July 19, 1927.

1,636,660

A. C. HOPKINS

BRAIDING MACHINE

Original Filed April 23, 1926 4 Sheets-Sheet 1

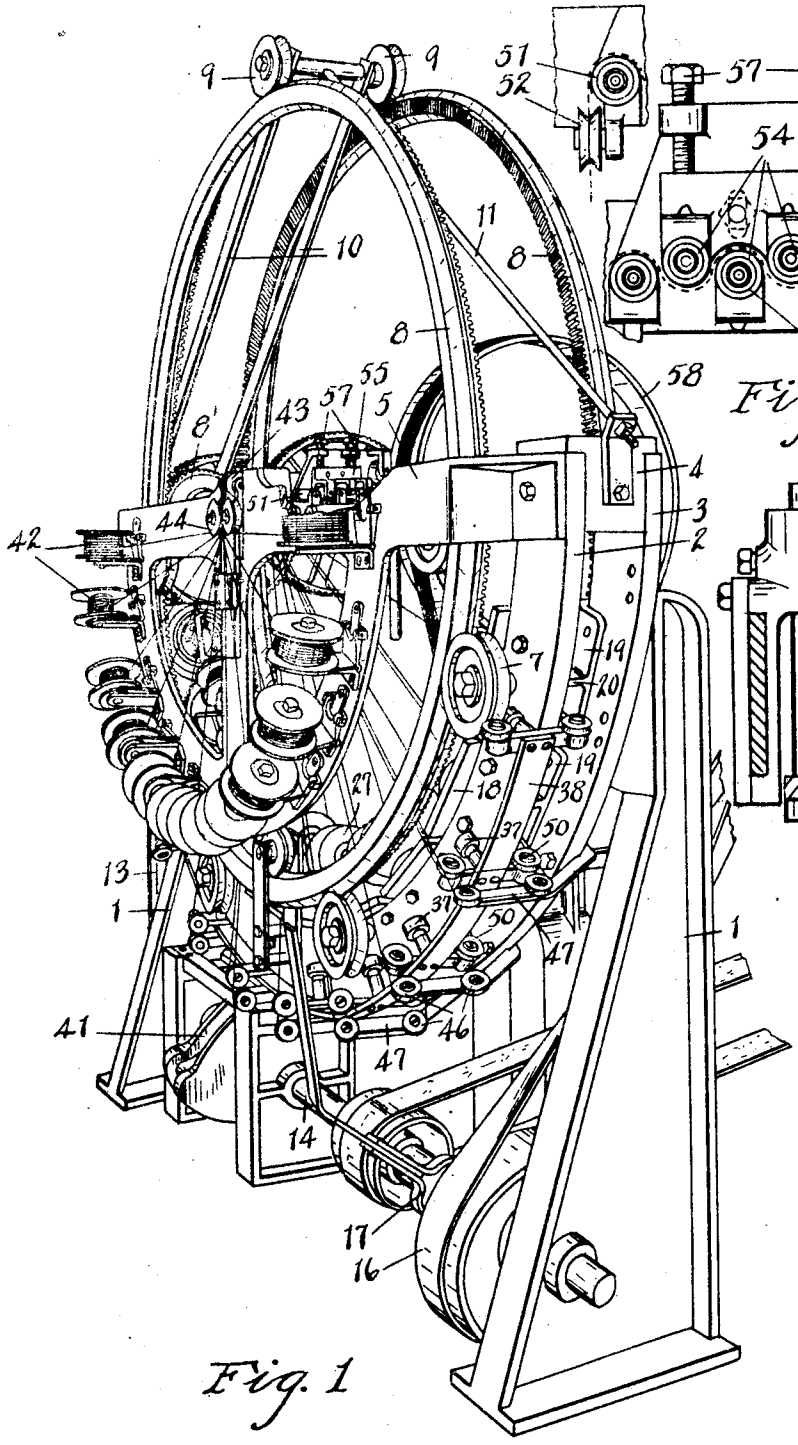

Fig. 1

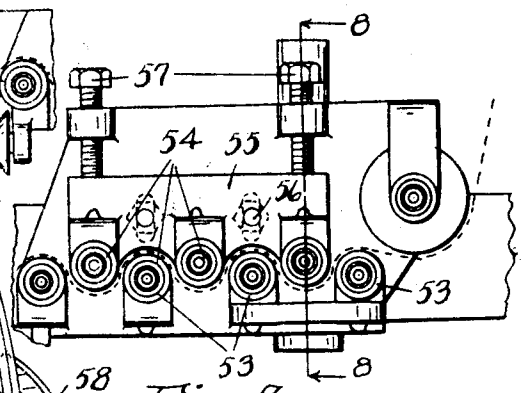

Fig. 7

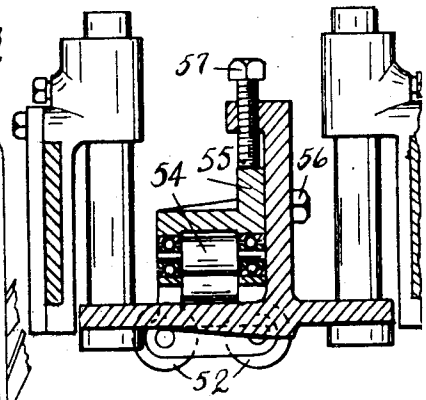

Fig. 8

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July 19, 1927.

