Feb. 27, 1968 V. SVATY ETAL 3,370,618

THREAD DISPENSING APPARATUS

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FIG. 2

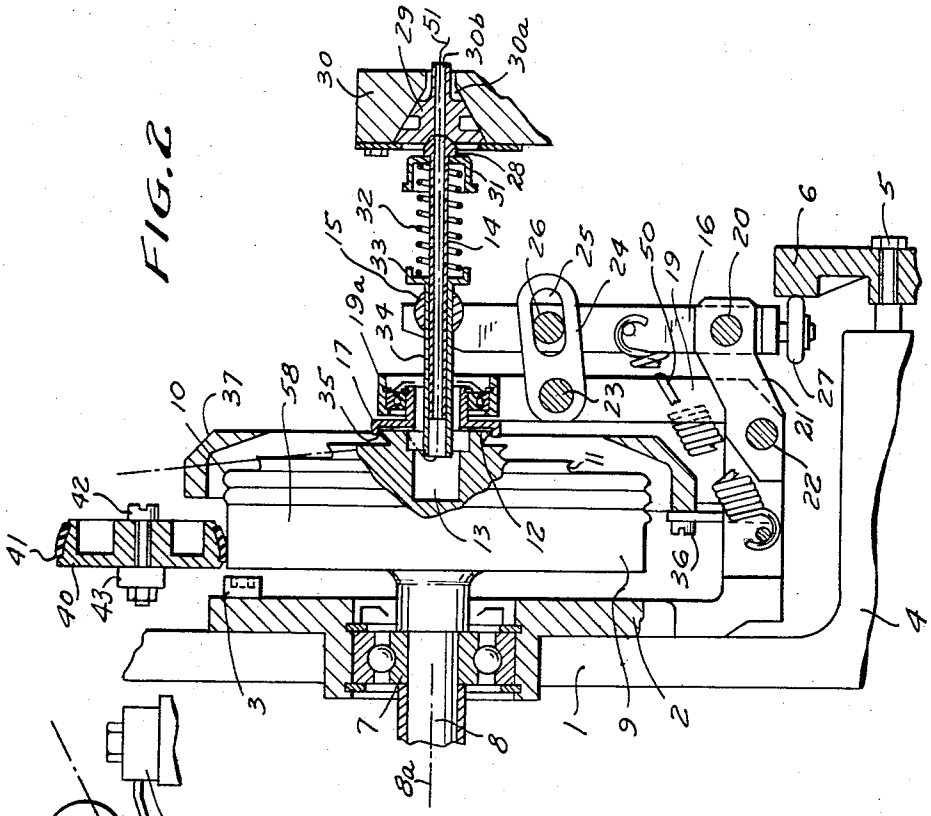

FIG. 1

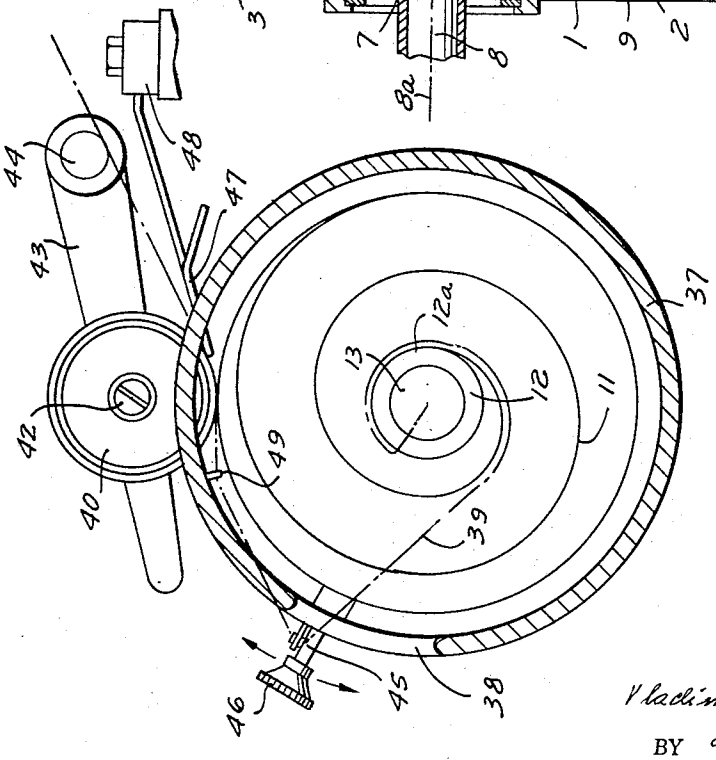

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FIG. 4

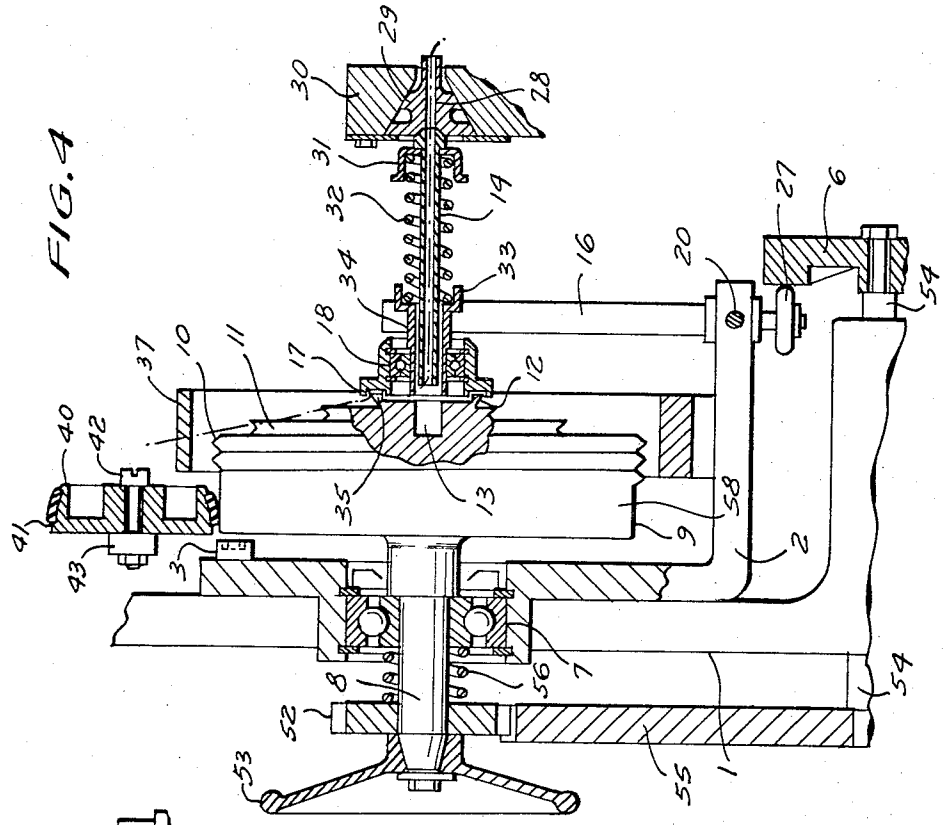
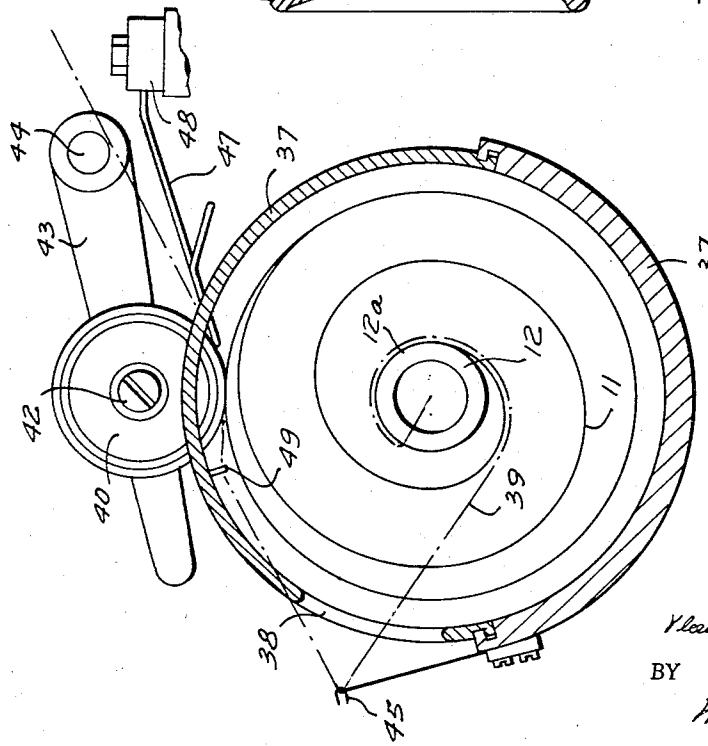


FIG. 3



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THREAD DISPENSING APPARATUS

Filed Nov. 19, 1965 3 Sheets-Sheet 3

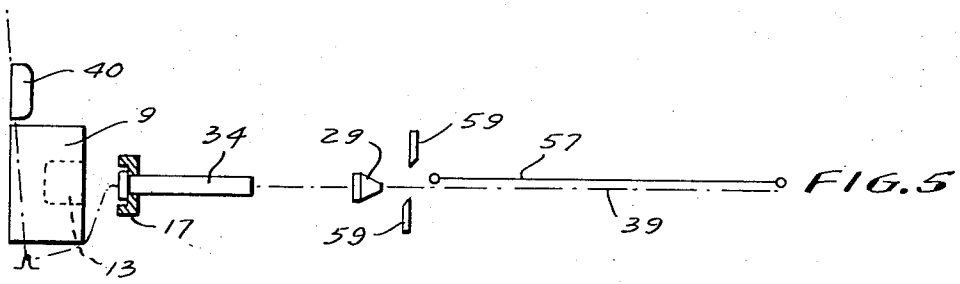

FIG. 5

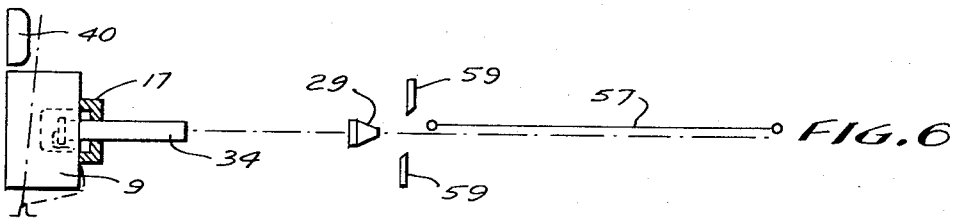

FIG. 6

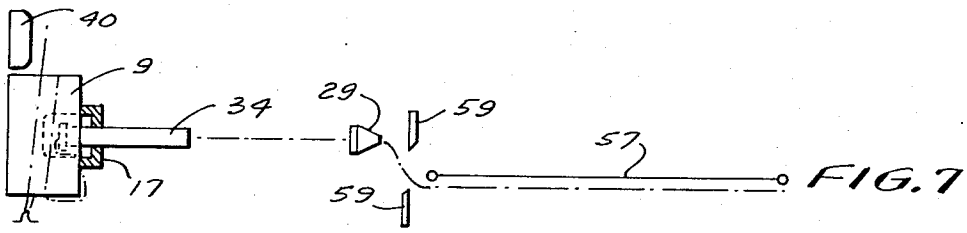

FIG. 7

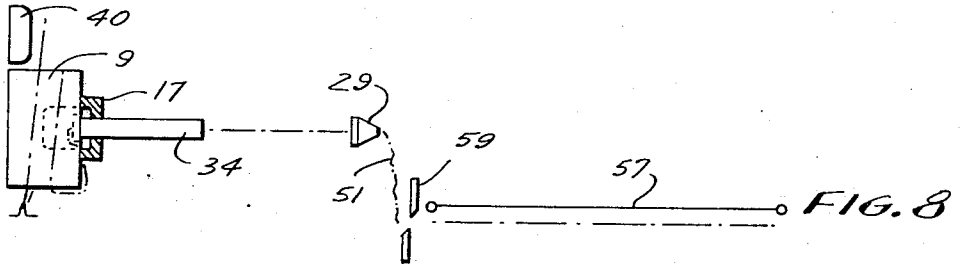

FIG. 8

