

Jan. 30, 1940.

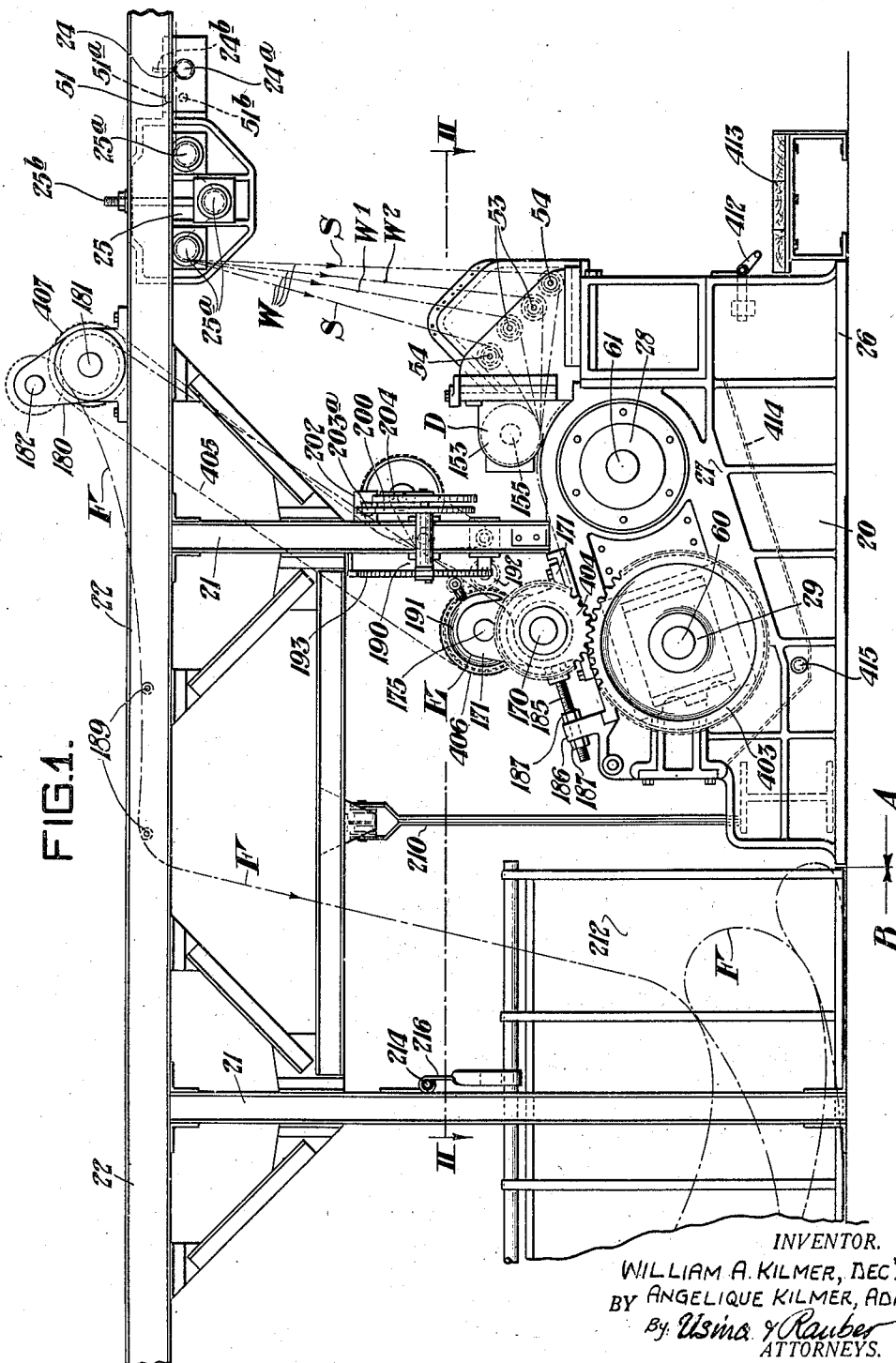
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets—Sheet 1



2,188,358

Filed Dec. 31, 1936

31 Sheets-Sheet 2



INVENTOR.
WILLIAM A. KILMER, DEC'D.
BY ANGELIQUE KILMER, ADMIN.
By: *Usina & Rauber*
ATTORNEYS.

6

Jan. 30, 1940.

W. A. KILMER

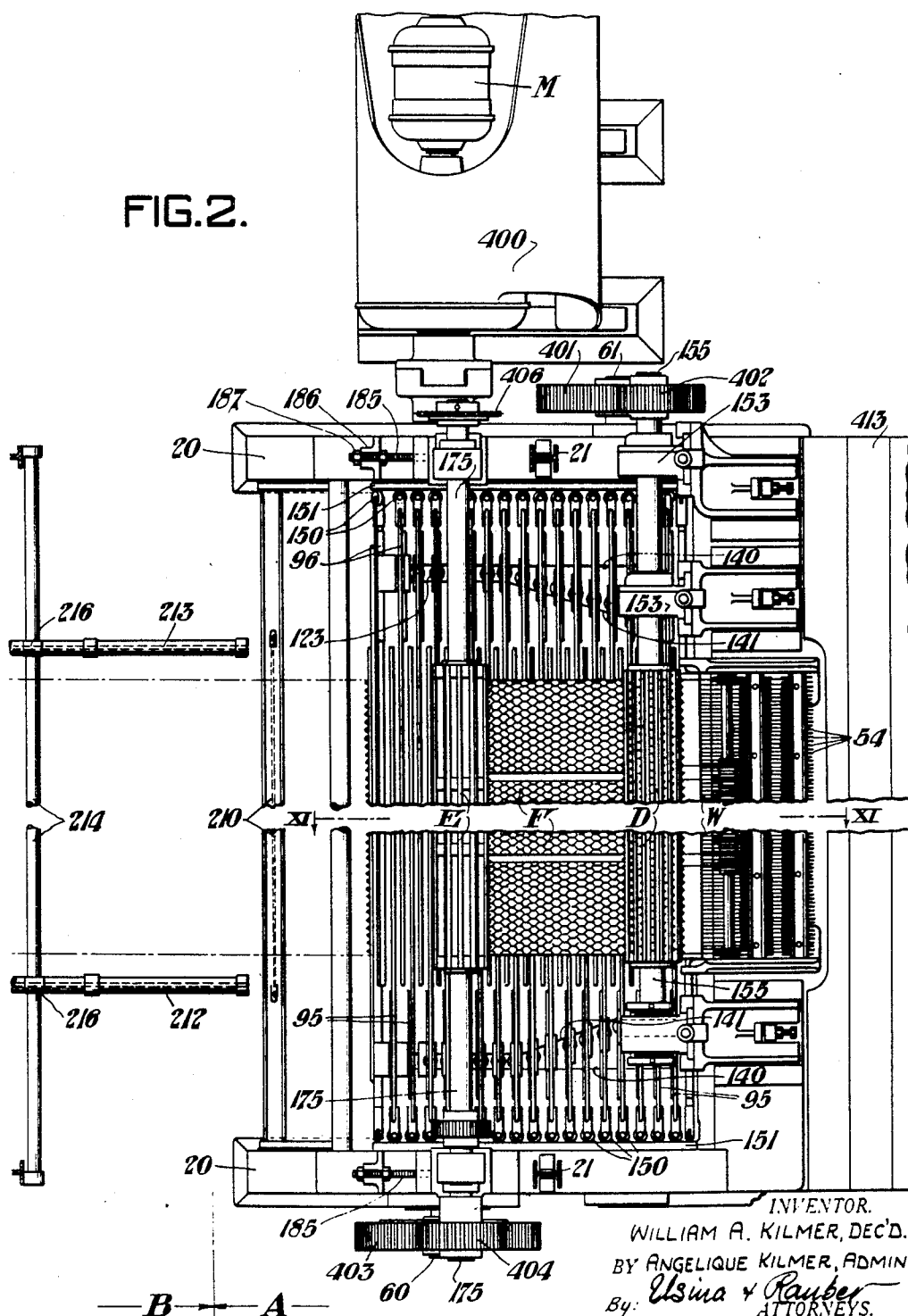
2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 3

FIG. 2.



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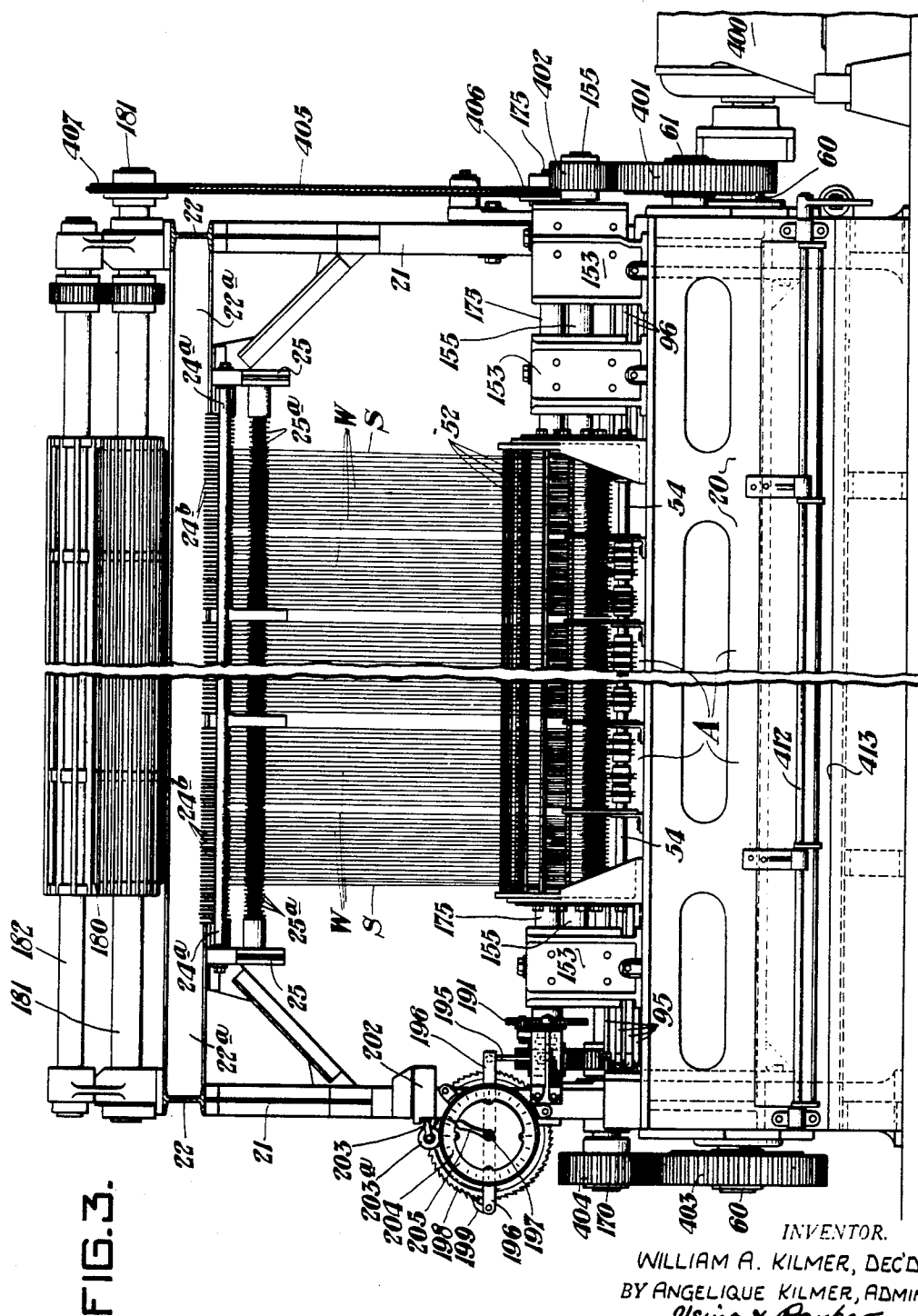
W. A. KILMER

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WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 4



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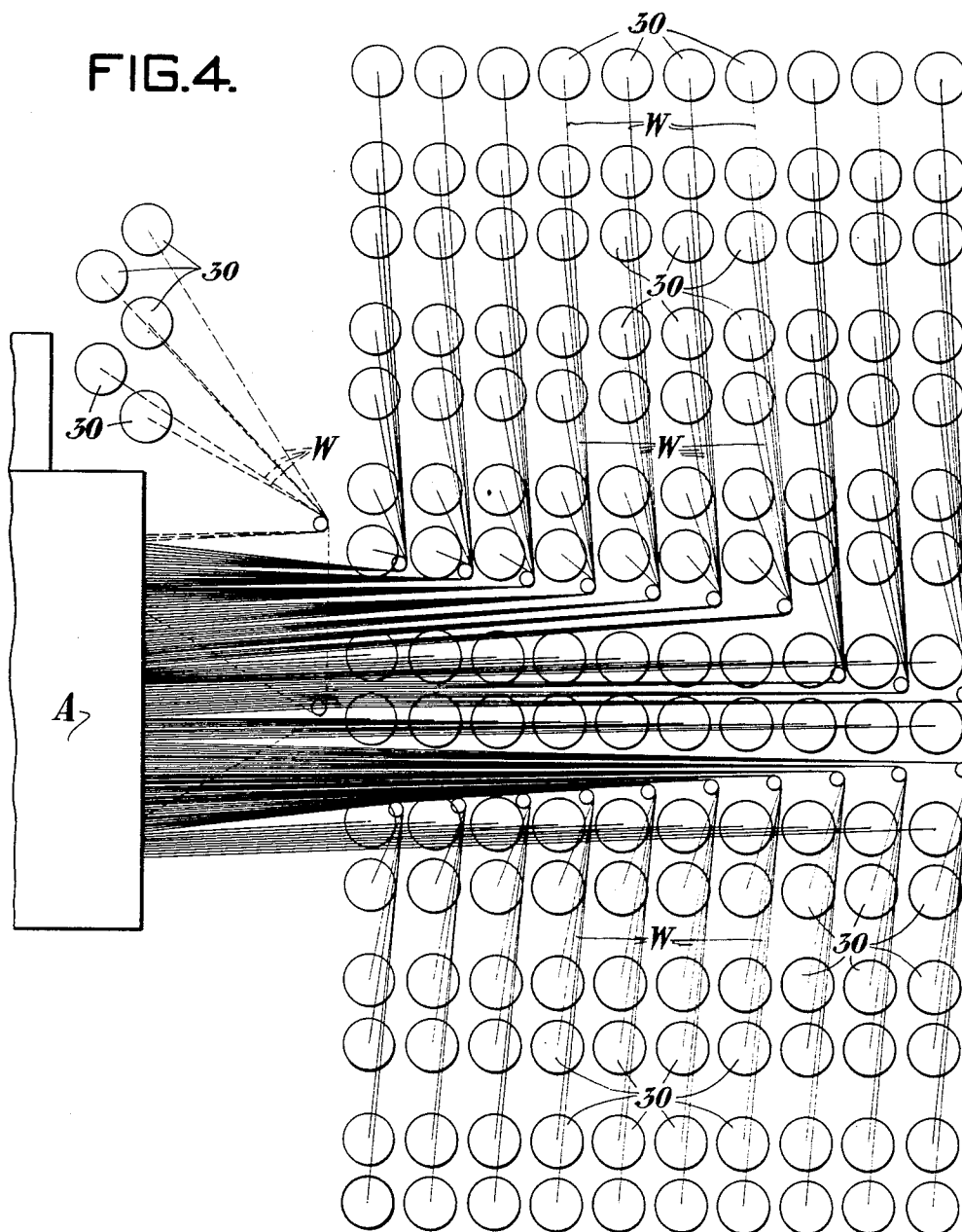
2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 5

FIG. 4.