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A. C. HOPKINS

BRAIDING MACHINE

Original Filed April 23, 1926 4 Sheets-Sheet 2

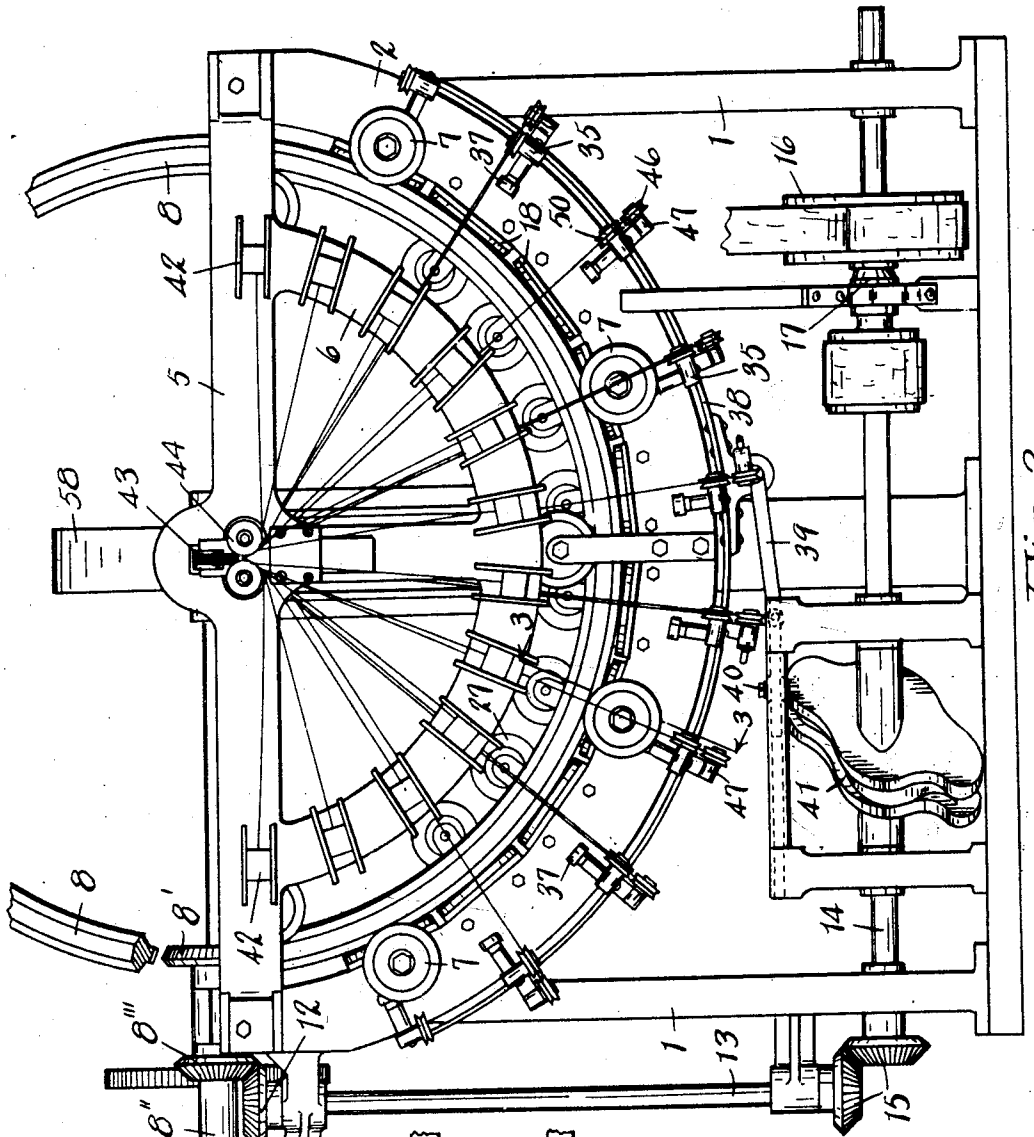

Fig. 2

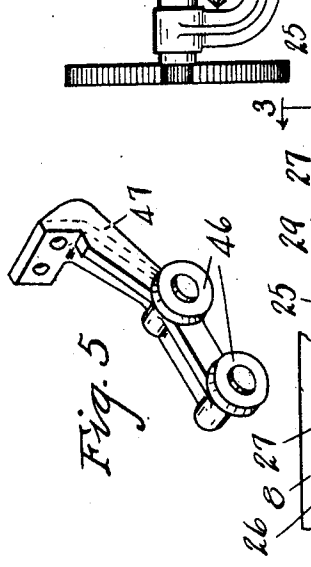

Fig. 4

Fig. 5

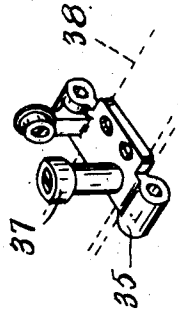

