United States Patent [19]

Berger

[11] **3,866,512**

[45] **Feb. 18, 1975**

[54] **APPARATUS FOR BRAIDING KNOTLESS NETTING**

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[73] Assignee: **August Heroz Maschinenfabrik,** Oldenburg, Germany

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[21] Appl. No.: **324,605**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 77,509, Oct. 2, 1970, Pat. No. 3,714,862.

[30] **Foreign Application Priority Data**

Oct. 3, 1969 Germany 1949893

[52] **U.S. Cl.** **87/37,** 87/8, 87/24, 87/33

[51] **Int. Cl.** **D04c 3/30**

[58] **Field of Search** 87/8, 33, 37, 38, 30, 12, 87/3, 24

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Primary Examiner—John Petrakes
Attorney, Agent, or Firm—Nolte and Nolte

[57] **ABSTRACT**

Track switch mechanism for a net braiding machine. Two rows of wing wheels of the machine have track switch units, between adjacent systems of wing wheels of both rows, for alternately circulating and interchanging thread supplying and thread guiding means (lacing needles), in and between the braiding heads formed by these systems of wheels. Each track switch unit periodically resets a number of track crossings in the track system of the machine. It does this in synchronism with the motions of the wing wheels and of the other track switch units. The machine produces netting which consists of braided legs interconnected by braiding, not by knots, and it produces such netting with speed and efficiency.

12 Claims, 18 Drawing Figures

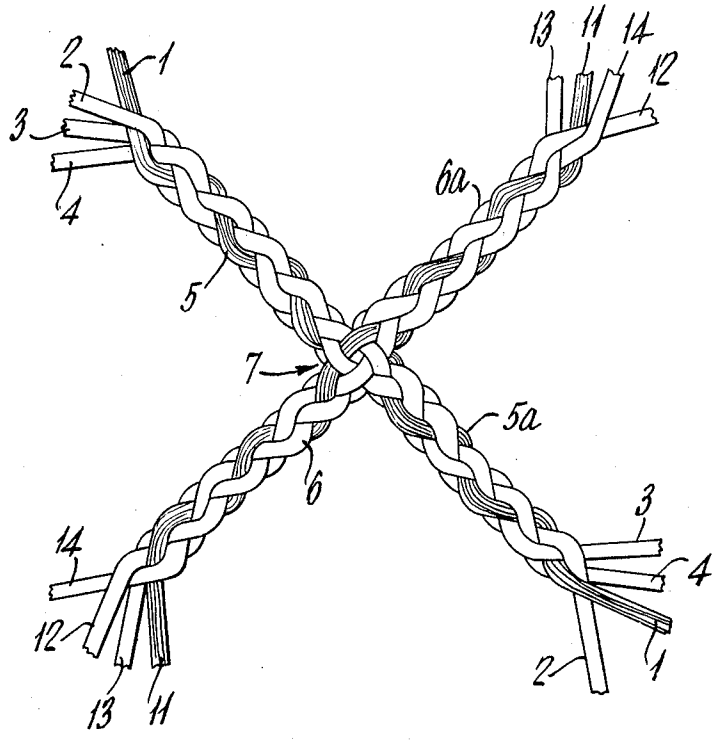


Fig. 1.

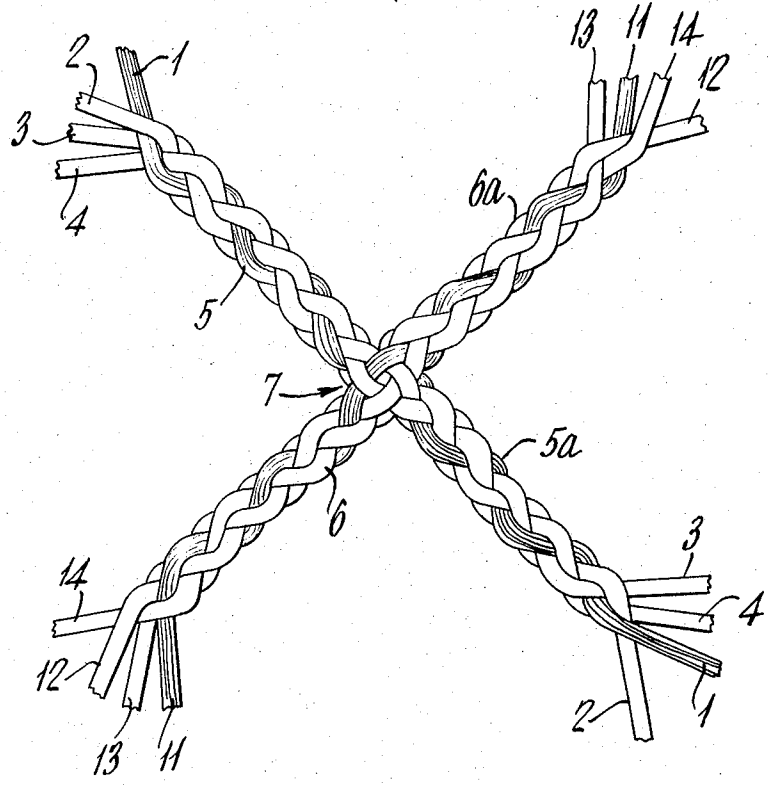


Fig. 4.

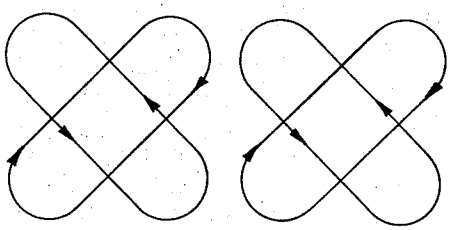


Fig. 4a.

