

July 6, 1948.

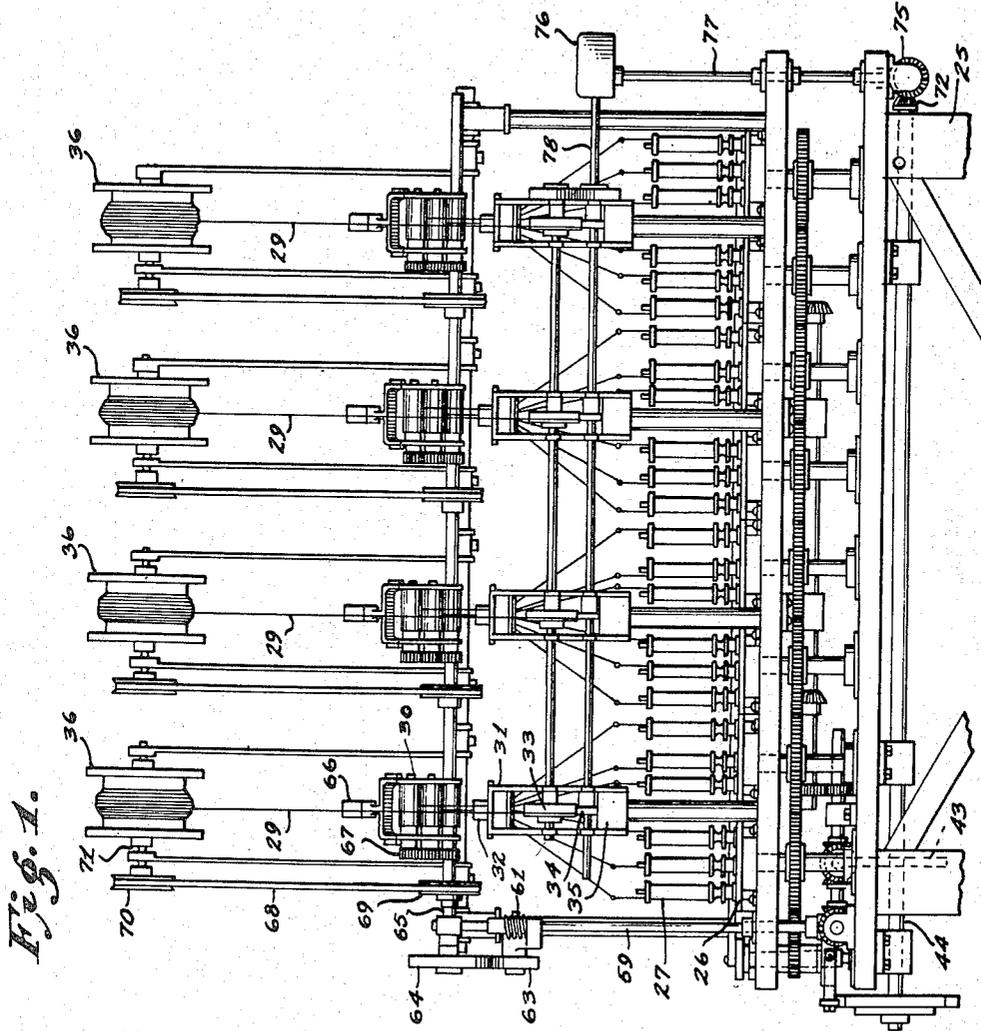
O. F. GOEFFERT

2,444,436

BRAIDING MACHINE

Filed Sept. 17, 1947

4 Sheets-Sheet 1



