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DEVICE FOR WEAVING OF FABRICS

Original Filed April 3, 1950 4 Sheets-Sheet 1

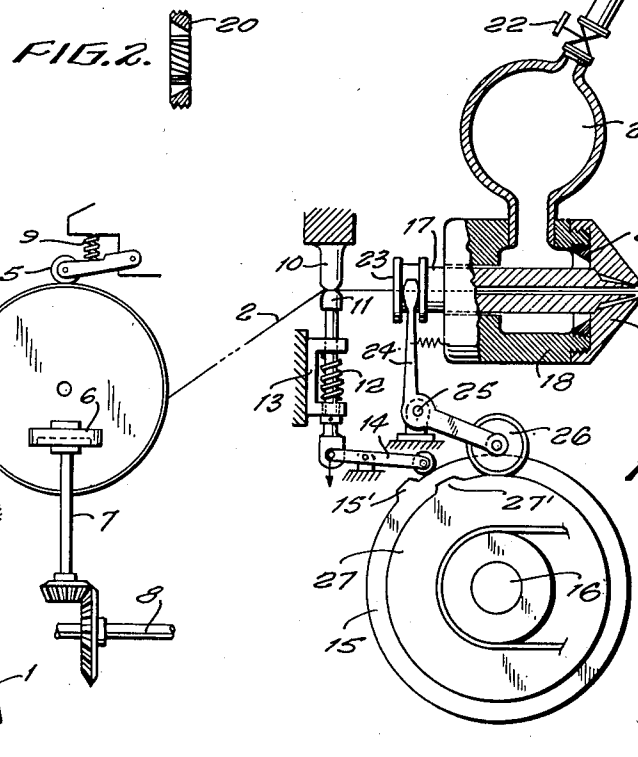

FIG. 1.

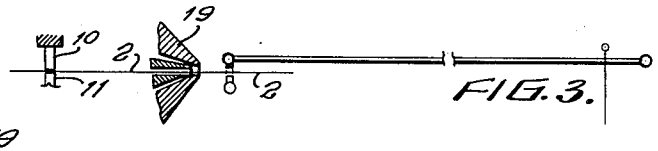

FIG. 3.

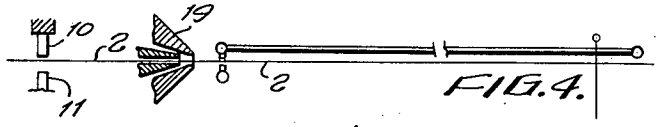

FIG. 4.

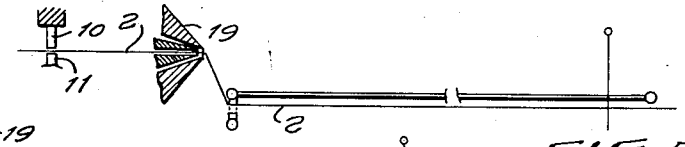

FIG. 5.

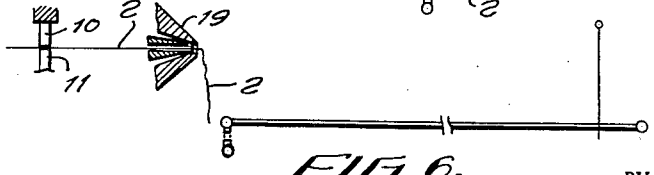

FIG. 6.

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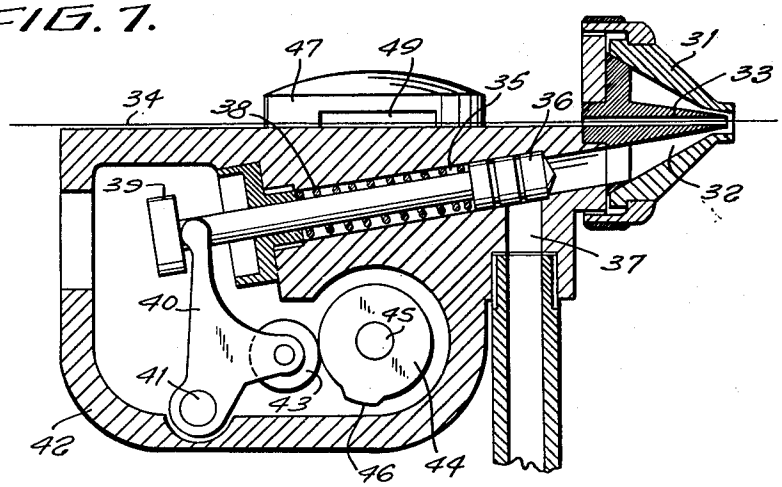
FIG. 7.



