its headplate 6, can rotate in the same direction as the thread lead 5, or in the opposite direction. This is obtained by means of a planetary gearwheel drive at the upper end of the thread feeder. The thread lead support bush 3 has an upper terminal flange 38 which has oppositely sit-

uated wings 38'. Fixed to each wing 38' there is a bearing pin 39 on which rotate a planetary gearwheel 40 which meshes, on the one hand, with a central gearwheel 41 fixed to the top end of the axle 2' which supports the coil support rods and, on the other hand with the internal teeth of an outer wheel 42 which rotates on a bearing on the thread lead support bush 3. The thread lead support bush 3 is driven by an external pulley 46 over a belt 44. The outer wheel 42 is driven separately by a pulley 45 over a belt 43. The two pulleys 46 and 45 are driven by an external power source 47. By driving the outer wheel 42 and the thread lead support bush 3 at different speeds the central shaft 2', with its coil support rods, can be made to rotate either in the same direction as the thread lead support bush 3, or in the opposite direction.

The thread lead support bush 3 has a longitudinal channel 21 terminating at its lower end in a thread outlet lead 22' which slopes diagonally outwards. The longitudinal channel 21 and the thread outlet lead 22' are in the same plane. It should be observed that the longitudinal channel 21 is situated in the region between the two planetary gear wheels 40, to allow the thread F to enter the rotating thread lead support bush 3 at its upper end.

When the thread feeder is operating the thread is delivered over the surface of the headplate 6, the cut-away surfaces 33 acting to ensure that the thread is delivered evenly.

In regard to the fourth example represented in Figures 14 and 15, the cam cylinder 11 is in one piece with the thread lead support 4.

The stationary bearing housing 1 is fixed to a frame or bracket 48. The central axle 2" is in this case driven in rotation by an external power source which is not represented in the figure. At the lower end of the central axle 2" the headplate 6 is fixed to a coil support 2" which is mounted on bearings on the central shaft 2", so that the headplate 6 is free to rotate relative to the axle 2". The thread lead support bush 3' is mounted on the axle 2", to which it is locked by a key 49, so that these two parts rotate together. The axle 2" contains a longitudinal thread channel 21 which has a radial thread outlet lead 22' continued radially through the thread lead support bush 3'. When the thread feeder is in operation the thread passes out through the radial thread outlet lead 22' and out through a radial passage 56 in the wall of the thread lead support 4 and down through the thread lead 5, the channel 56 being in line with the thread outlet lead 22'. The longitudinal channel 21 has a lower continuation in the form of an axial drilling 55 which allows the thread

to be threaded through the passages by means of a suitable tool.

A planetary gearwheel drive transmits drive from the thread lead support bush 3' to the coil support bush 2'''. The thread lead support bush 3' has two diametrically opposite pin shafts 50. Each pin shaft 50 has, fixed to each end, a pair of gearwheels 51 and 52. The gearwheel 51 meshes with peripheral teeth 53 on the stationary bearing housing 1. The other planetary gearwheel 52 meshes with peripheral teeth 54 of the coil support bush 2'''. By varying the gear ratio between the planetary gearwheel 52 and peripheral teeth 54 on the coil support bush 2'' the headplate 6, with its coil support rods, can be made to rotate either in the same direction as the thread lead 5, or in the opposite direction. The direction of rotation of the coil support rods is chosen to suit the nature of the thread F.

The thread feeder according to the invention, in all its versions, may be equipped with a control device, which can for example be mechanical or can take the form of a photocell control, which detects the number of turns of thread on the coil support and adjusts the drive in such a way that the desired number of turns is constantly maintained.

WHAT WE CLAIM IS:—

1. A thread feeder having a coil support for supporting a coil of thread, a thread lead for delivering thread tangentially to one end of the coil support, and a thrust surface at one end of the coil support for urging the delivered thread axially along the coil support towards the other end of the coil support from which the thread will, in use, be withdrawn, the coil support being formed by a number of separate parallel rods positioned at the corners of a polygon, the coil support and the thrust surface being rotatable relatively to one another about the axis of the coil, and the radially outermost extent of the thrust surface being such that, upon the relative rotation, the thrust surface overlaps and engages the thread stretched between two adjacent rods but passes inwardly of the radially outermost surfaces of the rods.

2. A thread feeder according to claim 1, in which the coil support is stationary and the thrust surface rotates relative to the coil support.

3. A thread feeder according to claim 1 or claim 2, in which the thrust surface is an axially facing cam surface at the edge of a cylinder, and the rods have free ends at the one end of the coil support with radially inner cut-away portions through which the periphery of the cylinder passes.

4. A thread feeder according to claim 2 or claim 3, in which the thread lead rotates with the cylinder.

5. A thread feeder according to any one of the preceding claims, in which a circular disc mounted on a central shaft is provided at the other end of the coil support whereby, in use, the thread is drawn substantially axially from the coil support over the rim of the disc, the rods being carried by and projecting from the disc.

6. A thread feeder according to claim 5, in which the disc has, on its face facing the one end of the coil support and between each adjacent pair of rods, a cut-away surface sloping inwards from its periphery towards the coil support.

