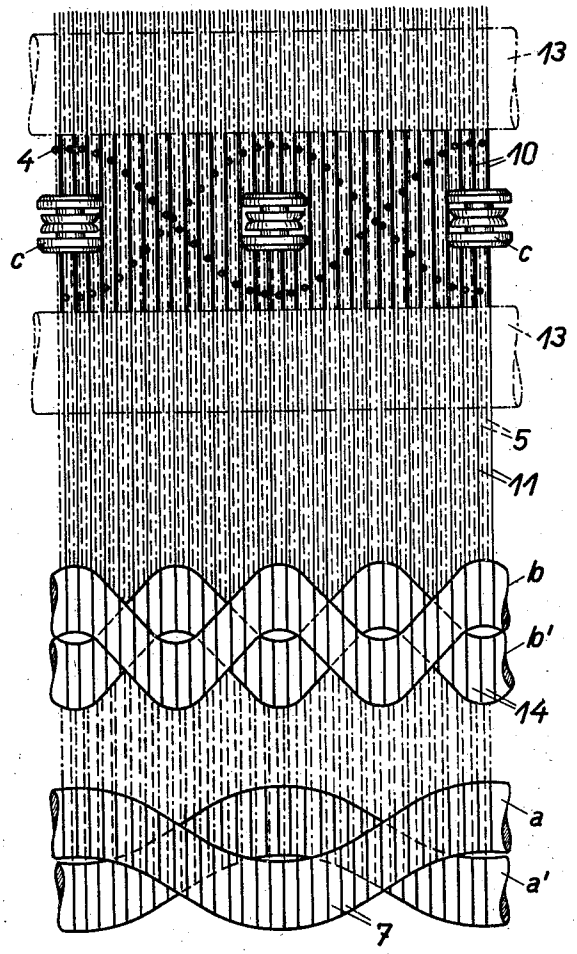
Jan. 6, 1931. O. PRIMAVESI 1,787,491

LOOM

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Fig. 1



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Fig. 2

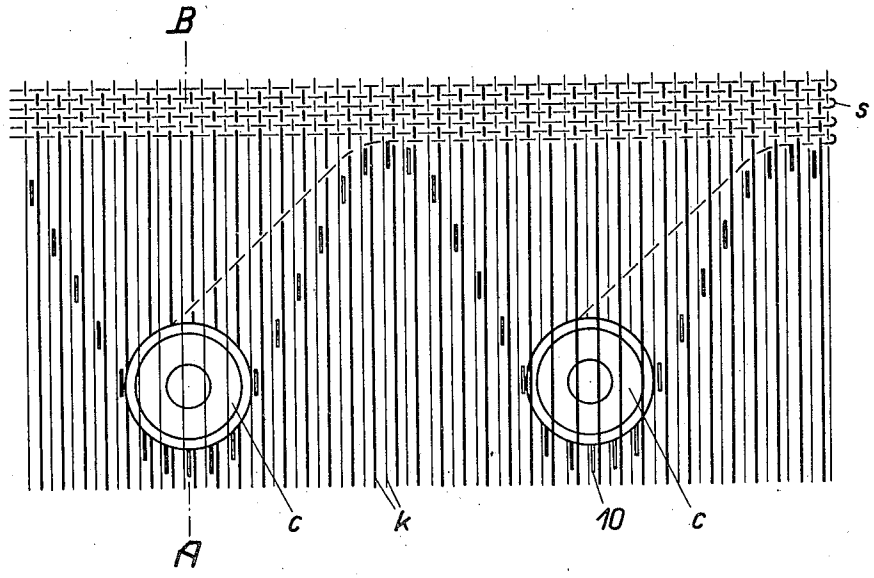
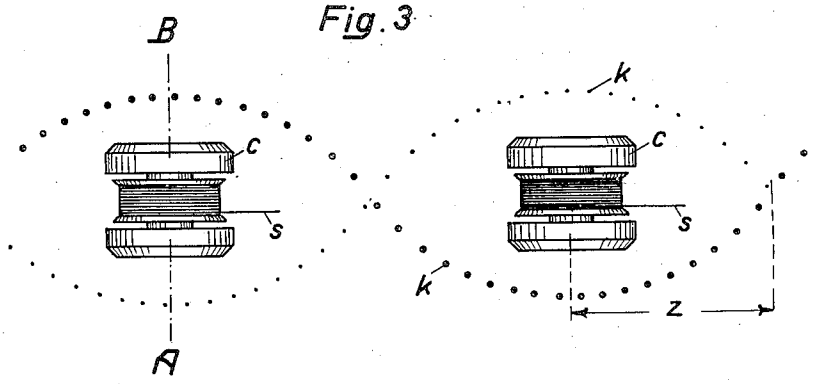