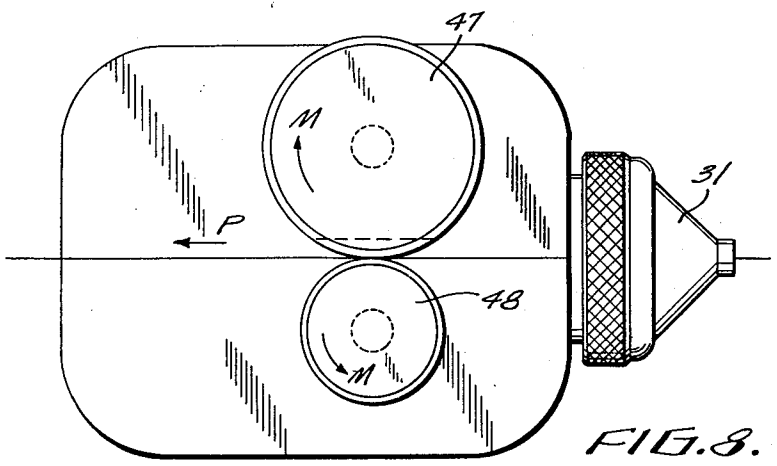


FIG. 8.

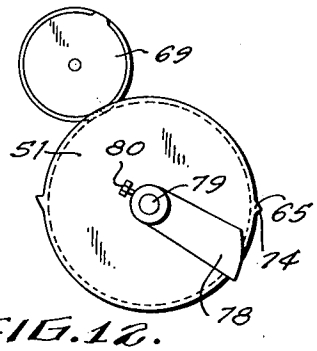


FIG. 12.

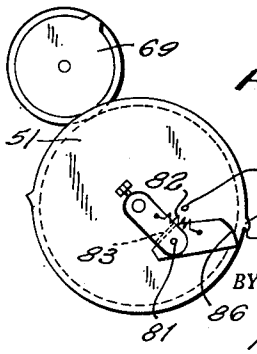


FIG. 13.

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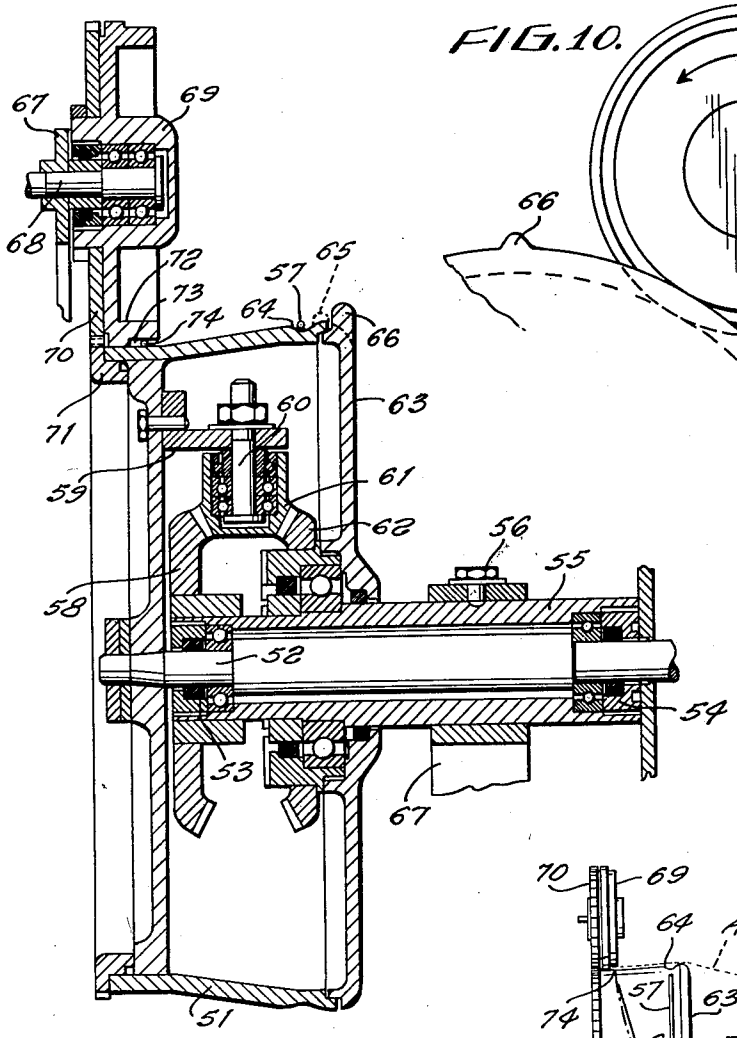

FIG. 9.