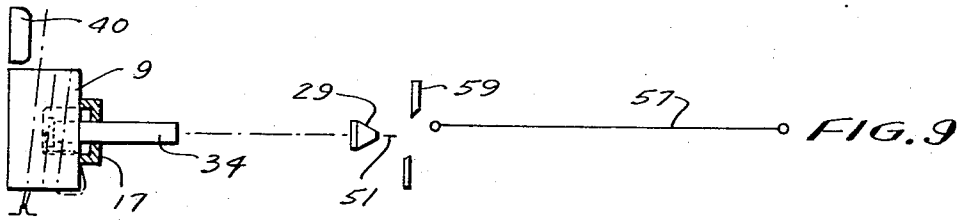

FIG. 9

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3,370,618

THREAD DISPENSING APPARATUS

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Filed Nov. 19, 1965, Ser. No. 508,646
Claims priority, application Czechoslovakia, Nov. 21, 1964, 6,406/64
18 Claims. (Cl. 139—122)

ABSTRACT OF THE DISCLOSURE

A weft thread portion of predetermined length is wound in a spiral-shaped groove of a rotating measuring body while clamped to the narrower end of the body. Before the insertion of the weft into a warp shed, the weft thread is released and during the insertion, a measured length of the weft thread is taken of the measuring body.