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Jan. 30, 1940.

W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 6

FIG. 6.

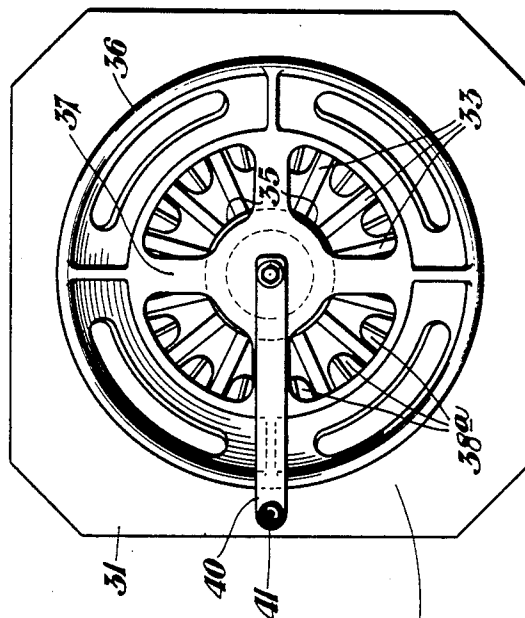


FIG. 7.

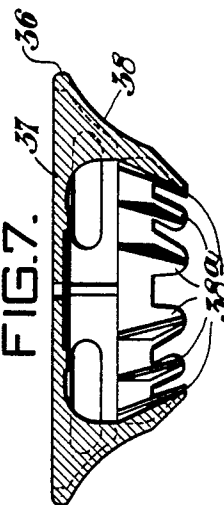
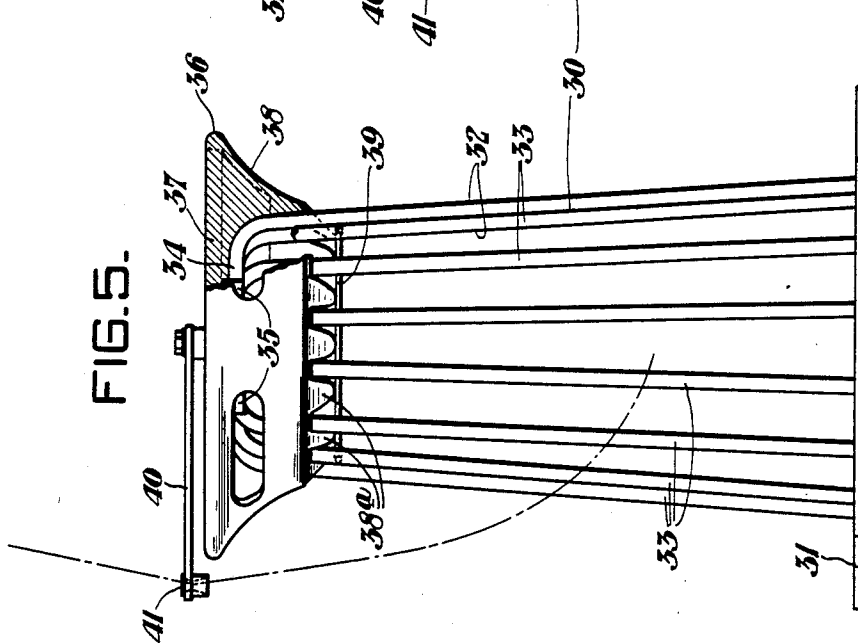


FIG. 5.



INVENTOR.

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Jan. 30, 1940.

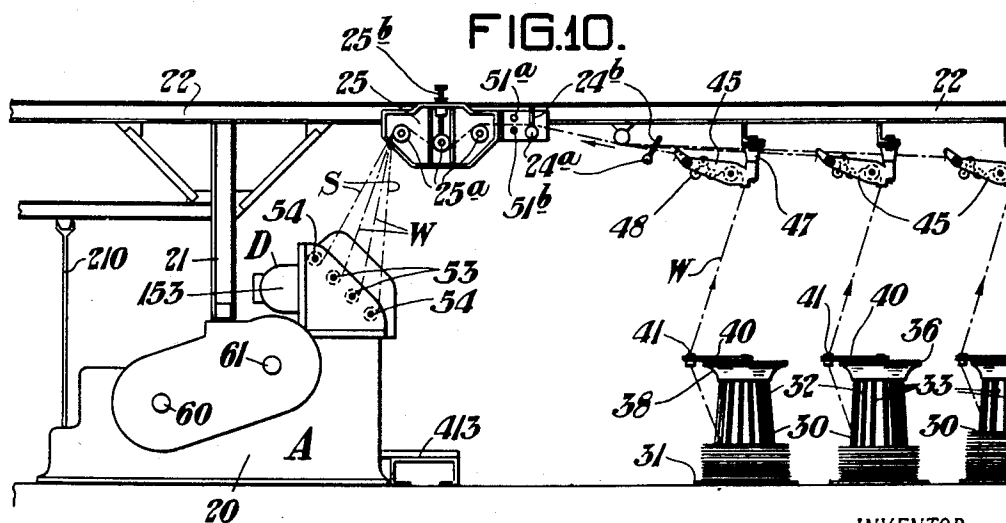
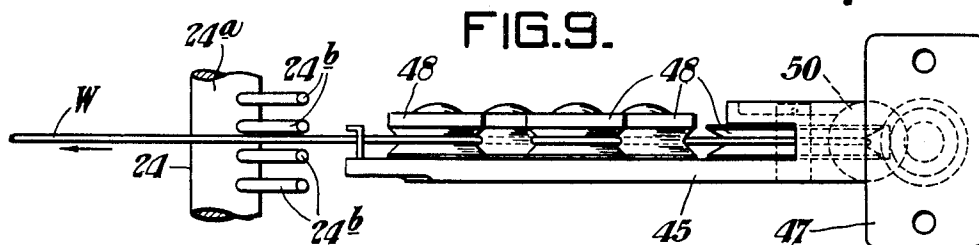
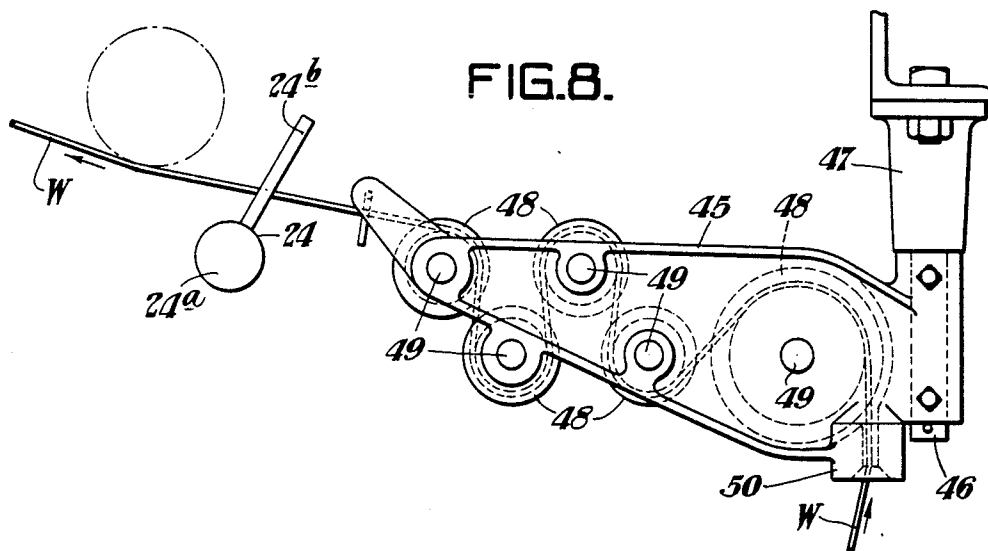
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets—Sheet 7



INVENTOR.
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Jan. 30, 1940.

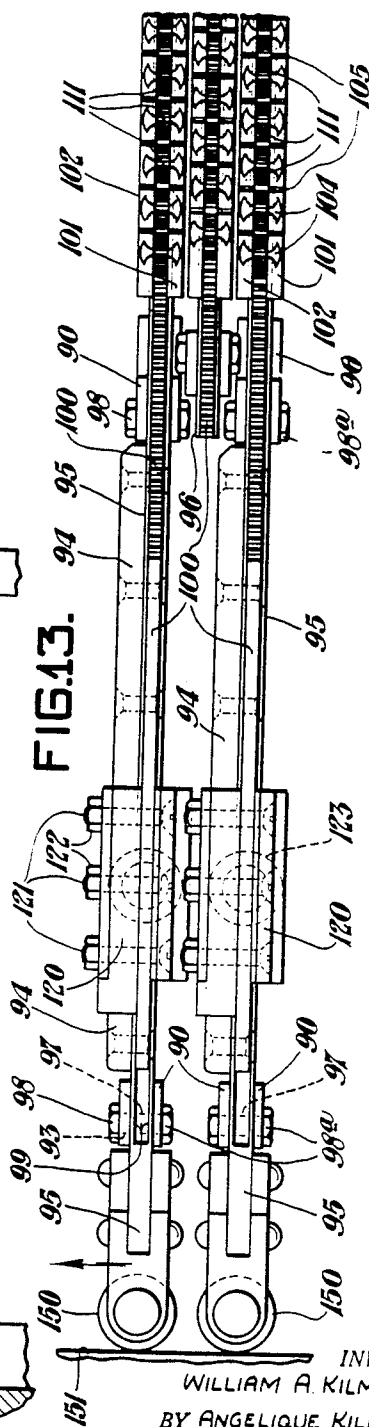
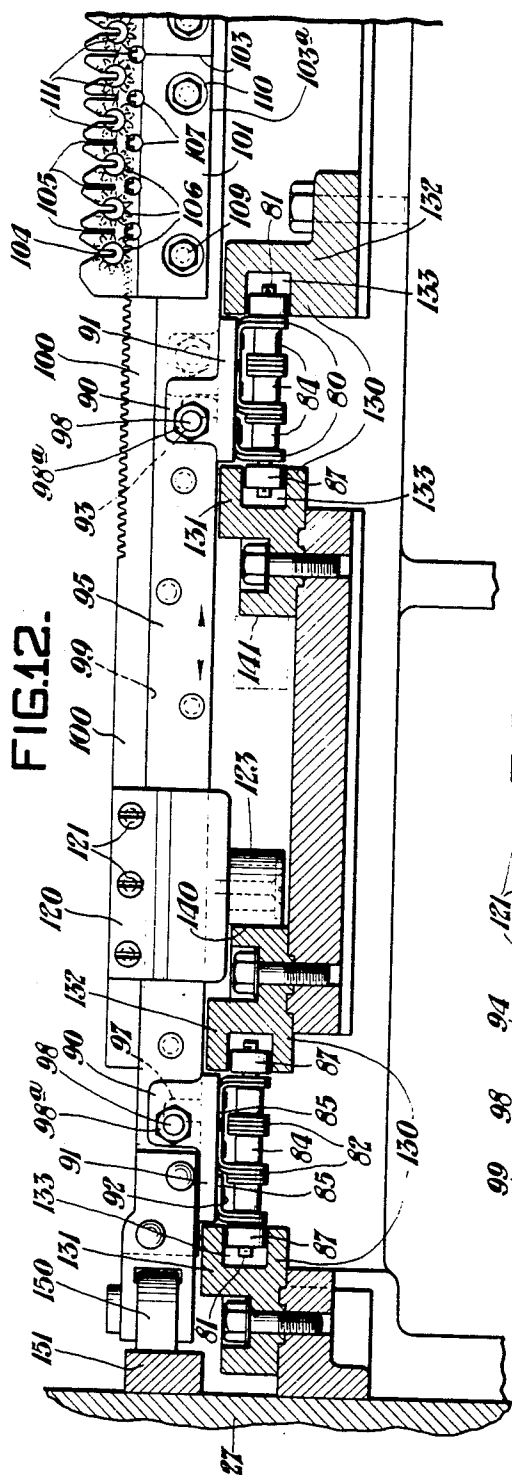
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 9



INVENTOR.
WILLIAM A. KILMER, DEC'D.
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Ulsina & Rauber
By: ATTORNEYS.

6

Jan. 30, 1940.