FIG. 10.

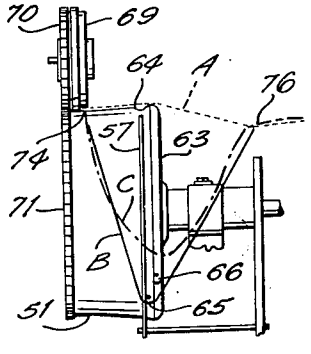

FIG. 11.

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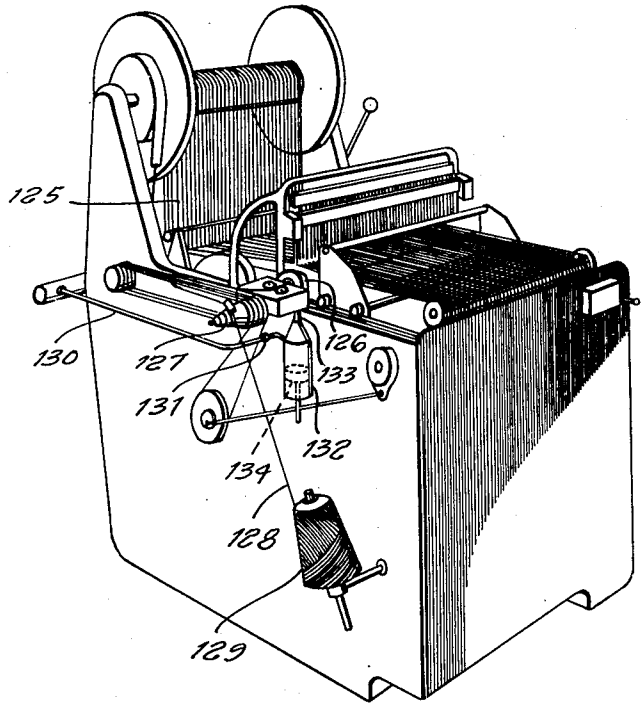

FIG. 15.

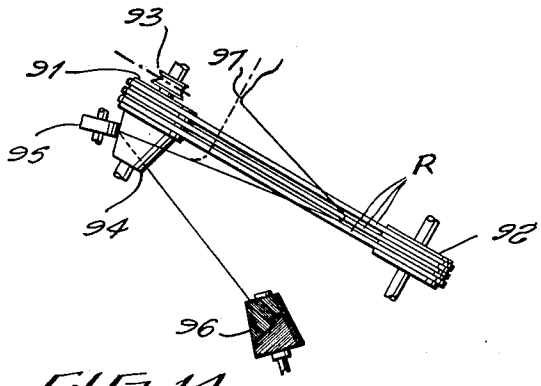

FIG. 14.

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UNITED STATES PATENT OFFICE

2,668,560

DEVICE FOR WEAVING OF FABRICS

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Original application April 3, 1950, Serial No. 153,507. Divided and this application January 15, 1952, Serial No. 268,427

Claims priority, application Czechoslovakia April 2, 1949

6 Claims. (Cl. 139—127)

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The present invention relates to a method and device for weaving of fabrics.

This application is a division of my copending application Serial No. 153,507, filed April 3, 1950.

The manufacture of fabrics on mechanical weaving looms as hitherto carried out is a rather slow operation, the average speed of which cannot practically be increased above 190 picks in a minute on fully automatic looms. Such looms are highly complex, costly and, as known, too noisy in operation.

The main object of the present invention resides in a substantial acceleration and simplification of the weaving operation. For this purpose the inserting (picking) of the weft thread into the shed by means of an air jet is made use of. The invention aims further to a substantially simpler and at the same time more efficient arrangement of a pneumatic weaving loom.

According to the invention the weaving operation is effected in such a way that one or a plurality of weft threads are inserted into a conventional shed of warp threads either from one or from both sides of the warp by means of air jets surrounding and entraining the weft thread or threads. The required rotation in the direction of twist of the weft thread is preferably imparted to such jets so as to prevent tearing up the thread and to smooth the picking motion.