Fig. 3



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Fig. 4

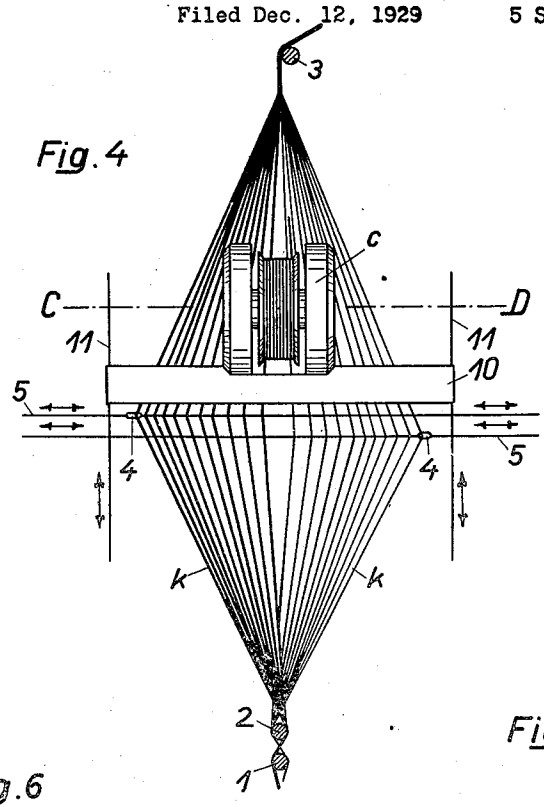


Fig. 6

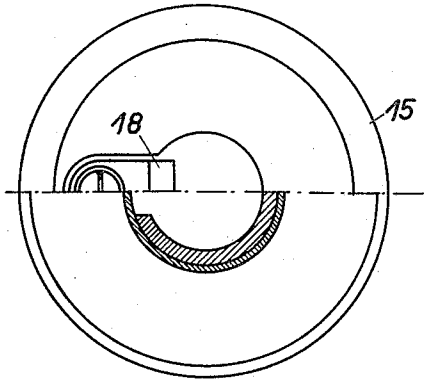
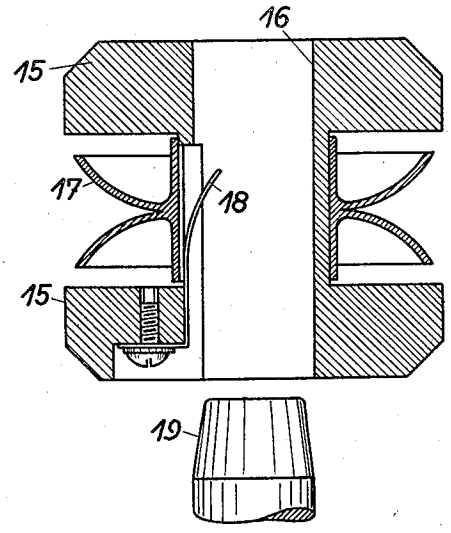


