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Dewas

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[54] TAPE DRIVE IN WEAVING MACHINES

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Aug. 13, 1973 Luxemburg 68217

[52] **U.S. Cl.** **139/123**
[51] **Int. Cl.^{2}** **D03D 47/00**
[58] **Field of Search** .... 139/122 R–127 R; 74/29, 30, 222, 226

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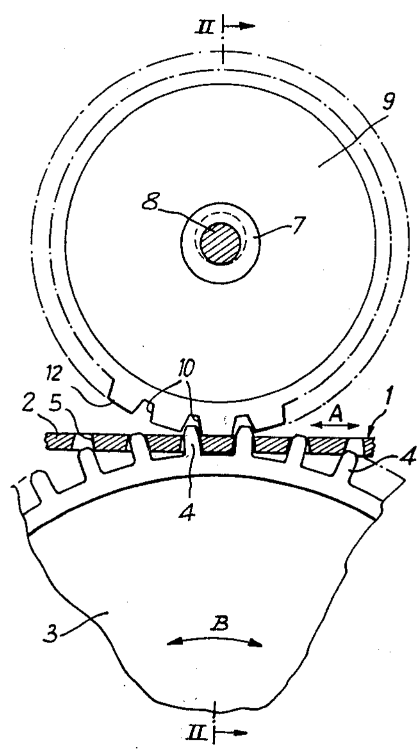
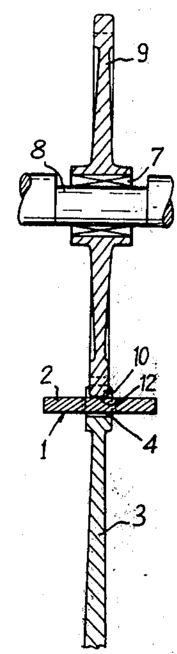
Primary Examiner—Henry S. Jaudon
Attorney, Agent, or Firm—V. Alexander Scher

[57] ABSTRACT

Weaving machine with weft supply by spools located outside the shed, comprising at least an inserter, or weft picker, having a flexible strip with perforations for its drive engagement by meshing with a toothed driving wheel designed to be driven along an alternating rotation movement, characterized by the fact that it comprises at least one auxiliary idle wheel comprising on the one hand means to bear on the face of the strip remote from the drive wheel axis, in the cooperation zone between the strip and the drive wheel, to prevent the strip being separated from the driving wheel axis and on the other hand, meshing means provided on its circumference and so adapted that, in said cooperation zone, a rotation movement is imparted to it by that of the drive wheel.

