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[54] **METHOD OF AND APPARATUS FOR METERING AND STORING WEFT YARN FOR INTERMITTENT INSERTION INTO THE SHED OF SHUTTLELESS LOOMS**

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[52] **U.S. Cl.** ..... **139/122 R**

[51] **Int. Cl.** **D03d 47/36**

[58] **Field of Search** ..... 139/122 R, 122 H, 139/127 P, 125, 126; 66/132

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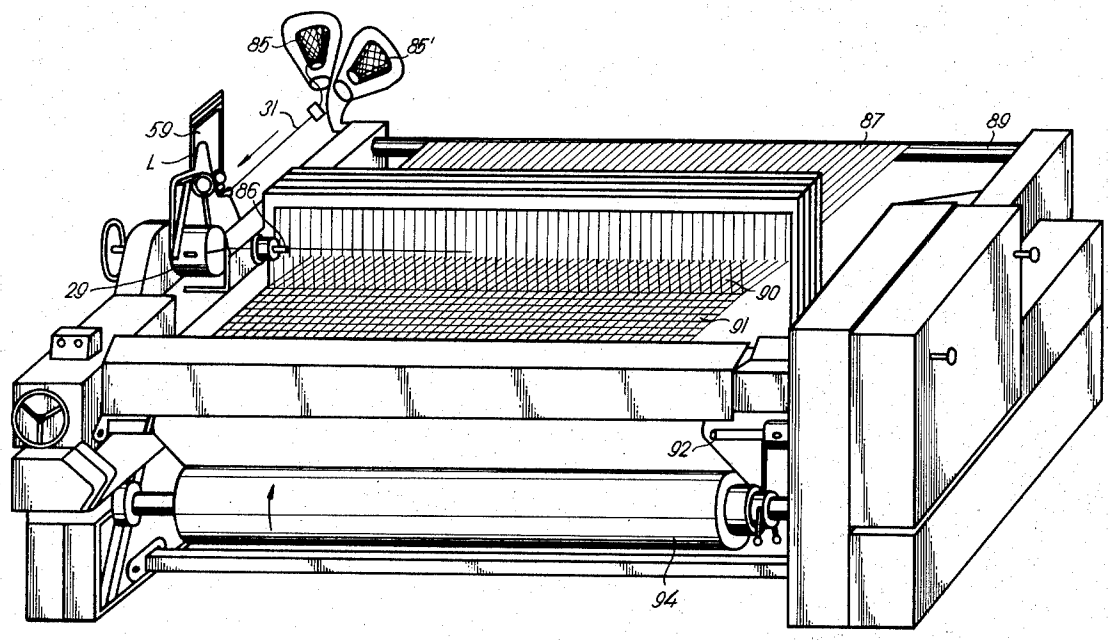
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[57] **ABSTRACT**

Method of and apparatus for metering and storing continuously metered weft yarn for intermittent inserting into the shed of a shuttleless loom. In such method the weft yarn metering rate is higher than the winding of the same onto a yarn storage drum, the remaining portion of the metered weft yarn length being stored as a loose loop. The device comprises a storage drum provided with a gripper controlled by a cam disc, a metering drum, a chamber, on the entering side of the chamber there being provided a pressing roller attached to the metering drum, and on the exit side thereof there being provided a device for weft yarn braking.