The leading portion of each picked thread is retained at the opposite side of the warp by a marginal binding for instance by a gauze-like crossing, i. e. binding of the weft and warp threads at the margin of the fabric, whereas the rear portion is clamped by tensioning means and, if necessary, additionally secured also by a marginal binding, whereupon by a blow of the reed the weft thread is tensioned under simultaneous braking of the leading portion by the marginal binding and clamping of the rear portion by the tensioning means. The thread is finally cut off, the shed changed and the weft thread woven in. For the purpose of achieving uniform and perfect results as well as economical use of the air the individual batches of air for each picking motion of the weft thread are adjusted exactly to a quantity which is just sufficient for causing the front wave of the air jet, by its impact against the free end of the weft thread, to straighten out the thread and impart thereto a suitable acceleration producing a flying movement, whereupon the pressure gradually drops. By this drop of air pressure at the discharge portion of the nozzle there is prevented the imparting of greater velocities to the rear portions of the weft thread,

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receiving the picking movement later, eliminating thus the formation of loops in the weft thread.

According to a further development of the new method the weft thread is first unwound from a storage source in the requisite length, subjected to the entraining influence of a jet produced by a predetermined batch of compressed air, driving the wound-off portion of the thread through the shed, the thread retained at the end of the fabric remote from the nozzle and tensioned by a pull acting in a direction opposite to the direction of the picking movement and after having been woven in it is cut off and its free end retracted towards the nozzle.

A device for carrying out such weaving process corresponds to a mechanical loom insofar as there remain the driving means for the warp, whereas the operating means for the weft, including its safety catches (weft stop motion) are replaced by a pneumatic apparatus for inserting the weft into the shed, as will be described later. The operation of such a pneumatic loom is noiseless, cheap and very quick. With approximately half the input of driving force about double the number of pickings, or even more may be achieved as compared with hitherto known looms.

In another embodiment of the device for carrying out the improved method there is arranged in front of the nozzle a pair of cooperating retracting rollers engaging the thread, said rollers revolving in a sense so as to impart movement to the thread opposite to the direction of picking and in one or in both rollers a relieving recess is provided, said recess being adapted to release the thread from engagement with the retracting rollers in the moment of operation of the air nozzle.

One or both retracting rollers are preferably yieldingly mounted so as to allow for irregularities in the thickness of the thread.

In the supply of compressed air a throttling valve is provided, and a storage chamber for compressed air interposed between the throttling valve and the nozzle, the throttling valve admitting into the chamber such amount of air only as is required for one picking operation.

Several examples of devices for weaving by the method according to the present invention are shown in the accompanying drawings wherein:

Figure 1 is a diagrammatic sectional view of an example of the weft inserting means;

Figure 2 shows a detail of the nozzle;

Figures 3, 4, 5 and 6 show the succession of the individual phases of operation in diagrammatic representation;

Figure 7 is a cross-sectional view of a modified nozzle and its simplified driving mechanism;

Figure 8 is an elevational view thereof;

Figure 9 illustrates an axial cross-section through one embodiment of the device;

Figure 10 is a front view of a portion of the device;

Figure 11 represents on a reduced scale a side view;

Figure 12 illustrates a diagrammatic elevational view of a modified embodiment;

Figure 13 illustrates a further modified embodiment;

Figure 14 shows another embodiment of the winding-off device; and

Figure 15 is a front view of the loom showing the overall arrangement of the device according to the invention.

Referring first to Figures 1 to 6, it may be seen that from a storage bobbin 1 the weft thread 2 is wound off over a small weft brake 3. In order to exactly adjust the requisite length of the thread a winding-off apparatus is used, consisting in this case of a pair of pressure rollers 5, 4 of which the lower roller 4 has a rough surface or is covered with velvet. Its circumference may correspond approximately to the so called "reed width" of the fabric, so that one revolution thereof will supply the requisite length of weft thread. It may be driven from a side by means of a friction disc 6, mounted for adjustment on its shaft 7, driven by the main shaft 8 of the loom. The upper pressure roller 5 is loaded by a spring 9.

Behind the winding-off apparatus the thread passes through suitable tensioning means 10, 11 the upper jaw 10 of which is rigidly mounted whereas the lower jaw 11 is biassed against the upper jaw 10 by a spring 12, supported in a rigidly mounted casing 13. A two-arm lever 14 is journalled at the low free end of the said jaw 11, said lever 14 being operated by a cam disc 15 on a shaft 16 which is driven from the main shaft of the loom, for instance by a chain, or by a gear transmission.