7. A thread feeder according to claim 5 or claim 6, in which the rim of the disc has a surrounding restrainer ring.

8. A thread feeder according to claim 2, in which the coil support is fixed to a central stationary axle on which a support carrying the thread lead rotates, the thread lead support having a longitudinal channel and the stationary axle having at its rear end an eccentric axle stub mounted in a bearing in a rotary support plate which rotates synchronously with the thread lead support and which has an opening in line with the longitudinal channel.

9. A thread feeder according to claim 8, in which the thread lead support has projecting from its rear end a driver pin which works in a radial slot in the rotary support plate.

10. A thread feeder according to claim 7, in which the rotary support plate is in the form of a gear wheel, both the thread lead support and the gear wheel having peripheral teeth which mesh with the teeth of a neighbouring gear wheel.

11. A thread feeder according to any one of claims 5 to 7, including a planetary gear drive for transmitting drive between an axle which supports the coil support, and the thread lead, an outer annulus of the planetary drive having internal teeth which mesh with the teeth of planetary gear wheels and being driven.

12. A thread feeder according to any one of claims 4 to 6, in which, between a bush forming part of the coil support and the thread lead, there is interposed a planetary drive consisting of two pairs of planetary gear wheels, one of the gear wheels in each pair meshing with a stationary gear wheel, and the other planetary wheel of each pair meshing with the peripheral teeth of the coil support bush which rotates on a driven central axle.



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F to be threaded through the passages by means of a suitable tool.

5 A planetary gearwheel drive transmits drive from the thread lead support bush 3' to the coil support bush 2". The thread lead support bush 3' has two diametrically opposite pin shafts 50. Each pin shaft 50 has, fixed to each end, a pair of gearwheels 51 and 52. The gearwheel 51 meshes with peripheral teeth 53 on the stationary bearing housing 1. The other planetary gearwheel 52 meshes with peripheral teeth 54 of the coil support bush 2". By varying the gear ratio between the planetary gearwheel 52 and peripheral teeth 54 on the coil support bush 2" the headplate 6, with its coil support rods, can be made to rotate either in the same direction as the thread lead 5, or in the opposite direction. The direction of rotation of the coil support rods is chosen to suit the nature of the thread F.

20 The thread feeder according to the invention, in all its versions, may be equipped with a control device, which can for example be mechanical or can take the form of a photocell control, which detects the number of turns of thread on the coil support and adjusts the drive in such a way that the desired number of turns is constantly maintained.

30 WHAT WE CLAIM IS:—

1. A thread feeder having a coil support for supporting a coil of thread, a thread lead for delivering thread tangentially to one end of the coil support, and a thrust surface at one end of the coil support for urging the delivered thread axially along the coil support towards the other end of the coil support from which the thread will, in use, be withdrawn, the coil support being formed by a number of separate parallel rods positioned at the corners of a polygon, the coil support and the thrust surface being rotatable relatively to one another about the axis of the coil, and the radially outermost extent of the thrust surface being such that, upon the relative rotation, the thrust surface overlaps and engages the thread stretched between two adjacent rods but passes inwardly of the radially outermost surfaces of the rods.

50 2. A thread feeder according to claim 1, in which the coil support is stationary and the thrust surface rotates relative to the coil support.

55 3. A thread feeder according to claim 1 or claim 2, in which the thrust surface is an axially facing cam surface at the edge of a cylinder, and the rods have free ends at the one end of the coil support with radially inner cut-away portions through which the periphery of the cylinder passes.

4. A thread feeder according to claim 2 or claim 3, in which the thread lead rotates with the cylinder.

5. A thread feeder according to any one of the preceding claims, in which a circular disc mounted on a central shaft is provided at the other end of the coil support whereby, in use, the thread is drawn substantially axially from the coil support over the rim of the disc, the rods being carried by and projecting from the disc.

6. A thread feeder according to claim 5, in which the disc has, on its face facing the one end of the coil support and between each adjacent pair of rods, a cut-away surface sloping inwards from its periphery towards the coil support.

7. A thread feeder according to claim 5 or claim 6, in which the rim of the disc has a surrounding restrainer ring.

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9. A thread feeder according to claim 8, in which the thread lead support has projecting from its rear end a driver pin which works in a radial slot in the rotary support plate.

10. A thread feeder according to claim 7, in which the rotary support plate is in the form of a gear wheel, both the thread lead support and the gear wheel having peripheral teeth which mesh with the teeth of a neighbouring gear wheel.

11. A thread feeder according to any one of claims 5 to 7, including a planetary gear drive for transmitting drive between an axle which supports the coil support, and the thread lead, an outer annulus of the planetary drive having internal teeth which mesh with the teeth of planetary gear wheels and being driven.

12. A thread feeder according to any one of claims 4 to 6, in which, between a bush forming part of the coil support and the thread lead, there is interposed a planetary drive consisting of two pairs of planetary gear wheels, one of the gear wheels in each pair meshing with a stationary gear wheel, and the other planetary wheel of each pair meshing with the peripheral teeth of the coil support bush which rotates on a driven central axle.



13. A thread feeder according to claim 1,
substantially as described with reference to
and as shown in Figures 1 to 6, Figures 7 and
8, Figures 9 to 13, or Figures 14 and 15,
5 of the accompanying drawings.

For the Applicants:—
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
51/52 Chancery Lane,
London, WC2A 1HN.

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