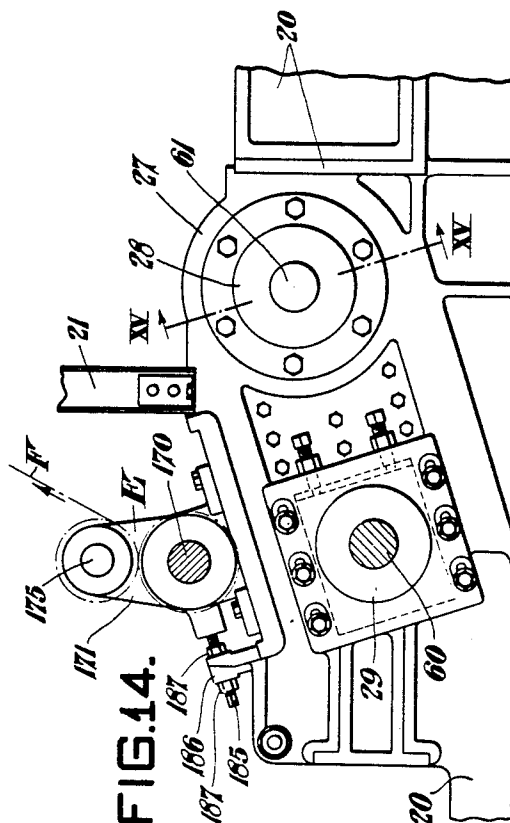
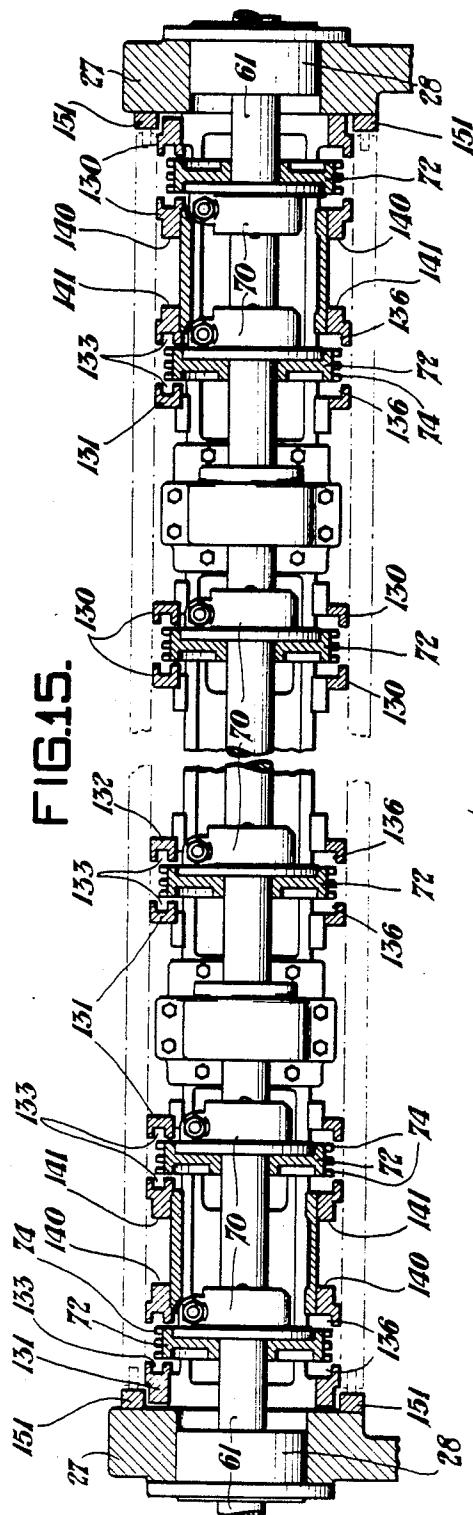
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 10



INVENTOR.
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Jan. 30, 1940.

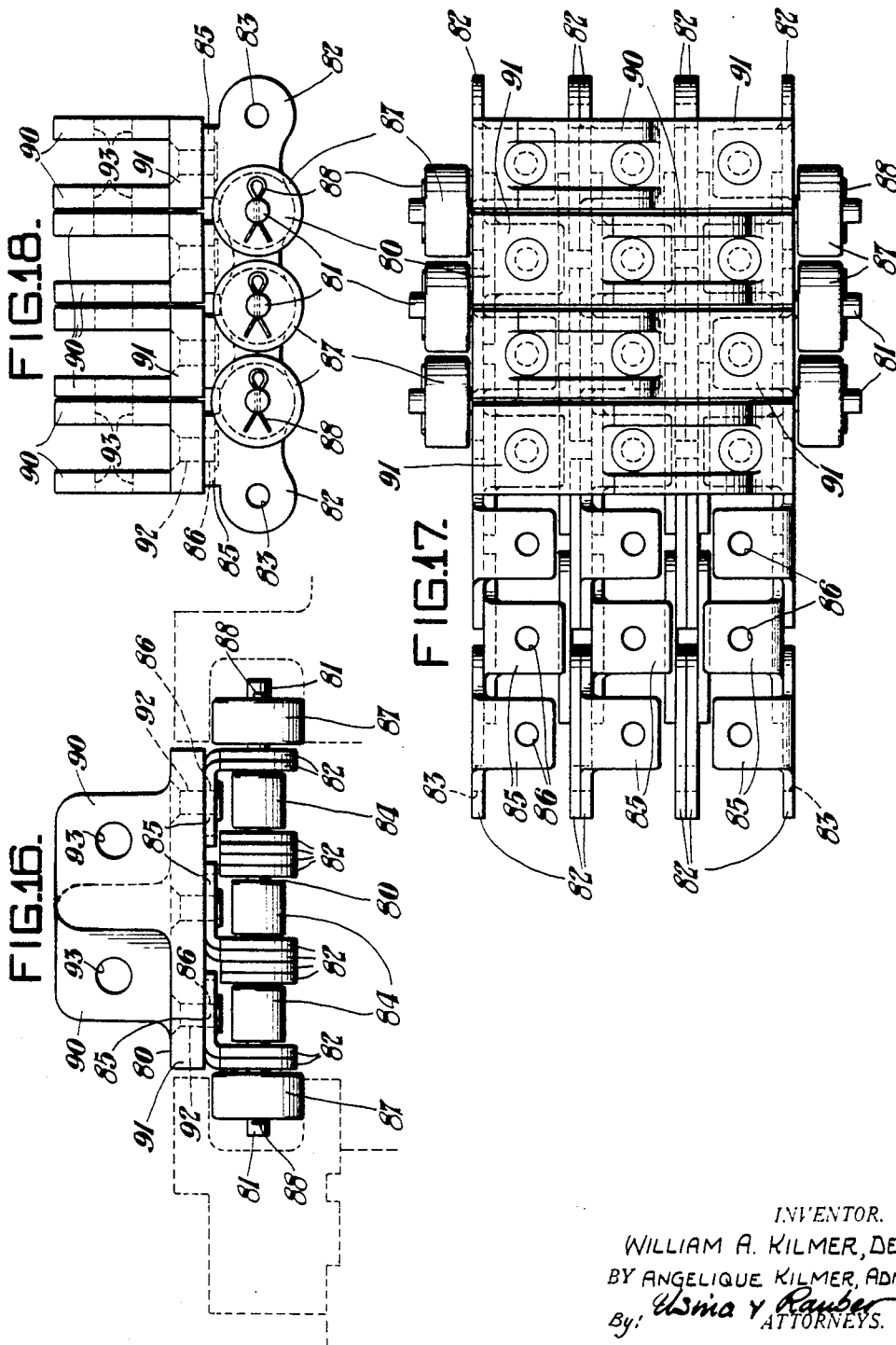
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

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31 Sheets-Sheet 11



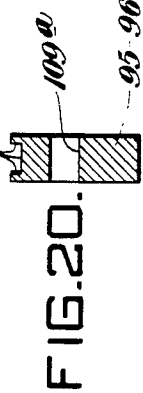
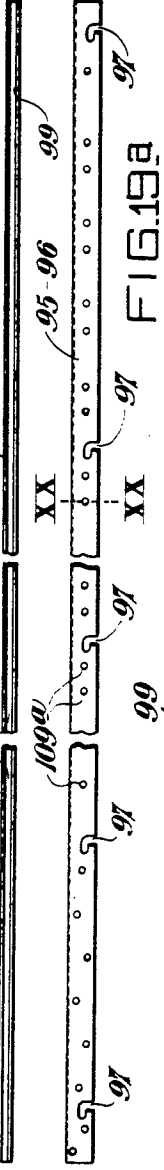
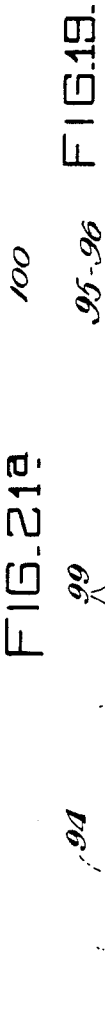
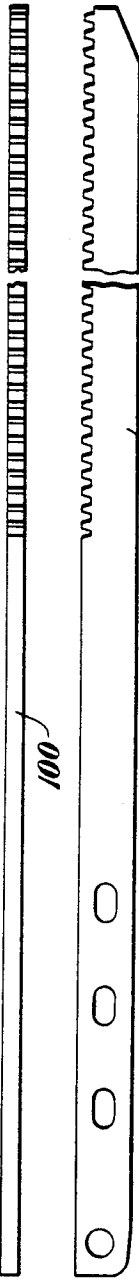
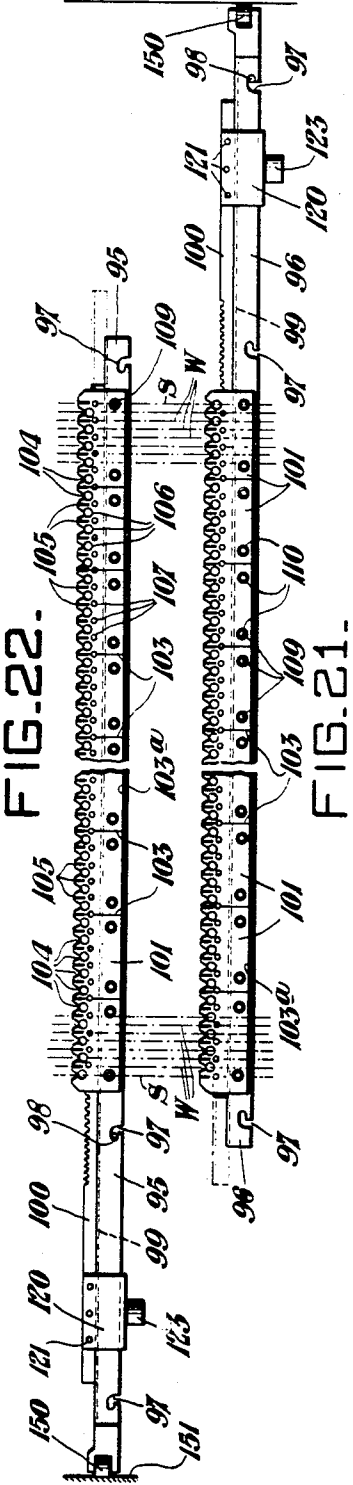
INVENTOR.
 WILLIAM A. KILMER, DEC'D.
 BY ANGELIQUE KILMER, ADMIN.
 By: *Wm. A. Kilmer* ATTORNEYS.

Jan. 30, 1940.

W. A. KILMER
WIRE FABRIC MACHINE
Filed Dec. 31, 1936

2,188,358

31 Sheets-Sheet 12



INVENTOR.
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BY ANGELIQUE KILMER, ADMIN.
By: *W. A. Kilmer* ATTORNEYS.

Jan. 30, 1940.

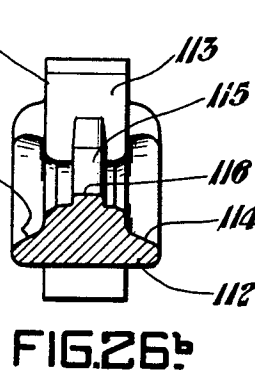
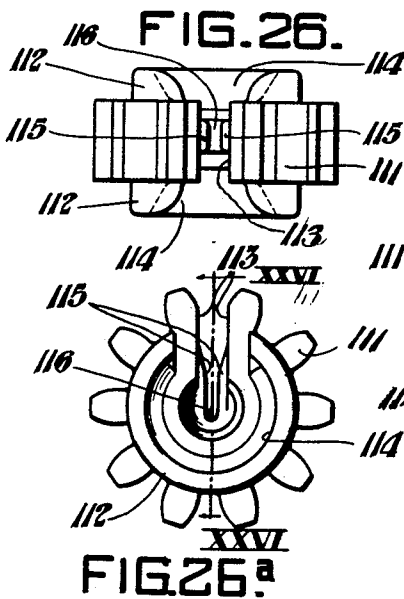
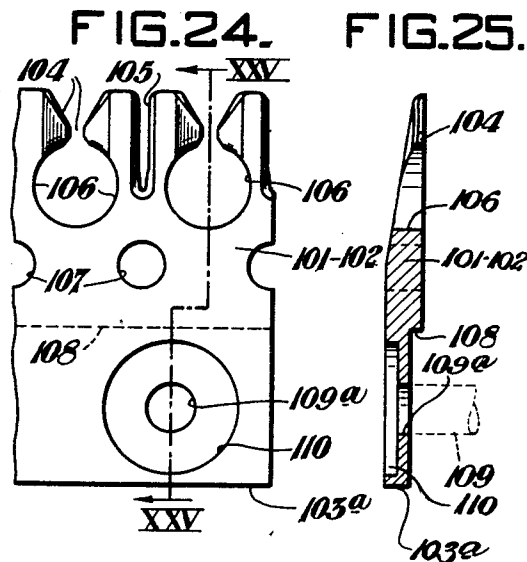
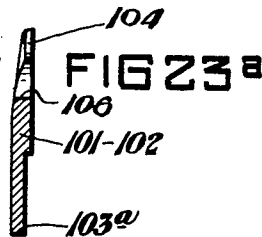
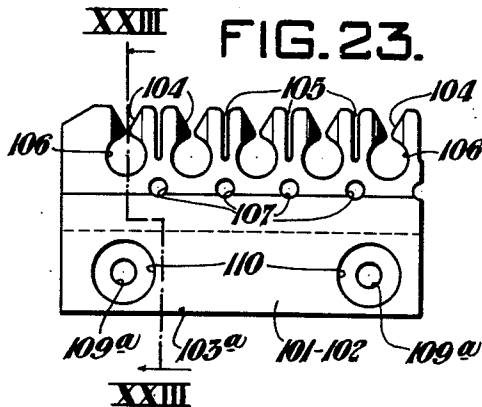
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