17 Claims, 16 Drawing Figures





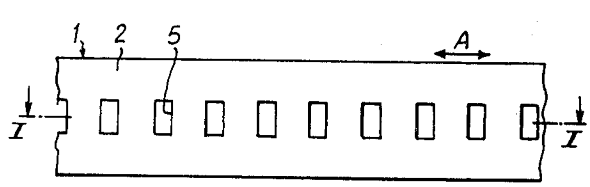


Fig:1

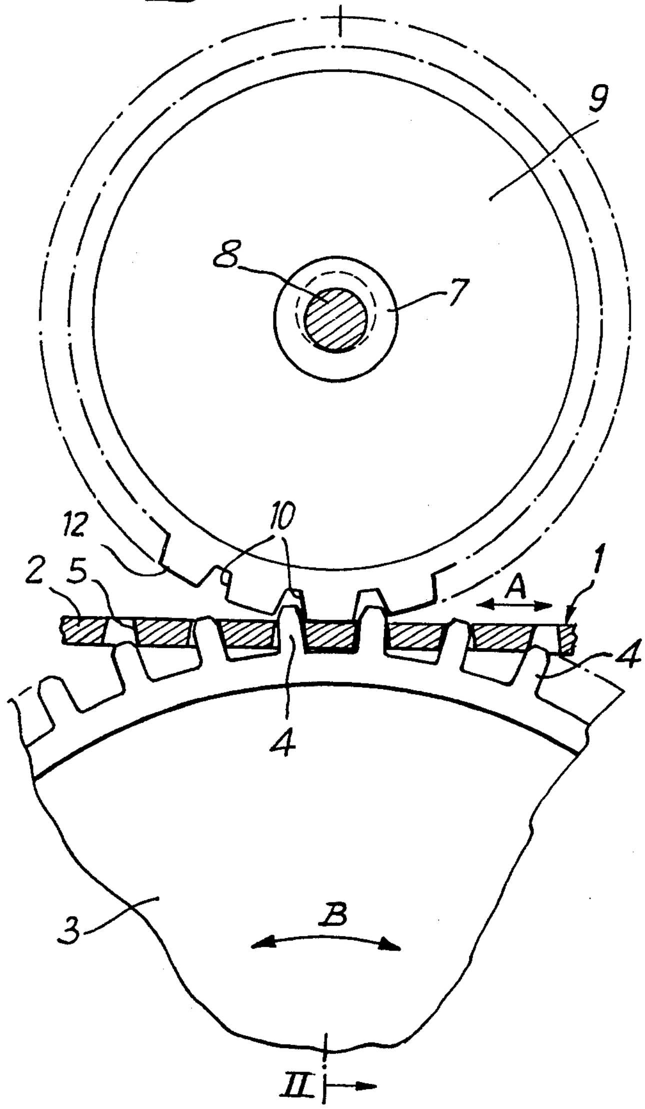


Fig:2

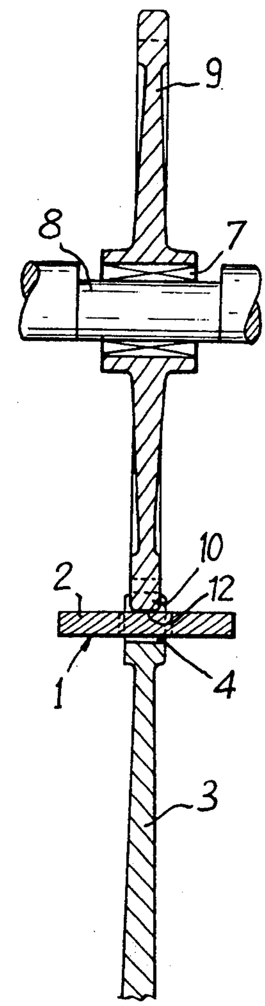


Fig:3

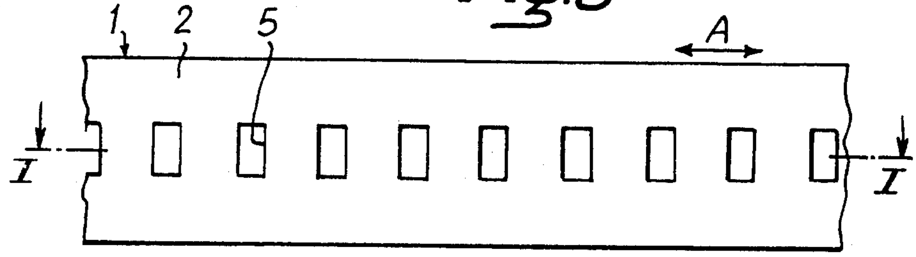