Fig. 6

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July 19, 1927. 1,636,660

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BRAIDING MACHINE

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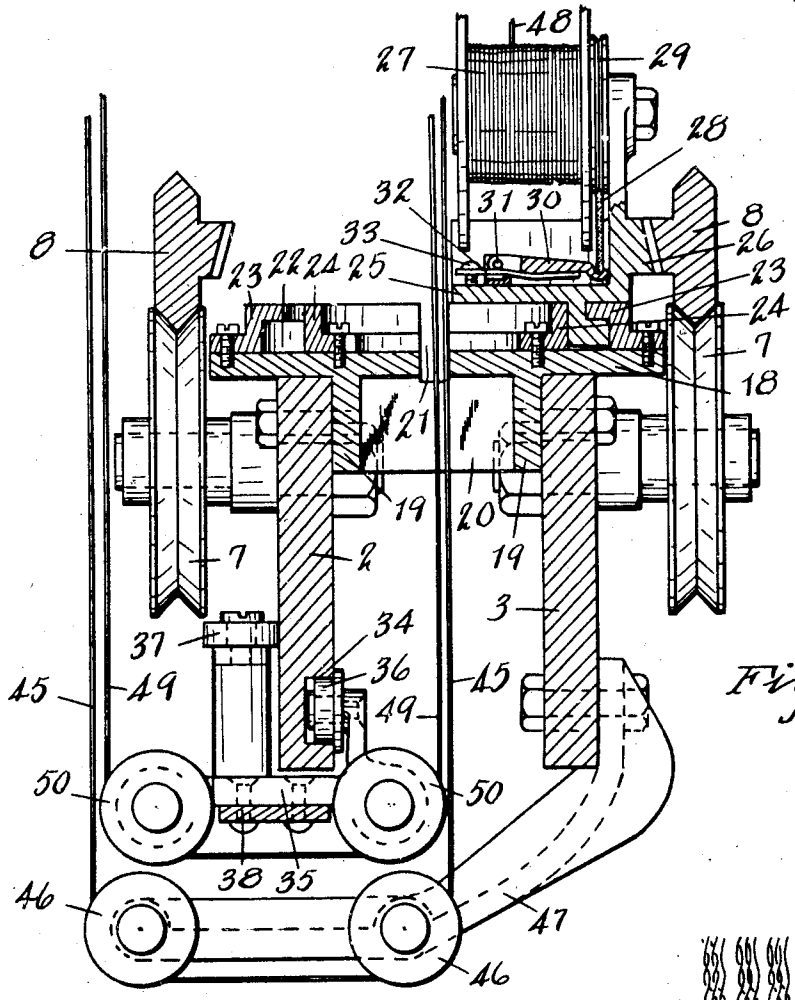