Fig. 7



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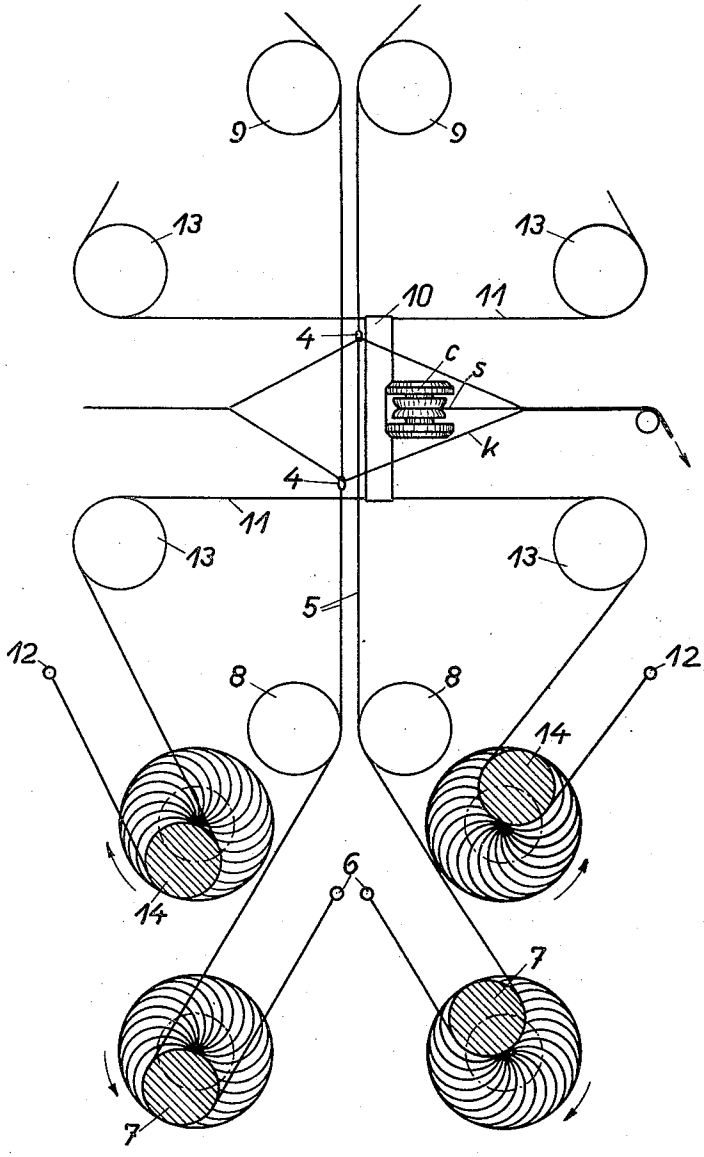
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Fig. 5



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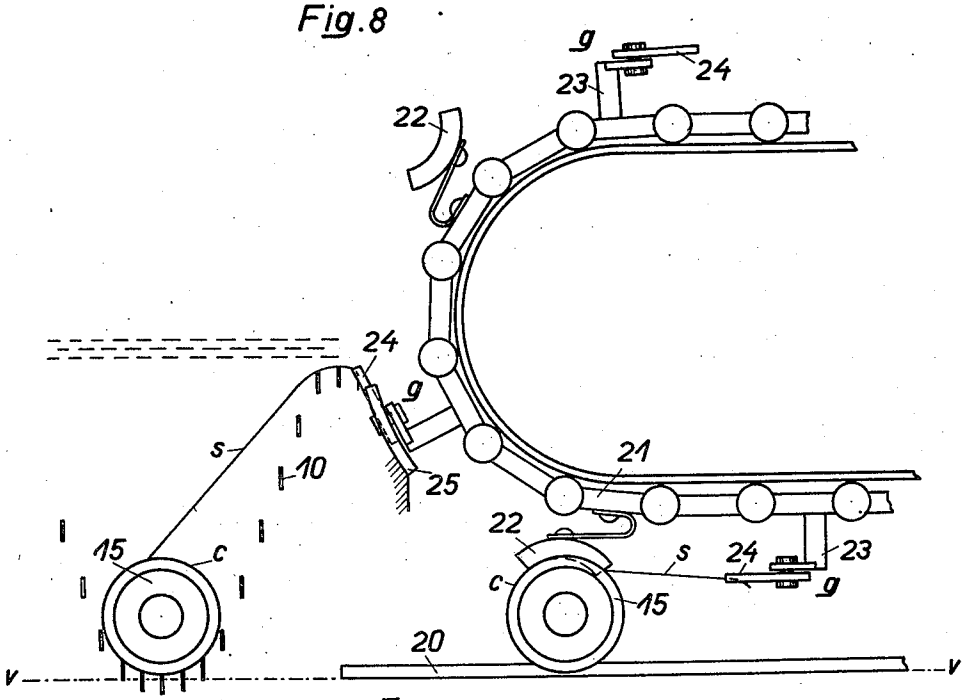
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Fig.8



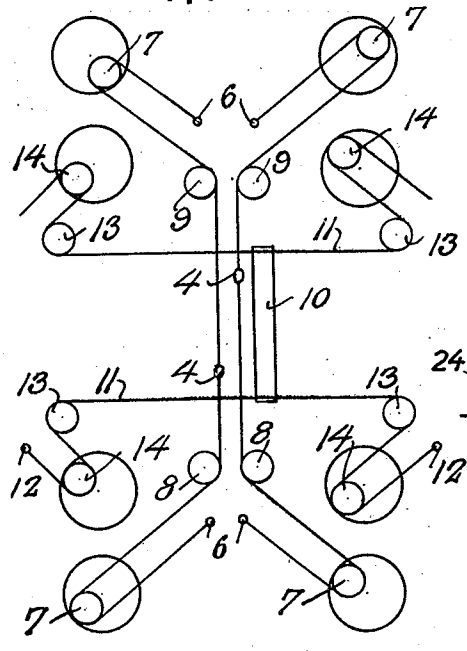


Fig.10.