Background of the invention

Some types of looms, such as shuttleless looms, and particularly looms in which the weft thread is picked by transporting it entrained in a stream of a fluid medium, require the measuring of a predetermined length of the weft thread before each pick. A measuring device is provided which draws the weft thread from a stationary supply reel and winds the thread on a drum so that the number of loops on the drum determines the measured length. Thereafter, the thread is taken off the measuring drum and propelled through the warp shed by a stream of the pressure fluid discharged from a nozzle.

It is important that the length of the weft which is to be picked is exactly measured since projecting weft ends have to be cut off resulting in waste, whereas weft threads which are too short will cause a fault in the fabric. It is also desirable to adjust the measured weft length, and it is particularly advantageous to adjust the measured and dispensed length of the weft thread even during the operation of the loom. It may be necessary to vary the width of the fabric, which requires also an adjustment of the measured length of the weft threads. In some cases, small adjustments are necessary, and it is desirable to carry out such adjustments of the dispensed length of thread without stopping the operation of the loom.

Such small adjustments may become necessary if synthetic yarns are used which are differently stretchable which can be only determined during the operation of the loom.

It is one object of the invention to provide a dispensing and measuring apparatus of simple construction capable of accurately dispensing and measuring a thread.

Another object of the invention is to provide a dispensing and measuring device which can be adjusted even during the operation of the loom.

Another object of the invention is to provide a dispensing and measuring method for winding up a measured length of thread without stretching, tensioning, or breaking the thread.

Another object of the invention is to provide a thread dispensing device which will not cause ballooning of the dispensed thread.

Particularly in jet looms, in which the weft thread is inserted into the warp shed by a stream of the pressure medium, it is advantageous that the dispensing device does not offer resistance to the thread movement during the pick.

It is consequently another object of the invention to provide a thread dispensing device which will freely release the dispensed weft during a pick so that a minimum

of pressure air or liquid is required for the insertion of a weft thread, resulting in a low consumption of the pressure medium.

It is another object of the invention to slacken or tension the measured, picked, and inserted weft end independently of the measuring and dispensing operation.

During the beat up stroke of the slay, a portion of the weft thread between the dispensing apparatus and the fabric would be stressed, which is prevented by automatically slacking the weft thread before the same is cut off. In this manner, breaking of the thread, or damage to the individual filaments forming a synthetic yarn is prevented. On the other hand, the weft thread should be slightly tensioned and straightened directly after insertion.

It is another object of the invention to provide means for automatically withdrawing the cut off thread end into the nozzle, and to slightly let off the thread before the pick is started by discharging pressure fluid from the nozzle.

In this manner, the stream of the pressure fluid is not directed against the same point of the thread, but at a slowly let off portion of the weft thread, preventing damage to the thread by the pressure fluid. If the weft thread would be immovably held by the dispensing device at the moment at which the end thereof is exposed to the stream of pressure fluid from the nozzle, the respective thread portion would be damaged, particularly if certain types of yarns are used as weft threads.

Rotary disc measuring devices are known which operate on the principle of intermittently drawing off a thread from a supply bobbin. At the beginning of the drawing off operation, the apparatus produces a sudden tensile stress in the stationary thread which is caught by a rotating part and rapidly accelerated to the peripheral velocity of the rotating part. This results not only in frequent breakage of the thread, but also adversely affects the accuracy of the measuring of the dispensed weft length, resulting in an increased amount of waste during the operation of the machine.

It is another object of the invention to provide a dispensing and measuring apparatus in which the thread is not rapidly accelerated and suddenly subjected to stress.

The prior art dispensing devices do not permit a variation of the length of the dispensed weft thread during the operation of the machine, which is of great advantage, particularly if synthetic yarns are used.

It is another object of the invention to provide a dispensing and measuring apparatus, and a method for dispensing and measuring a thread, which permits an adjustment of the dispensed thread length during the operation of the loom.

Summary of the invention

With these objects in view, the present invention relates to thread dispensing and measuring apparatus, and to a method for dispensing and measuring a thread, particularly a weft thread which is to be inserted into a warp shed by a stream of a fluid pressure medium discharged by a nozzle through which the weft thread passes.

One embodiment of the invention comprises a rotary measuring means having a spiral-shaped guide means whose radial distance from the axis of rotation of the measuring means increases between a smaller end and a larger end of the guide means, and which preferably also extends in axial direction of the measuring device; holding means for releasing and clamping a thread to the smaller end of the guide means; drive means for rotating the measuring means; and operating means for taking

at timed intervals the thread off the measuring means while the holding means releases the thread.

The term "spiral shaped" is used in the present application to mean "gradually approaching, or receding from a center," such as the axis of rotation of the measuring means, and does not include a cylindrical helix.

During rotation of the measuring means by the drive means, the thread is wound up in loops of gradually increasing size at a gradually increasing speed on the spiral-shaped guide means while the holding means clamps the thread to one end of the rotating measuring means. When the thread is released by the holding means at timed intervals after the winding of the desired thread length is completed, the stream of fluid pressure medium discharged by the nozzle which is part of the operating means, takes the thread out of the spiral-shaped guide means.

The measuring means is preferably a rotary body having a frusto conical portion with a smaller end portion, and a cylindrical end portion of large diameter at the larger end of the conical portion provided with a helical guide groove which merges into a spiral-shaped guide groove on the frusto conical portion leading to the smaller end portion of the measuring body. The winding of the thread starts adjacent the holding means in the portion of the guide groove of smallest diameter where the peripheral speed is comparatively small, and the winding speed gradually increases as the thread is wound into the portions of larger diameter of the spiral-shaped guide groove and is a maximum at the cylindrical end portion of the measuring body.

The thread supply means include a reel or bobbin supporting a thread package, a friction roller urging the supplied thread against the peripheral surface of the cylindrical portion of the measuring body, and a thread guide whose circumferential position can be adjusted during the operation of the machine, so that the length of the wound up, and later taken off thread can be exactly adjusted, since the thread portion between the thread guide and the holding means is dispensed.

The holding means include a clamping member mounted for rotation with a rotary measuring body and turning with the same while clamping the thread. The thread end is guided from the clamping member through a tube which is coaxial with the measuring body, and is connected with the nozzle which forms part of the operating means. When the clamping member releases the thread, the stream of pressure fluid draws the weft thread end through the tube and inserts it into the warp shed.