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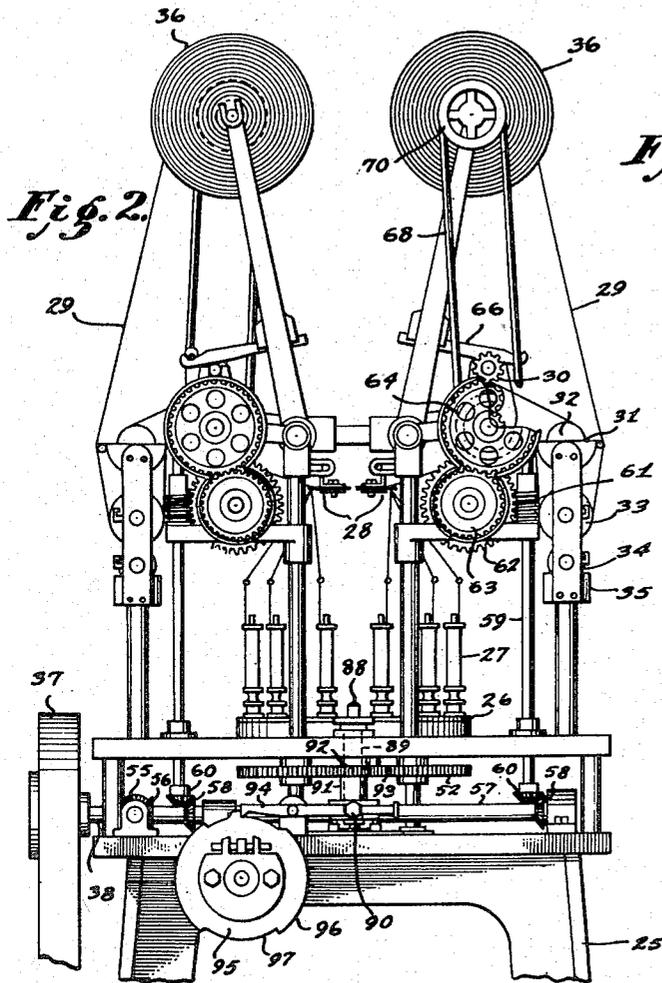
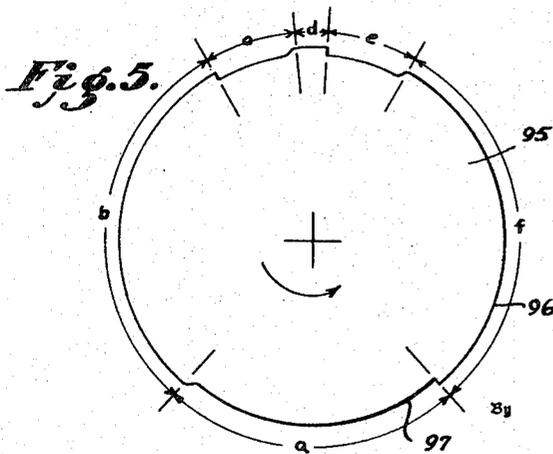
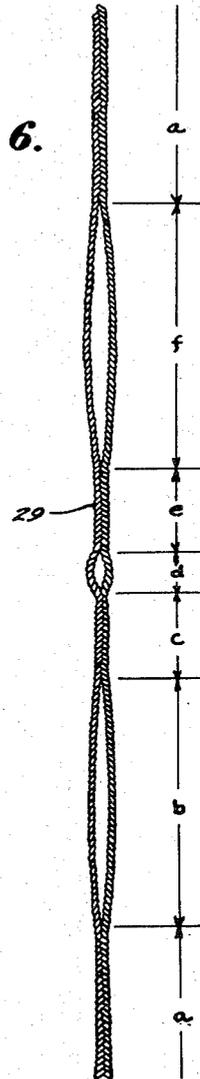


Fig. 6.