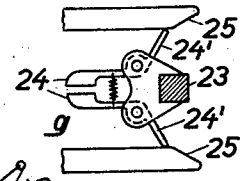


Fig.9.

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Patented Jan. 6, 1931 1,787,491

UNITED STATES PATENT OFFICE

OTTO PRIMAVESI, OF DRESDEN, GERMANY

LOOM

Application filed December 12, 1929, Serial No. 413,632, and in Germany September 11, 1926.

The loom according to the present invention has this in common with looms (circular looms) of a known type that the shed is formed progressively along the weaving width in an undulating line and that at any given moment several shuttles are within the weaving width. The invention therefore shares with them the advantage of greater output with the same mean weft speed and makes it possible to do away with the passing of the shuttles through the shed in the ordinary sense and to produce the shuttle motion for instance in the known and mechanically satisfactory way by the progressive undulating motion of lifters disposed between the warp threads.

The loom according to the present invention differs from the known type of circular loom firstly in this, that each separate weft is picked by a shuttle which has the necessary length of weft and unwinds the weft thread from a bobbin, the shuttles entering the path of the weft at the beginning of the weaving width and leaving it at the end of the weaving width.

These terms require some explanation. There is a distinct difference between "weaving width" and "path of the weft." Although in circular looms of a known type, when the material being woven is not tubular, the shuttles pass outside the weaving width which does not extend over the full periphery of the circle running through a portion of the periphery outside the weaving width and only then re-enter the weaving width, they remain the whole time in the path of the weft, that is to say they run continuously in a circle, this being just one of the advantages of the circular loom, the loss of weft thread due to the complete circumference not being utilized for the weaving width being tolerated.

This should make clear what is meant by a departure from the path of the weft in the present invention. Each shuttle only passes once through the weaving width in each operation of the loom. The invention thus departs from the essential peculiarity of the circular loom and provides that each shuttle shall be wound with the measured off length of weft, although it is of course impossible to avoid a certain loss of weft thread. In connection with the loom according to the invention automatic means may be used for automatically winding the bobbin shuttles or revolving shuttles (more particularly described below) and means for automatically introducing and removing the said shuttles which leave and re-enter the path of the weft and the loom. This winding device, however, forms no part of the present application.

In order to understand the advantages of this novel arrangement, it is necessary to realize that each shed at any moment or in other words at each period of the undulating line in which the formation of the shed progresses occupies a certain portion of the weaving width and that the size of this part and consequently the number of shuttles simultaneously in operation is determined by the longitudinal extent of the shuttle. If however the shuttles in a circular loom run round continuously in a circle as explained above, and the changing of the shuttles necessitates an interruption of the weaving operation (or at least a considerable loss of weft thread if automatic shuttle-changing means should be used, means for which might possibly be provided and certainly a considerable reduction in the speed of the shuttle), the shuttles must of necessity contain a great length of weft thread and consequently be correspondingly large. If weft threads of different colour are to alternate, the number of picks can never be greater than the number of shuttles simultaneously in operation. The invention thus leads to an increase in the number of simultaneously operative shuttles and consequently entails an increase in the output with otherwise similar conditions.

A further considerable advantage of the invention consists in this that the loom while having the advantage of the circular loom may be constructed as an ordinary loom. This will avoid the transition from the circular or arcuate position of the warp threads to the flat woven material with the consequent difference in length and tension and the effect

of the same on the weft and the finished fabric. The disturbing effect of centrifugal force is also eliminated and it is no longer necesary for the warp to be arranged vertically, although such an arrangement is the most obvious solution when the loom according to the invention is made in the form of an ordinary loom.