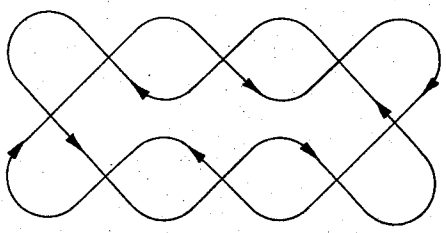


Fig. 2.

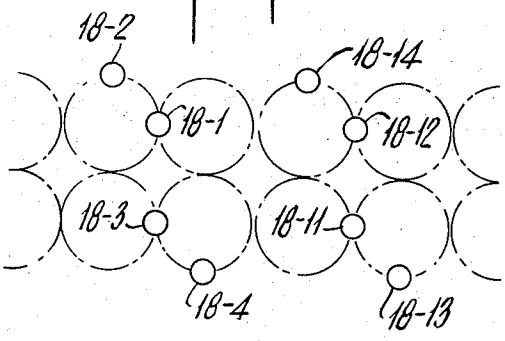


Fig. 3.

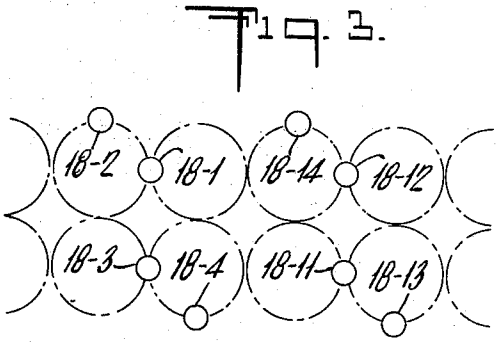


Fig. 2a.

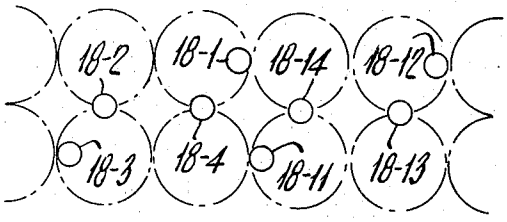


Fig. 3a.

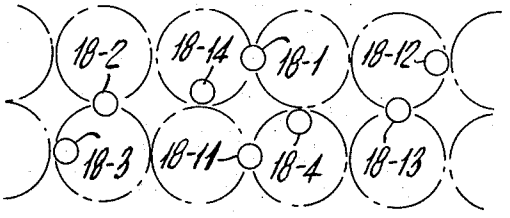


Fig. 2b.

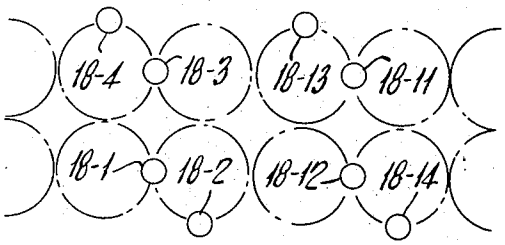


Fig. 3b.

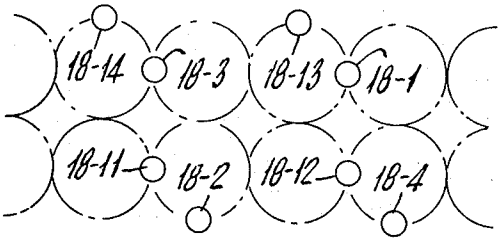


Fig. 2c.

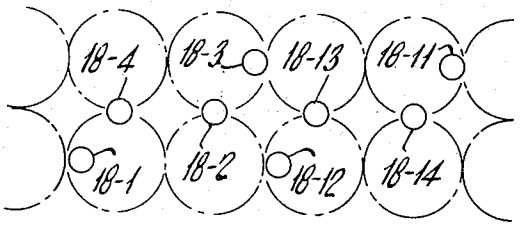


Fig. 3c.

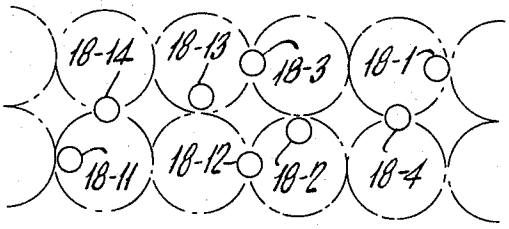


FIG. 5.