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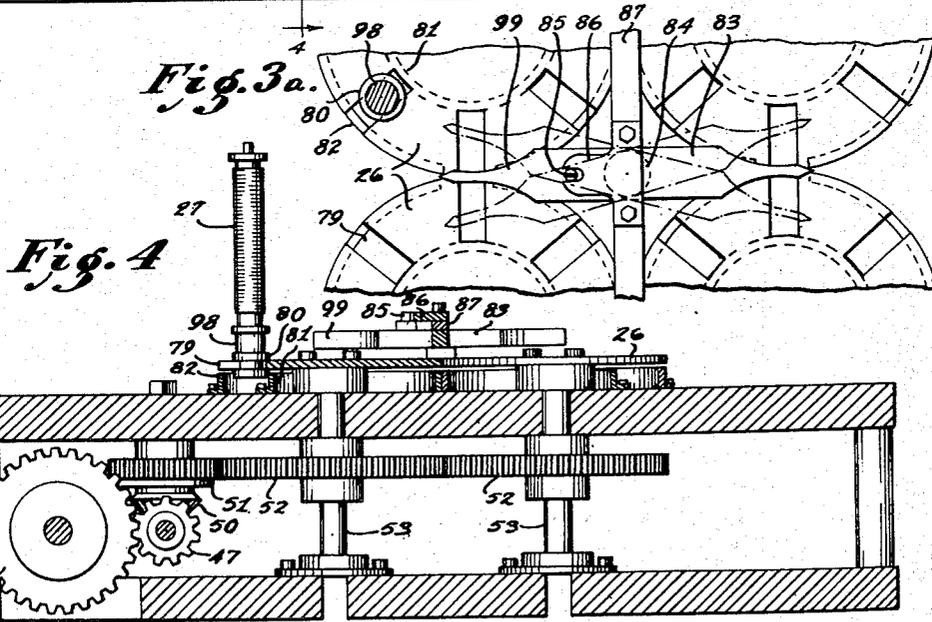
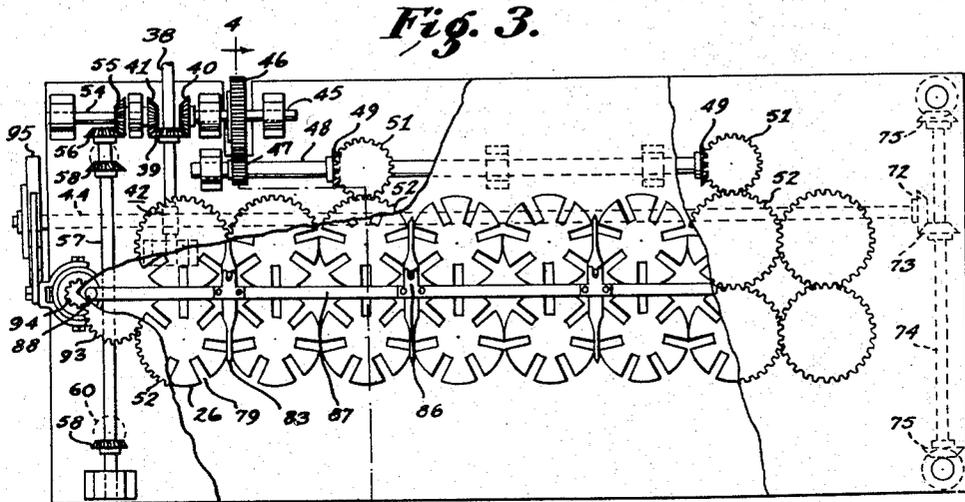
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4 Sheets-Sheet 3