Fig. 3

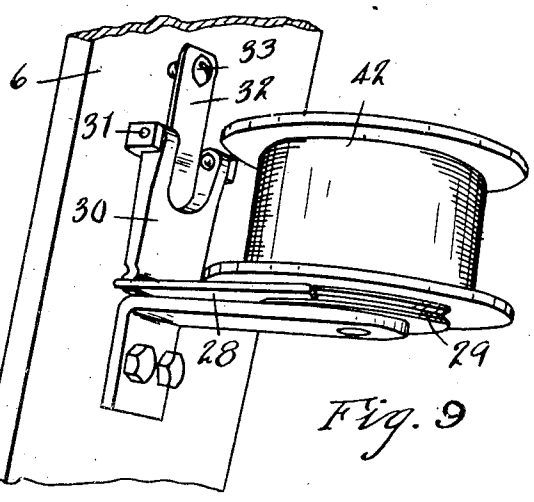

Fig. 9

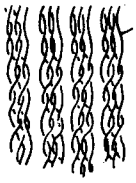

Fig. 11

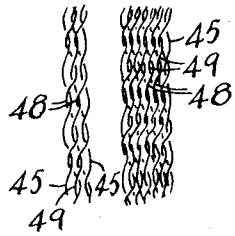

Fig. 12

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July 19, 1927. 1,636,660

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BRAIDING MACHINE

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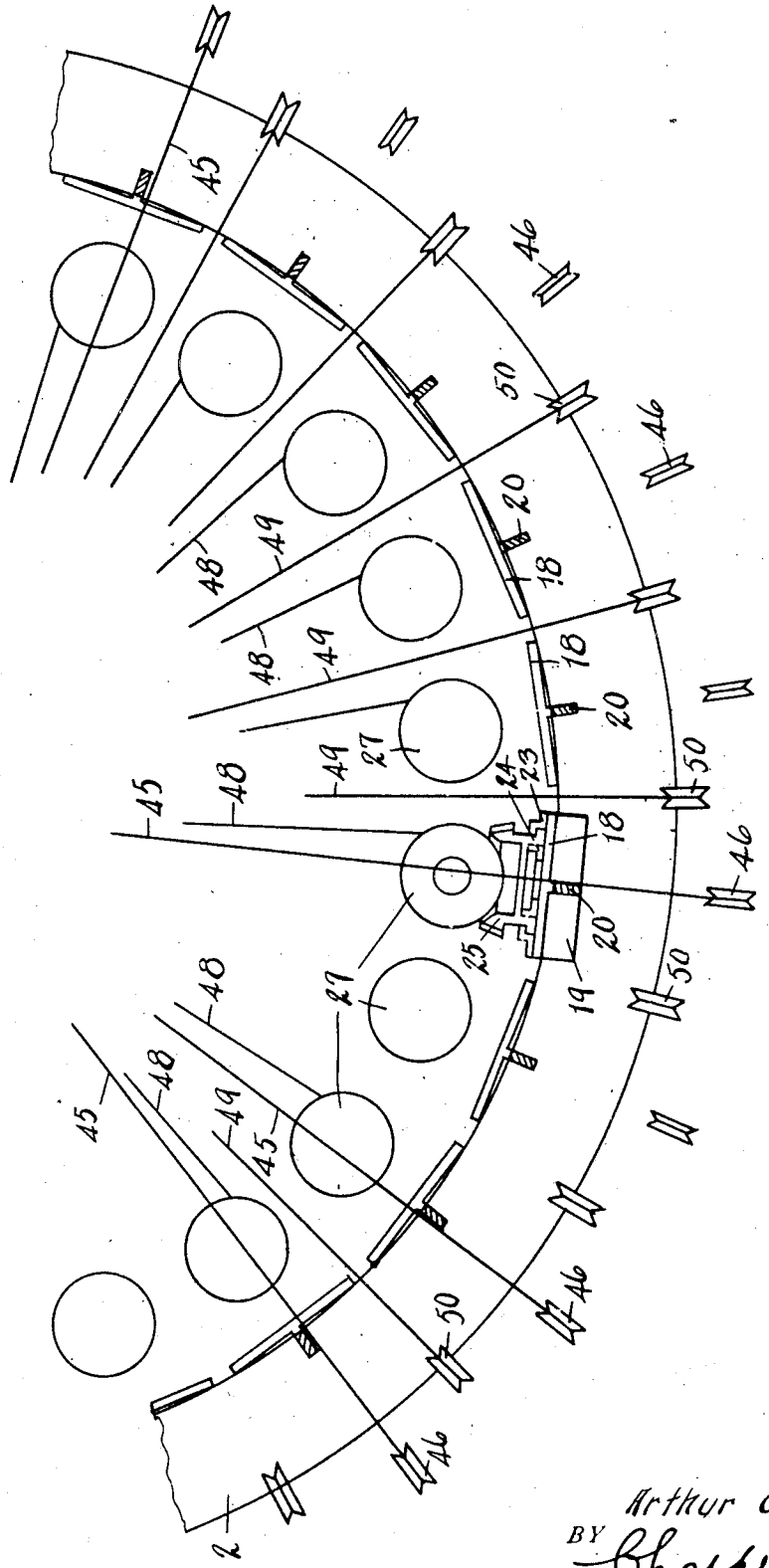

Fig. 10

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Patented July 19, 1927.