16 Claims, 4 Drawing Figures



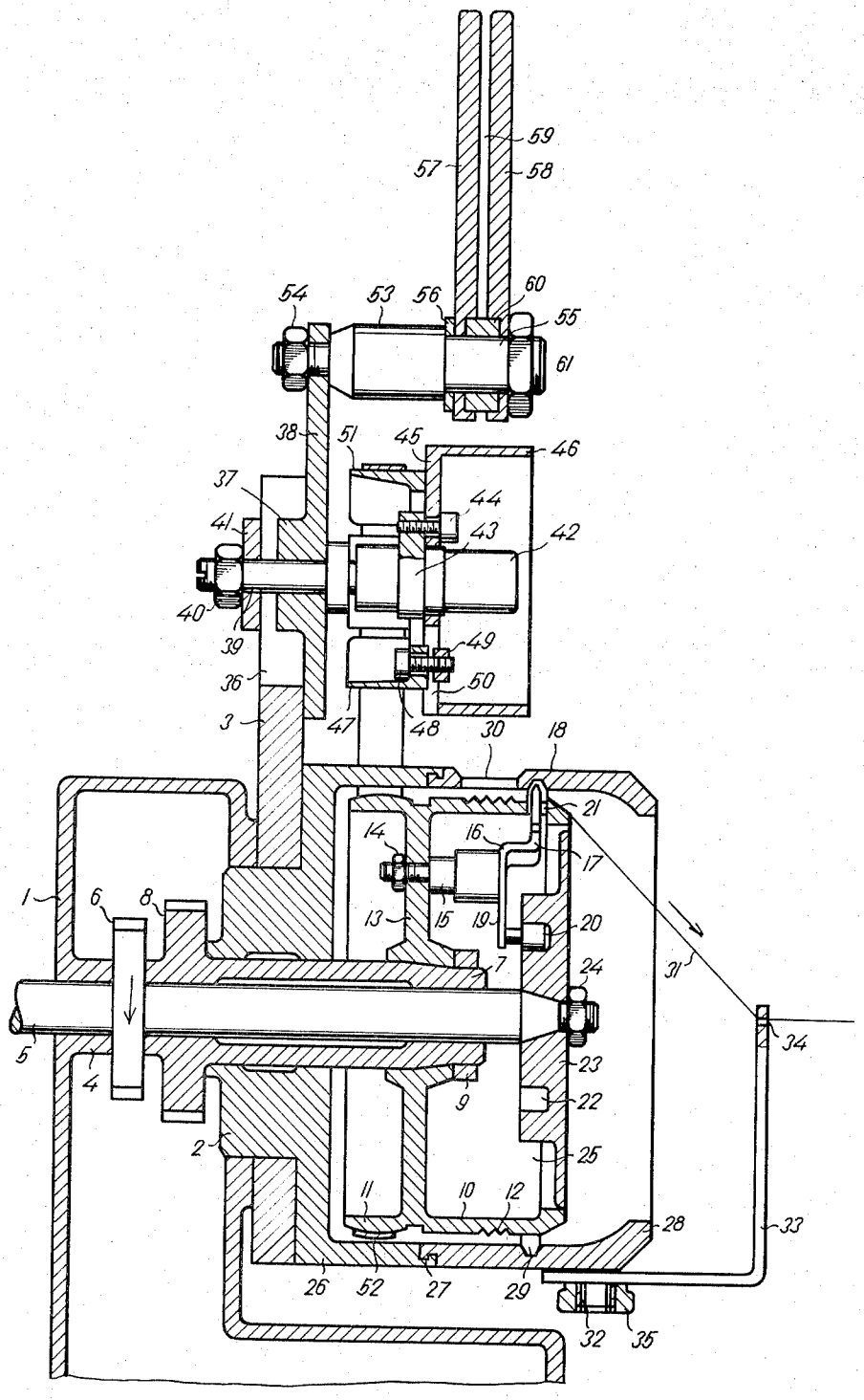

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Fig. 1.