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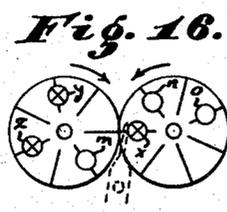
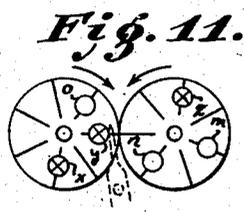
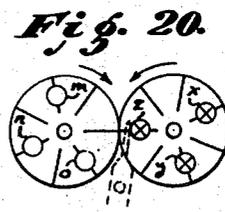
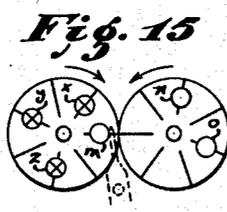
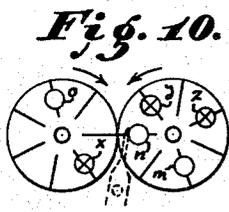
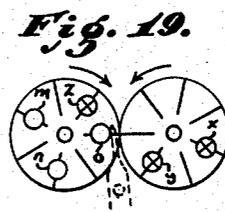
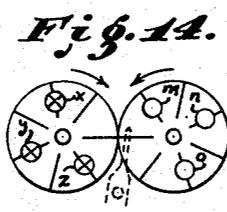
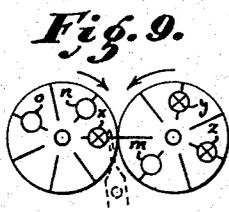
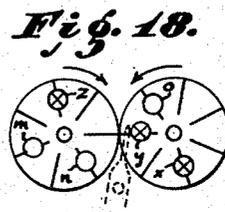
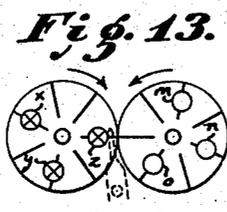
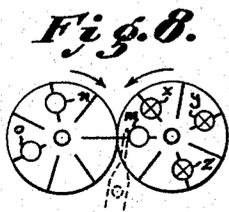
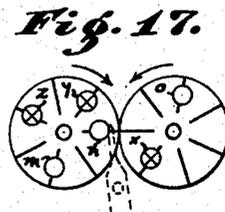
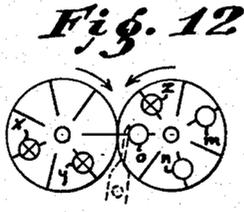
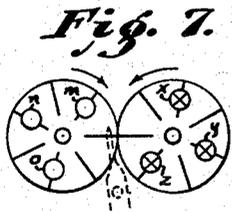
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2,444,436

BRAIDING MACHINE

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Application September 17, 1947, Serial No. 774,575

7 Claims. (Cl. 87-41)

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This invention relates to braiding machines and more especially to such a machine adapted particularly for forming heddles.

As is well known, heddles are used to control the shedding in weaving operations, and are formed with an eye for receiving a warp end and legs extending on either side of the eye for training on a frame. In this way, by using several frames, sets of warp ends may be controlled for shedding as desired.

In the usual case it is common to use a permanent type heddle made out of steel or the like. In many cases, however, this type of heddle is not desired or cannot be used, as in the weaving of endless belts in which a set of heddles is required for each belt made. For use in cases of this sort, heddles formed of yarn are commonly used.

The present invention is particularly adapted for forming heddles of this type, although as will appear from the more detailed description below, it is also applicable for use generally in braiding operations.

Briefly described the braiding machine of the present invention comprises essentially at least one pair of rotatable braiding tables formed with radially disposed guideways, carriers for yarn to be braided supported in these guideways, a shipper mechanism for transferring the carriers between the braiding tables, and a cam element arranged for controlling operation of the shipper mechanism whereby the carrier may be selectively rotated with the braiding tables for twisting to form the eye and legs of a heddle and transferred between the tables for braiding to close the eye and legs.

An important feature of the machine is the manner in which it is adapted for continuous automatic operation by arranging the guideways in the braiding tables in relation to the number of yarn carriers used. The number of yarn carriers used is determined by the number of yarns necessary to give the size and form of heddle desired. Having selected the number of yarns, which should be an even number, necessary for a particular heddle desired, a yarn carrier is provided for each yarn needed and these yarn carriers are divided in equal numbers for association with the braiding tables. The braiding tables in turn are formed with guideways to receive the yarn carriers in a number equal to one plus twice the number of yarn carriers associated with each table. This arrangement makes it possible to transfer the yarn carriers continuously between the braiding tables as is pointed out more in de-

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tail below, and thus obtain high speed, automatic operation.