1,636,660

UNITED STATES PATENT OFFICE.

ARTHUR C. HOPKINS, OF NILES, MICHIGAN, ASSIGNOR TO NATIONAL STANDARD COMPANY, OF NILES, MICHIGAN.

BRAIDING MACHINE.

Application filed April 23, 1926, Serial No. 104,122. Renewed January 5, 1927.

My present improvements relate to the type of machine illustrated and described in my application for Letters Patent filed July 24, 1925, Serial No. 45,812.

The main objects of the invention are:

First, to provide an improved braiding machine by means of which a plurality of strips or elements may be simultaneously braided or bonded together.

Second, to provide an improved braiding machine which is of very large capacity and adapted to form one or more braids or strips of wire strands at high speed.

Third, to provide an improved braiding machine in which there are relatively few movable parts and few reciprocating parts.

Objects pertaining to details and economies of construction and operation of my invention will definitely appear from the detailed description to follow. The invention is clearly defined and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawing forming a part of this application, in which:

Fig. 1 is a front perspective view of a machine embodying the features of my invention, parts being broken away for convenience in illustration.

Fig. 2 is a fragmentary front elevation.

Fig. 3 is an enlarged detail section on a line corresponding to line 3—3 of Figs. 2 and 4.

Fig. 4 is a fragmentary plan view of a pair of the braider units.

Fig. 5 is a perspective view of one of the guide roller brackets for the non-shiftable strands.

Fig. 6 is a perspective view of one of the shifter members, the guide rollers being omitted therefrom.

Fig. 7 is a detail view of the forming and killing rolls looking from the left of Fig. 8 with certain of the supporting parts omitted.

Fig. 8 is a detail section on a line corresponding to line 8—8 of Fig. 7 showing details of the killing rolls.

Fig. 9 is a perspective view of one of the bobbins.

Fig. 10 is a diagrammatic view illustrating the relation of the rotating shifting and non-shifting strands and also the adaptation of the machine for making a plurality of strips at the same time.

Figs. 11 and 12 are illustrations showing adaptations of the machine for making a plurality of strips of the same or a different number of strands.

In the embodiment illustrated my improved machine comprises a pair of pedestals or uprights 1 on which are mounted segmental frame members 2 and 3 supported in spaced relation by the blocks 4 in the upper ends thereof. A frame member 5 is mounted on the upper ends of the front member 2 and provided with an integral segmental hanger 6 on which the fixed bobbins are mounted as will be hereafter described.

Grooved rollers 7 are mounted on these segmental frame members 2 and 3 providing supports for the annular gears 8 by means of which the braider heads are driven. These annular gears are held upon the rollers 7 by means of retaining rollers 9 disposed at the top thereof, these rollers being supported by the arms 10 and 11 mounted on the frame and projecting upwardly between the gears 8.

These gears are both in mesh with the gear 8′ on the shaft 8″ which is provided with a beveled gear 8‴ meshing with the gear 12 on the vertical shaft 13 which is connected to the driving shaft 14 by beveled gears 15. This shaft 14 is connected to the driving pulley 16 by means of the clutch 17.

The braider heads are mounted on the frame members 2 and 3, these braider heads comprising plate-like body members 18 having downwardly projecting portions 19 fitting between the members 2 and 3 and connected by a central cross piece 20. These body members have slot-like throats 21 therein extending from the cross piece and opening at the edges of the body members.

Segmental complementary ways 22 are formed by the outer way members 23 and the inner way members 24 mounted upon these body members or head plates. The bobbin carriers 25 are mounted in these ways and provided with segmental gears 26 coacting with the gears 8. The gears 8 being

driven in opposite directions the bobbin carriers are continuously rotated in the same direction. The bobbin carriers have common driving means and are driven in synchronism with a minimum of back-lash.

The rotary bobbins 27 are mounted on these bobbin carriers, each bobbin being provided with a tension means comprising the shoe 28 which is urged against the grooved friction drum 29 on the bobbin, the shoe being urged against the drum by means of the spring pressed arm 30 which is pivoted at 31, the spring 32 being adjusted by means of the screw 33.

The front frame member 2 is provided with a segmental way 34. Shifters 35 are provided with rollers 36 traveling in these ways and with rollers 37 engaging the rear sides of the frame member 2 as shown in Fig. 3.

The several shifters are connected by the shifter bar 38 which is connected by the link 39 to a reciprocating slide 40 controlled by the cam 41 on the shaft 14, the drive being thus synchronized so that the operation of the shifter is properly timed relative to the rotation of the braider head members.