Actuating means including a cam and cam follower are provided for moving the tube in axial direction so that the inserted weft end can be slackened in accordance with the beat up stroke of the slay, or withdrawn in the opposite direction into the nozzle after having been cut off.

In one embodiment of the invention, the clamping member is operatively connected with the tube, and moves with the same between clamping and releasing positions under the control of the actuating cam means.

In another embodiment of the invention, the actuating cam means controls two cam followers connected by a linkage, and one cam follower operates the tube, while the other cam follower operates the clamping member.

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.

Brief description of the drawing

FIG. 1 is a fragmentary cross sectional view illustrating one embodiment of the invention at the beginning of the winding up of a measured length of thread;

FIG. 2 is a fragmentary axial sectional view of the embodiment of FIG. 1;

FIG. 3 is a fragmentary cross sectional view illustrating another embodiment of the invention at the beginning of the winding up of a measured length of thread;

FIG. 4 is a fragmentary axial sectional view of the embodiment of FIG. 3;

FIG. 5 is a schematic view illustrating an operational condition of the dispensing apparatus after a pick;

FIG. 6 is a schematic view illustrating another operational position of the apparatus at the beginning of the winding up of a new length of thread, and corresponding to the position of FIG. 2;

FIG. 7 is a schematic view illustrating the apparatus during winding and after the slay has started its movement to the beat-up position;

FIG. 8 is a schematic view illustrating the apparatus in a position in which the inserted weft thread has been cut off; and

FIG. 9 is a schematic view illustrating the apparatus in a position in which a measured length of weft thread has been wound up, the cut off weft thread end retracted, and the slay returned to a position opposite the nozzle so that the next pick may be started.

Description of the preferred embodiments

Referring now to the drawings, and more particularly to FIGS. 1 and 2, a bracket **2** including a flange is secured by screws **3** to a frame wall **1** of a loom. Frame wall **1** has a boss **4** provided with bearings for an actuating shaft **5** carrying a cam **6** and being driven in timed relation with a shaft **8**, but at a different rotary speed. Referring to FIG. 4, it will be seen that shaft **54** corresponds to shaft **5**, and carries a large gear **55** meshing with a smaller gear **52** which rotates with shaft **8**. A corresponding transmission is provided in the embodiment of FIGS. 1 and 2, but not shown for the sake of simplicity. Actuating shafts **5** and **54** rotate in synchronism with the main shaft of the loom, while shaft **8** performs four revolutions for each revolution of actuating shaft **5** or **54**.

Shaft **8** is mounted in a ball bearing **7** and carries a measuring body or means **9** which has a somewhat frusto-conical end portion **12** of smaller diameter, and a cylindrical end portion **58** of larger diameter. Measuring means **9** and shaft **8** rotate about an axis **8***a*. A guide groove or guide means connects the end portions and includes a helical groove portion **10** merging into the peripheral surface of end portion **58**, and a spiral-shaped guide groove **11** whose radial distance from the axis of measuring body **9** gradually decreases from the helical guide groove **10** to the end portion **12**, the end of guide groove **11** having the smallest radius of curvature and merging into an annular end face **12***a* surrounding an axial recess **13** in end portion **12**.

Annular end face **12***a* confronts an annular clamping face on the flange of a clamping member **17** which is mounted in a bearing **19***a* supported on a rocker lever **19**. When rocker lever **19** is moved toward the measuring body in an manner which will be described hereinafter in greater detail, a thread located in guide groove **11** and passing over annular end face **12***a* into a tube **34** will be clamped while clamping member **17** rotates with measuring body **9**. A friction lining **35** on clamping member **17** prevents any damage to the thread.

The peripheral cylindrical surface of end portion **58** of measuring body **9** is engaged by a friction wheel **40** which has a circumferentially extending rubber ring **41** and is rotatably mounted on a pivot means **42** carried by a lever arm **43** which is turnable about a pivot **44** on the frame of the loom.

Bracket 2 carries a stationary annular member 37 which surrounds the portion of measuring body 9 on which the spiral-shaped guide groove 11 is provided. A thread guide 45 is carried by a manually adjustable means 46 which has a threaded spindle passing through a slot 38 in annular member 37 permitting circumferential adjustment of thread guide 45 in relation to measuring body 9. Another thread guide 49 is fixed to the stationary annular member 37, and a thread supplied from a thread package, not shown, is guided between friction roller 40 and cylindrical portion 58 to thread guide 49 and thread guide 45, and from there to the end face 12*a* where it is clamped by clamping member 17. Consequently, when measuring body 9 is rotated by shaft 8, the thread will be drawn off the package and wound in guide groove 10, 11. A certain length of thread will be wound up in the guide groove 10, 11 and on the cylindrical portion 58 during a given number of revolutions of measuring body 9, but the measured length of the thread can be varied by adjusting the circumferential position of thread guide 45 which determines the end of the wound up thread on the cylindrical portion 58.

Friction roller 40 has preferably a frustoconical slanted peripheral surface provided with the friction lining 41. A wire guide 47 secured to a swinging arm 48 guides the thread toward the bight of friction roller 40 and end portion 58. A particularly accurate measuring of weft thread 39 is obtained when after the selected number of revolutions of measuring body 58, swing arm 48 is turned by a cam, not shown, so that wire guide 47 pulls the thread out of the bight of friction roller 40, which is facilitated by the frustoconical shape of ring 41, whereby the thread is no longer transported by the rotating measuring body 9, and friction roller 40, 41. When swing arm 48 is operated in the opposite direction, the thread is inserted into the bight between friction roller 40, 41 and the cylindrical end portion 58.

As explained above, measuring body 9 performs, for example, four revolutions for each revolution of actuating shaft 5, and the movement of swing arm 48 can be controlled by a cam, not shown, rotating at the same speed as actuating shaft 5 so that after four revolutions of measuring body 58, the thread is first released by wire guide 47 from friction roller 40 and end portion 58 of the measuring body, to stop winding up of thread, while at the proper moments the thread is again inserted by wire guide 47 between friction roller 40, 41 and end portion 58.

Actuating shaft 5 rotates a cam 6 which is engaged by a cam follower roller 27 on a cam follower lever 16 mounted on a pivot 20 which is carried by an arm 21 of bracket 2 so that cam follower lever 16 rocks about pivot 20 under control of cam 6. A ball journal 15 is mounted on the free end of cam follower lever 16 and supports sleeve 34 which has a flange 33 abutting a spring 32 whose other end abuts a bell-shaped flange 31 on an inner tubular member 14. Spring 32 urges the end portion 28 of tubular member 14 against a corresponding seat in an inner nozzle 29 surrounded by an outer nozzle means 30 so that the passage 15 in tubular member 14 communicates with a passage in 30*b* in the inner nozzle 29. The thread passes into the end of tube 34 and through the passages in tubular member 14 and in nozzle 29 so that the free end 51 of the thread projects out of the nozzle. Nozzle 29 and 30, form ducts 30*a* surrounding nozzle 29, so that air or water discharged from ducts 30*a* will carry along the thread end supplied through passage 30*b*.