The braiding machine of the present invention is illustrated in the accompanying drawing, in which:

Fig. 1 is a side elevation of the machine;

Fig. 2 is a corresponding left end elevation;

Fig. 3 is a plan view showing the arrangement of the braiding table, and partly cut away to illustrate the relation of other operating elements;

Fig. 3a is a fragmentary plan detail illustrating the operation of the shipper mechanism;

Fig. 4 is a detail in vertical section taken substantially on the line 4-4 in Fig. 3, showing the manner in which the yarn carriers are associated with the braiding tables, and further details of the driving connections for these tables;

Fig. 5 is a diagrammatic illustration of the cam element for controlling the shipper mechanism;

Fig. 6 is a diagrammatic detail of a heddle as formed on the braiding machine of the present invention; and,

Figs. 7 to 20, inclusive, are schematic details illustrating a cycle of operation of the braiding tables and shipper mechanism.

Referring first to Figs. 1 and 2 of the drawing, the machine as shown is arranged on a suitable frame structure indicated fragmentarily at 25. The braiding tables are shown at 26 arranged in pairs for rotation on the frame structure 25. A plurality of yarn carriers 27 are associated with each braiding table 26, and the yarn is taken off from these carriers through a guide 28 at each pair of braiding tables 26.

The yarn is braided or twisted as it passes through the guide 28, as described more in detail below, so that a continuous strand 29 of heddles is drawn upward from the guide 28. This strand 29 is trained through a tier of three-fluted rollers 30 which are driven, as will appear presently, so as to draw yarn off the carriers 27 at a proper rate. From the rollers 30 the strand 29 is taken through a water bath at 31 around a roller 32 to condition the yarn in the strand 29, and then between a carrier roll 33 and a marking roll 34 which rotates in an ink bath 35 and is formed with a projection (not shown) for marking the eye of each heddle in the strand 29 so that it may be easily found. From this point, the strand 29 is trained to take-up spools at 36.

The machine is connected with any suitable driving means, such as an electric motor or the like (not shown), through a belt and pulley as at 37 (see Fig. 2). The pulley shaft 38 carries a

bevel gear 39 which meshes with two bevel gears 40 and 41 through which the braiding tables 26 and the take-up mechanism for the strand 29 are driven, as will be described presently. The pulley shaft 38 also carries a worm as indicated at 42 in Fig. 3, which engages a worm wheel as at 43 in Fig. 1 to drive a cam shaft 44.

The above mentioned bevel gear 40 provided for driving the braiding tables 26 is mounted on a shaft 45 disposed to carry a spur gear 46 for engagement with a second spur gear 47 mounted on a countershaft 48. This countershaft 48 in turn carries a plurality of bevel gears as at 49 which mesh with bevel gears 50 having spur gears 51 fixed to rotate with them (see Fig. 4). These spur gears 51 drive gears 52 which rotate the braiding tables 26, and all of the gears 52 are intermeshed so that all of the braiding tables 26 rotate together and at the same rate. The gears 52 are shown in Fig. 4 mounted on the shafts 53 supporting the braiding tables 26 for rotation.

The other bevel gear 41 driven from the pulley shaft 38 is mounted on a shaft 54 which supports a second bevel gear 55 which meshes with a bevel gear 56 to drive a cross shaft 57. Further bevel gears 58 are fitted on the cross shaft 57 to drive vertically disposed shafts 59 through mating bevel gears 60. The vertical shafts 59 carry worms 61 at their upper ends to engage worm wheels 62 arranged to drive the fluted rollers 30 through a pair of spur gears 63 and 64 and shaft 65. The shaft 65 carries the bottom fluted rollers 30, the other rollers 30 being tiered upward and held in position by a weighting mechanism 66 which provides the necessary pressure for taking off the strand 29 without slippage. Each of the rollers 30 is driven from the bottom roller through gears 67 associated with each roller. The take-up spools 36 are also driven from the shaft 65 by means of belts 68 extended between pulleys 69 carried on shaft 65 and pulleys 70 carried on the mounting shafts 71 for the spools 36. The belts 68 are arranged relatively loose on the pulleys 68 and 69 so that the necessary variation in winding speed of the spools 36 as the strand 29 builds up on them is accommodated by slippage of the belts 68. The marking rolls 34 are driven from the cam shaft 44 which extends to carry a bevel gear 72 in mesh with a bevel gear 73 on a cross shaft 74. Further bevel gear sets at 75 and 76 connect this cross shaft 74 through vertically disposed shafts 77 for driving the shaft 78 on which the marking rolls 34 are mounted.