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31 Sheets-Sheet 13



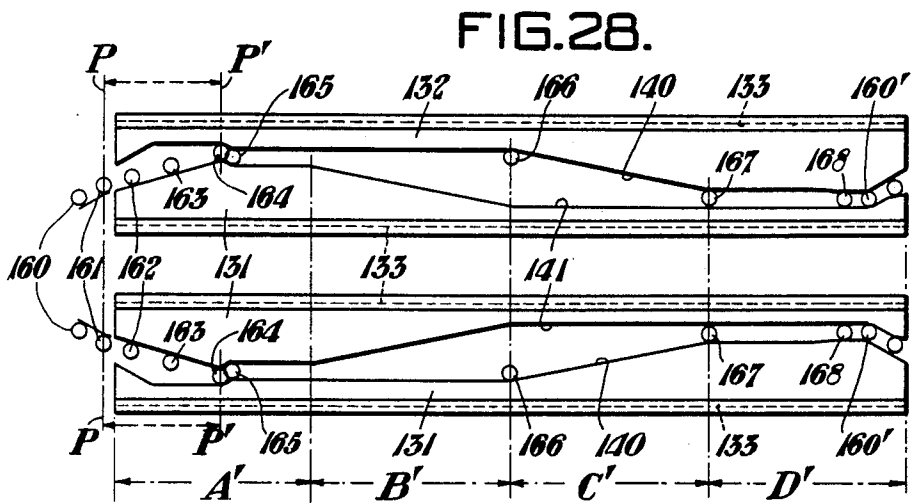
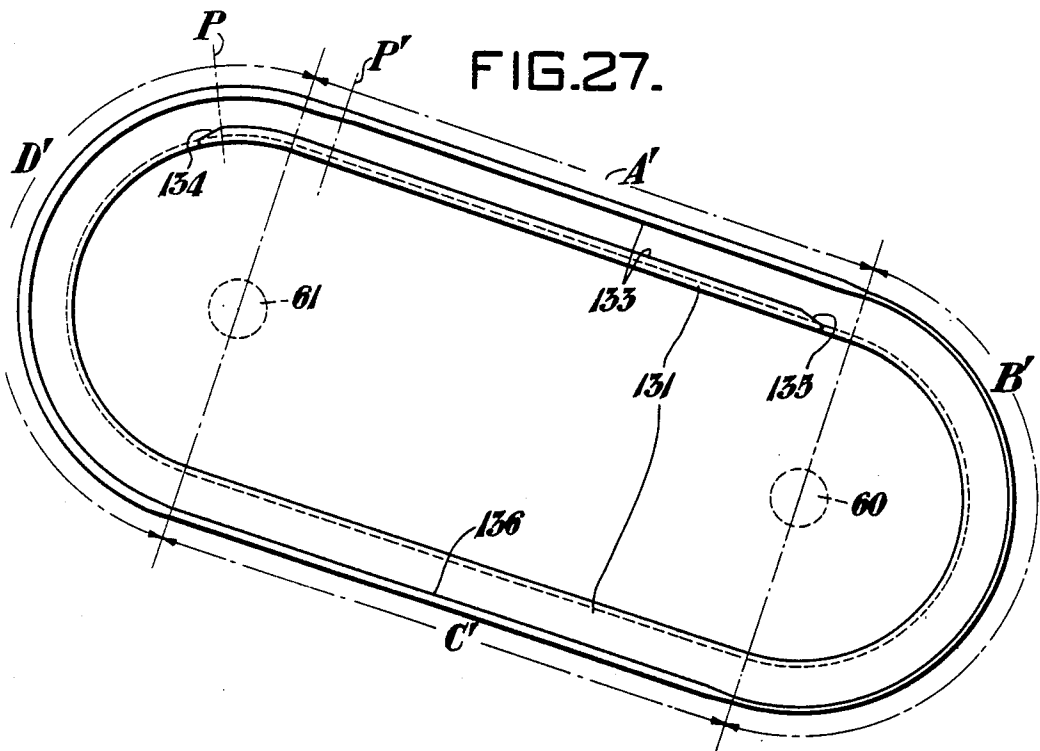
INVENTOR.
WILLIAM A. KILMER, DEC'D.
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By: *Usina & Rauter*
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Jan. 30, 1940.

W. A. KILMER
WIRE FABRIC MACHINE
Filed Dec. 31, 1936

2,188,358

31 Sheets-Sheet 14



INVENTOR.
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By: *Elsina & Rauber*
ATTORNEYS.

Jan. 30, 1940.

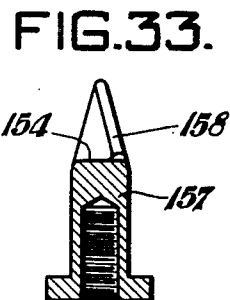
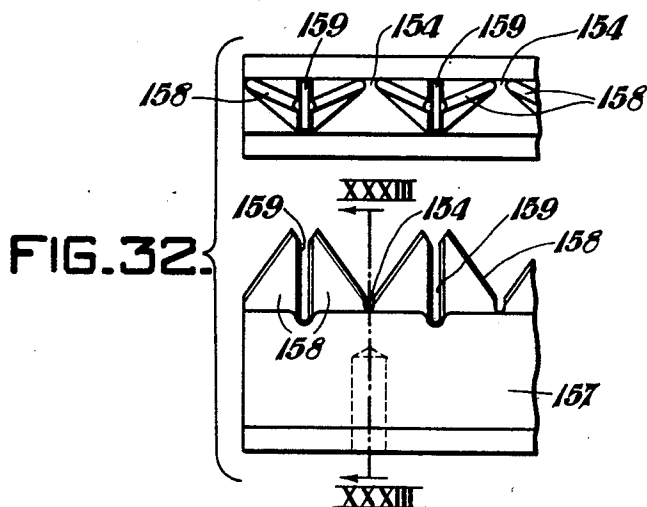
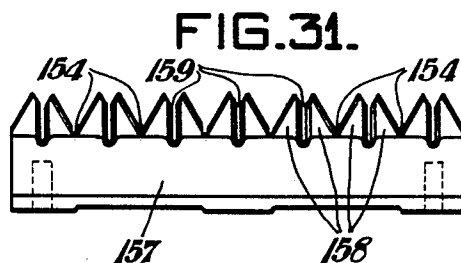
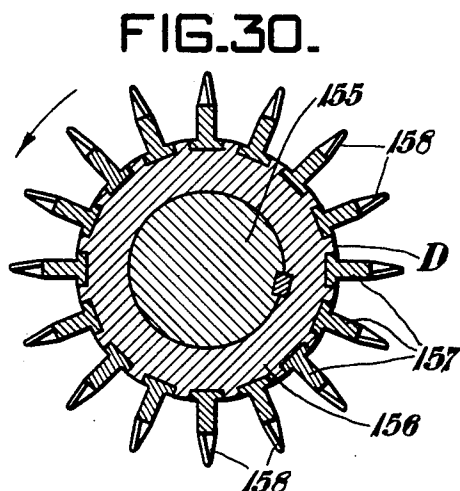
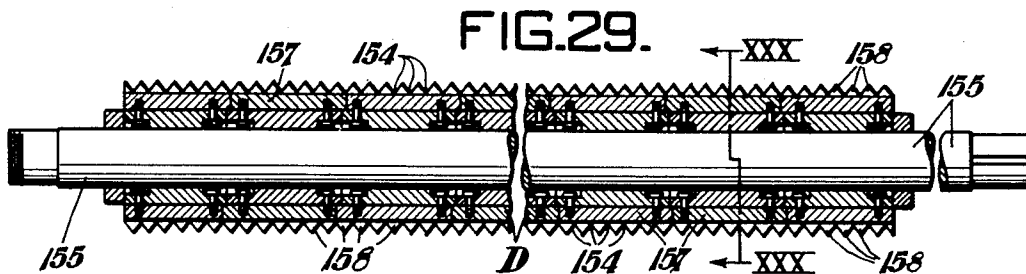
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 15



INVENTOR.
WILLIAM A. KILMER, DEC'D.
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Jan. 30, 1940.

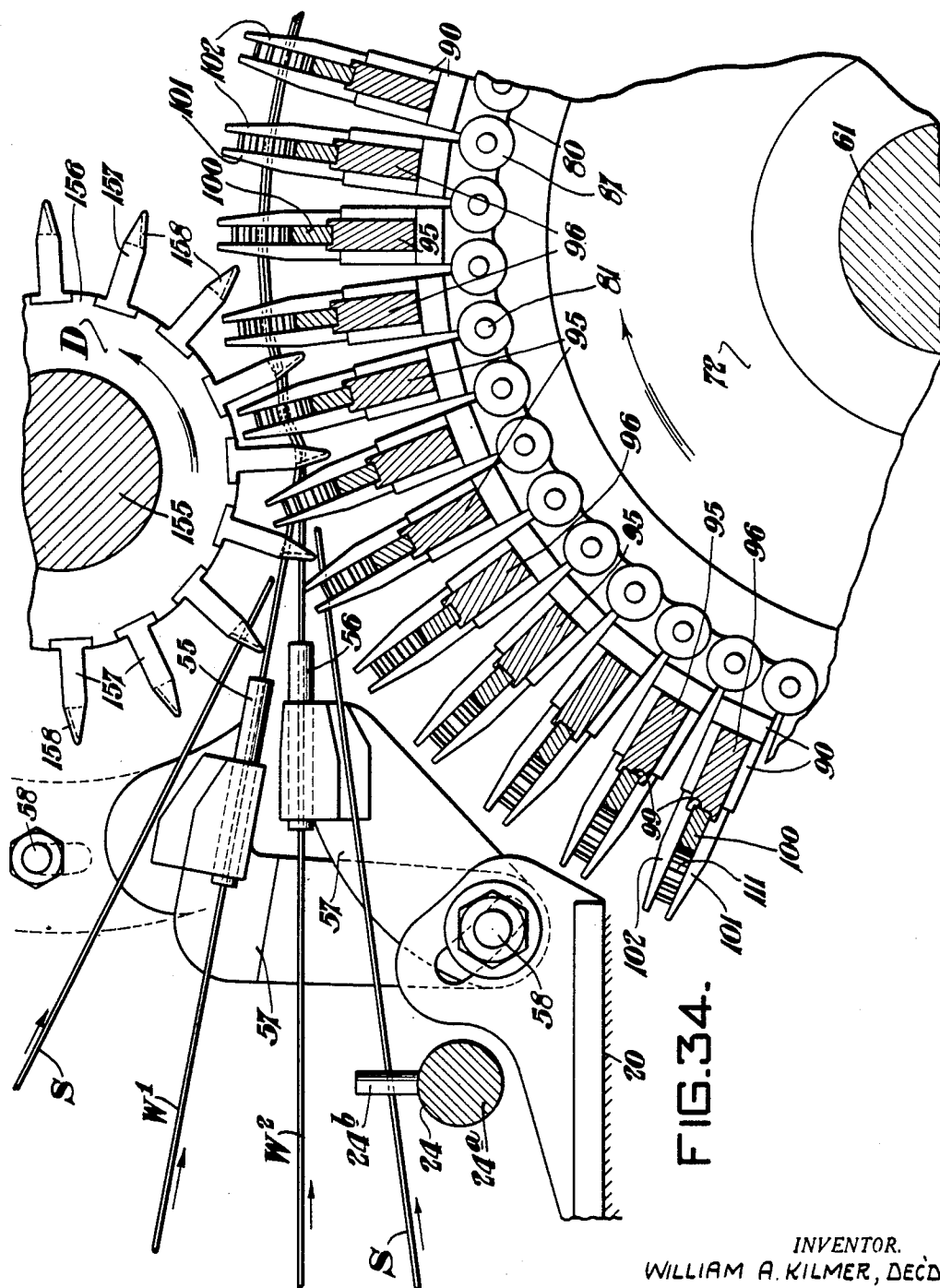
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

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31 Sheets-Sheet 16



INVENTOR.
 WILLIAM A. KILMER, DEC'D.
 BY ANGELIQUE KILMER, ADMIN.
Wesina & Rauber
 ATTORNEYS.

Jan. 30, 1940.

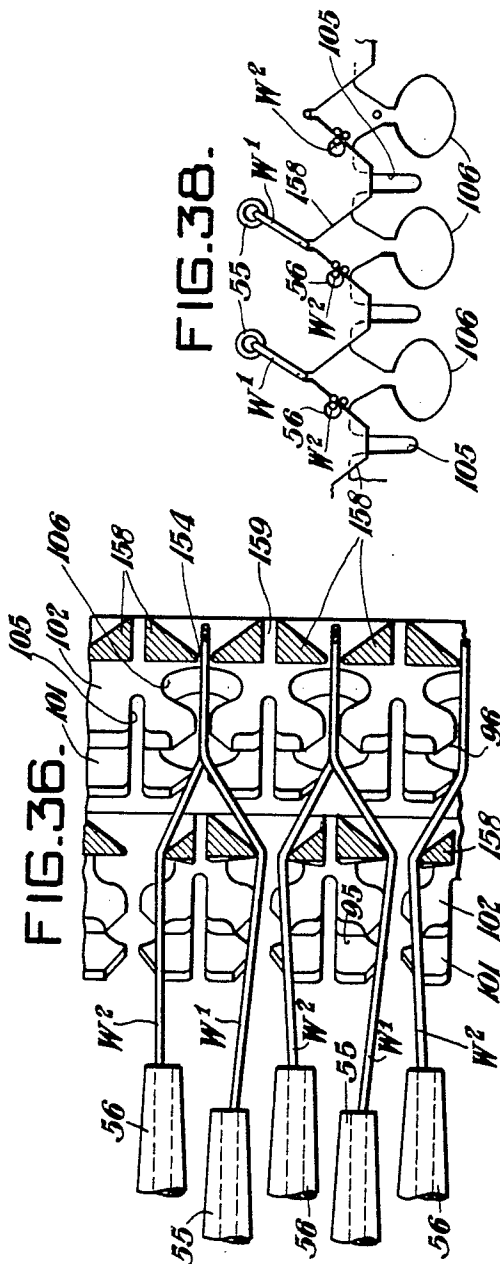
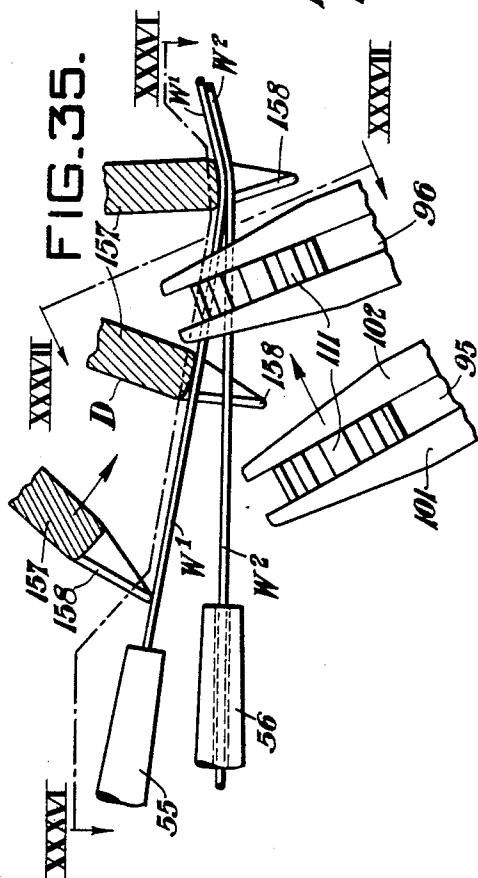
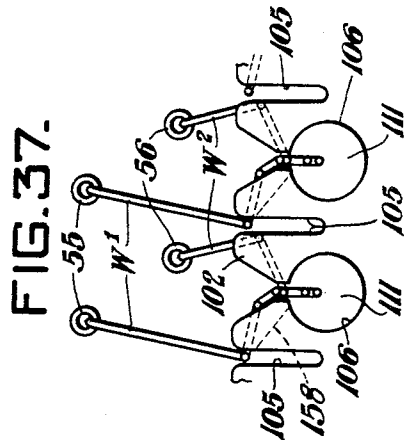
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

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31 Sheets-Sheet 17



INVENTOR.
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6

Jan. 30, 1940.