Fig:4

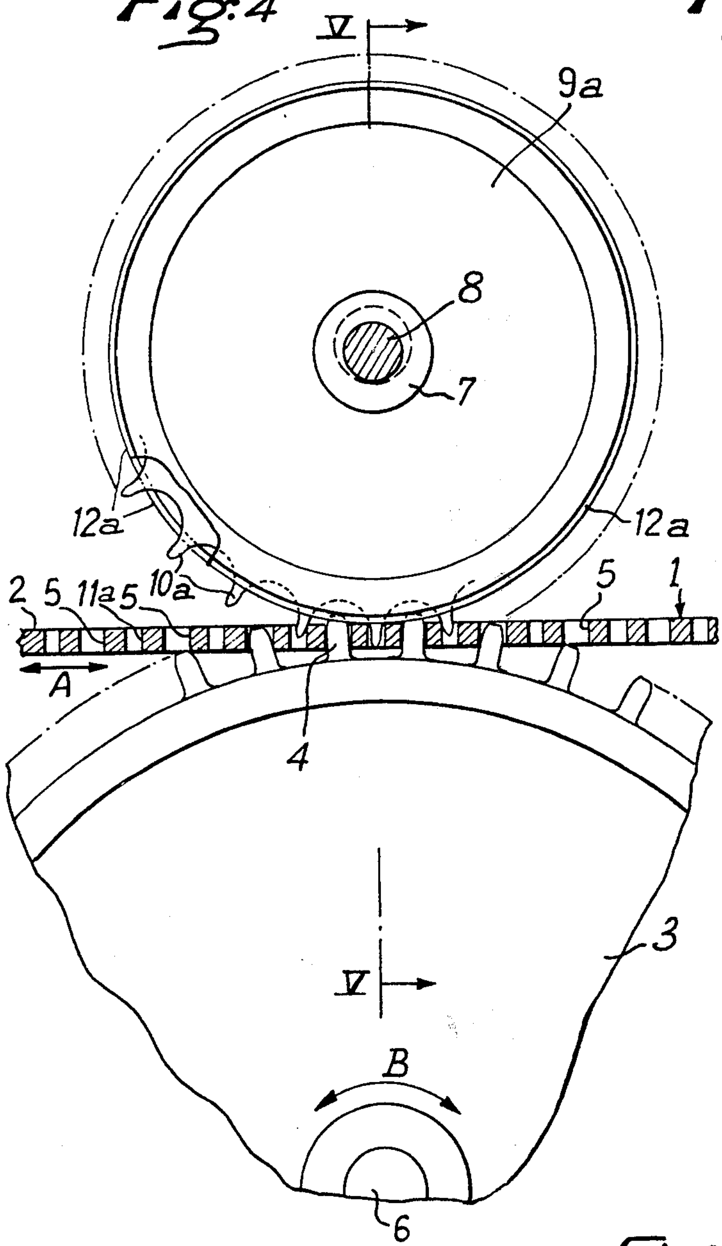


Fig:5

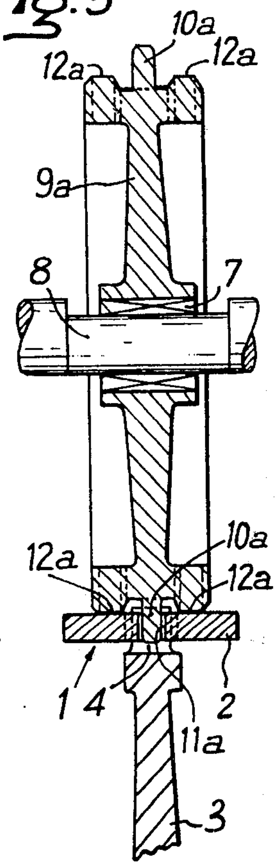


Fig:6

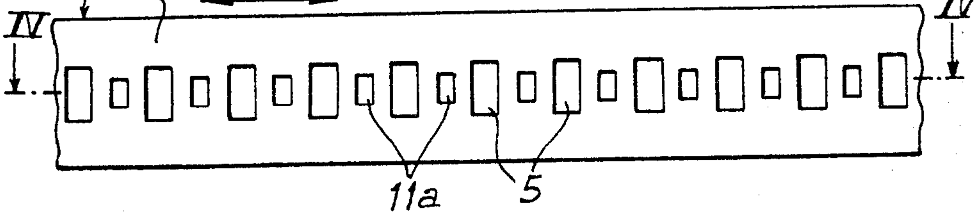


Fig: 7

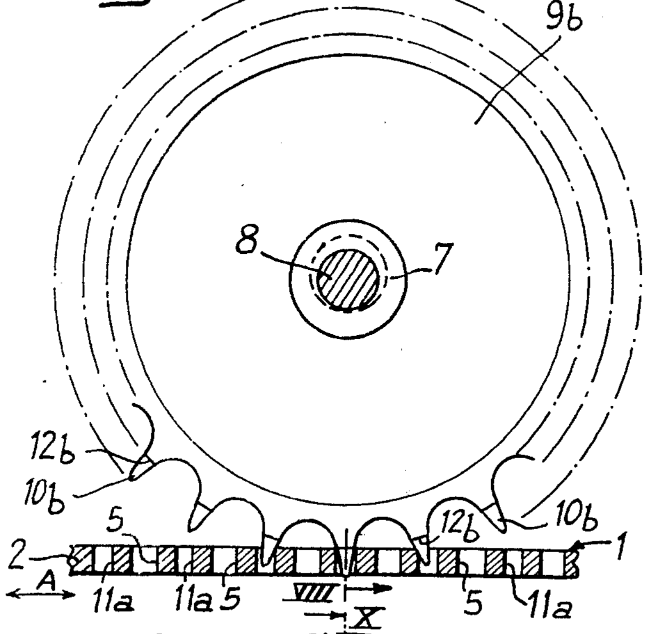