The weft thread is finally passed through an axial cavity in a valve body 17 of an air nozzle. The nozzle body 18 is provided with a mouthpiece 19 into whose orifice a sharp edge of the valve body 17 projects. Into the annular path of air, arranged preferably according to the principles of a De Laval nozzle, there is secured near the mouth portion a stationary blade wheel 20 consisting of tangentially inclined blades deflecting the air, similar to a distribution wheel of a turbine (shown diagrammatically in Fig. 2), by which rotation is imparted to the air jet. The cavity in the nozzle body 18 is in open connection with a storage chamber 21 for compressed air connected over a throttling valve 22 with a source of pressure medium. The chamber 21 may be provided with adjustable walls for the adjustment of the volume thereof to a quantity of air which is just required for one picking operation. The valve body 17 is mounted for sliding movement in longitudinal direction of the nozzle body 18 and has at its free projecting end a flange 23 engaged by a bell crank lever 24. The latter is journalled at 25 and provided with a follower roller 26 at its free end, which rests against the circumference of a cam disc 27, connected with the disc 15 on the shaft 16.

The device described above operates as follows:

The prepared portion of the weft thread is supplied by the continuously operating winding-off mechanism always in front of the clamped tensioning means 10, 11 and the leading portion of the weft thread 2 projects from the orifice of the mouthpiece 19 of the nozzle 18 after having been cut off from the weft previously inserted, see also Fig. 6. In the first phase of operation, Figure 3, the valve 17 of the nozzle 18 is temporarily opened by the influence of the projection 27' on the cam disc 27 acting on the follower roller 26 of the lever 24 and the emerging jet of compressed air, accumulated in the chamber 21 tensions the weft portion 2, remaining after the weft has been cut off, and directs it to the shed. In the immediately following phase, Figure 4, the projection 15' on the cam disc 15 abuts against the free end of the lever 14; the clamping action of the lower jaw 11 of the tensioning means is temporarily released setting free the clamped thread 2 in a length previously wound-off, for flying through the shed under the tensioning influence of the air jet. In the further phase, Figure 5, the leading portion of the picked thread is retained at the opposite side of the warp by a marginal binding of the weft threads by e. g. 3 warp threads, the weft thread is tensioned by a blow of the reed and in the last phase woven in by the change of the shed, cut off by a cutting edge 28, Fig. 5, whereupon the whole process is repeated.

A modified embodiment of the device is shown in Figures 7 and 8.

The nozzle 31 shown in Figure 7 comprises an air passage 32 and a central passage 33 for the thread 34. Mounted for sliding movement in a bore 35 is a valve piston 36 adapted to close the conduit 37 for the supply of compressed air into the nozzle. The valve 36 is biassed by a spring 38 into closed position. At the outer end of the valve stem a collar 39 is rigidly secured, said collar being engaged by a lever 40 journalled on a pivot 41 in the casting 42 of the nozzle. The lever 40 carries a follower 43 arranged for cooperation with a cam 44 journalled on a pivot 45. The cam is provided with a projection 46.

Mounted for rotation on top of the casing 42 are two retracting rollers 47 and 48 driven in synchronism with the drive of the cam 44 by any suitable means, not shown, for instance by bevel gearing, in the direction of arrows M. A relieving recess 49 is provided in one, or in both, of the rollers, in the example shown in the roller 47 and preferably at least one of the retracting rollers is yieldingly mounted.

As shown in Fig. 7 the arrangement is such that the thread 34 passes in a straight line from the supplying device (winding-off apparatus) through the rollers 47, 48 into the passage 33 of the nozzle 31.