During the angular reciprocation of lever 16, tube 34 is moved into and out of recess 13, while being guided on tubular member 14 which is pressed by spring 32 against nozzle 29. The journal 15 permits the end of lever 16 to move along a circular path about pivot 20.

The rocker lever 19 is mounted on a pivot 22 carried by bracket 2 and has a pivot means 23 on which a link 24 is mounted. Cam follower lever 16 carries a pin located in an elongated slot 25 of link 24 so that levers 19 and 16 are connected by a lost-motion means which permits a relative movement between lever 16 and lever 19 so that lever 19 oscillates a smaller angle than lever 16. A spring 50 is secured to a pin on bracket 2 and to another pin on lever 16 and urges the same to turn in counterclockwise direction as viewed in the drawing to a position in which cam follower roller 27 rides along the cam track of cam 6. Consequently, the position of tube 24 is determined by higher and lower portions of cam 6 and during each reciprocating motion of the slay, not shown, tube 34 moves into and out of recess 13 under the control of cam 6 which rotates in synchronism with the slay movement since cam 6 has the same rotary speed as the main drive shaft, not shown, of the loom.

As explained above, the free end of lever 19 has an annular portion 19*a* in which bearing 18 and clamping member 17 are mounted. Consequently, the movement of clamping member 17 between a clamping position and a position releasing the thread, which is shown in chain lines, is determined by the actuating cam 6, but the lost-motion means 25, 26 permits movement of tube 34 relative to clamping member 17 when the same is blocked in the clamping position after engaging end face 12*a* of end portion 12 of measuring body 9.

During the picking of a weft thread end 51 by a stream of pressure fluid discharged from duct 30*a* of nozzle means 29, 30, the highest point of cam 6 acts on cam follower roller 27, so that lever 16 turns in clockwise direction and tube 34 is moved to the right to an end position, compressing spring 32, and firmly pressing end portion 28 against the corresponding seat in nozzle 29. Lever 19 is also turned in clockwise direction when pin 26 engages the right end of slot 25, and end portion 19*a* of lever 19 moves bearing 18 and clamping member 17 with friction lining 35 to the right to a position releasing the thread which was clamped between the lining 35 and the end face 12*a* of measuring body 9.

At this moment, the stream of pressure fluid discharged by nozzle means 29, 30 is directed against the end portion 51 of the weft thread, which was previously cut off, and the weft thread entrained in the stream is carried through the warp shed while the thread is taken out of guide groove 11, 10 and wound off the measuring body 9 up to the thread guide 45, which frictionally engages thread 39.

In order to obtain very accurately measured lengths of the thread, it is advisable to free the thread from friction roller 40, 41 exactly at the moment in which the discharge of the pressure fluid from nozzle means 29, 30 ends, and the picking of the weft thread terminates. If the thread control means 40, 47, 48 are not provided, a certain length of the weft thread 39 will be wound onto end portion 58 while the weft thread is being taken off the measuring body 9 by the action of the stream of pressure fluid. Such winding onto end portion 58 does not always terminate exactly at the moment at which the picking operation terminates, but sometimes ends sooner because as soon as the stream of pressure fluid has stopped after taking off a part of the wound up weft thread from the spiral-shaped groove 11, the remaining loops of the weft thread on cylindrical end portion 58 slip and no thread is being wound while the measuring body still rotates with the thread loops wound on cylindrical portion 58 slipping on the same. The amount of slippage depends on the quality and properties of the weft thread, on the working speed of the machine, and on other factors so that the weft thread length is inaccurately measured.

The thread control means 48, 47, 40 terminate the winding and consequently the measuring of the weft thread 39 exactly at the moment at which the picking terminates so that measuring accuracy is assured.

The measuring body 9 performs four revolutions for each revolution of cam 6 and for each reciprocating motion of the slay. During the weft insertion, the highest point of the cam track of cam 6 acts on roller 27 so that lever 16 swings about pivot 20 in clockwise direction

whereby tube 34 is moved by journal 15 to its end position on the right, while spring 32 is compressed and end portion 28 of tubular member 14 is pressed against a corresponding seat in nozzle 29 which is mounted on the stationary support 30. At a certain delay, caused by the lost-motion means 25, 26, lever 19 is also turned in clockwise direction by link 24 to its extreme right hand end position so that end portion 19*a* moves bearing 18 with clamping member 17, 35 to the right to a position in which the thread on the end face 12*a* of end portion 12 is released.

At this moment, the weft thread is picked and inserted into the warp shed by a stream of pressure fluid emitted by nozzle means 29, 30 so that the thread is drawn through the passage in tube 14 and nozzle passage 30*b*, through the gap between clamping member 17, 35 and end face 12*a*, and out of the groove 11, 10, substantially in the position shown in FIG. 5 which also illustrates a slay 57 and cutting means 59. At the same time, a part of the weft thread 39, which is being measured, is positively fed by friction wheel 40 and end portion 58 and wound onto the latter.

After the pick, a lower portion of cam 6 engages roller 27 so that spring 50 urges lever 16 to turn in counterclockwise direction as viewed in FIG. 2. After a certain delay, caused by the lost-motion means 25, 26, rocking lever 19 is also turned in counterclockwise direction together with end portion 19*a* whereby bearing 18 and clamping means 17, 35 are moved toward the left into the clamping position in which the thread is clamped against end face 12*a*. Lever 16 and journal 15 move tube 34 relative to tubular member 14 to the left to the position illustrated in FIG. 2 in which the end of tube 14 projects into the central recess 13 of measuring body 9 so that the thread end 51 is somewhat retracted.

At the same time, the swinging arm 48 with wire guide 47 is displaced by a cam, not shown, whereby the weft thread is laterally pushed out of the bight between friction roller 40, 41 and end portion 58 of measuring body 9.

As soon as the friction lining 35 clamps the weft thread 39 against annular face 12*a*, clamping member 17 begins to rotate with measuring body 9 in bearing 18. Weft thread 39 is drawn from a supply package, not shown, and is wound first onto the groove portion in end portion 12, and in loops of increasing diameter into spiral-shaped guide grooves 11, into the helical groove 10, and finally onto the cylindrical surface of end portion 58. The spiral-shaped groove 11 permits a smooth winding of the weft thread from the clamped point first into a groove portion of small diameter on end portion 12, and gradually in larger loops until loops of greater diameter are made on cylindrical end portion 58.