As previously mentioned, the rotating braiding tables 26 are formed with radially disposed guideways 79 (see Figs. 3, 3a, and 4), which open at the periphery of the braiding tables 26 and are equally spaced, and in which the yarn carriers 27 are supported. The yarn carriers 27, which may be of any conventional form such as is commonly used in braiding machines, are fitted with adaptors 80 so they may be supported in the guideways 79 as shown best in Fig. 4. The yarn carriers 27 are thus disposed to rotate with the braiding tables 26 for twisting of the yarn withdrawn to form the strand 29. Inner and outer annular partitions 81 and 82 are arranged below the braiding tables 26 to maintain the yarn carriers 27 in position in the guideways 79 during twisting, the outer partitions 82 being slotted appropriately at the point of tangency of each pair of braiding tables 26 to allow transfer of the yarn carriers 27 between the tables 26 for braiding.

Transfer of the carriers 27 between the tables 26 is effected by a shipper mechanism comprising

a shipper 83 pivoted as indicated at 84 in Fig. 3a to be rocked between the positions shown in dotted lines with respect to the braiding tables 26. The shippers 83 are each rocked through a pin 85 by a yoke 86 pivotably associated with connecting rods 87 extending between the yokes 86 and between the left end yoke 86 (as seen in Fig. 3) and a crank pin 88 carried on a shaft 89 which extends to a clutch mechanism at 90 (see Figs. 1 and 2). The clutch mechanism 90 includes a sleeve 91 assembled for free rotation on the shaft 89 and fitted with a spur gear 92 which is engaged by an intermediate spur gear 93 driven from the gears 52 which drive the braiding tables 26 so that the sleeve 91 is constantly rotated with the braiding tables 26 during operation of the machine. This rotation of the sleeve 91 is transmitted through the clutch mechanism 90 to the shaft 89 for operation of the shipper mechanism when it is desired to transfer the yarn carriers 27 between the braiding tables 26 for braiding. The clutch mechanism 90 is actuated for this purpose through an operating arm 94 from a cam element 95 mounted on the cam shaft 44. As shown in Fig. 2, the cam element 95 is arranged with outer or raised actuating surface portions as at 96 which shift the operating arm 94 to cause the clutch mechanism 90 to assume an open position so that the shipper mechanism is inactive and the yarn carriers will rotate with the braiding tables 26 for twisting. The cam element 95 also has inner actuating surface portions as at 97 which allow the clutch mechanism 90 to shift to closed position and operate the shipper mechanism to transfer the yarn carriers 27 between the braiding tables 26 for braiding.

The cam element 95 is illustrated diagrammatically in Fig. 5 to show the manner in which it is arranged for forming a strand 29 of heddles as illustrated, also diagrammatically, in Fig. 6. As shown in Fig. 5, the cam element 95 rotates in a counterclockwise direction, and the segment *a*, being an inner actuating surface, represents a period of braiding (compare Fig. 6). The segment *b*, being an outer actuating surface, represents a period of twisting during which one of the legs of the heddle is formed. The segment *c* represents a further period of braiding during which the heddle is closed at the top of the leg just formed and on one side of the eye formed at the segment *d*. The other side of the eye is closed at the segment *c*, the second leg is formed at the segment *e*, and then a new cycle is begun at the segment *a* which forms a braided portion to close the extending legs of adjoining heddles in the strand 29 and which is long enough to be cut in two when the individual heddles are separated from the strand 29.