The device described above operates as follows:

Shortly before the beginning of the picking operation the relieving recess 49 in the roller 47 assumes approximately the position shown in Fig. 8 in which it relieves the thread 34 from engagement with the rollers 47, 48. Immediately thereupon the projection 46 of the cam 44 strikes against the follower 43 rocking the lever 40 in counterclockwise direction so as to open the valve 36 and admit air from the conduit 37 into the air passage 32. The jet of compressed air entrains now the thread 34 which shoots with a high velocity through the shed on the loom. Upon completion of the picking movement i. e. after the wound-off length of thread has been passed through the shed, the end of the weft thread is secured by a gauze-like crossing in the

marginal portion of the fabric, for instance in the width of 3 or more warp threads at the end which is remote from the nozzle. At this time the rollers 47 and 48 have already rotated to such an extent from the position shown in Figure 8 that the full circumferential portion of the roller 47 engages the thread 34 and exerts now a pulling action thereon in the direction of the arrow P in Figure 8, tensioning thus the thread. Hereupon the reed imparts a blow to the weft thread, the shed is changed and the weft thread woven in. A cutting edge or a shearing mechanism arranged near the margin of the fabric cuts off the thread, which is now retracted backwards in the direction of the arrow P by rollers 47, 48 so that the free end of the thread, hanging down from the discharge orifice of the nozzle 31, is retracted back into the nozzle.

The winding-off apparatus for preparing the weft thread may also be modified and examples of such modified arrangements will now be described.

Figures 9 to 11 show one such modification.

The device comprises a winding-off drum 51 which is preferably slightly conical, as illustrated in the drawing. The drum 51 is rigidly secured to a shaft 52 which receives movement from any desired driving mechanism, not illustrated, for instance through a gearing from the main shaft of the machine. The shaft 52 is supported in bearings 53, 54, mounted in a rigid sleeve 55 in the frame of the machine. On the sleeve 55 in the interior of the drum 51 a gear 58 is rigidly keyed on, said gear being a so-called sun-gear of a planet differential gearing which will be described later. A carrier 59 is secured to the bottom of the drum 51, said carrier mounting for instance on a pivot 60 a planet gear 61 meshing with the sun-gear 58. The gear 61 is in engagement with a driven gear 62 which is rigidly secured to a disc 63 which in the following description will be called casting-off disc. From the embodiment as illustrated it is apparent that upon rotation of the shaft 52 through one revolution, the drum 51, which is rigidly secured to this shaft will carry out also one revolution, whereas the casting-off disc 63 will at the same time carry out two revolutions in the same direction of rotation by the intermediary of the planet gearing.

The circumference of the drum 51 is provided with a shallow groove 64 which serves for mounting a guide 57 for the thread and further there are two thread entraining dogs having the form of projections 65 (see also Figure 10) which are positioned diametrically opposite each other. The disc 63 is provided with one extension 66 which in the following description will be called casting off member. This extension 66 is slightly higher than the projection 65 on the drum 51.

On the carrier 67, which is mounted for rocking movement around the axis of the shaft 52 and is adjustable in any desired position for instance by a screw 56 on the sleeve 55, a braking wheel 69 is mounted for free rotation on a pivot 68. In the embodiment shown the wheel 69 is provided with a ring gear 70 engaging a ring gear 71 the ratio of diameters of the rings being such that upon one revolution of the drum 51 the braking wheel will carry out two revolutions. The braking wheel has a flange 72 of such a formation that between the wheel 69 and the surface of the drum 51 a gap 73 is left for the receiving of the thread 74 supplied from any suitable storage source for instance from a bobbin or the like. On one point of its circumference the braking wheel is provided with a braking member for instance in the shape of a projection 75 (see Fig. 10). This projection is arranged in such a way that when it is opposite the surface of the drum 51 it presses the thread 74 against the circumference thereof firmly clamping or braking the thread.

From the foregoing it is obvious that the braking wheel 69 revolves with the same velocity as the disc 63, i. e. twice as fast as the drum 51.

The device operates as follows:

The thread supplied from the bobbin passes through the gap 73 along the circumference of the drum 51, to point 76 (see Figure 11) where it is introduced into a taking-off mechanism, for instance a feeding device of a mehanical or pneumatic loom or the like. This position A of the thread is shown in Figure 11 with a broken line. Upon rotation of the drum 51 the dog 65 engages the thread 74 and carries it along. A loop is thus formed on the thread, marked with B in Figure 11. In the meantime, however, the casting off extension 66 on the disc 63 catches up with the projection 65, since it travels with double its velocity, until finally in the required moment it overtakes the projection 65 and in consequence of its greater height, or possibly of its suitably shaped ramp, it casts off the thread 74 from the projection 65 i. e. disengages the thread from the projection. At the same time, however, the braking projection 75 on the braking wheel 69 has been positioned against the drum 51 and has clamped the thread, so that the feeding mechanism 76 can now feed such a length of thread only as has been pulled in this way into the loop B. The thread in the moment of feeding is shown in Figure 11 by a chain line C.