Fig: 8

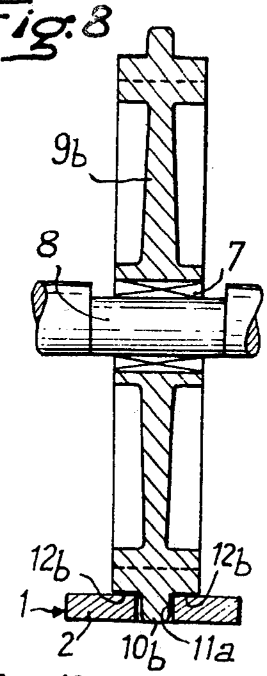


Fig: 9

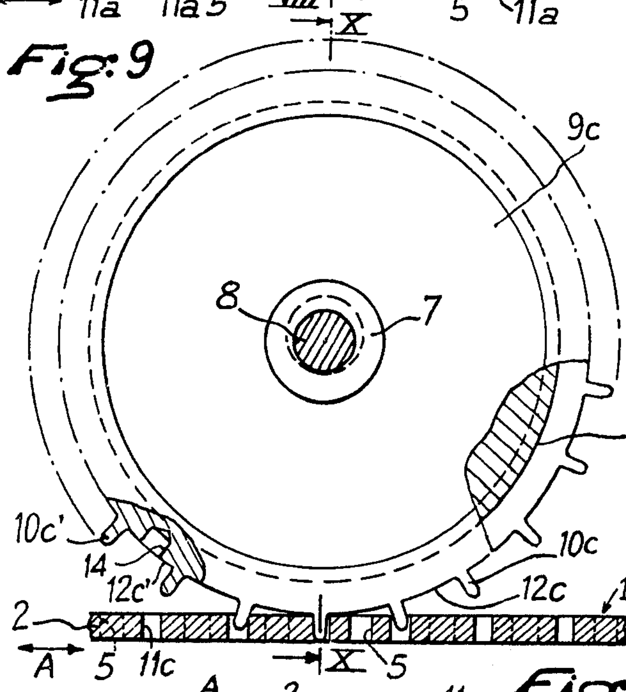


Fig: 10

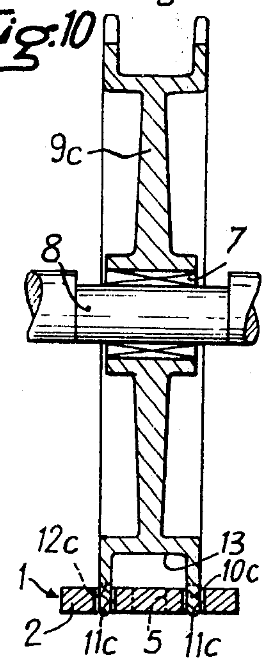
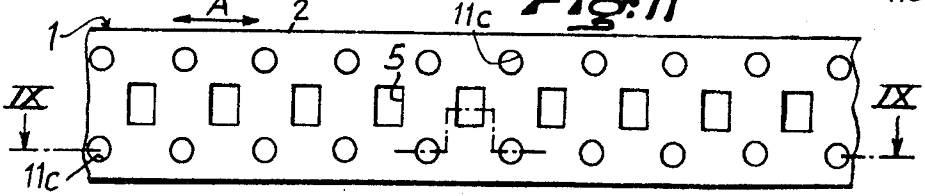