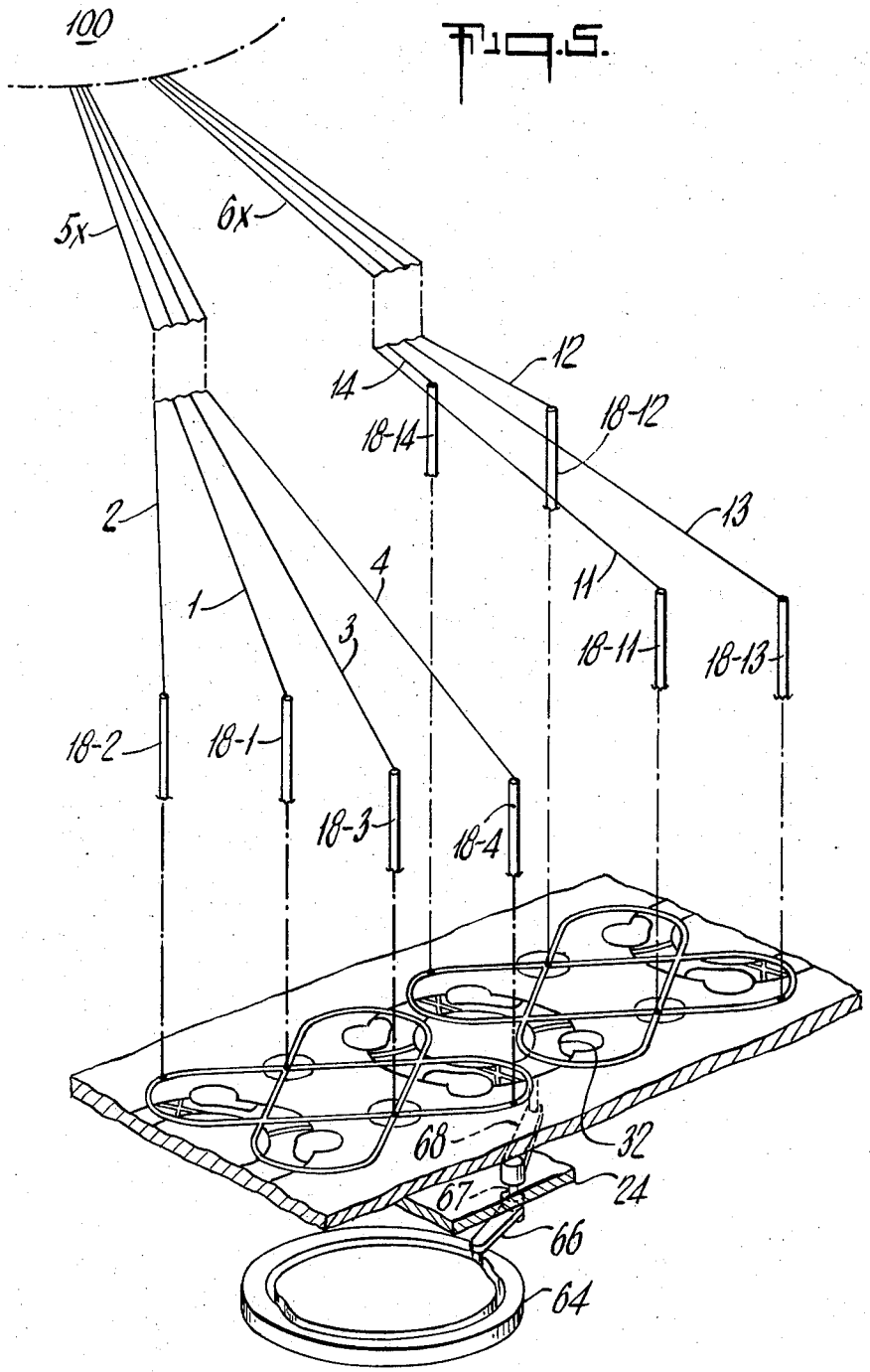

100
5x
6x
12
14
18-14
18-12
13
2
4
11
1
3
18-11
18-13
18-2
18-1
18-3
18-4
68
32
67
24
66
64

Fig. 6.