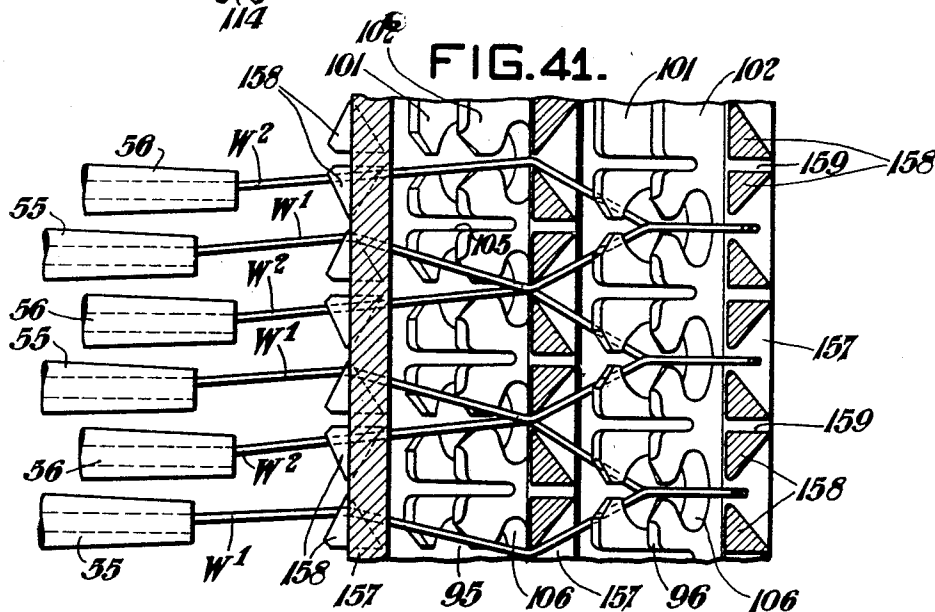
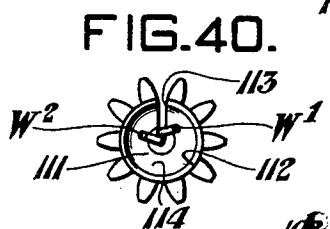
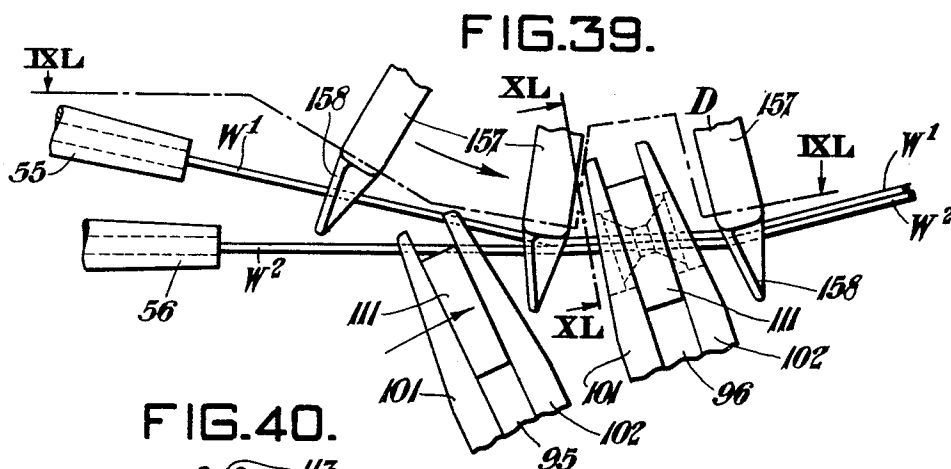
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

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31 Sheets-Sheet 18



INVENTOR.
WILLIAM A. KILMER, DEC'D.
BY ANGELIQUE KILMER, ADMIN.
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ATTORNEYS.

Jan. 30, 1940.

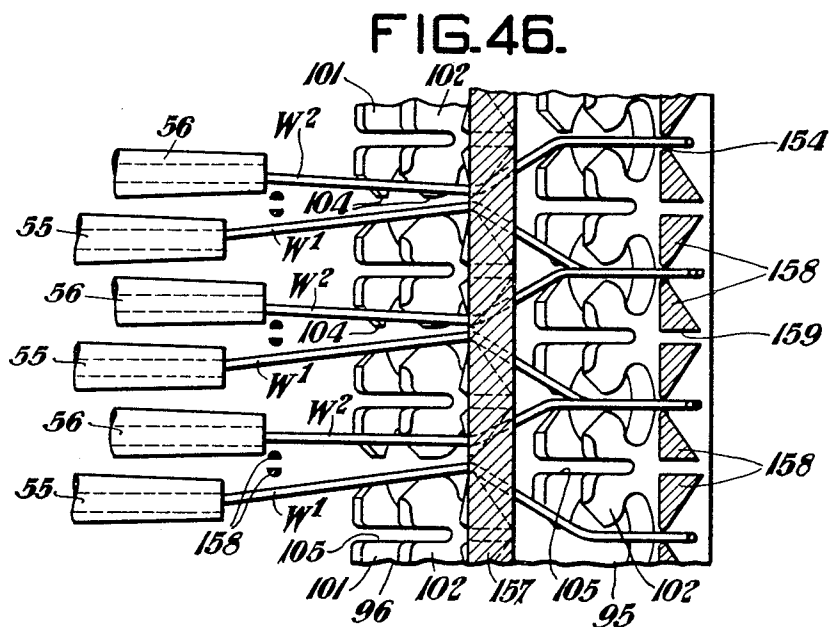
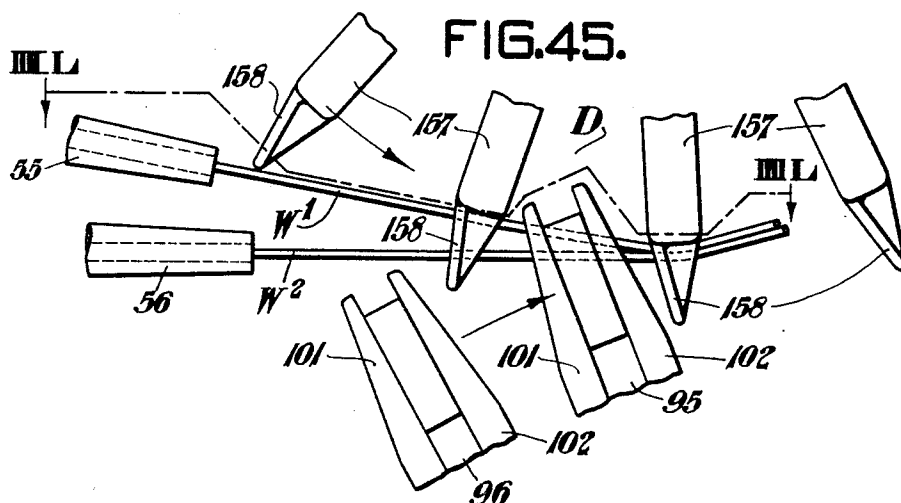
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

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31 Sheets-Sheet 20



INVENTOR.
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Jan. 30, 1940.

W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 21

FIG. 47.

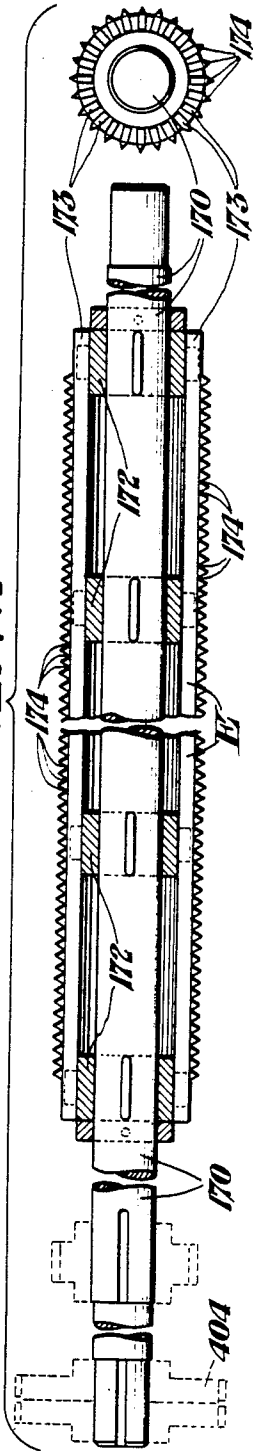
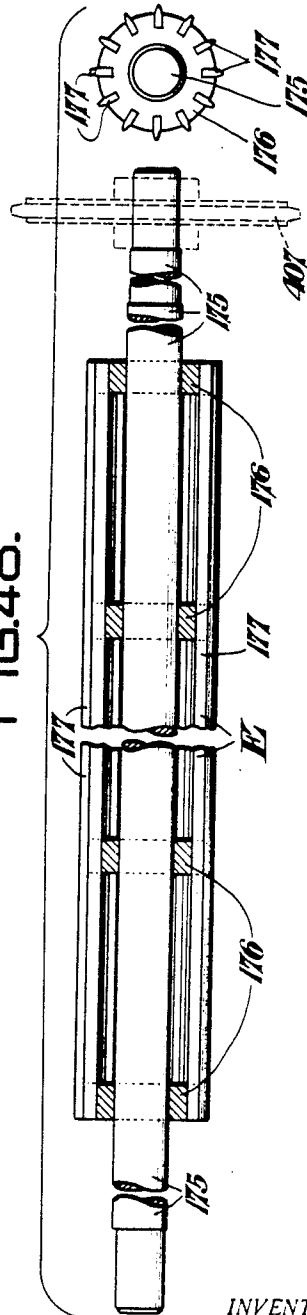


FIG. 48.



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Jan. 30, 1940.

W. A. KILMER
WIRE FABRIC MACHINE
Filed Dec. 31, 1936

2,188,358

31 Sheets-Sheet 22

FIG. 51.

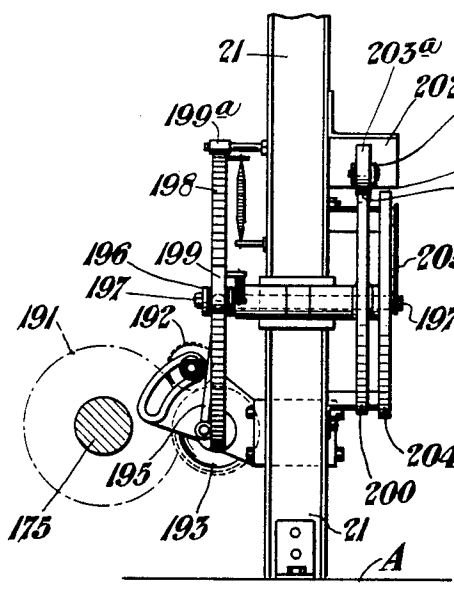


FIG. 49.

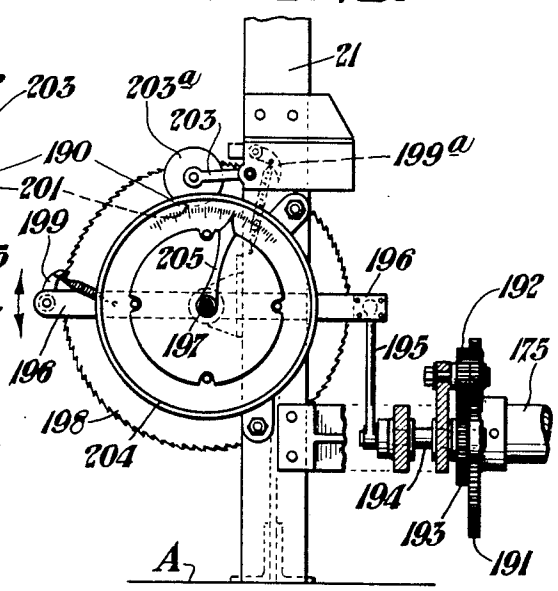
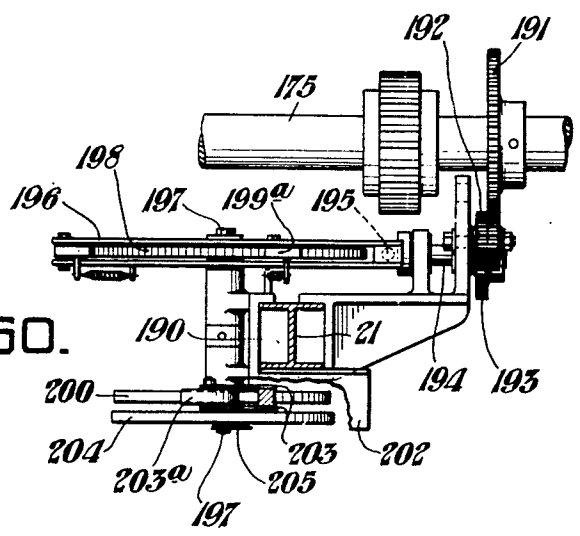


FIG. 50.