The device measures in this way a predetermined length of thread with a high degree of accuracy since the moment of casting off the thread from the projection 65 may be exactly controlled.

In the example as described and illustrated the drum is provided with two projections 65 and the disc 63 with a single extension 66. It is evident, of course, that any other number of such projections may be arranged, for instance three or four projections 65 on the drum and one or two extensions 66 on the disc 63. In this case the ratio or rotation of the casting-off disc to the velocity of the winding-off drum has to be selected in accordance with the proportion of the number of dogs 65 on the winding-off drum to the number of casting-off members 66 on the disc.

The same applies to the braking wheel 69 which may be provided also with the plurality of braking extensions 75; in such a case the velocity of the braking wheel has to be suitably adjusted.

Figures 12 and 13 illustrate other modified embodiments of the winding-off mechanism.

According to Figure 12 the winding-off drum 51 and the braking wheel 69 are arranged in a similar way as in the embodiment according to Figures 9 to 11. The casting-off member, however, consists in this case of a stationary ramp 78 which in the illustrated example is rigidly secured, for instance to a sleeve 79 on which it may be adjusted in any conventional manner, for instance by a screw 80. The operation of this embodiment will be apparent from the preceding explanation. The projection 65, entraining the thread 74 carries the thread to the ramp 78, along which the thread is shifted radially in the direc-

tion from the axis of rotation of the drum 51 until it is cast off from engagement with the projection 65.

Because the stationary ramp may be objectionable for certain kinds of threads the device may be arranged in a way shown in Figure 13.

Also in this case the drum 51 and the braking wheel 69 are arranged similar as in the example according to Figure 9, but the casting-off member consists of a lever 86, journalled on a stationary axis 81. The lever is biassed by a spring 82 in counter-clockwise direction into inoperative position and is provided with a ramp 83 cooperating with projections 84 on the drum 51.

Upon movement of the drum 51 the thread 74 is entrained by the projection 65 and as soon as it reaches a position opposite the end surface of the lever 86, the projection 84 abuts against the ramp 83 rocking the lever 86 in clockwise direction; the thread is thus lifted above the projection 65 and so released. In consequence of the ratio of distances from the axis of rotation 81 to the extension 84 and from the axis of rotation 81 to the end surface of the lever 86 the said end surface of the lever moves with a higher velocity than the circumference of the drum 51, so that also in this case an overtaking movement i. e. a smooth-disengagement of the thread from the projection 65 takes place.

A further modification is shown in Figure 14.

In this case a pair of grooved discs 91, 92 are mounted at a suitable distance and provided by a requisite number of ropes R preferably of round cross-section of any desired material. One disc 91 of this pair is driven at a requisite velocity from any desired driving mechanism or receives drive from a pulley 93 from any shaft of the main machine. The driven disc 91 is provided with a conical extension 94 along the circumference of which there rolls a pressure winding roller 95; the position of the latter can be adjusted to any desired radius of the conical extension 94 for the purpose of adjusting the winding-off velocity and in this way the length of the supplied piece of thread.

The device operates as follows:

The thread from the storage bobbin 96 is inserted underneath the pressure winding roller 95 on the conical extension 94 and is then alternately interlaced between the ropes R by which the pair of grooved discs 91, 92 is surrounded, whereupon in the place 97 it is introduced into a machine, not shown, to which it supplies pieces of threads. The device is thus prepared for operation. After the machine together with the feeder has been set in operation the thread is wound off by the roller 95, entrained between the ropes and forms a loose loop for such a length of time until its end which is gripped by any desired feeding mechanism of the proper machine, such as by the picking element of a mechanical loom or by a nozzle of a pneumatic loom, is, together with the wound off loop of an adjusted length, pulled in for instance into the shed on the said loom under simultaneous braking and cutting-off operation, whereupon the procedure is repeated.

Figure 15 shows the overall arrangement of the loom provided with a device according to the invention. The loom marked with the general reference numeral 125 may comprise the usual warp operating mechanisms which are well known and need not be described in detail. At one or at both sides of the loom the nozzle mechanism marked generally 126 is mounted. In front of the nozzle the winding-off apparatus 127 is arranged, preparing the predetermined length of the thread, marked here 128, supplied by a bobbin 129 for picking by the nozzle. Compressed air is supplied by a conduit 130 over a throttling valve 131 into a storage chamber 132 and from here through a tube 133 into the nozzle.