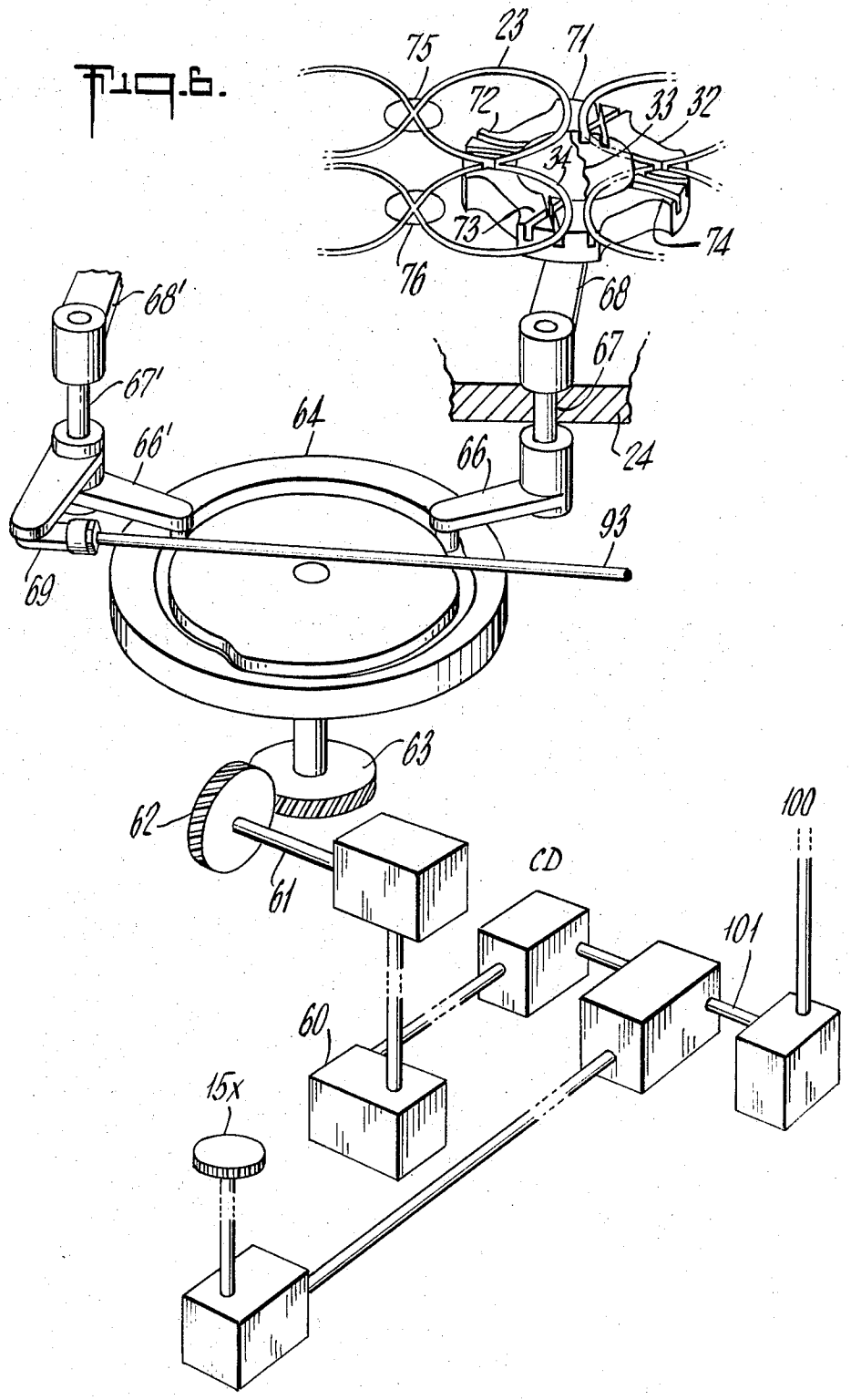

75
23
71
72
33
32
34
73
74
76
68
68'
67
67'
66'
64
66
24
93
69
63
62
61
100
CD
101
60
15x

Fig. 7.

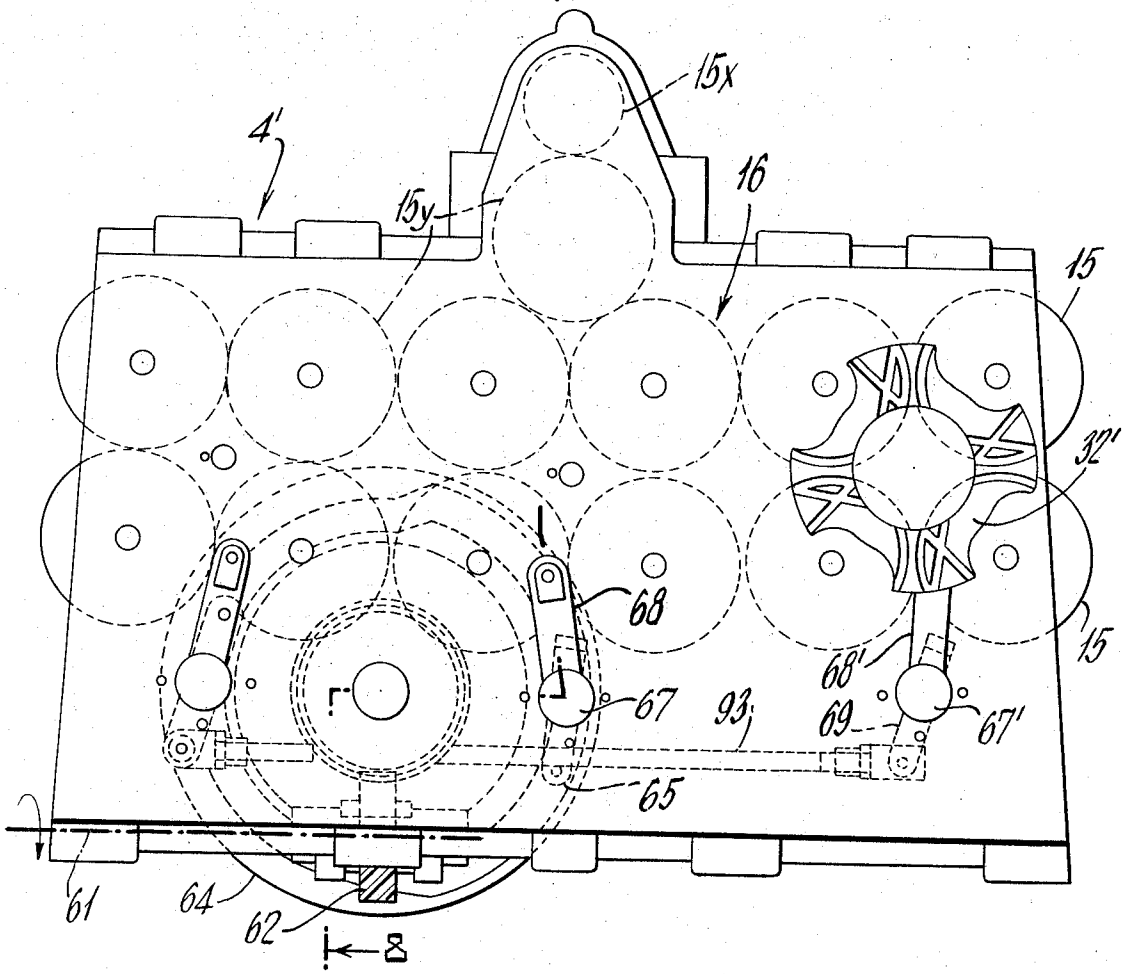

8
15x
4'
15y
16
15
32'
68
68'
15
67
93
69
67'
65
61
64
62
8

Fig. 8.