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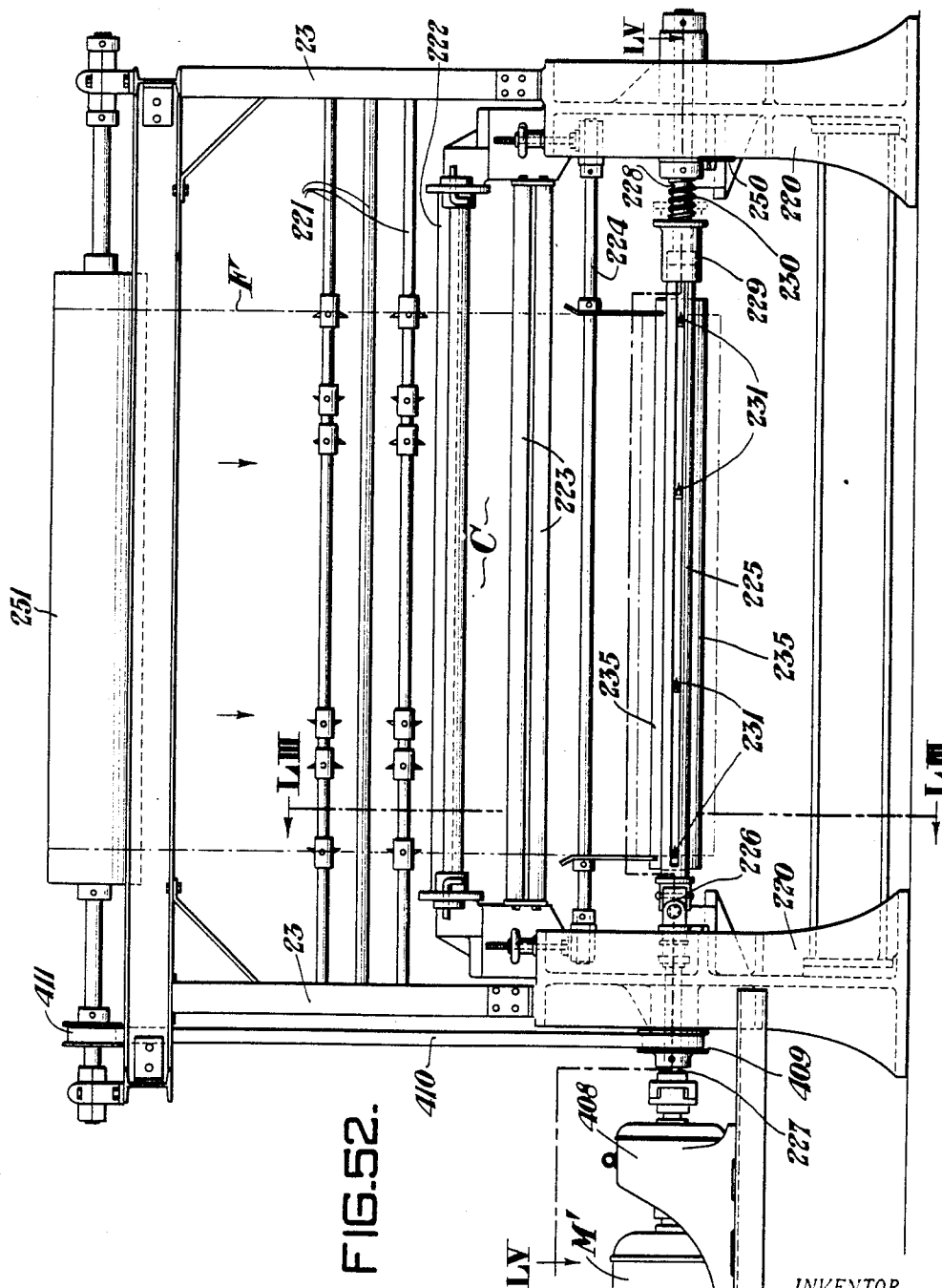
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 23



25.613

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Jan. 30, 1940.

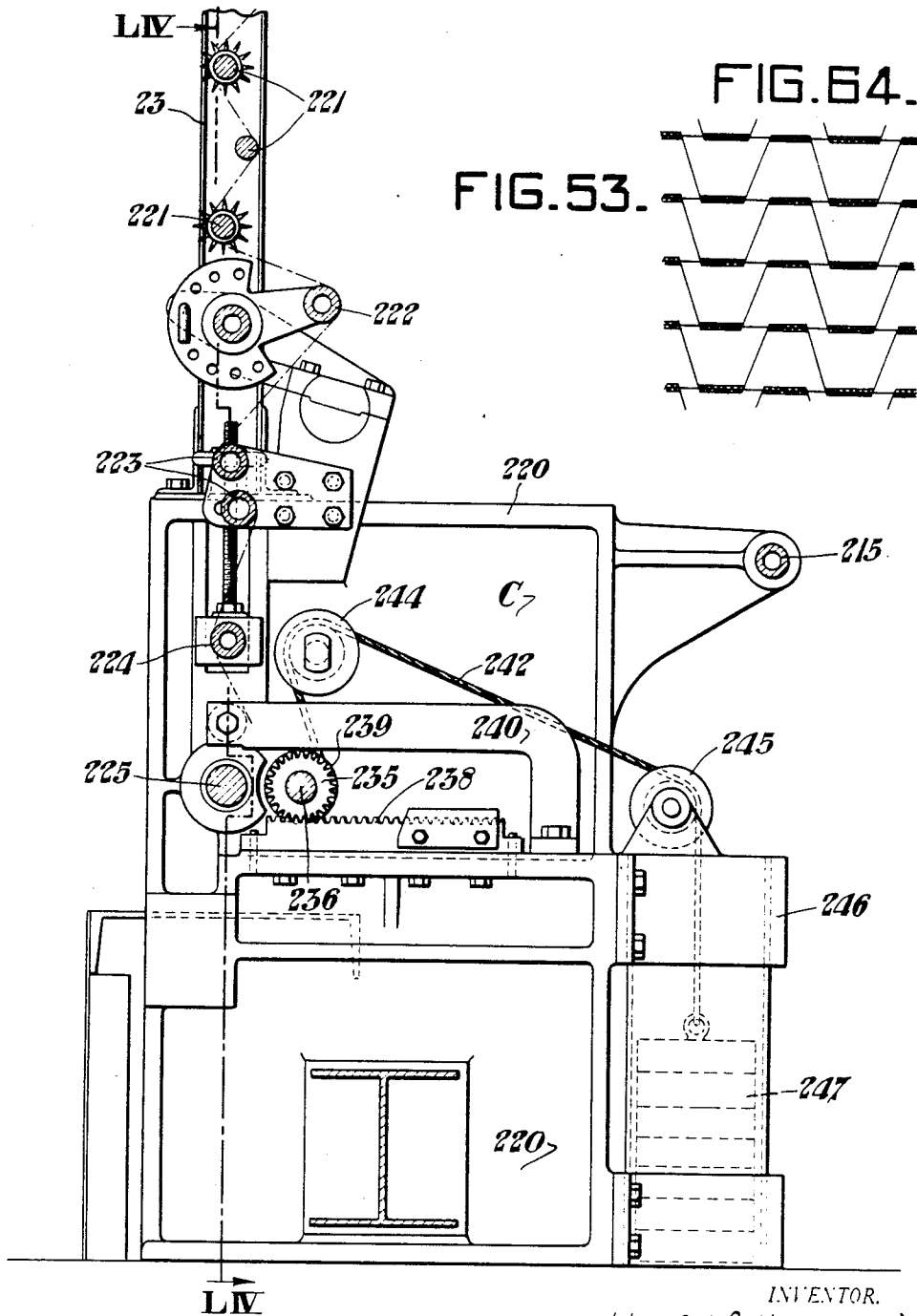
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 24



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By *W. A. Kilmer*
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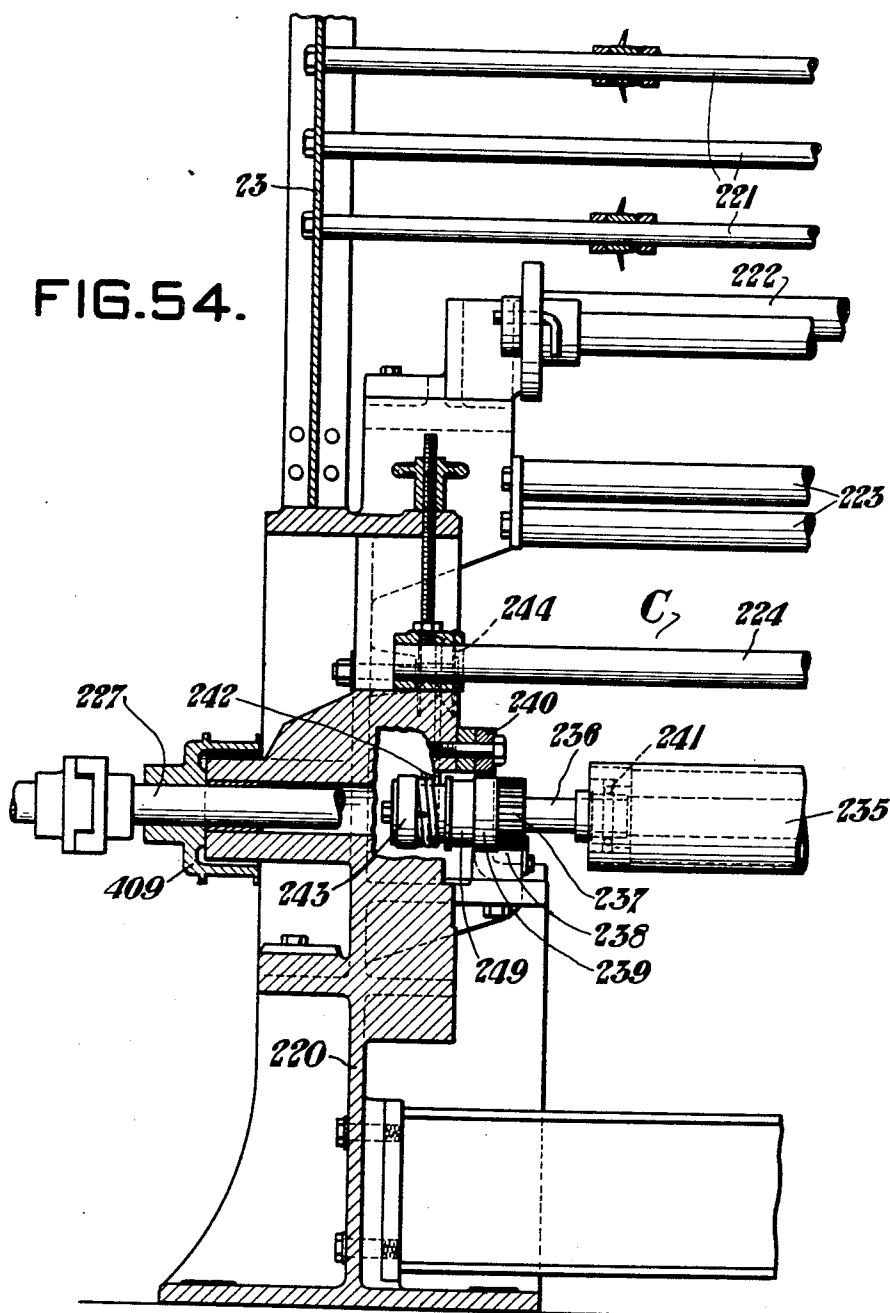
2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 25

FIG. 54.



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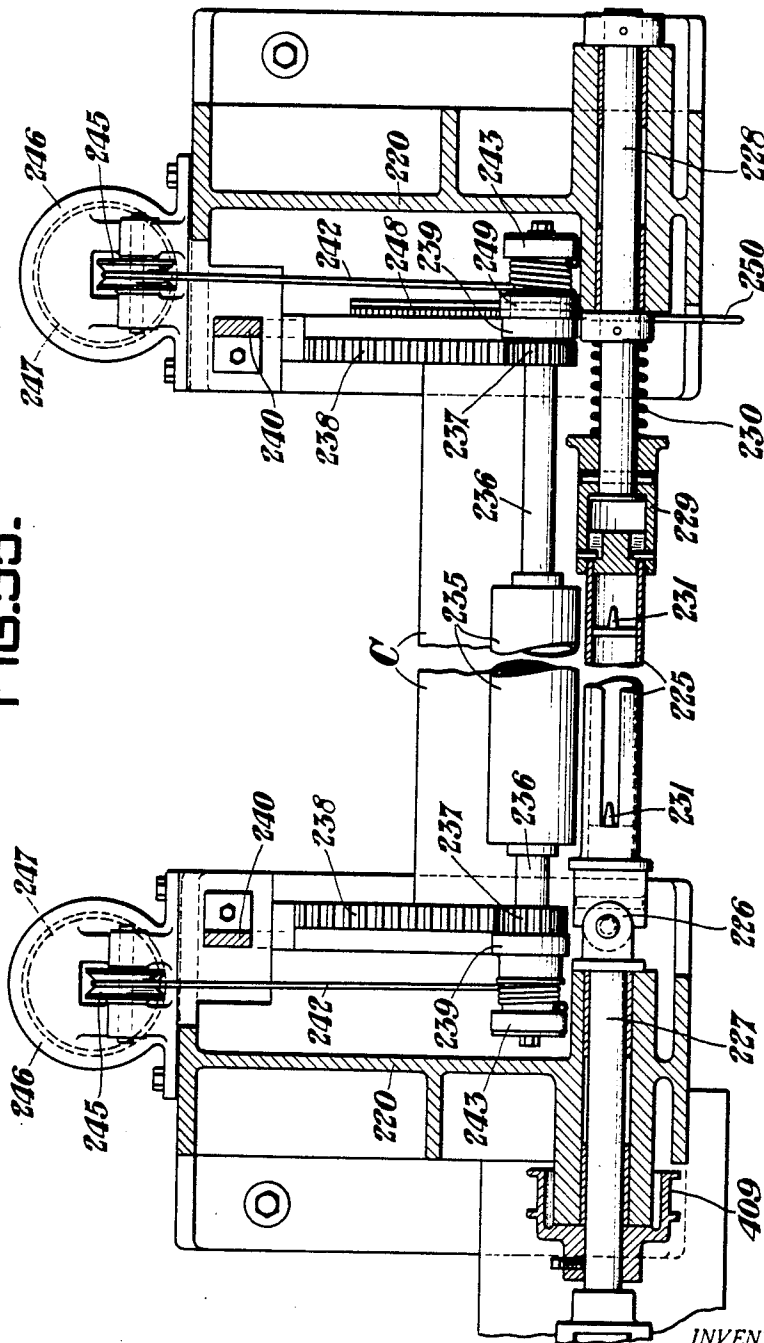
2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 26

FIG. 55.