With some kind of threads which may be damaged by excessive tension, such as synthetic fibers, it is advantageous to exactly adjust the weft thread length between friction roller 40 and the warp shed, even if the thread has already been clamped between clamping member 17, 35 and end face 12*a*. Such an adjustment can be obtained by axially displacing tube 34 into the recess 13 of measuring body 9 after the weft thread has been clamped. For example, the inserted weft thread may be slightly retracted from the warp shed immediately after completion of a pick, which is obtained by the above described movement of tube 34 to the left, or the weft thread may be slackened before being cut off at the selvedge of the fabric by movement of tube 34 to the right relative to clamping member 17, 35 which remains in the clamping position. The lost-motion means 25, 26 permits such relative movement under control of a cam portion on cam 6 which is not high enough to cause also displacement of link 24 with lever 16 by pin 26 engaging the end of slot 25. A slight movement of tube 34 to the right will also permit the cut off thread end 51 to slowly move forward when the stream of a pressure fluid is started with clamping member 17, 35 still in clamping position. In this manner, damage to the thread end impinged by the stream of pressure fluid is avoided, which would otherwise occur if the stream of pressure fluid would be directed against the same point of thread end 51, if the same would be prevented from moving even slightly with the stream of pressure fluid. In looms of the type with which the present invention is concerned, it is necessary to start the jet of air or liquid before clamping member 17, 35 releases the thread for insertion into the warp shed. The stream of pressure fluid has considerable power, and if directed at the same point of the thread, dishevels and damages the respective portion of an immovable thread. By slowly and gradually letting off a small portion of the weft thread before the same is fully released by the clamping member, the stream of pressure fluid does not act on the same point of the weft thread, but on a small moving portion of the thread so that damage is prevented.

It will be seen that tube 34 is a control means for slackening or tensioning the inserted thread end. Actuating means 5, 6, 27, 16, 50, 15 move the control tube 34 in axial direction between a position leading clamping member 17, 35, and a position trailing clamping member 17, 35 in the direction in which the thread end is inserted. Holding means 19, 19*a*, 18, 17, 35 are operable between a clamping position and a releasing position and are connected by lost-motion means 25, 26 to the actuating means 5, 6, 27, 16, 50, 15.

A further adjustment of the length of the dispensed weft thread can be obtained even during the operation of the loom, by setting thread guide 45 in different circumferential positions. By circumferential adjustment of thread guide 45, the clamping of the weft thread on end face 12*a* of end portion 12 by clamping member 17 is effected at a different point of the thread, and consequently the winding of the thread starts sooner or later resulting in winding a greater or smaller length of thread on the measuring body 9. In order to adjust the position of thread guide 45, nut 46 is manually loosened, whereupon the device is shifted in circumferential direction, and then secured again by tightening nut 46, and such resetting of thread guide 45 may be carried out even during the operation of the loom.

Since the weft thread is first caught on the small diameter portion of guide groove 11 which moves at a low circumferential speed, the winding of the thread is started without a jerk on the thread, whereupon the winding speed gradually increases corresponding to the increasing diameter of the guide groove 11. When weft thread 39 is taken out of the guide grooves 11 and 10 of measuring body 9 by the action of the pressure fluid flowing through jet nozzle 29, 30 the winding off causes only a minimal resistance to the inserting motion since the thread is first unwound from the guide groove portion on end portion 12, which has a small diameter, and where only a small thread balloon is formed. The point where the thread separates from the measuring body moves gradually along the spiral-shaped groove 11 to the helical groove portion 10 which has a greater diameter so that a larger balloon is formed. However, the larger balloons are formed only at a moment in which a considerable length of weft thread is already entrained in the stream of pressure fluid so that the stream of pressure fluid exerts already a considerable force on the weft thread so that the same moves rapidly to reduce the size of the balloon. The stationary annular member 37 controls the thread balloons developed during the take-off of the thread from the measuring body during the picking of the weft end.

The apparatus of the invention permits an adjustment of the length of the weft thread in the region between the portion clamped by clamping member 17, 35 and the nozzle 29 even during the time in which the weft is wound on the measuring body 9.

When cam 6 acts on follower lever 16 in such a way that tube 34 is moved into recess 13 of the measuring body 9, clamping member 17 is also moved in the same

direction until it clamps the weft thread. Since measuring body 9 continues its rotation, the measuring of weft thread 39 begins when it is first wound onto end portion 12, then into spiral-shaped grooves 11 and finally into the peripheral helical grooves 10. During this part of the winding operation, tube 34 can further move into recess 13 directly after the picking operation has been carried out, so that the picked and inserted weft thread is retracted from the shed during the time in which a new length of weft is already being wound up and measured. However, during the measuring of the next following weft thread, the just picked and inserted weft thread is cut off, and in order to slacken the inserted weft thread during the cutting operation, cam 6 causes movement of tube 34 out of recess 13 and toward the right as viewed in FIG. 2 so that the portion of the weft between the clamping member 17 and the end of tube 34 is added to the weft end before the same is cut. In this manner, excess tension of the weft, which may be caused by the reciprocating stroke of slay 57 to the beat up position, as shown in FIGS. 6 and 7, is avoided. After cutting of the weft in the position of FIG. 8 by cutting means 59, tube 34 is moved into recess 13 of measuring body 9 to retract the weft end portion 51 into the nozzle 29, as shown in FIGS. 8 and 9. For starting the next pick, nozzle 29 is opened and supplied with pressure fluid, such as air, while at the same time tube 34 is slowly moved out of recess 13 to the position of FIG. 8 so that the thread portion between clamping member 17 and the end of tube 34 is added to the weft thread end, permitting the cut-off end portion 51 of the weft to move slowly out of the nozzle for a short distance when impinged by the stream of pressure fluid discharged by the nozzle. If such movement were not permitted, the immovable end portion 51 of the weft would be damaged, disheveled, or torn off by the pressure medium.

As soon as the short projecting end portion of the weft has been solidly entrained in the stream of pressure fluid, lever 16 is turned by cam 6 farther in clockwise direction and causes by link 24 turning of lever 19 in clockwise direction whereby clamping member 17 is moved to the right as viewed in FIG. 2 to a releasing position spaced from the end face 12*a*. The pull of the stream of pressure fluid on the thread end portion 51 now takes the thread out of the guide groove 11, 10 and unwinds it from the measuring body 9 so that a weft thread length up to thread guide 45 and friction roller 40, 41 is moved and straightened by the stream of pressure fluid while the leading thread portion is inserted into the warp shed.

The embodiment described with reference to FIGS. 1 and 2 permits the retraction of a portion of the inserted weft thread, which is particularly advantageous for a hydraulic jet loom using a liquid as pressure fluid. The retraction of the inserted weft permits the removal of a loop which is formed by thread encircling a droplet of water pulling the weft into the shed.