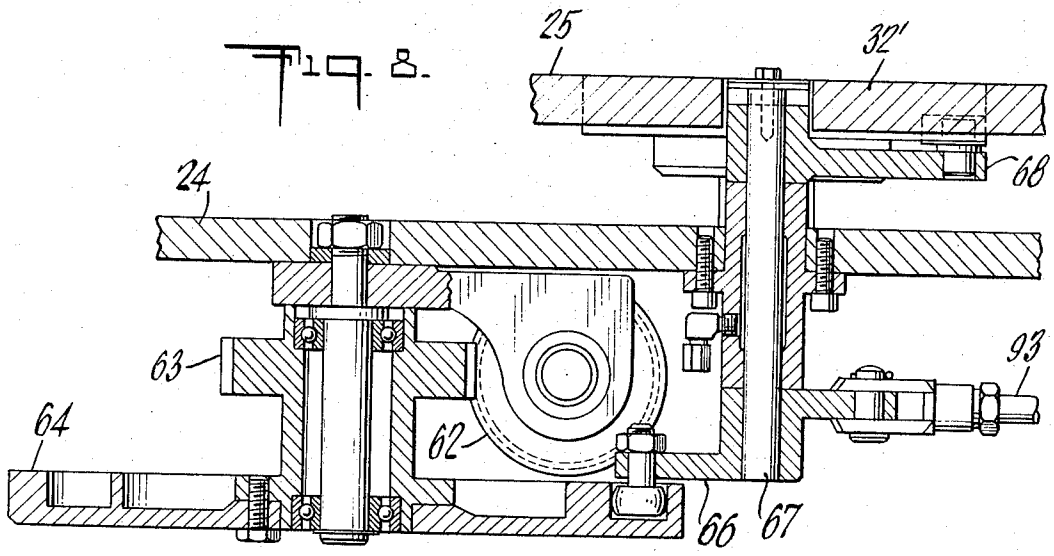

25
32'
68
24
63
93
64
62
66
67

Fig. 9.

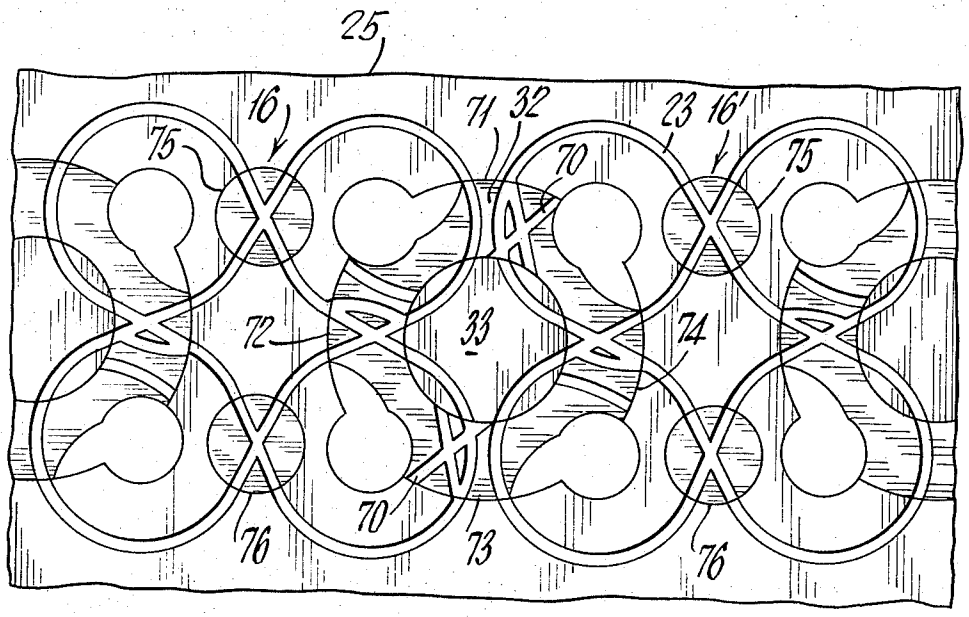


Fig. 9a.