While the loom according to the invention will as a rule be in the form of an ordinary loom it can also be made in the form of a circular loom, as such a loom embodies at least in part the advantages described above. The further advantage of a circular loom constructed in accordance with the present invention may here be mentioned that even when the periphery of the circle is not even approximately fully utilized (where the weaving width is small) the great loss of weft thread will be reduced to a minimum in accordance with the invention, so that narrow widths can be made with advantage.

It has been stated above that each shuttle is provided with the measured length of weft thread for one single pick. It is only an apparent departure from this idea if two shuttles which follow one another and which are connected by the weft thread together contain the measured length of weft for two successive single picks, since in this case as well each of the two shuttles contains only the length of weft for a single pick. This arrangement has the advantage, however, that at least at one edge of the woven fabric a proper selvedge will be formed, that the loss of weft thread will be still further reduced and that it will no longer be necessary for each weft thread to be fixed at the beginning of the weaving width. In order to keep the length of the shuttle as small as possible (and also the height which is of importance as regards the amount by which the warp threads have to be pulled out of the plane of the warp) and in order to enable the shuttle to pass smoothly through lifters rising and falling in an undulating line with a short period, the shuttle is made in the form of a revolving shuttle. It consists of a pair of rollers, on the axis of which between the two rollers a bobbin is mounted so as to be rotatable.

In the accompanying drawings an ordinary loom embodying the present invention is shown as far as is necessary for the correct understanding of the invention. Fig. 1 is a plan view showing only a portion of the weaving width, Fig 2 a corresponding elevation to a somewhat larger scale, Fig. 3 a horizontal cross-section on line C—D of Fig. 4 which is a vertical cross-section on line A—B. The diagrammatic vertical cross-section in Fig. 5 represents as far as necessary the means for forming the shed and imparting motion to the lifters. In Fig. 6 the revolving shuttle is shown half in elevation and half in section and in Fig. 7 in horizontal cross-section to an enlarged scale.

Fig. 8 shows a fragmentary side elevation of a portion of a chain with grippers and shoes; and

Fig. 9 is a plan view of the thread grippers shown in Fig. 8 and Fig. 10 is a diagrammatic view corresponding to Fig. 5.

The warp beam is to be imagined as lying at the bottom, the warp threads passing upwards over the lease rods 1, 2 past the place where the shed is formed. The forming of the woven fabric thus proceeds relatively downwards, the finished fabric being carried away upwards over the breast beam 3 and thence to the cloth beam which is not shown in the drawing.

The formation of the shed which proceeds from the right to the left in Fig. 2 in an undulating line is produced as follows: the warp threads k are guided in a known manner through eyes 4. The healds 5 containing the eyes are fixed at 6 to stationary points, then pass over pulleys 7 having a revolving motion like a crank pin and hereinafter referred to as eccentrics and thence over guide rollers 8 and 9. The healds may be arranged symmetrically with respect to the warp plane, as shown in Fig. 5, in which case the eccentrics 7 which are alike must be placed opposite to one another. These eccentrics are combined to form a crank shaft a, a' which has the appearance of a helix. As two eccentrics belonging to adjacent healds and warp threads swing simultaneously in different directions, one warp thread will be drawn forward and the other backwards, thus forming the shed. From the arrangement of the eccentrics which follows a helical line is derived the progressive formation of the shed in an undulating line. In Figs. 2 and 3 for the sake of clearness each first, third, fifth . . . warp thread is shown by a heavy line and each second, fourth, sixth . . . warp thread by a thin line.

What has been said about the forming of the shed applies to plain weave. By any other suitable arrangement of the eccentrics other weaves may of course be produced.

By means of crank shafts b, b' formed in a corresponding manner to the crank shafts a, a' the undulating motion of the lifters is controlled for producing the peristaltic forward motion of the shuttles. The lifters 10 which lie in the ordinary way between the warp threads are fixed at either end to healds 11, the ends of which are fixed at stationary points 12. Between these stationary points the healds pass over the guide rollers 13 and the eccentrics 14 forming the crank shafts b, b'. As to each to and fro motion of the warp threads during the formation of the shed there corresponds a to and fro motion of each lifter, each half "period" of the crank shafts a, a' must have a corresponding full "period" of the crank shafts b, b. The mo-

tions of the eyes 4 and of the lifters 10 must of course be in correct relation to one another as regards time.

Owing to the fact that the healds 5 and 11 are fixed at stationary points and the loops lying over the eccentrics 7 and 14 are drawn out and allowed to return it follows that the requisite distance travelled by the eyes or lifters 10 is produced with a smaller eccentricity of the parts 7 and 14 than would be necessary for a direct pull on the healds. Although not shown on the drawing the other heald 11 is also operated by two disks 14.