Fig: 11



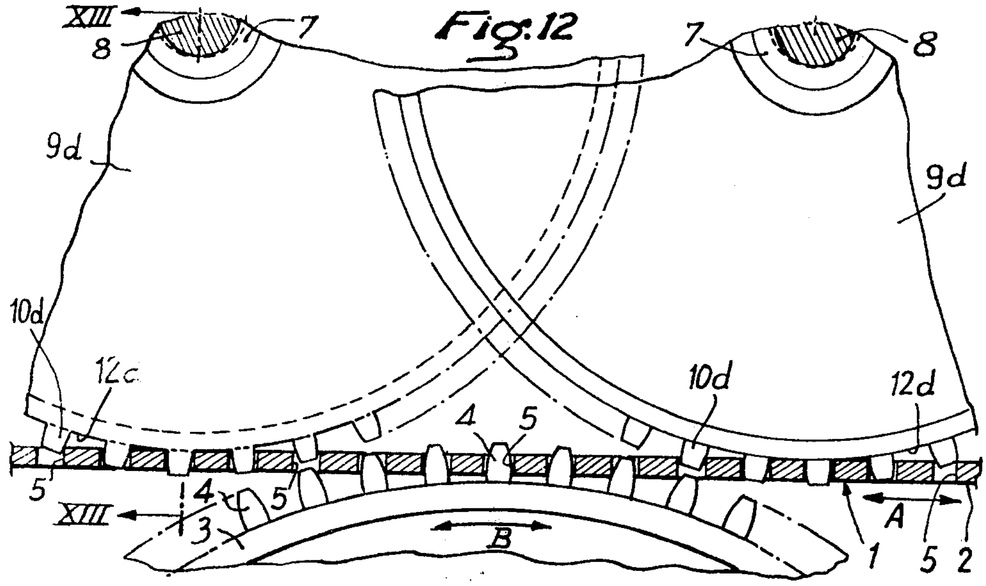


Fig:12

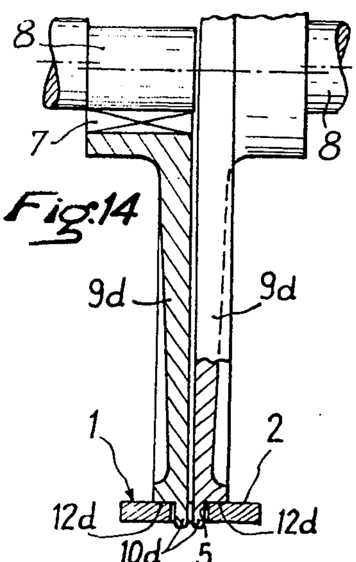


Fig:14

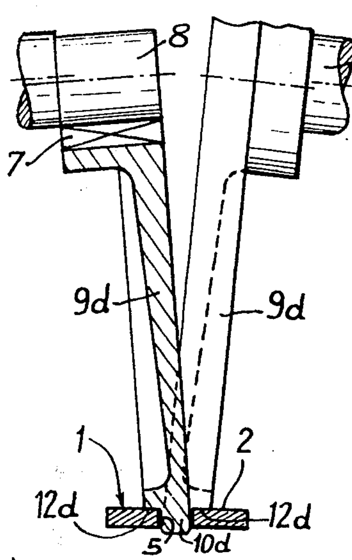


Fig:13

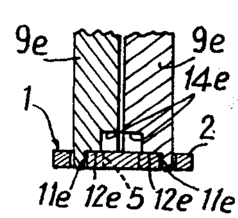


Fig:16

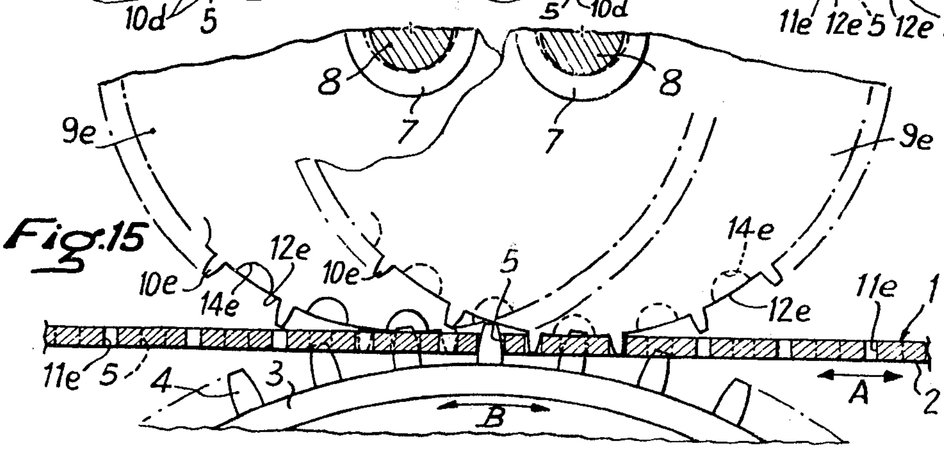


Fig:15

TAPE DRIVE IN WEAVING MACHINES

This invention relates to weaving machines with weft supply by spools located outside the shed. These machines comprise, for the insertion of the weft, either a single weft picker, or weft needle, which conducts the weft over the entire width of the shed, or two opposite weft pickers or needles, one of which conducts the weft to the middle of the shed, which weft is taken up and drawn by the other as far as the selvedge.

The needles are generally composed of two elements: a flexible strip and a front section, generally rigid, and comprising a needle body and a head, the needle body being fixed along its lower face to the forward portion of the strip.

Outside the shed, the strip edges are engaged in rectilinear slideways and, for dimensional reasons, the strip passes through a hoop which conducts it inside, to the lower part of the machine.

To drive the strip, it is provided with perforations designed to mesh in with the teeth of a drive wheel to which a power source imparts an alternating rotation movement.

These types of machine are described, for example, in the applicant's British Pat. No. **1,005,512.**

When it meshes with the drive wheel, the strip is subjected by the wheel and in both directions of movement, to a driving force which offers a radial component, due to the angle of pressure, this component tending consequently, on meshing, to separate the strip from the wheel. To prevent this effect, fixed slideways are now used which maintain the strip in a normal meshing position with the drive wheel.

As these machines are employed at increasingly high running speeds and/or increasingly large widths, the drive wheel should, to meet these operating conditions, revolve increasingly fast. This means that the strip, in the meshing zone, is subject to a considerable radial component and rubs intensely against the slideways. This results in a friction resistance which causes rapid heating of the slideways and the strip, damage to the strip structure, abnormal wear on the perforation sides, fatigue of the mechanical parts and a loss of power.

To attempt to remedy these drawbacks, it has been proposed replacing the slideways, in the meshing zone, by rollers whose circumference would bear against the outer side of the strip. With this arrangement, however, the frequent and rapid reversals of direction cause more or less permanent slippage of the rollers on the strip; as a matter of fact, the rollers are only driven by friction, and, owing to their inertia, cannot instantaneously follow the strip's movement. This results in considerable friction on the strip.

An object of this invention is to supply a weaving machine, of the type indicated, which does not offer the drawbacks mentioned.

For this purpose, the weaving machine according to the invention, comprising at least an inserter, or weft picker, comprising a flexible strip with perforations for its drive engagment by meshing with a toothed driving wheel designed to be driven along an alternating rotation movement, is characterized by the fact that it comprises at least one auxiliary idle wheel, comprising on the one hand means to bear on the face of the strip remote from the driving wheel axis, in the cooperation zone between the strip and the driving wheel, so as to prevent the strip being separated from the driving

wheel axis, and on the other hand meshing means provided on its circumference and adapted so that, in said cooperation zone, a rotation movement is imparted to it by that of the driving wheel.

According to one feature of the invention, the bearing means are composed of at least one revolution surface whose axis is that of the auxiliary wheel and which is continuous or not. This revolution surface is cylindrical or conical depending as to whether the plane of the auxiliary wheel is perpendicular or inclined with respect to the strip plane, respectively.

Accordingly to another feature of the invention, the auxiliary wheel's meshing means are composed of teeth which mesh either directly with the top of the driving wheel teeth which pass through the strip, or with the perforations of the strip, itself driven by the driving wheel.

According to one embodiment of the invention, there is an auxiliary wheel which cooperates with the strip and is more or less tangent to the driving wheel.

According to another embodiment of the invention, there are two auxiliary wheels which cooperate with the strip/on either side of the center of the zone in which the strip cooperates with the driving wheel.