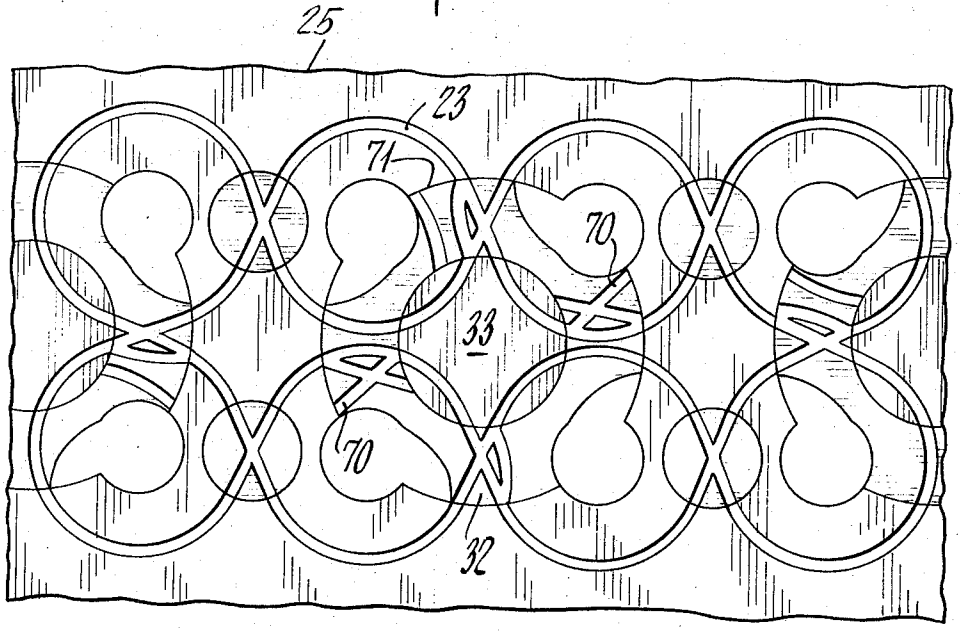
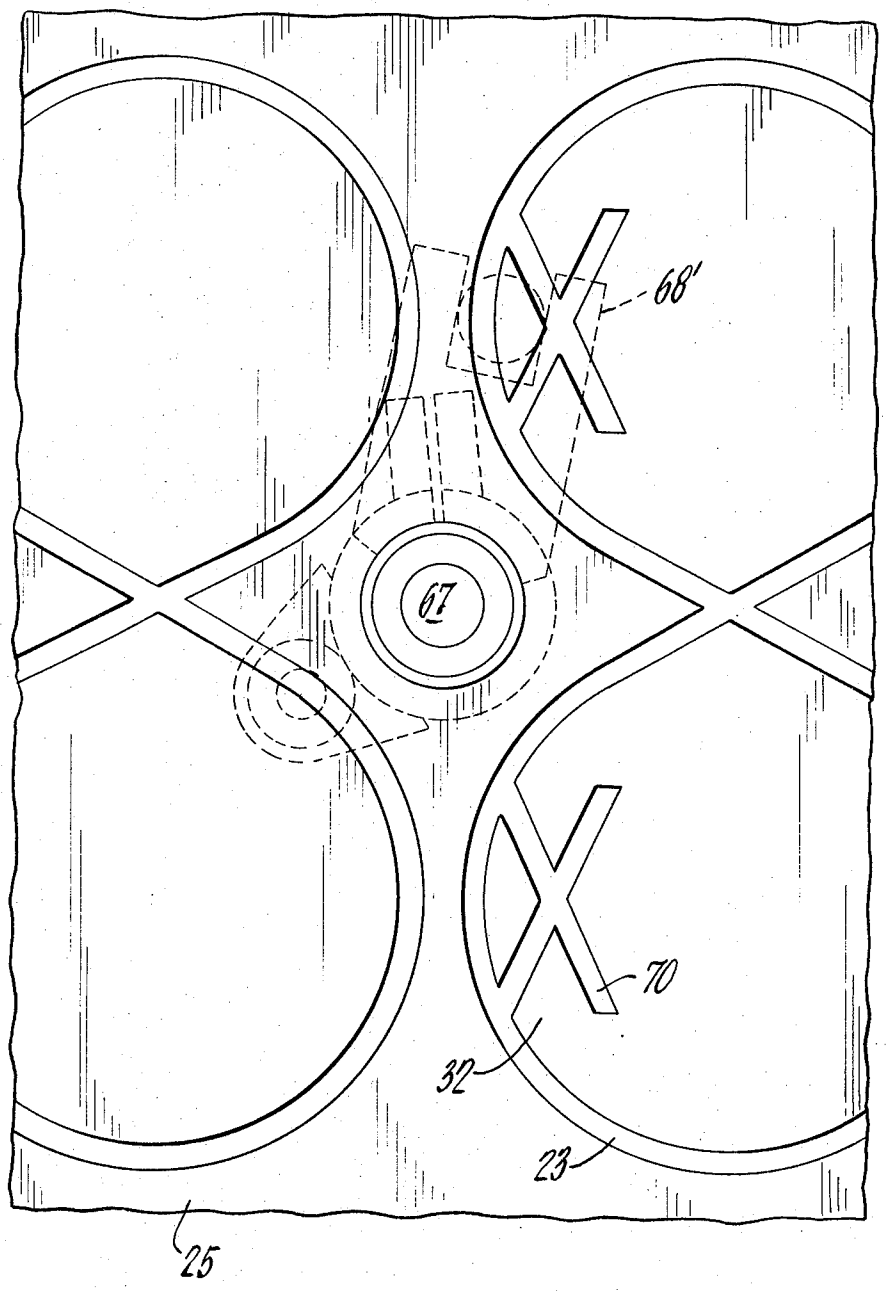


FIG. 10.



APPARATUS FOR BRAIDING KNOTLESS NETTING

This is a continuation-in-part of Ser. No. 77,509, filed Oct. 2, 1970 now U.S. Pat. No. 3,714,862.

BACKGROUND AND NATURE OF THE INVENTION

Various machines for braiding knotless nets have been designed and introduced. They have been subject to limitations, particularly regarding the speed of net braiding and the dimensions of braided loops, attainable therein.

The invention improves a machine of this type by incorporating therein track switch apparatus which simultaneously resets track crossings at a pair of sets of track locations, in a certain resetting program. The arrangement of tracks and crossings is such as to provide the shortest possible path for interchanges of braid segments, as well as for the bobbin motions between such interchanges, thereby making it possible also to provide the nets with the shortest possible distances between braided interconnections between the braided strings or legs.

For this purpose, it is preferred to arrange the wing wheels in two parallel or concentric rows; to provide each row with a series of braiding heads, each having the form of a system of four wing wheels arranged as a square; to provide a track switch unit of the new type between every two braiding heads; and to provide novel track switch mechanisms, each interconnecting three of the new track switch units. The lacing needles, carrying the thread bobbins, can then be propelled along suitably changing tracks, with maximum effectiveness as to changes of the track length, and corresponding length of threads, between the points of bobbin interchange.