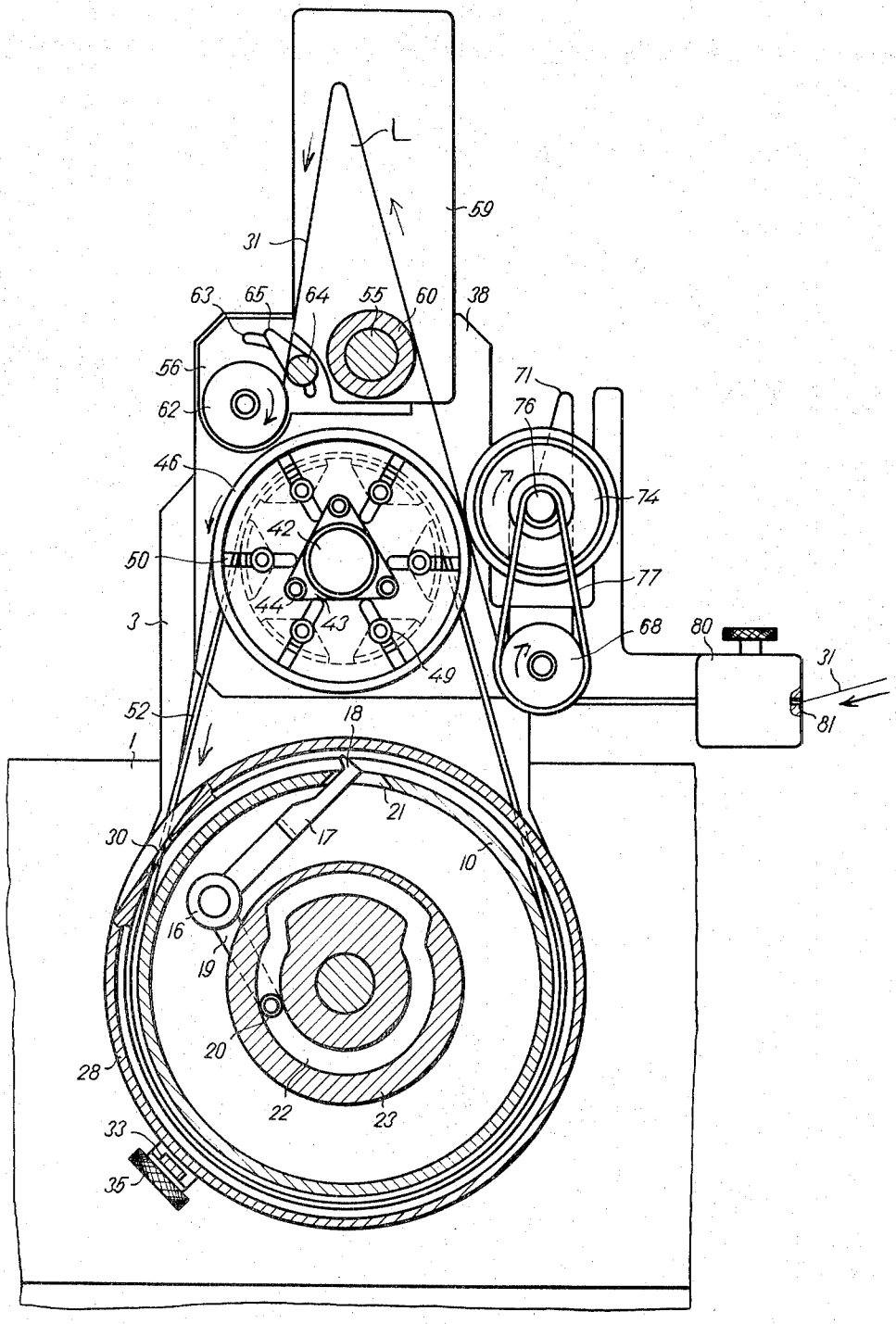

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Fig. 2.

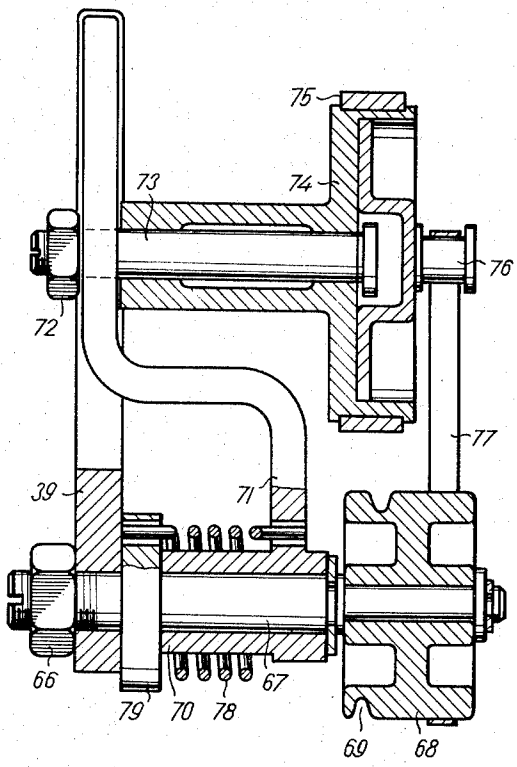


Fig. 3.