Jet looms using air as a pressure fluid can be provided with a modified and simpler embodiment of the invention, which is illustrated in FIGS. 3 and 4 in which parts corresponding to parts of the embodiment of FIGS. 1 and 2 are indicated by like reference numerals.

Bracket 2 on frame wall 1 has a bearing 7 for a shaft 8 which carries the measuring body 9 and the hand wheel 53. A gear 52 is mounted on shaft 8 for axial movement against the action of a spring 56, and is connected with shaft 8 by a key. Gear 52 meshes with a gear 55 on shaft 54 which carries cam 6. The construction of measuring body 9 is the same as described with reference to FIGS. 1 and 2, and a friction wheel 40, 41 is again provided for feeding the thread along the periphery of cylindrical end portion 58. Cam follower lever 16 is mounted on a pivot 20 on bracket 2, and has a follower roller engaged by cam 6 so that cam follower lever 16 is rocked about pivot 20. The end of lever 16 is connected by a journal, not shown, to tube 34 which has a flange abutting a spring 32 whose other end abuts a bell-shaped portion of a tubular member 14 whose end portion abuts a seat in nozzle 29.

Tube 34 is secured to a bearing 18 which rotatably supports clamping member 17 so that turning of lever 16 in counterclockwise direction displaces bearings 18 with clamping member 17 for pressing the lining 35 against the end face 12*a* of the end portion 12 of measuring body 9. Movement of tube 34 to the right as viewed in FIG. 4, will cause movement of clamping member 17 away from end face 12*a* for releasing a weft thread previously clamped between friction lining 35 and end face 12*a*. Spring 32 not only presses the end portion of tube 14 against the seat in nozzle 29, but also exerts pressure on tube 14 and lever 16 to turn the latter in counterclockwise direction for moving cam follower roller 27 toward the lower portion of cam 6.

As compared with the embodiment of FIGS. 1 and 2 the construction of FIGS. 3 and 4 omits lever 19, and the lost-motion means between lever 19 and lever 16 so that it is not possible to effect relative movement between clamping member 18 and tube 34.

A stationary annular member 37 is mounted on bracket 2 and surrounds the portion of measuring body 9 on which the spiral-shaped guide groove 11 is provided. Annular member 37 controlls ballooning of the thread when the same is taken off the measuring body. A thread guide 45 is mounted on member 37, as best seen in FIG. 3 for guiding the thread which is supplied through a thread guide 49 on the inner face of annular member 37 and the bight between friction roller 40, 41 and end portion 58 from a thread package, not shown. A cam controlled swing arm 48 carries a wire guide 47 by which the thread is inserted into the bight between friction roller 40, 41 and end portion 58, and moved out of the bight, at the proper moment as explained with reference to FIGS. 1 and 2.

Measuring body 9 is driven by the transmission 52, 55 to perform four revolutions for each revolution on the main drive shaft of the loom, and of shaft 54 with cam 6.

During a pick of the weft, the highest point of cam 6 acts on roller 27 so that lever 16 is turned about pivot 20 in clockwise direction so that tube 34 is moved with clamping member 17, 35 away from the end face 12*a* of portion 12 of measuring body 9. The air stream discharged by nozzle 29, 30 draws the weft thread 39 through tubular member 14, tube 34 and the passage in nozzle 29, inserts the end of the weft into the warp shed while pulling the thread out of the guide groove 11, 10 and unwinds the windings on end portion 58 until further movement of the weft is prevented by friction roller 40.

After the insertion of the weft thread end has been completed, a lower portion on cam 6 permits spring 32 to urge tube 34 with clamping member 17 to the clamping position in which friction lining 35 abuts end face 12*a* of measuring body 9 so that the thread is clamped. A new winding operation starts during which the thread is wound into the spiral-shaped groove 11, into helical groove 10, and onto the cylindrical peripheral surface of end portion 58.

The simplified embodiment of FIGS. 3 and 4 measures the weft thread accurately, and permits an easy and precise adjustment of the weft length and varying the starting point of the winding in the guide groove of the measuring body.

In the embodiment of FIGS. 3 and 4, the adjustment is effected by pushing hand wheel 53 against the action of spring 56 to the right as viewed in FIG. 4 whereby the gear 52 is shifted in axial direction to a position disengaged from gear 55. By turning hand wheel 53, shaft 8, and measuring body 9 are angularly displaced in relation to the thread guide 45. The embodiment of FIGS. 1 and 2 may also be provided with this construction, instead of making the thread guide 45 settable in circumferential direction of the measuring body.

The embodiment of FIGS. 3 and 4 permits a very easy assembly and disassembly, since by compressing spring

32, tube 14, tube 34, and clamping member 17 are disengaged from the journal mounting on lever 16.

The operation of the embodiment of FIGS. 1 and 2 will now be described with reference to FIGS. 5 and 9, and it will be understood that in the embodiment of FIGS. 3 and 4, clamping member 17 operates in the same manner to start winding and unwinding of the weft thread in synchronism with the picking of the weft thread end.

In the position of FIG. 5, a weft 39 has just been inserted into the warp shed while the slay 57 is in the illustrated position. The weft has been unwound from measuring body 9 after clamping member 17 has been moved to the releasing position. Tube 34 is in the extreme right position. The length of the weft thread drawn from measuring body 9 by the stream of pressure fluid discharged by nozzle 29 is determined by friction roller 40.

Clamping member 17 is now moved to the clamping position in which the thread is clamped against measuring body 9. At the same time, tube 34 is moved farther to the left into the recess of the measuring body so that a small portion of the inserted weft thread is withdrawn.

Until this moment, the slay 57 is in its rear position, but after the thread has been clamped, the slay begins its beat-up stroke and moves to the position shown in FIG. 7, while the winding of the weft thread into the spiral-shaped groove 11 and helical groove 10 starts. The winding is continued while the slay 57 continues its movement to the beat-up position shown in FIG. 8, but tube 34 is moved to the right to slacken the thread end which is tensioned by the displacement of slay 57, so that cutting means 59 can be operated to cut the weft thread end. An end portion 51 of the cut-off weft hangs down from nozzle 29.