For the rest the motion of the shuttles is known, as also that the upwardly moving lifters effect the beating up or more correctly the pushing home of the weft.

The revolving shuttle *c* consists as shown in Figs. 6 and 7 of a pair of rollers 15 mounted on a fixed, hollow axle 16, about which the bobbin 17 which always remains in the shuttle is rotatable. As will be seen from Fig. 2, the weft thread *s* is so wound on to the bobbin that as the revolving shuttles run forward, the bobbin must rotate backwards when paying out the thread which produces a desired braking of the bobbin. If a stronger braking action should be required this can be produced by a spring fixed in the pair of rollers which presses through a slot in the hollow axle against the wall of the bore in the bobbin. The spring 18 shown in Figs. 6 and 7 may serve this purpose when made of a suitable shape and given a suitable initial stressing, but serves for another purpose as well, only the latter purpose being shown in the drawing.

Before the revolving shuttle enters the path of the weft the bobbin should be prevented from turning prematurely which might result in the thread unwinding. This may be effected for instance by the tapered peg 19 shown in Fig. 7, the function of which is to guide the shuttle into the path of the weft, forcing the spring 18 outwards and against the wall of the bore of the bobbin. For this purpose the peg must move in the direction of the path of the weft at the speed at which the formation of the shed proceeds. At the moment in which the bobbin is to enter the shed the peg draws back in the direction of its axis, at the same time releasing the bobbin so that it can rotate.

In the drawing it is assumed that two adjacent revolving shuttles are connected by the weft thread *s* of twice the length of the weft. The two shuttles of the pair supported by two adjacent pegs at the distance of a period in the formation of the shed will in the first instance move at the same speed towards where the weaving width commences. When entering the opened "first" shed the bobbin of the forward shuttle will be released in the manner described by the peg 19 retreating, while the bobbin of the following shuttle will still be braked. In spite of this the thread will in the first instance not commence to unwind from the first bobbin. When, however, the preceding shuttle has travelled through a distance *z* (Fig. 3), that is to say through half the length of the shed, the thread will be brought to rest in the absolute sense by the first impact of the upwardly moving first lifter, so that the thread will commence to be paid out. From this moment the unrolling of the thread from the first bobbin commences. Between the first interlacing point of the bobbin and the following shuttle a loop will in the meantime have formed which during the subsequent entry of the second shuttle will at first be made taut, whereupon the second bobbin may commence to pay out its thread.

With this arrangement the beginning of the thread need not be fixed until the moment of the first interlacing. This is different when each shuttle operates by itself with a single weft length. In this case the arrangement may be for instance that described later on with reference to Figs. 8 and 9 which at the same time incorporates a possible way of introducing the revolving shuttles into the path of the weft. Fig. 8 shows similarly to Fig. 2 the right hand end portion of the weaving width with the forward feeding device for the revolving shuttles placed in front of it in the plane of the weft path, only the left hand portion of the said device being shown. Fig. 9 is a plan view of the thread gripper shown in Fig. 8.

v—*v* is a line representing the lowest position of the lifters 10 and therefore the "gauge line" of the revolving shuttles. In the plane of this line rails 20 lead up to the path of the weft, along which the revolving shuttles are fed forward at the velocity with which they subsequently travel through the weaving width. This is effected by the chain 21 which presses by means of the shoes 22 mounted on it at distances corresponding to the shuttle sequence on the bobbins 17 as long as the chain runs in the horizontal direction. By means of these shoes the pairs of rollers 15 are carried along while retaining their rotatability while the bobbins 17 are prevented from turning and consequently from paying out the thread. The thread end is held by a tongs-like gripper *g*. As soon as the chain 21 commences to move upwards the shoes 22 release the bobbins. The shuttles will continue to roll due to their inertia into the shed which is open at the critical moment. The thread will still not commence to unwind from the bobbin as the gripper *g* follows the revolving shuttle at the same speed. As the chain moves out of the horizontal direction the gripper will pull the thread upwards and will release it as soon as it has been interlaced in the fabric being woven. The grippers *g* may be ar-

ranged for instance as shown in Fig. 9. On the short bars 23 mounted on the chain 21 the jaws 24 are pivoted, which pull towards one another and by a spring grip the thread between them. On the fingers 24′ of the jaws sliding along the sliding path 25 which opens out at the entering end, the gripper will open and release the thread end.