DRAWINGS

FIG. 1 is a schematic fractional view of the braided net, produced by the machine;

FIG. 2 is a schematic fractional plan view of the machine and of the new track switch apparatus therein;

FIGS. 2*a*, 2*b* and 2*c* are views similar to FIG. 2, showing consecutive positions of the apparatus;

FIGS. 3, 3*a*, 3*b* and 3*c* show still other positions of the apparatus of FIG. 2;

FIG. 4 is a view wherein the positions of FIGS. 2 to 2*c* are schematically summarized;

FIG. 4*a* is a view generally similar to FIG. 4 but summarizing the positions of FIGS. 3 to 3*c*;

FIG. 5 is a comprehensive perspective view showing one of the new track switches, parts of two adjoining track switches, and a pertinent, generally sector-shaped portion of the complete machine;

FIG. 6 shows details from and for the mechanism of FIG. 5;

FIG. 7 is a plan view showing the mechanism of FIG. 6, together with certain associated elements but omitting others;

FIG. 8 is a cross sectional view taken along line 8—8 in FIG. 7;

FIG. 9 is a fragmentary plan view similar to FIG. 7 but showing the elements omitted in that figure;

FIG. 9*a* is a view similar to FIG. 9 but showing a different position of the apparatus; and

FIG. 10 is an enlarged view, schematically showing a detail from FIG. 9.

GENERAL DESCRIPTION, FIGS. 1 to 4*a*

As shown in FIG. 1, four threads or yarns 1, 2, 3, 4, are braided into a string or leg or section 5 while four similar threads 11, 12, 13, 14, are braided into a similar string or section 6. The two strings are interconnected, not by a knot but by braiding them together so that strings 1–4, 11–14 are braided together, in a direct but altered continuation of the braiding sequence, at connection point 7. This is done when the braiding of separate legs 5 and 6, which is done at left, has progressed to the proper length of these legs, from the braiding area at left to the connection 7. Previously legs 5′ and 6′ have been braided and subsequently a new connection (not shown) is reached, always progressing in a general leftward direction, while successive connecting and separate braiding operations are repeated.

The braiding of the separate legs is consecutively clockwise and counterclockwise. This may be noted by comparing the braiding patterns for thread 1, up to connection point 7, as seen from the lower right hand corner of FIG. 1 with the braiding pattern of the same thread as it continues further up from point 7 and as seen from the same lower right hand location.

The new apparatus for such braid connecting of braided strings is schematically shown in FIG. 2, wherein brading bobbins for threads 1 to 4 are shown by small circles 18–1 to 18–4 and those for threads 11 to 14 are shown at 18–11 to 18–14. The larger circles 15–I to 15–VIII show the general pattern of bobbin guiding grooves or tracks and underlying wing wheels 15. As further shown in FIGS. 2*a*, 2*b* and 2*c*, the positions of the braiding bobbins, along these grooves of tracks, are varied consecutively during the braiding of the string portion, by motions of the wing wheels. Between connecting points of such a portion, the sequence of positions of FIGS. 2, 2*a*, 2*b* and 2*c* is traversed a number of times, this number being determined by control equipment not shown herein but shown in Ser. No. 77,509.

As further shown in FIGS. 3–3*c*, the positions of the needle bobbins along their tracks vary in a different sequence during the braiding of the connection 7 between the braided string portions. During this connection braiding time, bobbins are interchanged between portions of their normal tracks, through suitable track switches. For example, bobbins 18–1 and 18–14 are interchanged between the left and right braiding heads shown in FIG. 3*a*. Bobbins 18–3 and 18–13 are similarly interchanged in FIG. 3*c*.

The resulting paths of needles are summarized in FIG. 4 (showing the path during the braiding of the legs) and in FIG. 4*a* (showing the braiding of the leg connections).

THE TRACK SWITCH MECHANISM, FIGS. 5–10

The changing bobbin paths as established according to the invention are shown more realistically in FIGS. 5–10.

Each of FIGS. 5 and 6 contains a complete showing of a single one of the new track switch units 32. FIG. 5 shows it with upper parts of its mechanism and FIG. 6 with the lower parts thereof.

A central drive CD, schematically indicated at the bottom of FIG. 6 and more fully shown in Ser. No.

77,509, has drive means 15*x* for driving the wing wheels of the braiding units. These wheels are annularly disposed under cover plate 25 (FIG. 5) of the braiding aseembly, but are not shown in these figures. The aforesaid central drive CD, shown in FIG. 6, by drive means 60 and 61 also drives the mechanisms 62–68 for the new track switch units 32. These mechanisms include helical gears 62, 63 for rotating horizontal switch control cam 64, below bearing plate 24; cam follower levers 66, 66′ pivoted in this bearing plate at 67, 67′; and switch turning levers 68, 68′ for turning switch units 32.

The wing wheel units 15, driven by drive means 15*x*, are shown in FIG. 7. They are disposed in a flat region 15′ between plates 24 and 25. The wing wheels are arranged in this region in form of braiding heads; a pair 16, 16′ of such heads partly underlying each of the new switch units 32 (FIGS. 2, 3, 7 and 9). Each braiding head comprises four wing wheel units 15 arranged to form a square shaped unit and jointly supplying two pairs of thread, for example 1, 2, 3 and 4, through the corresponding needle bobbin units 18–1, 18–2 and 18–3, 18–4 (FIG. 5). From these needle bobbin units the threads run inwardly upwardly to the central elevated braid lifter unit 100, more fully described in Ser. No. 77,509.