As mentioned above, an important feature of the braiding machine of the present invention is the manner in which the guideways 79 are arranged in the braiding tables 26 to provide for continuous automatic operation of the machine. This feature is illustrated in Figs. 7 to 20, inclusive, of the drawing which show schematically a complete cycle of transfer of the yarn carriers 27 between a pair of the braiding tables 26. It has previously been pointed out that the number of yarn carriers 27 used depends on the number of yarns required for forming the particular heddle desired. In the present case, six yarns are used for purposes of illustration, and the carriers 27 for these yarns are initially divided equally, three to each braiding table, as indicated in Fig. 7. In order to follow the yarn carriers

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through the cycle of transfer, one set of three is indicated by the reference letters *m*, *n*, *o*, and the other set by the reference letters *x*, *y*, *z*. Having selected six yarns for the heddle to be formed so that three yarn carriers are associated with each braiding table, the braiding tables used are formed with seven guideways, or one plus twice the number of yarn carriers, as indicated in Figs. 7 to 20.

Now if it is assumed that the yarn carriers are in the positions indicated in Fig. 7 following a period of twisting when a period of braiding is initiated, rocking of the shipper mechanism will effect transfer of the yarn carriers between the braiding tables in the sequence illustrated in Figs. 7 to 20. It will be noted that the yarn carriers are initially associated with the braiding tables in alternate guideways and in staggered relation as between a pair of braiding tables. That is, as the guideways of each pair of braiding tables are successively aligned at the point of tangency of the tables, the guideway of one table will contain a yarn carrier while the guideway of the other table will be empty, except that at one position during each complete revolution of the tables both guideways will be empty which allows continuous transfer of the yarn carriers between the tables for braiding as described further below.

With the yarn carriers in the positions indicated in Fig. 7, rocking of the shipper mechanism will pick up the yarn carrier *m* on the left hand table first, and transfer it to the right hand table (as indicated in Fig. 8) when the guideway carrying it on the lefthand table reaches the point of tangency of the tables so that it is in alignment with an empty guideway on the right hand table. The manner in which the yarn carrier can be picked up in this way and transferred by the shipper mechanism is illustrated in Figs. 3a and 4 already referred to above. For this purpose the yarn carrier adapters 88 are formed with a grooved portion 89 extending above the guideways 79 at the level of operation of the shipper 83. The blade 90 of shipper 83 passes behind this grooved portion 89 when it is rocked to pick up a yarn carrier 27, and thus shifts the carrier for transfer on its return movement.

Referring again to Fig. 8 of the drawing, when the yarn carrier *m* has been transferred as shown to the right hand table, the shipper mechanism will have rocked so that it is disposed to pick up the yarn carrier *x* on the right hand table and transfer it to the left hand table as indicated in Fig. 9. This process will then be repeated with the succeeding yarn carriers *n* and *y*, and *o* and *z*, as indicated in Figs. 10 to 13, inclusive, until all of the yarn carriers have been transferred from the braiding table with which they were originally associated to the other table.

In Fig. 13, the braiding tables and yarn carriers are represented in the position they would assume upon transfer of the last yarn carrier *z* from the right to the left hand table completing one transfer of all of the yarn carriers. The disposition of the tables and yarn carriers at this point illustrates the importance, as noted above, of the manner in which the tables are formed with guideways in a number equal to one plus twice the number of yarn carriers associated with each table. By comparing Fig. 13 with the preceding figures of the drawing, it will be seen that the shipper mechanism is disposed in Fig. 13 to pick up a yarn carrier in the next suc-