What happens to the empty revolving shuttles after passing through the weaving width lies outside the scope of the present invention. After leaving the shed they might drop into a collecting device which receives them gently if they are not to be fed to the automatic winding device mentioned at the commencement of the specification.

What I claim is:

1. In combination with a loom of the kind in which the shed is formed progressively in an undulating line along the weaving width and a plurality of shuttles travel simultaneously through the weaving width, a plurality of shuttles each wound with a length of weft thread corresponding to the length of a single pick and capable of paying out the said length of thread as it travels through the shed and means for causing each shuttle to traverse the weaving width in the path of the weft in one direction only, as and for the purpose set forth.

2. In combination with a loom of the kind in which the warp threads lie in a plane, the path of the weft is in a straight line, the shed is formed progressively in an undulating line along the weaving width and a plurality of shuttles travel simultaneously through the weaving width, a plurality of shuttles each wound with a length of weft thread corresponding to the length of a single pick and capable of paying out the said length of thread as it travels through the shed and means for causing each shuttle to traverse the weaving width in the path of the weft in one direction only, as and for the purpose set forth.

3. In combination with a loom of the kind in which the shed is formed progressively in an undulating line along the weaving width and a plurality of shuttles travel simultaneously through the weaving width, a plurality of shuttles each consisting of a pair of rollers and a bobbin which is rotatable about the axis of the said pair of rollers, wound with a length of weft thread corresponding to the length of a single pick and capable of paying out the said length of thread as it travels through the shed and means for causing each shuttle to traverse the weaving width in the path of the weft in one direction only, as and for the purpose set forth.

4. A loom as claimed in claim 1 and comprising a plurality of heald eyes for displacing the warp threads to form the shed and a plurality of discs or pulleys mounted side by side eccentrically with respect to one another so as to form together a helically curved crank shaft and means for transmitting the motion of the said crank shaft to the heald eyes, as and for the purpose set forth.

5. In combination with a loom of the kind in which the shed is formed progressively in an undulating line along the weaving width and a plurality of shuttles travel simultaneously through the weaving width, a plurality of shuttles each wound with a length of weft thread corresponding to the length of a single pick and capable of paying out the said length of thread as it travels through the shed, a plurality of lifters capable of moving to and fro in the direction of the warp threads and a plurality of discs mounted side by side eccentrically with respect to one another so as to form together a helically curved crank shaft capable of operating with the lifters for imparting an undulating motion to them as and for the purpose set forth.

6. A loom as claimed in claim 3 and comprising a track for the said shuttles, a chain conveyor for conveying the shuttles along the said track into the weaving width, shoes on the said chain for engaging with the shuttle bobbins and springs on the chain capable of pressing the shoes against the bobbins for preventing their rotation about the axis of the rollers while the shuttles are being conveyed into the weaving width, as and for the purpose set forth.

7. A loom as claimed in claim 3 and comprising a track for the said shuttles, a chain conveyor for conveying the shuttles along the said track into the weaving width, shoes on the said chain for engaging with the shuttle bobbins, springs on the chain capable of pressing the shoes against the bobbins for preventing their rotation about the axis of the rollers while the shuttles are being conveyed into the weaving width, grippers on the chain for holding the weft thread ends and means capable of coacting with the grippers for causing them to release the weft thread ends after the weft thread has been secured by the first interlace, as and for the purpose set forth.

8. A loom as claimed in claim 3 and comprising a track for the said shuttles, a chain conveyor for conveying the shuttles along the said track into the weaving width, shoes on the said chain for engaging with the shuttle bobbins, springs on the chain capable of pressing the shoes against the bobbins for preventing their rotation about the axis of the rollers while the shuttles are being conveyed into the weaving width, grippers on the chain for holding the weft thread ends and an inclined surface arrangement capable of coacting with the grippers for causing them to release the weft thread ends after the weft thread has been

secured by the first interlace, as and for the purpose set forth.

9. A loom as claimed in claim 1 and in which each pair of successive shuttles are wound with a length of weft thread corresponding to the length of two picks and comprising means for causing the thread to be paid out first by the preceding shuttle only and, after the thread has been secured by the first interlace, to be paid out by the second shuttle as it enters the weaving with, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification.

OTTO PRIMAVESI.