Other features of the invention will be displayed on reading the following description and by referring to the accompanying drawings in which:

FIG. **1** is an elevation, partially in cross-section along line I—I of FIG. **3,** showing the driving wheel, the strip and the auxiliary wheel, according to a first embodiment of the invention;

FIG. **2** is a section along line II—II of FIG. **1;**

FIG. **3** is a plan view of the strip employed in the embodiment shown in FIGS. **1** and **2;**

FIG. **4** is an elevation, partially in cross-section along line IV—IV of FIG. **6** and partially broken away, showing the driving wheel, the strip and the auxiliary wheel, according to a second embodiment;

FIG. **5** is a cross-section along line V—V of FIG. **4;**

FIG. **6** is a plan view of the strip employed in the embodiment shown in FIGS. **4** and **5;**

FIG. **7** is an elevation, partially in cross-section, showing the strip and the auxiliary wheel, according to a third embodiment, the driving wheel not being shown;

FIG. **8** is a cross-section along line VIII—VIII of FIG. **7;**

FIG. **9** and **10** are views similar to FIG. **7** and **8** and show a fourth embodiment, FIG. **9** being a cross-section along line IX—IX of FIG. **11** and FIG. **10** being a cross-section along line X—X of FIG. **9;**

FIG. **11** is a plan view of the strip utilized in the embodiment shown in FIGS. **9** and **10;**

FIG. **12** is an elevation, partially in cross- section, showing the driving wheel, the strip and two auxiliary wheels, according to a fifth embodiment;

FIG. **13** is a cross-section according to line XIII—XIII of FIG. **12;**

FIG. **14** shows a modification of FIG. **13** and

FIG. **15** and **16** are views similar to FIGS. **12** and **14** and relative to a sixth embodiment.

The weaving machine, according to the invention, only a part of which is shown on the drawings, comprises, as is known, at least one inserter **1,** or weft picker, which includes a flexible strip **2** to which a front rigid section (not shown) is secured.

An alternating movement is imparted to the flexible strip **2** as per the double arrow A (FIGS. **1, 3, 4, 6, 7,** 9, 11, 12 and 15); the strip is driven by a driving wheel **3** which is secured on its shaft **6** and to which a corresponding alternating rotation movement is imparted as per the double arrow B (FIGS. **1, 4, 12** and **15**). The wheel **3** carries on its circumference teeth **4** which penetrate into perforations **5** made regularly through the strip, in a longitudinal series, at the pitch of the teeth **4.** The strip **2** meshes with the wheel **3** in the upper part of the wheel **3,** in the embodiments shown.

On its alternating movement, the inserter **1** takes the weft from outside the shed and enters it into the latter, either as far as the other end, or as far as about the middle of the shed. For further details concerning the operation of this type of machine reference will be made to British Pat. No. **1,005,512** already mentioned.

It can be conceived that the teeth **4** of wheel **3** exert a force on the strip **2** which offers a vertical component, directed upwards and tending to raise the strip.

To prevent this raising movement, at least one auxiliary idle wheel is provided, according to the invention, comprising on the one hand means to bear on the upper side of the strip, in the zone of cooperation between the latter and the wheel **3,** and on the other hand meshing means on its circumference so that the rotation movement of wheel **3** is imparted to said idle wheel in this cooperation zone.

In all the embodiments shown and described, the auxiliary wheel is mounted in an idle manner, as shown schematically by a bearing **7,** on a shaft **8.** The plane of the auxiliary wheel is either perpendicular to the plane of the strip in the said cooperation zone, in which case its axis is parallel to the strip in this zone and its bearing means are constituted by a cylindrical revolution surface, the axis of which is that of the auxiliary wheel, or inclined with respect to the plane of the strip in this zone, in which case its axis is inclined with respect to the strip and its bearing means are constituted by a conical revolution surface the axis of which is that of the auxiliary wheel.

In the embodiment shown in FIGS. **1** to **3,** the auxiliary wheel **9** bears on the strip **2** and its movement is imparted to it directly by the driving wheel **3.** The wheels **3** and **9** are in the same plane. The strip **3** has aligned perforations **5** designed to mesh with the teeth **4** on the driving wheel **3.**

The auxiliary wheel **9** has on its circumference cylindrical surface sections **12** separated by the tooth clearings or gaps **10.** The axis of shaft **8** is that of the surfaces **12** which are designed to bear on the strip, whilst the tooth clearings **10** are adapted to mesh directly in a drive engagement with the teeth **4** of wheel **3,** suitably shaped to extend sufficiently from and over the strip. Eventually, in order to have a continuous bearing surface, two side flanges could be provided with the same diameter as the surfaces **12.**

In operation, wheel **3** in its alternating movement according to arrow B drives directly, through its teeth **4,** both the strip and wheel **9,** whereas wheel **9** cooperates with the strip only by bearing and rolling substantially without slippage on it in order to prevent the strip being raised with respect to wheel **3.** There is therefore no heating of slideways and strip, nor damage to the strip. Moreover, the auxiliary wheel **9** has very low inertia; it therefore absorbs quite negligeable energy.

In the embodiment shown in FIGS. **4** to **6,** the auxiliary wheel **9***a* is also in the plane of wheel **3** and it is driven by the strip **2,** while bearing on it by two continuous cylindrical surfaces. The wheel **9***a* has teeth **10***a* on its circumference, at the pitch of the perforations **5** of the strip and teeth **4** of wheel **3.** The teeth **10***a* mesh with perforations **11***a* of the strip, alternating with the perforations **5** and located on the same longitudinal line as they. In the cooperation zone between wheels **3,** **9***a* and strip **2,** the teeth of one wheel are offset by one-half pitch as compared to those of the other and enter without contact into the tooth clearings of this other wheel. The bearing surfaces are formed of two flanges **12***a* whose axis is that of shaft **8.** The flanges **12***a* are located apart and spaced axially from the teeth **10***a* to bear on the strip **2** along to longitudinal bands located on either side of the line of perforations **5, 11***a*.