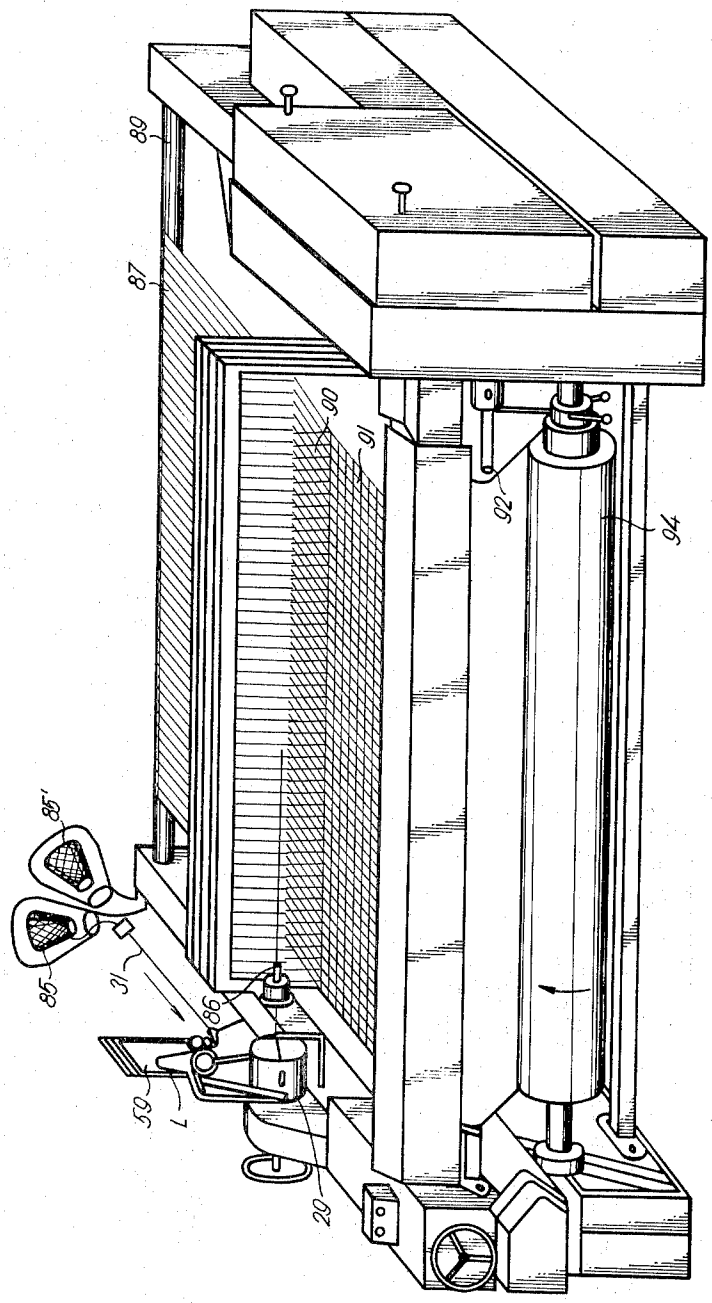


Fig. 4.

METHOD OF AND APPARATUS FOR METERING AND STORING WEFT YARN FOR INTERMITTENT INSERTION INTO THE SHED OF SHUTTLELESS LOOMS

This invention relates to a method of and a device for adjustably metering and storing yarn which is continuously metered and intermittently inserted into the shed of shuttleless looms, especially of jet looms.

On shuttleless looms with a jet or a similar pick, it is necessary to meter the required yarn length for each individual pick. For this purpose various devices are used, such devices being placed on the loom near the picking jet.

Up to now the most perfect known way of carrying out the above method consists in the continuous metering of the weft yarn all the time between two consecutive picks, the yarn metered in the time interval between picks being stored in a spiral form on a storing drum. In the moment of the pick, due to the action of the inserting jet, the stock on the drum is first drawn off and the remaining portion of the weft yarn length required is metered before the pick is accomplished.

The device for carrying out the above-described method consists of a rotating storage drum, a pivoted pressing roller being closely fitted to the metering portion of the surface of the drum. The yarn unwound from the bobbin is carried between the storage drum surface and the pressing roller, and is wound up onto the threaded portion of the storage drum, the diameter of which is approximately in accordance with the diameter of the metering portion of the storage drum.

A disadvantage of the described method and thus of the device in question is that after drawing off the stock on the drum, which takes place in a short time at a high delivery speed of the inserting jet, a sudden braking of the weft yarn occurs, the speed of which decreases to a metering speed, this being less than the weft insertion rate. This sudden change of the weft insertion rate causes irregularities in the pick, thereby reducing the quality of the fabric.

A method of and a device for yarn metering is also known wherein the weft yarn is continuously metered by a couple of drums and forms a loop due to its kinetic energy, either in a free space or one limited by means of a limiting screen, a guard board parallel with the plane of the loop, or a chamber. In some cases the metered yarn comes into contact with a stream of air under pressure to insure a more perfect loop formation and at the same time to prevent the torsion of the same, which may occur due to the considerable size of the loop.

A disadvantage of this method and of the device for metering the weft yarn length in accordance therewith is a high initial resistance or tension of the yarn being taken-up into the shed, this being caused by a relatively great inertial mass of the length of metered yarn. The weft yarn therefore starts slowly, this causing, especially in the case of a yarn of a less strength or in the case of a heavy yarn, partial defibering resulting in an increased rate of breakage.

In the final phase of the pick, a further disadvantage appears, as well as in the case of the storage drum, in the sudden braking of the weft yarn decreasing the metering speed of the metering drum, the metering speed being less than the weft insertion rate.

A further disadvantage of this device, especially when metering a greater weft length, e.g., for modern jet looms, there are required relatively large dimensioned magazines for storing the loop.