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2,188,358

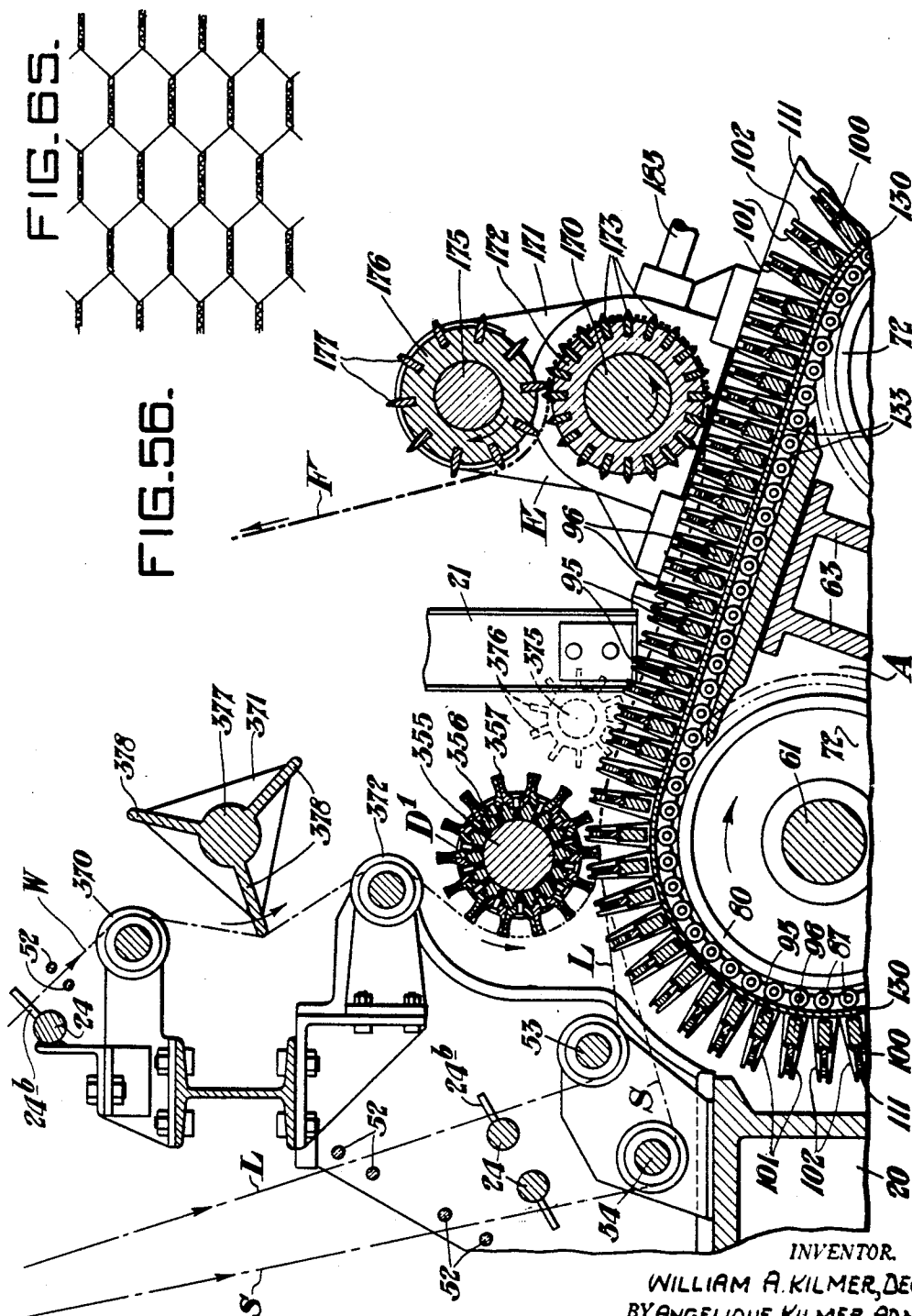
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Filed Dec. 31, 1936

31 Sheets-Sheet 27

FIG. 65.

FIG. 56.



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2,188,358

WIRE FABRIC MACHINE

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31 Sheets-Sheet 28

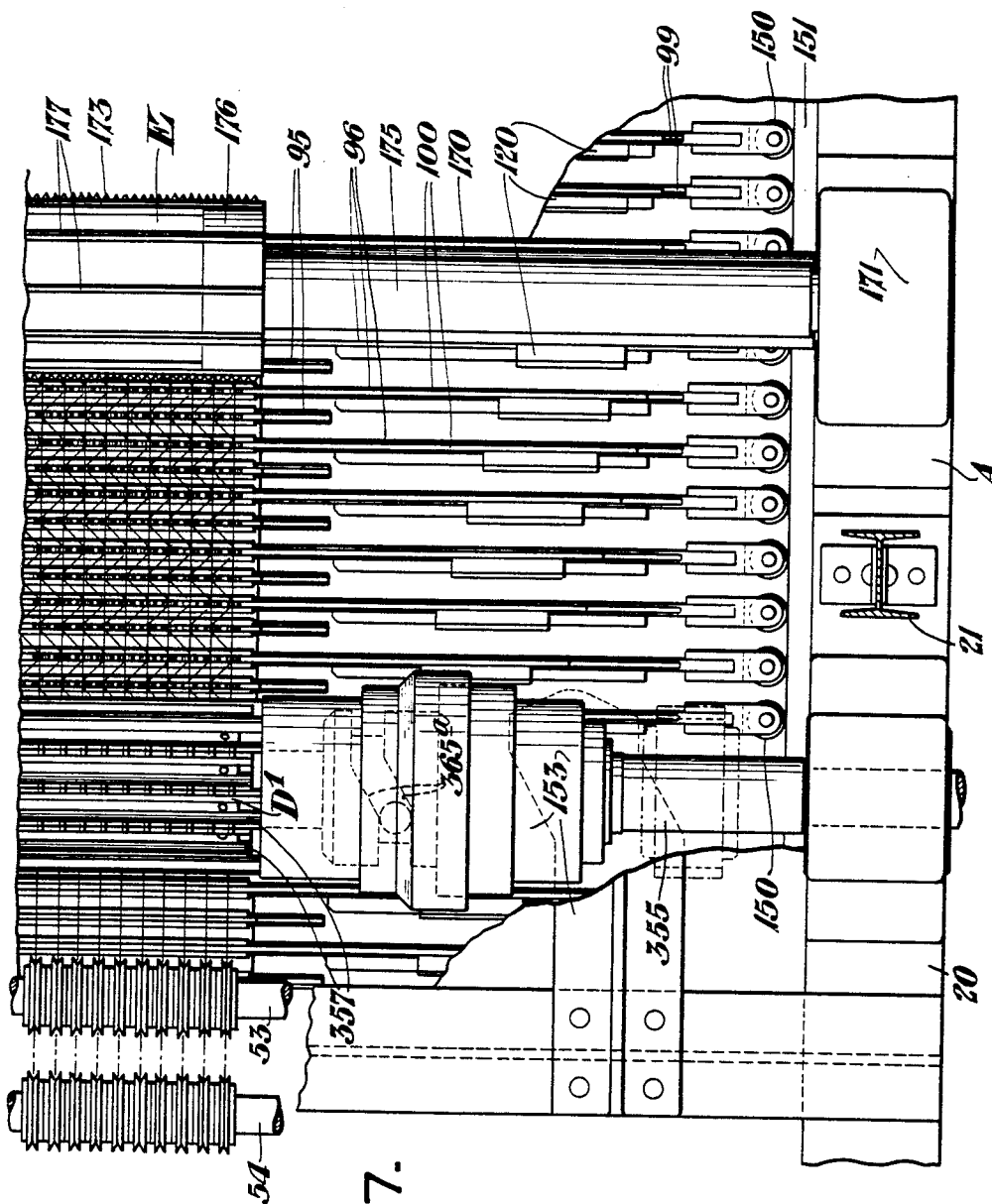


FIG. 57.

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6

Jan. 30, 1940.

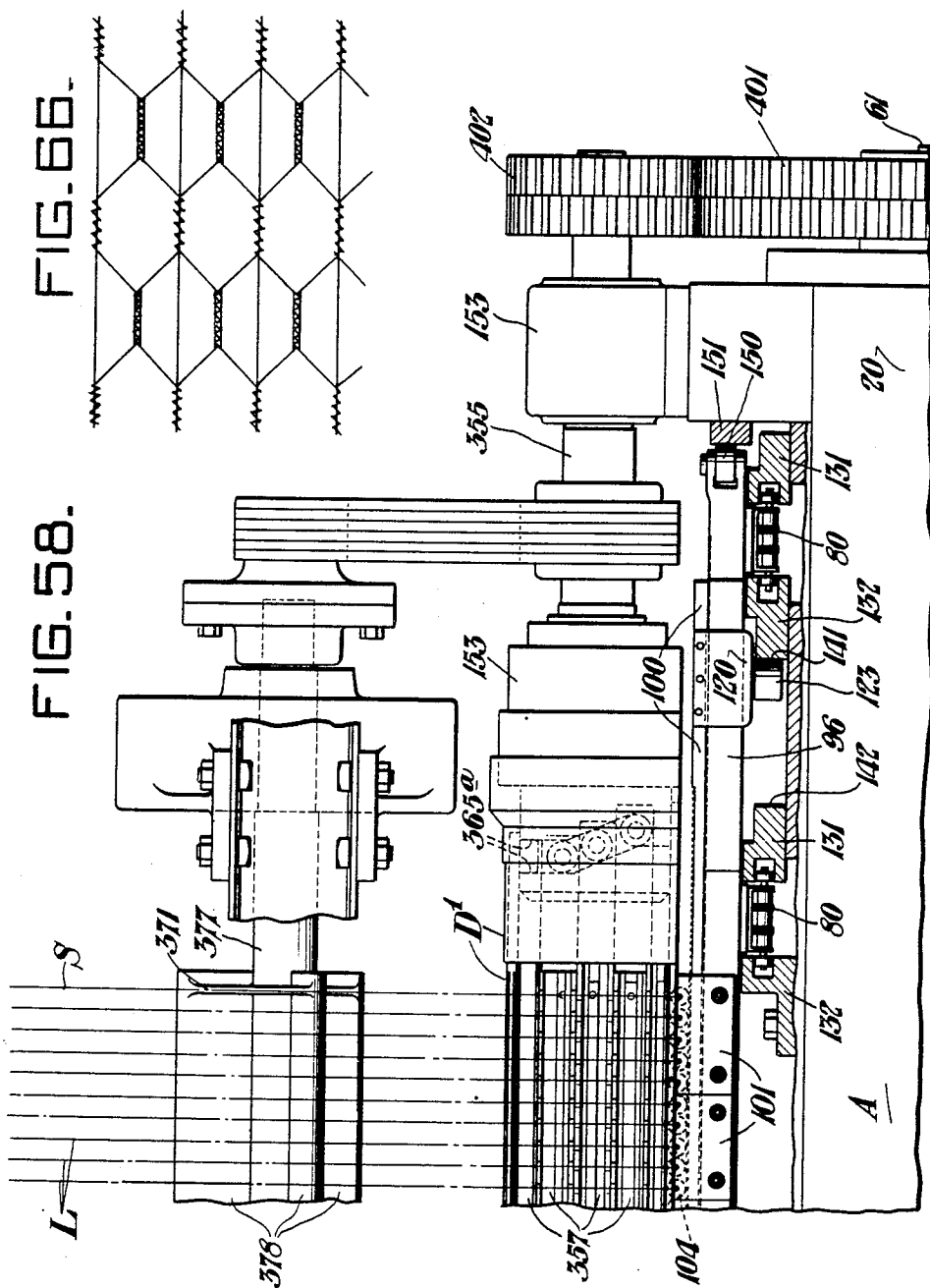
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 29



INVENTOR.
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By: *Wisma & Raube*
ATTORNEYS.

Jan. 30, 1940.