The diameter of the flanges **12***a*, the diameter of the pitch circle of wheel **9***a* and the distance between the axes of wheels **3, 9***a* are calculated so that, when the strip is tangent to the flanges, the teeth **10***a* mesh correctly with the perforations **11***a* of the strip.

In operation, wheel **3,** in its alternating rotation movement according to arrow B, imparts an alternating movement according to arrow A to the strip. Simultaneously the wheel **9***a* is driven pratically without slippage by the strip on which it bears constantly by its flanges **12***a*. The strip is thus maintained on wheel **3** in its correct meshing position and, owing to the fact that wheel **9***a* is coupled to wheel **3** by the strip, it does not rub against it.

In the embodiment shown in FIGS. **7** and **8,** employing the strip of FIG. **6** with its two series of perforations **5, 11***a*, the auxiliary wheel **9***b* differs from wheel **9***a* of FIGS. **4** and **5** only by the arrangement of the bearing surfaces on the strip. The continuous flanges **12***a* of FIGS. **4** and **5** are deleted and replaced by shoulder pairs **12***b* which extend transversaly to the teeth **10***b*, similarly to the teeth **10***a* of wheel **9***a*, and which are radially inwardly offset in relation to teeth **10***b* so as to bear on the upper side of the strip while the teeth **10***b* mesh with perforations **11***a*.

Operation is similar to that described in reference to FIGS. **4** and **6.** It is only differentiated therefrom by the fact that the wheel **9***b* bears discontinuously through its shoulders **12***b*.

In the embodiment shown in FIGS. **9** to **11,** the auxiliary wheel **9***c* is still in the plane of wheel **3** and contains two series of teeth **10***c* arranged symmetrically in relation to the median plane of the wheel (FIG. **10**). In addition of the perforations **5,** the strip has to symmetrical series of perforations **11***c*.

The tooth clearings **10***c* form cylindrical surface sections **12***c* designed to bear on the strip. Between the two series of teeth **10***c*, the wheel **9***c* has a groove **13** for the passage of the drive wheel's (not shown) tooth tops without contact.

In the left broken away section of FIG. **9** a modification has been shown in which the auxiliary wheel has a cylindrical surface **12***c'* over its entire circumference from which teeth **10***c'* project to pass through the drive wheel's (not shown) tooth tips. The cylindrical surface **12***c'* is drilled with blind holes **14** for the passage of the drive wheel's (not shown) tooth tops. The teeth **10***c'* and hence the strip's auxiliary perforations are located in the plane of the holes **14** or offset in relation to this plane. In the first case, use is made of the strip of FIG.

6 and, in the second case, use is made of the strip of FIG. 11.

Operation is similar to that of the embodiment of FIGS. 7 and 8 with the difference that the bearing on the strip is obtained between the consecutive teeth of the auxiliary wheel and moreover on the intermediate cylindrical surface **12c'** in the case of the modification shown on the left broken away section of FIG. 9, instead of taking place on the side of the teeth.

Two embodiments have been shown on FIGS. 12 and 16 in which two auxiliary wheels are employed instead of the single auxiliary wheel **9–9c** on FIGS. 1 to 11.

In the embodiment shown in FIGS. 12 to 14, two identical auxiliary wheels **9d** are provided with their circumference fitted with teeth **10d** to mesh with the perforations **5** of the strip **2** which in this case is that of FIG. 3, these perforations being also used for the strip cooperation with the drive wheel **3**. The teeth **10d** extend from the outer surface **12d** of the wheel **9d**, said surface **12d** being adapted to bear on the strip. The auxiliary wheels **9d** are offset with respect to the center of the cooperation zone of the strip **2** and the drive wheel **3**. The position of the auxiliary wheel axes is chosen so that teeth **10d** pass at close proximity of teeth **4** of driving wheel **3**, whatever the diameter of said auxiliary wheels may be.

The diameter of the wheels **9d** can be chosen in such a manner that the contours of these wheels do not overlap. However with wheels of low diameter, the contact surface with the strip is very small and meshing is imperfect. For this reason, as shown in FIG. 12, the wheels **9d** have a large diameter and their contours overlap. For their mounting and operation, they are inclined on either side of the median vertical longitudinal plane of strip **2** (FIG. 13), or offset axially in relation to this plane (FIG. 14). In the first case (FIG. 13), the bearing surfaces **12d** are conical and teeth **10d** occupy substantially all the width of perforations **5**. In the second case (FIG. 14), the bearing surfaces **14d** are cylindrical and teeth **10d** are located near the facing radial faces of the auxiliary wheels and have an axial width so adapted that they engage only a lateral portion of the contour of the perforations **5**, as shown by the cross-section and the break-away of FIG. 14.