A disadvantage of both of the above known devices is the short service life of the metering drum, where either wearing or permanent deformation of the drum is caused by the metered yarn, this becoming evident in the reduced accuracy of the length of the metered weft yarn. A further disadvantage of both of such devices is a considerable difficulty in changing the length of the metered yarn.

All the above-described disadvantages and drawbacks are eliminated by the method of metering and storing the yarn according to the present invention wherein the metering of the weft yarn metering rate is higher than the rate of winding of the same onto the storage drum, the remaining portion of the metered weft yarn length being stored as a loose loop.

All disadvantages and drawbacks described in connection with the known devices are eliminated by the device according to the invention, which comprises a pivoted storage drum provided with a swinging gripper controlled by a cam disc pivoted and mounted coaxially of the storage drum, this being provided with a pulley by means of which the same is connected with the adjustable pulley of the metering drum. The diameter of the storage drum is larger than the diameter of the adjustable pulley. In the plane of rotation of the metering drum there are arranged two guide plates defining a chamber, on the entering side of which a pressing roller is attached to the metering drum, and on the exit side of the drum there is provided a device for braking the weft yarn. A distributing disc with a curved groove is pivotably adjoined to the pressing roller.

In accordance with a preferred embodiment of the invention, weft yarn braking device includes a cylindrical member which is pivotally and adjustably mounted, an adjustable braking element being attached to such member.

The adjustable pulley preferably consists of jaws adjustably attached by means of screws to the disc of the metering drum.

A considerable advantage of the method according to the invention consists in an easy and fast-starting of the metered weft yarn movement at the beginning of the pick when a small inertial mass of the continuously rapidly unwound weft yarn from the storage drum acts on the draw-off force into the shed. Thus, the weft yarn remains qualitatively unchanged, the breakage rate of the same being low. In the final phase of the pick, after drawing off the yarn stock from the storage drum, the yarn stock of the loop is used via the braking elements. This passage is absolutely continuous without any disadvantageous effect on the proper weft insertion.

By action of the braking elements there occurs a gradual decrease of the weft delivery speed from the loop to the metering rate; thus the weft in this phase is inserted continuously, thereby advantageously affecting the fabric quality.

The device for carrying out the method according to the invention has all the advantages described.

A further advantage of this device consists in its relatively small dimensions even when it is used on looms of greater widths.

Another advantage of the device is a substantially longer life of the metering drum, the wear of which is

considerably reduced. This fact becomes evident in the permanent metering of the same lengths of weft yarn.

A further advantage of the device according to the invention is an easy change of the rate of yarn metering, such change being made in the portion of the metered weft length which is stored in a loose loop.

The method of metering and storing of the continuous metered weft yarn is evident from the following example:

The weft yarn is metered at a rate which is time dependent and which depends further on the required weft length in such a manner that in the time between two consecutive weft insertions the required weft yarn length is metered. The metering rate is, at the same time, higher than the rate at which the metered weft yarn is stored on the storage drum. The excess length portion of the metered weft yarn therefore forms a loose loop as a supply stock for the final phase of weft yarn insertion.

An exemplary embodiment of the device according to the invention is illustrated in the drawings:

FIG. **1** is a diagrammatic section of the device viewed from in front;

FIG. **2** is a view in side elevation of the device;

FIG. **3** is a sectional view of the pressing roller and of the yarn distributing disc; and

FIG. **4** is a view in perspective of a jet loom to which the apparatus of the invention may advantageously be applied.

To a housing **1** which is an integral part of the loom, a flange **2** is attached, e.g., by means of screws (not shown). Between the housing **1** and the flange **2** there is fixed a supporting plate **3.** In the housing **1** there is a bearing **4,** in which the shaft **5** provided with a gear wheel **6** is journalled. The shaft **5** is further journalled in a coaxially arranged hollow shaft **7,** this being journalled in the flange **2** and inside of the housing **1** being provided with a gear wheel **8.** Both gear wheels, the gear wheel **6** and the gear wheel **8** are, via other unillustrated gears, connected with the main shaft of the loom in such a manner that the shaft **5** turns through one more or one less revolution than the hollow shaft **7** in each cycle of the loom.