A plurality of fixed bobbins 42 are mounted on the hangers 6, the gathering roll 43 being disposed centrally relative to the arc formed by these bobbins 42. Guide rollers 44 guide the strands from the several fixed bobbins to this gathering roll.

From the gathering roll a part of the strands, designated by the numeral 45, pass to the fixed guide rollers 46 on the supporting arms 47 which project forwardly from the frame member 3 so that these strands 45 are guided into the throats 21 and into a central position or close to the cross piece 20 so that as the bobbin carriers revolve the strands 48 running from the bobbins 27 are carried or rotated around the strands 45. They are also carried or rotated around the shifting strands 49 which pass from the gathering roll to the guide rollers 50 on the shifters 35. These strands 49 are shifted alternately from one throat 21 to an adjacent throat so that this group of strands is alternately engaged by the rotating strands between the pair of heads through which it is shifted.

In Fig. 10 I illustrate the machine of this application set up to simultaneously produce a five-strand strip having two fixed or non-shiftable strands, the machine then being threaded up to utilize two non-shifting strands, two rotary strands and one shifting strand for one strip, and for the other strip two non-shifting strands, five shifting strands and six rotating strands. These may be arranged in any combination desired which is one of the great advantages of my improved machine.

From the mechanisms just described the strands pass to the forming roll 51 to which they are guided by the rollers 52 and from this forming roll they pass through a set of killing rolls consisting of non-adjustable rolls 53 and adjustable rolls 54 mounted on carrier 55 which is adjustably supported by the bolts 56 and provided with adjusting screws 57.

From the killing rolls the strand passes to the take-off capstan 58.

Machines embodying the features of this invention may be operated at very high speed, there being few reciprocating parts. As stated, the machine is readily adapted for making strips of a different number of strands simultaneously if desired which greatly adds to the usefulness and value of the machine.

I have not attempted to illustrate various adaptations and set-ups possible as I believe the disclosure made will enable those skilled in the art to embody or adapt my improvements as may be desired.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a machine of the class described, the combination of a frame comprising front and rear segmental frame members, the front frame member having a segmental shifter way in the inner side thereof, gear supporting rollers mounted on said frame members, oppositely driven annular bobbin driving gears carried by said rollers, braider head members mounted on said frame members and having opposed slot-like throats, said braider head members being provided with complementary bobbin carrier ways, bobbin carriers mounted in said ways and provided with bobbins and with segmental gears coacting with said annular driving gears, a forming roll disposed centrally relative to said braider heads, a plurality of fixed bobbins disposed in an arc, a gathering roll disposed centrally relative to said fixed bobbins and head members and over which the strands are led from said fixed bobbins, shifters provided with rollers having horizontal axes traveling in said shifter way and rollers having vertical axes traveling on the opposite side of the frame member, said shifters being provided with guide pulleys for guiding the shifting strands from said gathering roll to said throats, means for actuating said shifters in synchronism with said bobbin carriers, and brackets on the rear segmental frame members and provided with pairs of guide pulleys for guiding non-siftable strands to project below the front frame member to guide the non-shifting strands from said gathering roll to said throats.

2. In a machine of the class described, the combination of a frame comprising front and rear segmental frame members, the

front frame member having a segmental shifter way in the inner side thereof, gear supporting rollers mounted on said frame members, oppositely driven annular bobbin driving gears carried by said rollers, braider head members mounted on said frame members and having opposed slot-like throats, said braider head members being provided with complementary bobbin carrier ways, bobbin carriers mounted in said ways and provided with bobbins and with segmental gears coacting with said annular driving gears, a forming roll disposed centrally relative to said raider heads, a plurality of fixed bobbins disposed in an arc, a gathering roll disposed centrally relative to said fixed bobbins and head members and over which the strands are led from said fixed bobbins, shifters provided with rollers having horizontal axes traveling in said shifter way and rollers having vertical axes traveling on the opposite side of the frame member, said shifters being provided with guide pulleys for guiding the shifting strands from said gathering roll to said throats, and means for actuating said shifters in synchronism with said bobbin carriers.