In the position of FIG. 9, the slay has returned to its rear position, tube 34 has been moved to the left into the recess of the measuring body, and the winding of the weft has been continued. Due to the displacement of tube 34, the weft thread is retracted into the nozzle so that only a short end portion 51 projects from the same. Pressure fluid is now discharged from nozzle 29, 30 and directed against the thread end portion 51 while tube 34 is moved to the right to feed a short length of thread to the nozzle so that the weft is subjected to some pull by the stream of pressure fluid, without being damaged by the same. Thereupon, clamping member 17 is again moved to the releasing position of FIG. 5 so that the pull of the pressure fluid on end portion 51 unwinds the measured length of the weft spread from measuring body 9, and inserts the end of the weft thread into the shed. While the thread is taken off the measuring body, the winding of the thread onto end portion 58 continues, because the weft thread is nipped between friction roller 40, 41 and cylindrical portion 58 of measuring body 9 during the picking operation.

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 thread dispensing apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in an apparatus and method for measuring lengths of a weft thread before insertion into the warp shed by a stream of a pressure medium, 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 generic or specific 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. A thread dispensing apparatus comprising, in combination, a rotary measuring means having an axis and spiral-shaped guide means arranged coaxially with said axis of said rotary measuring means and composed of convolutions of increasing radial distance from said axis so that the radial distance of said spiral-shaped guide means gradually increases from one portion to another portion of said measuring means; clamping means operable between a releasing position, and a clamping position for clamping a thread to said one portion; thread supply means for supplying a thread to said other portion; drive means for rotating said measuring means about said axis whereby the thread is wound up in loops of gradually increasing size on said spiral-shaped guide means while said clamping means is in said clamping position; and operating means for taking at timed intervals the end of the thread off said measuring means while said clamping means is in said releasing position.

2. An apparatus according to claim 1, wherein said measuring means includes a frusto-conical part having said spiral-shaped guide means so that the same extends in axial and circumferential directions of said measuring means, and wherein said one portion cooperating with said clamping means for clamping the thread is the smaller end portion of said frusto-conical part.

3. An apparatus according to claim 2, wherein said other portion is cylindrical and has a helical guide means forming an extension of said spiral-shaped guide means.

4. An apparatus according to claim 1, wherein said clamping means includes a clamping member having a passage for said end of said thread extending in the direction of said axis; and wherein said operating means include inserting means for inserting said end of the thread into a warp shed.

5. An apparatus according to claim 4, and including control means between said clamping member and inserting means for moving said thread end relative to said clamping means in said clamping position in one direction for slackening, and in the opposite direction for tensioning the inserted thread end.

6. An apparatus according to claim 5, wherein said control means include a tube for guiding the thread end therein, and actuating means for reciprocating said tube in axial direction between a position leading said clamping member and a position trailing said clamping member in the direction in which the thread end is inserted.

7. An apparatus according to claim 1, wherein said thread supply means includes a thread guide, and stationary adjustable means supporting said thread guide in the region of said other portion for adjustment in circumferential direction of said measuring means whereby the length of the thread portion wound between said thread guide and said clamping means can be varied to dispense different measured lengths of the thread.

8. An apparatus according to claim 7, wherein said one portion is frusto-conical, and said other portion of said measuring means is cylindrical; and including a friction roller for rolling along the periphery of said cylindrical portion and for holding a thread on said periphery and for feeding the same to said thread guide.

9. An apparatus according to claim 8, and including a means for guiding the thread toward said friction roller, and being shiftable with the thread in axial direction for moving the thread out of and into engagement with said friction roller.

10. An apparatus according to claim 1, wherein said thread supply means include a stationary thread guide; wherein said drive means include a shaft connected with said measuring means, and clutch means for driving said shaft; and comprising manually operated means for turning said shaft in a disengaged condition of said clutch means whereby said measuring means is turned to angu-

lar positions in which said thread guide is located opposite different circumferential points of said measuring means.

11. An apparatus according to claim 1 wherein said measuring means is a measuring body, wherein said one portion is an end portion having an end face, and said other portion is a cylindrical portion; wherein said clamping means include a clamping member cooperating with said end face for clamping a thread wound in said guide means in said clamping position; wherein said drive means include a drive shaft connected with said measuring body; wherein said operating means include a nozzle adapted to discharge at timed intervals a pressure fluid for inserting the end of the thread into a warp shed; and comprising actuating means for moving said clamping member at timed intervals between said clamping and releasing positions so that the thread is inserted into a warp shed when said clamping member is in said releasing position, and wound up while said clamping member is in said clamping position.

12. An apparatus according to claim 11 wherein said actuating means include a cam shaft and a cam, a cam follower means operated by said cam, a tube mounted on said cam follower means and having a passage for the thread, said tube being located intermediate said nozzle and said clamping member for guiding the thread from said clamping member to said nozzle; and comprising means connecting said drive shaft with said cam shaft for rotation at a predetermined ratio.

13. An apparatus according to claim 12 wherein said tube supports said clamping member for movement therewith between said clamping and releasing positions, and for rotary movement together with said measuring body in said clamping position.

14. An apparatus according to claim 12 wherein said one end portion of said measuring body has a recess receiving the end of said tube during movement of the same; and wherein said clamping means include a rocking lever supporting said clamping member for rotation, and for movement therewith between said clamping and releasing positions; and wherein said actuating means include lost-motion means connecting said cam follower means with said rocking lever so that said tube moves relative to said clamping member for moving the thread in said nozzle relative to the same while the thread is clamped in said clamping position whereby the end of the thread can be slackened, tensioned, withdrawn into the nozzle after being cut off, and let out of the nozzle a short distance for impingement by the stream of pressure fluid.

15. An apparatus according to claim 12 including a tubular member having an end portion abutting said nozzle and having a passage for the thread, said tube being guided on said tubular member; and comprising spring means between said tubular member and said tube.

16. An apparatus according to claim 11 including a friction roller cooperating with said cylindrical portion of said measuring body, and a means for inserting a thread between said friction roller and said measuring body, and for moving the thread out of the bight between said friction roller and said measuring body, said last mentioned means operating in timed relation with the insertion of the thread into a warp shed.

17. An apparatus according to claim 16 and including a thread guide receiving a thread from said friction roller and measuring body; and means for causing relative angular displacement between said thread guide and said measuring body for variation of the starting point of the windings on said cylindrical end portion of said measuring body.

18. A thread dispensing apparatus comprising, in combination, a rotary measuring means having an axis of rotation and a spiral-shaped guide means arranged coaxially with said axis of said rotary measuring means and composed of convolutions of increasing radial distance from said axis so that the radial distance of said spiral-shaped guide means gradually increase from an end portion to another portion of said measuring means; clamping means operable between a releasing position, and a clamping position for clamping a thread to said end portion, said clamping means having a passage for said thread; thread supply means for supplying a thread to said other portion; drive means for rotating said measuring means about said axis whereby the thread is wound up in loops of gradually increasing size on said spiral-shaped guide means when said clamping means is in said clamping means is in said clamping position; and operating means for pulling at timed intervals said thread through said passage and off said measuring means while said clamping means is in said releasing position.

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