On the hollow shaft **7** outside the housing **1** there is affixed a storage drum **10** by means of a nut **9,** the surface of the drum being divided into two parts. One part **11,** placed nearer to the flange **2,** has the shape of a pulley, while the other part is provided with shallow grooves **12** arranged in a helix. To the web or disc **13** of the storage drum **10** there is affixed a pin **15** by means of a nut **14;** on the pin **15** there is swingably mounted a gripper **16** in the shape of a double-arm lever, one arm **17** of which is provided on its outer end with a trapping claw **18** and the opposite arm **19** with the roller **20** on its outer end. At the point where the path of the end of arm **17** intersects the trapping claw **18** the storage drum **10,** the same is provided with an aperture **21** for the intermittent projecting of the trapping claw **18** over the surface of the storage drum **10.** The roller **20** attached to the other arm **19** engages a groove **22** formed in a cam disc **23,** which is fixed on the end of shaft **5** and is locked by a nut **24.** The cam disc **23** is placed in the hollow **25** of the storage drum **10.** The storage drum **10** is partially covered with a cylindrical collar **26** affixed to the flange **2.** A guard **28** covering and partially exceeding in axial length the remaining portion of the storage drum **10** is affixed to the collar **26** by means of, e.g., a bayonet catch **27.** The guard **28** is, at the point of the path of the trapping claw **18** of the gripper **16,** provided with a circular groove **29,** and at the point opposite to the shallow helical groove **12,** is provided with a slot **30** for the feeding of the weft yarn **31.** To the outer surface of the guard **28** there is attached a screw **32,** on which a bracket **33** with an eyelet **34,** placed opposite to the shaft **5** and coaxial of drum **10,** is mounted. The bracket **33** is locked in a preset position by means of a nut **35.**

The supporting plate **3** is provided with a recess **36,** in which another plate **38** is adjustably mounted by a projection **37** thereon which is joined with the supporting plate **3** by a stepped pin **39** and a nut **40** with a washer **41.** On the stepped pin **39** there is pivoted a boss **42** with a triangularly shaped flange **43** to which the web or disc **45** of a metering drum is fixed by means of three screws **44.** On the opposite side of the metering drum **46** there are adjustably attached six arcuate jaws **47** by means of screws **48** and nuts **49,** the attaching means for the jaws **47** passing in the disc **45** through six symmetrically and radially arranged slots **50.** The system of jaws **47** forms a pulley **51** of adjustable diameter, the diameter of pulley **51** being always less than the diameter of the metering drum **46.** The pulley **51** is connected with the pulley **11,** mounted on the storage drum **10,** by means of a belt **52,** passing through apertures (not shown) in the cylindrical collar **26** of the flange **2.**

Above the metering drum **46** a supporting pin **53** is anchored in the plate **38** by a nut **54.** On the stepped portion **55** of the pin there are fitted a holder **56** and two guide plates **57** and **58.** The surfaces of the guide plates **57** and **58** which face each other define a chamber **59,** the plates being spaced on the portion **55** of the supporting pin **53** by a spacing ring **60** inserted between them. All parts fitted on the stepped portion **55** are tightened by a nut **61.**

On the holder **56,** as shown in FIGS. **1** and **2,** there is adjustably pivoted a cylindrical braking element **62.** Around a portion of its circumference in the holder **56** there is provided an arcuate slot **63** in which by means of a screw (not shown) an adjustable braking element **64** with projections **65** for guiding weft yarn **31** is adjustably fixed. Both braking elements **62** and **64** are placed on the side of the delivery of weft yarn **31** from the chamber **59.**

On the side of the feeding of the weft yarn **31** into the chamber **59,** there is attached a distributing pin **67** to the plate **38** by means of the nut **66,** as shown in FIG. **3.** A distributing roller **68** is journalled on pin **67,** the surface of roller **68** being provided with an annular groove **69** of curved section. On the distributing pin **67** there is swingably mounted a boss **70** with an arm **71** to which the pin **73** is fixed by means of a nut **72.** On the pin **73** there is freely journalled a pressing roller **74** with an elastic covering band **75** for engaging with the metering drum **46,** as shown in FIG. **2.** The pressing roller **74,** as shown in FIG. **3,** is provided with a pulley **76** which together with the distributing roller **68** is embraced by a belt **77.** The pressing roller **74** is thrust onto the metering drum **46** by a torsion spring **78,** wrapped around the boss **70** of the arm **71** and anchored with one end in the collar, **79** of the distributing pin **67** and with the opposite end in the arm **71.**