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ceeding guideway of the left hand table for transfer to the right hand table. But this next succeeding guideway is empty, and it would be empty too if guideways in a number only twice the number of yarn carriers were used, so that the shipper mechanism must make an idle stroke. If guideways in a number only twice the number of yarn carriers were used, however, this idle stroke would not position the shipper mechanism with respect to the right hand table in time to pick up the next succeeding yarn carrier *m* (compare Fig. 14). But with guideways provided in a number equal to one plus twice the number of yarn carriers, a pair of empty guideways are aligned at the point of tangency of the tables during the idle stroke of the shipper mechanism (see Fig. 14) so that it is disposed properly to pick up the yarn carrier *m* and continue transfer of the yarn carriers in order as illustrated in Figs. 14 to 20 of the drawing.

The braiding machine of the present invention is thus adapted for continuous, high-speed, automatic operation, and may in fact be set in operation and left to run without attention except for maintenance and replenishment of the yarn supply.

I claim:

1. A braiding machine comprising at least one pair of rotatable braiding tables formed with radially disposed guideways, carriers for yarn to be braided supported in said guideways, a shipper mechanism for transferring said carriers between said tables, and a cam element arranged for controlling operation of said shipper mechanism whereby said carriers may be selectively rotated with said braiding tables for twisting and transferred between said tables for braiding.

2. A braiding machine comprising at least one pair of rotatable braiding tables formed with radially disposed guideways, carriers for yarn to be braided supported in said guideways, a shipper mechanism for transferring said carriers between said tables, driving means arranged for correlated operation of said braiding tables and said shipper mechanism, clutch means interposed between said driving means and said shipper mechanism, and a cam element disposed for actuating said clutch means whereby said carriers may be selectively rotated with said braiding tables for twisting and transferred between said tables for braiding.

3. A braiding machine comprising at least one pair of rotatable braiding tables formed with radially disposed guideways, carriers for yarn to be braided supported in said guideways, an equal number of yarn carriers being provided for each braiding table and each braiding table being formed with guideways in a number equal to one plus twice the number of yarn carriers provided, and a shipper mechanism for transferring said yarn carriers between said tables for braiding.

4. A braiding machine adapted particularly for forming heddles comprising at least one pair of rotatable braiding tables formed with radially disposed guideways, yarn carriers supported in said guideways, a shipper mechanism for transferring said carriers between said tables, and a cam element arranged for controlling operation of said shipper mechanism whereby said carriers may be selectively rotated with said braiding tables for twisting to form the eye and legs of a heddle and transferred between said tables for braiding to close said eye and legs.

5. A braiding machine as defined in claim 4 and further characterized in that an equal number of

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yarn carriers is provided for each braiding table and each braiding table is formed with guideways in a number equal to one plus twice the number of yarn carriers provided.

6. A braiding machine adapted particularly for forming heddles comprising at least one pair of rotatable braiding tables formed with radially disposed and equally spaced guideways open at the periphery of said tables, yarn carriers supported in said guideways, an equal number of yarn carriers being provided for each braiding table and each braiding table being formed with guideways in a number equal to one plus twice the number of yarn carriers provided, a shipper mechanism for transferring said carriers between said tables, driving means arranged for correlated operation of said braiding tables and said shipper mechanism, clutch means interposed between said driving means and said shipper mechanism, and a cam element disposed for actuating said clutch means whereby said carriers may be selectively rotated with said braiding tables for twisting to form the eye and legs of a heddle and transferred between said tables for braiding to close said eye and legs.

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7. A braiding machine comprising at least one pair of rotatable braiding tables formed with radially disposed and equally spaced guideways open at the periphery of said tables, carriers for yarn to be braided supported in said guideways, an equal number of yarn carriers being provided for each braiding table and each braiding table being formed with guideways in a number equal to one plus twice the number of yarn carriers provided, the yarn carriers being supported in alternate guideways of each braiding table and in staggered relation as between each pair of braiding tables, and a shipper mechanism for transferring said yarn carriers between said tables for braiding.

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