3. In a machine of the class described, the combination of a frame comprising front and rear segmental frame members, gear supporting rollers mounted on said frame members, oppositely driven annular bobbin carrier driving gears carried by said rollers, braider head members mounted on said frame members and having opposed slot-like throats, said braider head members being provided with complementary bobbin carrier ways, bobbin carriers mounted in said ways and provided with bobbins and with segmental gears coacting with said annular driving gears, a forming roll disposed centrally relative to said braider heads, a plurality of fixed bobbins disposed in an arc, a gathering roll disposed centrally relative to said fixed bobbins and head members and over which the strands are led from said fixed bobbins, shifters mounted on the rear frame member, said shifters being provided with guide pulleys for guiding the shifting strands from said gathering roll to said throats, means for actuating said shifters in synchronism with said bobbin carriers, and brackets mounted on the rear segmental frame member and provided with pairs of guide pulleys for guiding non-shiftable strands to project below the front frame member to guide the non-shifting strands from said gathering roll to said throats.

4. A structure of the class described comprising a pair of segmental frame members, one of said frame members having a segmental shifter way therein, head members having alined throats mounted on said frame members and provided with complementary bobbin carrier ways, bobbin carriers mounted in said ways and provided with bobbins, shifters provided with rollers coacting with said way and with rollers coacting with the opposite side of said frame member, said shifters being provided with rollers for guiding the strands to said throats, means for actuating said shifters synchronized with the bobbin carrier driving means, and guide brackets mounted on one of said frame members to project below the braider head members and provided with guide rollers whereby non-shifting strands are guided to said throats.

5. A structure of the class described comprising a segmental frame member having a segmental shifter way in one side thereof, head members mounted in an arc and having alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said carriers continuously in one direction common to all of them, shifters provided with rollers having horizontal axes coacting with said way and with rollers having vertical axes engaging the opposite side of said way member, a shifter bar connecting said shifters, and means for actuating said shifter bar in synchronism with the rotation of said bobbin carriers.

6. In a structure of the class described, the combination of a plurality of braider units comprising head members with alined throats, said head members being arranged in the arc of a circle, a take-off means including a forming roll disposed centrally relative to said head members, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbins continuously in one direction, strand shifters operatively associated with said head members for shifting a strand from the throat of one head member to that of an adjacent head member, a plurality of fixed bobbins disposed in the arc of a circle, a gathering roll disposed centrally relative thereto and to said braider heads, and non-shifting strand guide means disposed to guide a strand to selected throats of said head members, the strands being passed from said gathering roll to said shifters and said guide means, all coacting for the purpose specified.

7. In a structure of the class described, the combination of a plurality of braider units comprising head members with alined throats, a take-off means including a forming roll disposed centrally relative to said head members, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbins continuously in one direction, strand shifters operatively associated with said head members for shifting a strand from the throat of one head member to that of an adjacent head member, a plurality of fixed

bobbins, a gathering roll, and non-shifting strand guide means disposed to guide a strand to selected throats of said head members, the strands being passed from said gathering roll to said shifters and said guide means, all coacting for the purpose specified.

8. A structure of the class described comprising head members arranged in a segmentally disposed series and having aligned throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbin carriers continuously in one direction, a take-off means including a forming roll disposed centrally relative to said series of said head members, strand shifters operatively associated with said head members for shifting strands from the throat of one head member to that of adjacent head members, means for guiding non-shifting strands to selected throats, a plurality of fixed bobbins arranged in segmental series, a gathering roll over which the strands are passed from said fixed bobbins to said strand shifters, and non-shifting strand guide means disposed centrally of said series of fixed bobbins and said head members.

9. A structure of the class described comprising head members having alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbin carriers continuously in one direction, a take-off means, strand shifters operatively associated with said head members for shifting strands from the throat of one head member to that of adjacent head members, means for guiding non-shifting strands to selected throats, a plurality of fixed bobbins, and a gathering roll over which the strands are passed from said fixed bobbins to said strand shifters and said non-shifting strand guide means.

10. A structure of the class described comprising front and rear segmental frame members, head members having alined throats mounted on said frame members, bobbin carriers rotatably mounted on said head members and provided with bobbins, shifters reciprocatingly mounted on the front segmental frame member and provided with rollers for guiding the shifting strands to said throats, means for actuating said shifters synchronized with the bobbin carrier driving means, and non-shifting strand guide means mounted on the rear frame member to project below the head members for guiding non-shifting strands to selected throats.

11. In a machine of the class described, the combination of front and rear segmental frame members, head members having alined throats mounted on said frame members, bobbin carriers rotatably mounted on said head members and provided with bobbins, shifters reciprocatingly mounted on the front frame member and provided with guide rollers for guiding shifting strands to said throats, means for actuating said shifters synchronized with the bobbin carrier driving means, and guide brackets mounted on the rear frame member and provided with guide rollers for guiding non-shifting strands to selected throats.