When the unillustrated main shaft of the loom rotates, the gear wheel **6** is set into a rotary motion by

means of unillustrated gears in the housing **1** and, simultaneously in the same direction, the gear wheel **8** in such a manner that the revolutions of the gear wheel **6** are by one revolution higher or lower than the revolutions of the gear wheel **8** in each cycle of the loom. The shaft **5** and the cam disc **23** rotate in accordance with the rotation of the gear wheel **6.** The hollow shaft **7** and the storage drum **10** rotate in accordance with the rotation of the gear wheel **8.** Due to the different number of revolutions of gears **6** and **8,** the cam disc **23** overruns the storing drum **10** or vice versa; there is thus caused a periodical swinging motion of the gripper **16** carried by the storage drum **10,** this being a consequence of the asymmetric position of the groove **22** in the cam disc **23,** engaged by the roller **20** of the gripper **16.** Due to the swinging motion of the gripper **16,** the trapping claw **18** of the gripper **16** alternately hides or protrudes over the surface of the storage drum **10.** The rotary motion of the storage drum **10** is transmitted to the adjustable pulley **51** by the belt **52** and simultaneously to the metering drum **46,** joined with the same. The metering drum **46** by friction sets the pressing roller **74** into rotary motion, the rotary motion being transmitted by means of the pulley **76** and the belt **77** to the distributing disc **68** with the curved groove **69.**

As can be seen in FIG. **2,** the weft yarn **31** passes from a supply bobbin (not shown) through the eyelet **81** and the yarn brake **80,** from which the yarn is guided to the distributing disc **68,** in which the weft yarn engages a portion of length of the curved groove **69.** From here it passes between the metering drum **46** and the pressing roller **74** to the chamber **59,** and from the chamber between the adjustable braking element **64** and the cylindrical braking element **62** to the slot **30** in the guard **28,** thence to the surface of the storage drum **10** and from it through the eyelet **34** to a picking mechanism, e.g., to the jet of the loom.

After completing the insertion of weft yarn **31,** the cam disc **23,** due to its continuous rotary motion, assumes a position in which the gripper **16** swings due to the asymmetry of the groove **22** in the cam disc **23** and the trapping claw **18** of the same protrudes over the surface of the storage drum **10.** In its continuous rotary motion with the storage drum **10,** the trapping claw **18** traps the weft yarn **31,** which is held in its path by the slot **30** and the eyelet **34.** The weft yarn **31** trapped in this way starts taking up into the shallow helical groove **12** on the surface of the storage drum **10.** The taken-up weft yarn **31** is taken off via the cylindrical braking element **62** and the adjustable braking element **64** from the stock of the weft yarn **31** in the loop shape located in the chamber **59** between the guide plates **57** and **58.** The stock in loop shape is continuously replenished with weft yarn by the metering drum **46** and the pressing roller **74.** Between the metering drum **46** and the pressing roller **74** the weft yarn **31** is led by the distributing disc **68,** the curved groove **69** of which, due to rotation of the distributing disc **68,** continuously alternately moves the metered weft yarn **31** on the contact straight line between the metering drum **46** and the pressing roller **74.** The weft yarn **31** is at the same time continuously wound off from the unillustrated bobbin and is braked by the yarn brake **80.** The direction of travel of the yarn in various parts of the device, and the direction of rotation of the various rotatable drums, pulleys, etc. are indicated by straight and curved arrows, respectively, in the drawings.

In view of the fact that the diameter of the metering drum **47** is always larger than the diameter of the adjustable pulley **51** joined by means of the belt **52** with the storage drum **10,** the metering speed of the weft yarn is higher than the winding speed of the same on the storage drum **10,** so the portion of the metered weft yarn **31** not taken up rapidly thrust upwardly against the action of gravity to form an enlarging loop L in the chamber **59.**

At the moment of starting of weft insertion **31** into the loom, the cam disc **23** assumes a position in which the gripper **16** swings out due to the asymmetry of the groove **22** in such a manner that its trapping claw **18** dips under the surface of the storage drum **10,** thus enabling the weft yarn **31** to be continuously, thread by thread, withdrawn from the surface of the storage drum **10** by the action of the drawing-off force of the picking mechanism. After drawing off this stock, further weft yarn **31** is drawn-off from the loop in the chamber **59** by the picking mechanism over the braking elements **62** and **64,** the loop diminishing in size in spite of its being continuously replenished by the metering drum **46.** The reason is that the delivery speed of the weft yarn **31** is several times higher than the metering rate. At the moment of completing the insertion of the weft yarn **31,** the stocking loop is fully spent and the gripper **16** with its trapping claw **18** again traps the weft yarn **31,** which starts winding-up onto the storage drum **10.**

The whole cycle described above is regularly repeated during the weaving process.