In the embodiment shown in FIGS. 15 and 16 two auxiliary wheels **9e** are mounted in facing relationship on either sides of the median vertical plane of the strip, their axes being very nearer than the axes in FIG. 12. For their driving they are provided with teeth **10e** which mesh, as shown in FIG. 16, with lateral perforations **11e** of the strip **2** which is similar to that of FIG. 11. Teeth **10e** extend from a cylindrical surface **12e** bearing on the strip **2**. Inwardly from the cylindrical surface **12e** are provided recesses **14e** for the passage of the driving wheel tooth tops without contact. For drawing clarity, the strip is shown in FIG. 15 in cross-section successively in the planes of the teeth **10e** and **4** of wheels **9e** and **3**.

As an alternative to the embodiment shown in FIGS. 15 and 16, the strip in FIG. 6 could be employed but with making the perforations **11a** wider and with arranging the auxiliary wheels in a manner similar to that in FIGS. 13 and 14.

In all the embodiments described, it is advisable to be able to adjust the height of the auxiliary wheel or wheels. To this end, as shown in FIGS. 1, 2, 4, 5, 7–10 and 12–15, shaft **8** is an eccentric shaft whose rotation enables the position of the auxiliary wheel that it carries to be varied.

It results from the above that, whatever the embodiment adopted, the auxiliary wheel is driven in synchronism with the drive wheel and the strip and that the slippage between the auxiliary wheel and the strip is pratically non-existant.

Moreover, as the auxiliary wheel is subjected to a high speed alternating movement and to frequent reversals of direction, and as it transmits no torque, it is arranged so that it has aslow as possible an inertia moment with respect to its axis. For this purpose, it is composed of light material, it is hollowed out to a maximum, and, preferably, given a diameter less than that of the drive wheel **3**.

The invention is not restricted to the embodiments which have been described; on the contrary, it would be possible to conceive various modifications without departing from its scope, particularly by combining the types of bearing on the strip and of meshing as described in the above.

It is also possible to provide one auxiliary wheel according to FIG. 1, bordered by two auxiliary wheels according to FIG. 12 but with a diameter sufficiently little so that their teeth are in the same plane, the central wheel being inclined on one side of the longitudinal median vertical plane of the strip **2** and the two other wheels being inclined on the other side of said plane.

It is also possible, in embodiments of FIGS. 12 and 15, to dispose the auxiliary wheels in two vertical adjacent planes slightly inclined with respect to the longitunal median vertical plane of the strip **2**.

What I claim is:

1. In a weaving machine, a guide for a weft inserting control tape, comprising at least one inserter having a flexible strip with perforations, a driving wheel adapted to be rotated by a reciprotating movement and having teeth meshing with said perforations, whereby a cooperation zone is formed between the strip, and the wheel and an auxiliary idle wheel having means engaging an outer surface of said strip in said zone to prevent a separation of the strip from said driving wheel, as well as meshing means carried upon the circumference of the idle wheel to cause said driving wheel to impart a rotary movement to said idle wheel.

2. Weaving machine according to claim **1**, wherein the auxiliary wheel meshing means is composed of teeth arranged to mesh directly in a driving engagement with the teeth of the driving wheel which extend beyond the strip.

3. Weaving machine according to claim **1**, wherein the auxiliary wheel meshing means is composed of teeth with the pitch of the perforations of the strip and teeth of the driving wheel and arranged to mesh in a driving engagement with auxiliary perforations of the strip these auxiliary perforations alternating with the perforations of the strip which mesh with the teeth of the drive wheel and being offset laterally or not with respect to the strip perforations meshing with the driving wheel.

4. Weaving machine according to claim **3**, wherein the bearing means are composed of at least one revolution surface whose axis is that of the auxiliary wheel.

5. Weaving machine according to claim **4**, wherein the bearing means are composed of at least one continuous flange.

6. Weaving machine according to claim 4, wherein the bearing means are composed of a number of separate surfaces.

7. Weaving machine according to claim 6, wherein the auxiliary wheel has over its entire circumference a revolution surface on which teeth are provided.

8. Weaving machine according to claim 7, wherein the bearing means are located between the meshing means.

9. Weaving machine according to claim 7, wherein the bearing means are located laterally to the meshing means.

10. Weaving machine according to claim 9, wherein the bearing means have recesses for the passage of the tops of the teeth of the driving wheel.

11. Weaving machine according to claim 10, wherein the auxiliary wheel is single and located in the driving wheel plane.

12. Weaving machine according to claim 10, comprising two auxiliary wheels which are offset with respect to the driving wheel plane and whose contours overlap, said auxiliary wheels being arranged to cooperate with the strip on either sides of the center of the said cooperation zone.

13. Weaving machine according to claim 10, comprising two auxiliary wheels which are in the driving wheel plane and which are provided with teeth adapted to mesh with the strip perforations meshing with the driving wheel teeth.

14. Weaving machine according to claim 13, wherein the plane of the auxiliary wheel is perpendicular to the plane of the strip in the cooperation zone and bearing means are formed by a cylindrical revolution surface.

15. Weaving machine according to claim 12, wherein the plane of the auxiliary wheel is inclined with respect to the plane of the strip in the cooperation zone and bearing means are formed by a conical revolution surface.

16. Weaving machine according to claim 15, wherein the auxiliary wheel has a low inertia moment with respect to its axis.

17. Weaving machine according to claim 16, wherein the auxiliary wheel is mounted on an excentric shaft.

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