It is an important feature of the invention to provide the storage chamber 132 for compressed air, as in this way exactly measured batches of air can be supplied to the nozzle; only in this way uniform results may be obtained. For this reason it is also important to be able to change the volume of this storage chamber. To this end it is possible to use either several interchangeable chambers of different volume or to arrange a substantially cylindrical storage chamber provided with an adjustable piston 134. By changing of the position of this piston the volume of the storage chamber can be readily changed in the correspondence with the prevailing conditions. Furthermore, in consequence of this arrangement the entraining effect of the air jet is maximum at the beginning of the blowing operation whereupon it gradually sinks upon the drop of pressure in the chamber 132. The full pressure impact of the compressed air is imparted to the leading portion of the thread only, whereas the subsequent portions of the thread are subjected to a far smaller influence of the air jet. In this way a correct picking operation is assured. If on the other hand the air pressure would remain constant or substantially constant throughout the full period of picking operation the thread would be liable to become entangled as the rear portions thereof, which would be subjected to the driving force of the air jet for a longer time would be accelerated more than the leading portion and might easily overtake the latter during their flight through the shed; this would result in the weft thread becoming entangled.

It is of course possible instead of a single nozzle to arrange a whole system of nozzles next to each other or in a common body by which different or differently coloured weft threads may be picked. According to requirements a substitution or change of a weft thread by another thread may be effected in any moment by a mere shifting of the common body.

In addition to the abovementioned basic advantages the invention is further advantageous inter alia by the fact that it makes possible the weaving-in of even very thin wefts and also of wefts of any desired thickness and of little strength as well as wefts of a slight twist or even without the same, because there are no such rigorous requirements placed on the quality of the weft as in weaving on a shuttle loom.

While I have disclosed the principles of my invention in connection with several embodiments it will be understood that these embodiments are given by way of example only and not as limiting the scope of the invention as set forth in the appended claims.

I claim:

1. A device for weaving of fabrics comprising in combination means for operating the weft threads, a nozzle for the production of an air jet, adapted to entrain the weft thread into the shed of warp threads, a winding-off drum for the weft thread, at least one thread-entraining dog on the winding-off drum, a casting off member, adapted to release the thread from engagement with the said dog, a braking member adapted to cooperate with the winding-off drum and with

the weft thread passing between the said braking member and the winding-off drum and adapted to brake the thread in the moment of its release from engagement with the dog.

2. A device for weaving of fabrics comprising in combination means for operating the weft threads, a nozzle for the production of an air jet, adapted to entrain the weft thread into the shed of warp threads, a winding-off drum for the weft thread, at least one thread-entraining dog on the winding-off drum, a casting off member, adapted to release the thread from engagement with the said dog, a braking wheel cooperating with the winding-off drum, a gap between the circumference of the braking wheel and the winding-off drum for free passage of the thread, a braking extension on at least one point of the circumference of the braking wheel, said braking extension being adapted to close the gap and clamp the thread.

3. A device for weaving of fabrics comprising in combination means for operating the weft, a nozzle for the production of an air jet adapted to entrain the weft thread into the shed, a rotatable winding-off drum for the weft thread, at least one thread-entraining dog on the winding-off drum, a casting off disc mounted for rotation in close proximity of the winding-off drum, a casting off member provided on the casting off disc, means for rotating the casting off disc at a higher velocity than the winding-off drum, the ratio of velocity of the casting-off disc to the velocity of the winding-off drum being equal to the proportion of the number of dogs on the winding-off drum to the number of casting-off members on the disc.

4. A device as claimed in claim 1 wherein the winding-off drum is provided with a groove for the thread.

5. A device as claimed in claim 1 wherein the winding-off drum is provided with a groove for the thread and with a guide mounted in the said groove.

6. A device for weaving of fabrics comprising in combination means for operating the weft, a nozzle for the production of an air jet adapted to entrain the weft thread into the shed, a rotatable winding-off drum for the weft thread, at least one thread-entraining dog on the winding-off drum, a casting-off disc, mounted for rotation in close proximity of the winding-off drum, a casting off member provided on the casting off disc, a planet gearing adapted to impart rotation to the winding-off drum and rotation at higher velocity to the casting-off disc, a braking wheel mounted for cooperation with the winding-off drum, a gearing on the circumference of the winding-off drum, a gearing on the braking wheel meshing with the said gearing on the winding-off drum.

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