By changing the diameter of the adjustable pulley **51** it is possible to change the metering rate of the weft yarn **31** when it is necessary to change the weft yarn length **31** metered in an interval of one operation cycle. This change of diameter can be achieved by moving the jaws **47** by hand after a previous loosening of the nuts **49.**

By moving the adjustable braking element **64** in the slot **63** it is possible to change the intensity of braking effect of both braking elements **62** and **64** by changing the amount of their embracement of the yarn. By changing the intensity of the braking effect, the amount of the course of withdrawal from the stock loop up to its full drawing off can be changed, when the weft yarn **31** partially encircles the spacing ring **60** and the remaining length of the weft yarn **31** required for the pick is drawn-off from the metering drum **46.**

The invention can be applied to all types of weaving looms on which a metered length of weft yarn is inserted by the picking mechanism, e.g., by a jet, and where continuous uniform feed of an exactly metered length is required.

In FIG. **4** there is shown the illustrative embodiment of weft metering device of the invention applied to a conventional jet loom. Weft yarn **31** from alternative weft yarn supplies **85, 85'** passes to the weft metering device and thence to the jet nozzle **86** of the loom. The jet sequentially pulls weft yarn from the weft yarn supply through the weft metering device and inserts it into the shed in a warp **87** which travels from a warp beam (not shown) over a back rest **89.** After each weft insertion the reeds **90** beat up the weft. The resulting cloth **91** is pulled forwardly by a draw beam **92,** and is wound upon a cloth beam **94.**

Although the invention is illustrated and described with reference to one preferred embodiment thereof, it is to be expressly understood that it is in no way limited

to the disclosure thereof, but is capable of numerous modifications within the scope of the appended claims.

What is claimed is:

1. A method of handling weft yarn for insertion in successive picks into a shuttleless loom, comprising continuously metering the yarn and feeding it forward into a loose loop, withdrawing the yarn from the loop and winding it on a storage drum at a rate less than that of the metering of the yarn, and intermittently withdrawing the yarn from the storage drum and inserting it in a pick into the shed of the loom.

2. A method according to claim **1,** wherein the yarn is retarded in the zone thereof between the loop and the storage drum.

3. A method according to claim **2,** wherein in each pick the yarn is first withdrawn from the storage drum, and thereafter, in the final phase of the pick, the yarn is withdrawn from the loop under the retardation thereof imposed thereupon in said zone.

4. A method according to claim **1,** wherein the metering and feeding of the yarn into the loop takes place at constant speed.

5. A method according to claim **1,** wherein the yarn is gripped to wind it upon the storage drum between successive picks, and the gripping of the yarn on the storage drum is released at the beginning of each pick.

6. Apparatus for handling weft yarn for insertion in successive picks into a shuttleless loom, comprising means for continuously metering the yarn and feeding it forward into a loose loop, a storage drum, means for withdrawing the yarn from the loop and winding it on the storage drum at a rate less than that of the metering of the yarn, and means for intermittently withdrawing the yarn from the storage drum and inserting it in a pick into the shed of the loom.

7. Apparatus according to claim **6,** comprising means for retarding the yarn in the zone thereof between the loop and the storage drum.

8. Apparatus according to claim **7,** wherein the means for intermittently withdrawing the yarn in each pick first withdraws it from the storage drum and thereafter, in the final phase of the pick withdraws the yarn from the loop under the retardation imposed thereupon in said zone.

9. Apparatus according to claim **6,** wherein the means for metering and feeding the yarn into the loop is driven at constant speed.

10. Apparatus according to claim **6,** comprising means for gripping the yarn to wind it upon the storage drum between successive picks and for releasing such gripping of the yarn on storage drum at the beginning of each pick.

11. Apparatus according to claim **10,** wherein the storage drum is rotatably driven, and the means to grip and release the yarn comprises a selectively radially outwardly advanceable and inwardly retractable finger on the drum, the finger when outwardly advanced forming a bight in the yarn passing around the storage drum.

12. Apparatus according to claim **6,** wherein the storage drum is provided with a swinging yarn gripper controlled by a rotatable cam disc mounted coaxially of the storage drum, the drum being provided with a pulley by means of which the same is connected with an adjustable pulley driving a metering drum, the diameter of the pulley on the drum being larger than the diameter of the adjustable pulley.

13. Apparatus according to claim **12,** comprising two guide plates arranged to define a loop-containing chamber, on the entering side of the chamber there being a pressing roller attached to the metering drum, and on the exit side thereof there being a device for weft yarn braking.

14. Apparatus according to claim **12,** comprising a distributing disc with a curved yarn-receiving groove journalled adjacent the pressing roller in advance thereof.

15. Apparatus according to claim **12,** wherein the means for retarding the weft yarn comprises an adjustably mounted rotatable cylindrical braking roller and a braking element adjustably mounted with respect thereto so that the yarn passes between the roller and the element.

16. Apparatus according to claim **12,** wherein the adjustable pulley comprises radially adjustable jaws attached to a disc secured to the metering drum.

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