Synchronous control is needed for the process performed in the new machine. Particularly according to the invention the interchange of braiding bobbins 18 is synchronized, which is largely effected by the bobbin drive and switch drive devices mentioned above. Bobbins 18 have a set of the same respective positions in every second and even numbered braiding head 16′, FIG. 2. Correspondingly bobbin needles 18 have another set of the same respective positions in all odd numbered heads 16. The braiding of one set of loops 5, 6 and interconnections 7, according to FIG. 1, requires that the eight lacing needles 18–1 to 18–14 of a pair of braiding heads 16, 16′ be moved along pathways crossing one another in the general form of "figure eights." These pathways are best shown in FIGS. 4 and 4*a* and the corresponding machine grooves are best shown in FIGS. 9 and 9*a*. They produce a quadrature of interlacing yarn, wherein the needles are guided from one braiding head to an adjacent one via track switches 32, FIGS. 6, 9, 9*a*.

The change of needle motion for interconnection of threads and interchange of thread supply needles is triggered by a control device, not specifically shown herein but shown in Ser. No. 77,509, as soon as the predetermined length of netting legs 5 and 6 has been braided. The control device, indirectly actuated from central drive CD, is rigidly connected with the braiding heads, the braid lifter assembly and the drive of the new switch units, by connecting mechanisms 15, 101 and 60, respectively. Particularly in connecting mechanism 60, a cam 64 has a groove of such shape as to cause on rotation of the cam, cyclic motions of cam follower lever 66 thereby effecting the phase control of the switch setting levers 68. The latter levers have forked ends 68′ (FIG. 10), which perform the shifting of track switches 32, and secure the shifted position of each.

Roller lever 66′ (FIGS. 6 and 7) is also connected with a hub 69 and rod 93 to transmit its motion to other track switches 32. When the several track switches have been shifted, simultaneously, their grooves 70 connect with stationary guide grooves 23 in top plate 25, and the lacing needles then are guided from one braiding unit to another by the continuous motion of the wing wheel mechanism (FIGS. 9 and 9*a*).

A plurality of switch units 32 thus forms a unitary switching mechanism and every one of the switch units 32 thus provides two pairs of switching pathways. More particularly, and as best shown in FIG. 6, each unit 32 is a generally disc-shaped cam, having four peripheral switch areas 71, 72, 73 and 74 thereon, flush with the surrounding upper surface of stationary plate 25, which surface also includes fixed track switches 75, 76 interposed on grooves 23. The areas 71 to 74, as shown, are also flush with the upper surface of a stationary core 33 in the center of the series of peripheral switch areas of each disc-shaped cam or switch unit.

Each of these peripheral areas in turn have a plurality of units of track portions. Preferably the arrangement of track portions on all four areas of the unit is substantially uniform (areas 71 and 73 being symmetrical about a vertical centerline in FIG. 9, whereas areas 72 and 74 are antisymmetrical thereto). Thus, a limited angular displacement of the switch unit, between the positions of FIGS. 9 and 9*a*, readily establishes the track system for connection braiding according to FIGS. 3 to 3*c*, from the track system for leg braiding according to FIGS. 2 to 2*c*, and the reverse. For this purpose, each track portion area 71 and 73 comprises a pair of mutually facing convex track portions and a pair of mutually crossing generally straight track portions. These pairs of track portions in each track portion area share their end points with corresponding points of inner and outer stationary tracks 23, 34 (FIG. 6).

What is claimed is:

1. A machine for knotless net braiding, comprising: a generally horizontal braiding assembly having a plurality of braiding units for braiding yarns into legs with braid-interlaced connections; a braid lifter assembly coordinated with said units, to receive the braided legs therefrom and to complete their braid-interlacing; a plurality of wing wheels in each braiding unit for said braiding; bobbin needles engageable by said wheels for sliding motions along tracks in said assembly; each of said braiding units comprising stationary guide grooves disposed in a plate member through which yarn to be braided passes; a plurality of rotary track switch units, each having a plurality of track switches, generally interposed between such braiding units; each of said track switches having movable grooves which upon shifting of said track switches connect a stationary guide groove of one braiding unit with a stationary guide groove of another braiding unit; and power and control means for the braiding and track switch units, to successively circulate the bobbin needles with the wheels and interchange them therebetween in a predetermined program.

2. A machine as described in claim 1, also including power means for synchronously operating the braid units and track switch units.

3. A machine according to claim 1, wherein all braiding units have mutually similar groups of even numbers of winged wheels, each group being arranged according to a regular pattern, whereby the yarns can be interlaced in form of 8's.

4. A machine according to claim 3, including a series of generally horizontal, plate-like structures providing pivot and housing means for said winged wheels and switch units.

5. A machine as described in claim 3, wherein each braiding unit has three braiding heads.

6. A machine as described in claim 5, wherein each pair of braiding heads has eight winged wheels and, between the two heads, one of the track switch units.

7. A machine as described in claim 5, wherein at least one braiding head in each braiding unit has track switch means including a horizontally shiftable rod and means for shifting the same.

8. A machine as described in claim 1, wherein each track switch unit comprises a generally circular disc having a number of peripheral track switch areas, and means to angularly move the disc.

9. A machine as described in claim 8, wherein each track switch area comprises at least two sub-areas each having a different track segment, one for said circulating and the other for said interchange of bobbin needles.

10. A machine as described in claim 8, wherein the disc has a stationary center, and each peripheral track switch area, the stationary center, and the disc-surrounding horizontal braiding assembly have mutually connected grooves for said circulating and interchanging of lacing needles.

11. A machine as described in claim 8, wherein such track switch discs have cam levers to provide said means for moving them.

12. A machine for knotless net braiding according to claim 1 wherein said track switch units are intermittently movable track switch units and said apparatus comprises means for intermittently moving said track switch units.

* * * * *