12. In a structure of the class described, the combination of braider units comprising a plurality of head members having alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbins, a plurality of strand shifters operatively associated with said head members to shift a strand from the throat of one head member to that of an adjacent head member, and non-shifting strand guide means for guiding strands to said throats.

13. In a structure of the class described, the combination of braider units comprising head members with alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbin carriers, strand shifting means for shifting a strand from the throat of one head member to the other synchronized with the rotation of the bobbin carriers, and means for guiding non-shifting strands to the throats of the head members.

14. In a structure of the class described, the combination of braider units comprising head members having alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbins continuously in one direction, a plurality of strand shifters operatively associated with said head members to shift a strand from the throat of one head member to that of an adjacent head member, and non-shifting strand guide means for guiding strands to certain of said throats.

15. In a structure of the class described, the combination of braider units comprising head members with alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbin carriers, strand sifting means for shifting a strand from the throat of one head member to that of an adjacent head member synchronized with the rotation of the bobbin carriers, and means for guiding non-shifting strands to at least one of the throats.

16. In a structure of the class described, the combination of a plurality of braider units comprising head members with alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbin carriers, strand shifting means for shifting a strand from the throat of one head member to that of an adjacent head member synchronized with the rotation of the bobbin car-

riers, and means for guiding non-shifting strands to the throats of non-adjacent head members.

17. In a structure of the class described, the combination of a plurality of braider units comprising head members with alined throats, bobbin carriers rotatably mounted on said head members and provided with bobbins, means for driving said bobbin carriers, strand shifting means for shifting a strand from the throat of one head member to that of an adjacent head member synchronized with the rotation of the bobbin carriers, and means for guiding non-shifting strands to the throats of selected head members.

18. In a machine of the class described, the combination of a forming means, a plurality of bobbins traveling in circuitous paths, means for driving said bobbins continuously in one direction, a plurality of strand shifters adapted to alternately carry shifting strands into and out of the paths of adjacent bobbins, and means for guiding non-shifting strands within the paths of selected bobbins.

19. In a machine of the class described, the combination of a forming means, a plurality of bobbins traveling in circuitous paths, means for driving said bobbins continuously in one direction, a plurality of strand shifters adapted to alternately carry shifting strands into and out of the paths of adjacent bobbins, and means for guiding non-shifting strands within the paths of one or more of said bobbins.

20. A structure of the class described, comprising bobbins traveling in circuitous paths, means for driving said bobbins continuously in one direction in said circuitous paths, a strand shifter operatively associated with said bobbins for shifting a strand alternately into the circuitous paths of said bobbins, means for actuating said shifter in synchronism with said bobbins, and means for guiding non-shifting strands into the paths of said bobbins.

21. In a machine of the class described, comprising a strand forming means, a plurality of strand supply means delivering strands to said forming means, each of said strand supply means traveling in an independent circuitous path, means for imparting continuous circuitous movement to said strand supply means, strand shifting means whereby strands are guided into cooperating relation with said strand supply means and successively brought into and out of the circuitous paths of said strand supply means, and means for guiding non-shifting strands into the circuitous paths of selected strand means.

22. In a machine of the class described, the combination with a strand forming means, of a plurality of strand supply means driven continuously in one direction in circuitous paths, a plurality of strand shifters movable in paths intersecting the circuitous paths of the said strand supply means whereby the shifter strands are alternately brought into the paths of adjacent strand supply means, and means for guiding non-shifting strands into the circuitous paths of certain of said strand supply means.

23. In braiding mechanism, strand supply means movable in a closed circuit, means for imparting movement thereto in said circuit, means for guiding a strand within the circuitous path of the strand supply means, additional strand guiding means movable in a path intersecting the circuitous path of the strand supply means, and means for shifting the second strand guiding means into and out of the path of the strand supply means.

24. In braiding mechanism, a plurality of strand supply means, each movable in an independent circuit, means for imparting continuous movement thereto, means for guiding a strand within the circuitous path of one of the strand supply means, a plurality of strand guiding means movable in paths intersecting the circuitous paths of adjacent strand supply means, and means for shifting the last mentioned strand guiding means in succession into position in the paths of the strand supply means intersected thereby.

25. In braiding mechanism, a plurality of strand supply means, each movable in an independent closed circuit, means for imparting continuous movement thereto, a plurality of substantially fixed strand guiding means for guiding strands within paths of certain of said strand supply means, a plurality of strand guiding means movable in paths intersecting the circuitous paths of adjacent strand supply means, and means for shifting the movable strand guiding means alternately into positions within the paths of adjacent strand supply means.

In witness whereof I have hereunto set my hand.

ARTHUR C. HOPKINS.