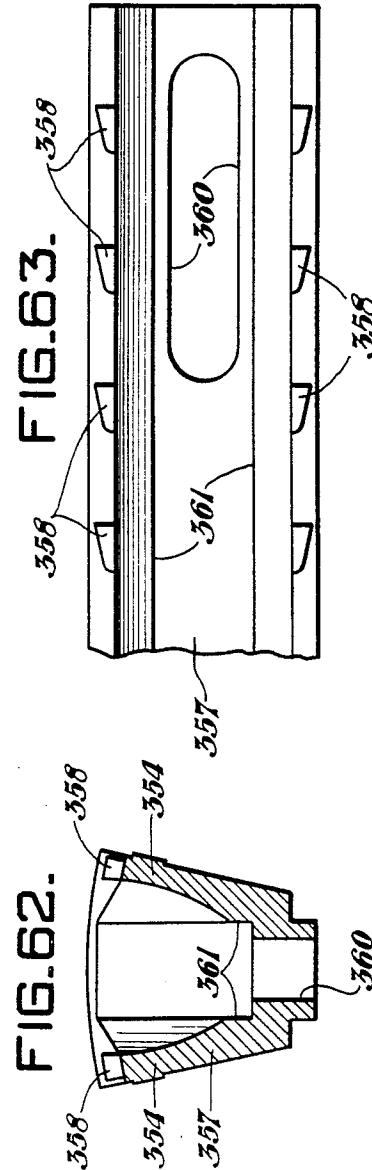
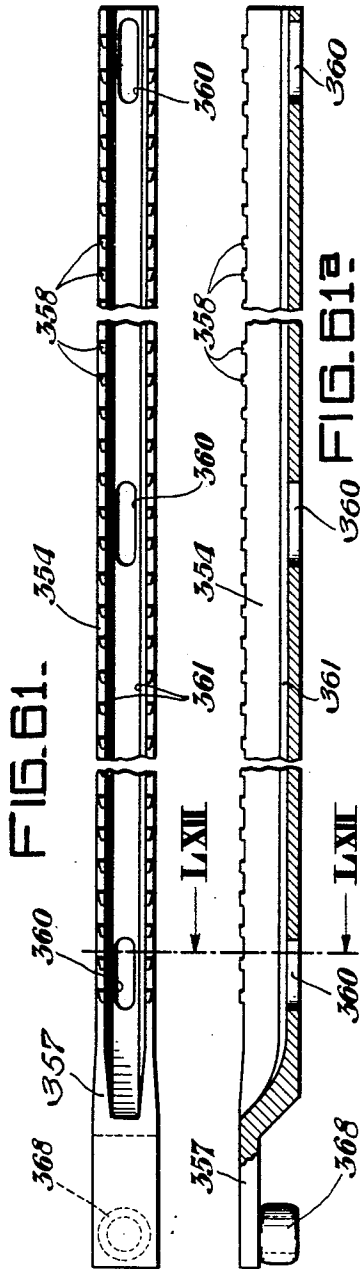
W. A. KILMER

2,188,358

WIRE FABRIC MACHINE

Filed Dec. 31, 1936

31 Sheets-Sheet 31



INVENTOR.
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 ATTORNEYS.

UNITED STATES PATENT OFFICE

2,188,358

WIRE FABRIC MACHINE

William A. Kilmer, deceased, late of De Kalb, Ill.,
by Angelique Kilmer, administratrix, De Kalb,
Ill.

Application December 31, 1936, Serial No. 118,686

71 Claims. (Cl. 140—6)

This invention relates to wire fabric machines, and, more particularly, to machines adapted to manufacture wire fence fabrics; such as, those commonly characterized as "hexagon mesh", "straight-line", poultry, and other, nettings.

Hitherto, machines of the character described have been designed to produce but one fabric of any general type. For instance, a machine adapted to fabricate hexagon netting has, heretofore, been restricted to the manufacture of plain hexagon netting, including hexagon netting into the mesh of which line wires have been incorporated. Similarly, a machine designed for the production of straight-line netting (sometimes called "herring-bone" netting) has, in the past, only been capable of producing that particular netting. In no case has any of these machines, whether of the hexagon or straight-line fabric type, been of such a construction whereby, with minor alterations, it could be easily converted from one type to another, and be employed in most of its essential parts to manufacture any of the types of fabric above enumerated.

These machines of the prior art, in addition to being limited in the variety of fabrics capable of being produced by any one of them, have all been of heavy, cumbersome construction, of inefficient design, and, in general, have presented such problems in operation as excessive wire breakage, undue wear of parts, slow production, and high power consumption, as to make their operation costly and undesirable.

The machine of the present invention is of the same general construction as those usually employed in the industry to manufacture netting of the class described. It includes a plurality of rows of twister heads mounted in transverse alignment upon a conveyor belt in relatively close, parallel relation. Mesh wires are directed to each of the twister heads through suitable guides so as to effect a predetermined order of distribution and association with each other. The portions of two or more wires sharing the same twister head are twisted together to form the netting. The netting is thereafter removed from the twister heads and bundled for shipment. However, the present invention differs specifically from the prior art machines and practices in employing highly refined and novel means for accomplishing the same end, and in certain new and useful devices supplementary thereto, which go to make up a superior machine that is capable of producing a better fabric, either of the hexagon or straight-line type.

The primary object of the present invention is the provision of a machine of highly refined construction and design which will rapidly and efficiently produce either hexagon netting or straight-line netting of great uniformity and symmetry of design, and which may be readily adapted to make either by the substitution of but one of its machine elements for another.

It is another object of the present invention to provide a machine having means for distributing and associating mesh wires preparatory to twisting, whereby each wire will always assume a predetermined position in the finished fabric, so that each will invariably assume the same relative position to the other wires.

It is still another object, and corollary to that next above, to provide a machine for making fabrics of the class described that will feed and twist the wires so as to provide absolutely uniform twists, thereby insuring that the mesh wires will be joined by the same number of twists at each joint, thus guaranteeing uniformity of fabric.

A further object is the provision of a novel twisting mechanism by which the twister heads are operated in a predetermined manner to assume certain positions relative to each other whereby surplus wire is obtained to form the twist.

Still a further object is the provision of a machine of the class described that may be operated continuously by splicing additional supply wires to the ends of those being consumed by it, and which can accommodate such splices without injury thereto, or without having its continuous operation interrupted.

It is still a further object of the present invention to provide a twister conveyor of improved anti-friction construction having novel means for mounting the twister heads so as to insure maximum ease of operation and rigidity of construction.

A further object is the provision of novel means for removing the completed fabric from the twisting mechanism which will function to treat the fabric in one of a selective number of ways to impart thereto any desired set as will be brought out hereinafter.

A further object is the provision of means for rapidly taking the mesh wires directly from the supply coils, such means including a novel supply reel construction, novel guiding and tensioning means for association with such reels, and guide means, all co-operating to supply wires to the

machine at high speed smoothly, continuously, and without snarling and kinking.

A further object is the provision of a novel fabric reeling or bundling mechanism adapted to exert upon the fabric any desired amount of tension, and, further, which is adapted to straighten, roll, and flatten the fabric in an improved manner.

A further object is the provision of novel devices and arrangement of parts in the machine which permit the fabric to be reeled and the bundles thereof removed without stopping the operation of the machine.

Other objects include providing a novel counting or measuring device for stopping the machine after a predetermined amount of fabric has been produced; improved broken wire stops which function to stop the machine upon the failure of one or more wires entering or passing therethrough, and, in general, an improved construction, arrangement, and novel association of parts, including guides, adjustments, special drives, mountings, and many other details and refinements which will be fully discussed and explained hereinafter.

The novel features considered characteristic of the present invention are set forth with particularity in the appended claims. The invention itself, however, as to details of construction and mode of operation, together with all objects and advantages thereof, may best be understood by reference to the annexed specification when considered in conjunction with the accompanying drawings, in which:

Figures 1 and 1a are a side elevational view of a machine completely embodying a preferred form of the present invention.

Figure 2 is a sectional plan view taken along line II—II of Figure 1.

Figure 3 is an end elevational view of the wire approach end (front) of the machine shown in Figure 1.

Figure 4 is a diagrammatic plan view of one form of layout for the multiplicity of wire supply reels required to feed the machine.

Figures 5, 6 and 7 illustrate in various views the details of construction of a supply reel employed as indicated in Figure 4.

Figures 8 and 9 are elevational and plan views, respectively, of a preferred form of wire guide and tension device such as are employed individually with each reel; Figure 10 is a schematic elevational view illustrating the relationships of the devices of Figures 4-9, inclusive, when assembled in operative positions.

Figure 11 is a longitudinal sectional view taken along line XI—XI of Figure 2.

Figure 12 is a fragmentary transverse sectional view taken along line XII—XII of Figure 11.

Figure 13 is a plan view of the construction shown in Figure 12.

Figure 14 is a schematic and fragmentary side elevational view of the twister mechanism assembly, per se, and Figure 15 is a correspondingly schematic section thereof taken along line XV—XV of Figure 14.

Figures 16, 17 and 18, are fragmentary end, plan, and side elevational views, respectively, of a twister mechanism conveyor chain.

Figures 19 and 19a are views showing a twister mechanism support bar in top plan and side-elevation, respectively; while Figure 20 is an enlarged transverse sectional view thereof taken at XX—XX, Figure 19a.

Figures 21 and 21a are views showing the plan

and side elevation, respectively, of one of the twister pinion rack bars.

Figure 22 is a composite view showing in side elevation two adjacent twister mechanism assemblies, and their positional relationship to each other.

Figure 23 is a view showing a twister side plate element in front elevation, and Figure 23a is a sectional view taken on line XXIII—XXIII of Figure 23. Figure 24 corresponds to Figure 23, but is an enlarged, fragmentary elevational view thereof. Figure 25 is a sectional view taken along line XXV—XXV, Figure 24.

Figures 26, 26a and 26b are views showing a twister pinion in front elevation, plan, and in vertical section, respectively; the last being taken along line XXVI—XXVI, Figure 26a.

Figure 27 is a side elevational view of a chain roller trackway and rack reciprocating element.

Figure 28 is a composite view showing in a schematic, planar projection the ellipsoidal right- and left-hand rack reciprocating cams and associated chain roller trackways, of which Figure 27 is a partial elevation.

Figure 29 is a longitudinal, mid-sectional view of a hexagon mesh distributor, and Figure 30 is a fragmentary sectional view thereof taken along line XXX—XXX, Figure 29.

Figures 31-33, inclusive, are detailed views showing elements and arrangement of the distributor.

Figure 34 is an enlarged, fragmentary, schematic elevational view of the distributor, twisting mechanisms, and wire guides showing the coaction therebetween to form the wires into mesh positions.

Figures 35 to 46, inclusive, are further schematic illustrations of progressive steps in the distribution of wires to the twisting mechanism to form the fabric—the sectional views being taken along lines in the elevational sketches marked with the Roman numerals corresponding to their figure numbers in Arabic, and are given in the order of their progression.

Figures 47 and 48 are diagrammatic, longitudinal, sectional views of a driven pull-out roll, and an idler roll, respectively.

Figure 49 is a front elevational view of the fabric measurer and automatic machine stop mechanism, and Figures 50 and 51 are plan and side elevational views thereof, respectively.

Figure 52 is a rear-end view of the entire machine, which constitutes, more particularly, a front elevation of the bundling machine, per se.

Figure 53 is a partial sectional view taken along line LIII—LIII, Figure 52.

Figure 54 is a sectional view taken along line LIV—LIV of Figure 53.

Figure 55 is a sectional plan view taken along line LV—LV, Figure 52.

Figure 56 is a fragmentary, longitudinal mid-sectional view of a straight-line netting machine, while Figures 57 and 58 are plan and front elevational views thereof, respectively.

Figure 59 is a longitudinal mid-sectional view of the straight-line mesh wire distributor.

Figure 60 is a half-sectional view taken along line LX—LX of Figure 59.

Figures 61 and 61a are sectional elevation and plan views respectively, of one distributor bar, and Figures 62 and 63 are views of an enlarged section taken at LXII—LXII, Figure 61a, and an enlarged fragmentary plan thereof, respectively.

Figures 64, 65 and 66 are fragmentary plan views of straight-line, hexagon, and hexagon-line,

wire nettings, which may be produced by the machine of this invention.

Referring now more specifically to the drawings in which like reference characters refer to like parts throughout:

In the more general views of Figures 1, 2 and 3, the actual fabric forming devices are shown at A: the fabric bundling apparatus is shown at C, and the fabric collecting receptacle, or well, is indicated by the letter B, and is suitably disposed between the fabric forming and bundling devices, A and C, respectively.

The fabric forming devices are mounted in and carried by a housing 20, and associated structural members 21 and 22. The members 22 extend to the opposite ends of the machine, and, adjacent the bundling apparatus C, are secured to uprights 23, constituting a part thereof. Guides 24 and tension rolls 25 are mounted from cross-members 22a, which extend between the members 22 at their ends remote from the bundling apparatus, and direct the wires W coming from the supply reels to the machine. The supply reels and associated devices, about to be described, for feeding wires to the machine, may be employed to great advantage, since their use eliminates the need for pre-spooled wire, as is usually employed, and thus eliminates lengthy spooling operations costly in both time and money.

The wires W which go into the construction of the finished fabric are fed to the machine from a plurality of reels 30 arranged upon a floor as is shown in Figure 4; each reel preferably being of a construction similar to that shown in Figures 5, 6 and 7. Any desired grouping of reels may be adopted, but the arrangement outlined in Figure 4 has been used to advantage to serve upwards of 150 wires to machines of this type.

Each supply reel is of the basket type, and is constructed in accordance with the improved design shown in Figures 5, 6 and 7.

Each reel is preferably composed of a base 31, consisting of a metallic plate, having a basket 32 thereon made up of a plurality of rods or pipes 33. These rods extend to the vertical, and are arranged in evenly spaced relationship in a circle concentrically upon the base. The lower extremities of the rods 33 are secured to the base in any desired manner to afford strength and rigidity. The upper extremities thereof are formed over and inwardly, as at 34, to lie substantially within a common horizontal plane. Each of these portions 34 is of an equal length, which is sufficient to cause them to come into abutment concentrically about the vertical axis of the assembly, and to cant said rods inwardly toward each other, so that the basket 32 is of a generally tapered construction. A castellated, or radially perforate annulus 35 is placed at the extremities of the formed-over portions 34 of the rods to secure them together. A hollow, cast metal cap 36 is provided in the form of an inverted, truncated cone, having a flat top portion 37 adapted to rest upon the horizontal portions 34 of the rods 33. The top 37 overhangs the extreme diameter of the basket by a considerable margin, and has tapering sides 38, which, at their bottom, are provided with inwardly and downwardly deflected fingers 38a. These fingers extend inwardly of the basket 32, beyond its innermost diameter, between the basket rods 33 and adjacent to an inner annular member 39 that is disposed in a horizontal plane inside the basket and secured to each of the rods 33 to stiffen the structure. Pivotally journaled centrally atop the

cap 37 is a rotary arm 40, which extends radially thereof to a point beyond its extreme diameter. A flared wire bearing 41 is positioned adjacent to the extremity of the arm; the axis of its bore being disposed in the vertical. When a coil of wire is to be put into place on the reel, the cap 36 is removed by lifting upwardly. Thereafter, it is replaced and the end of the wire is threaded through the bearing 41 at the end of arm 40. Since the wire is delivered to a guide mounted above the central vertical axis of the reel (as will be explained hereinafter), it causes the arm to rotate or follow around the cap. This keeps the wire free running as the wire is paid out. Sloping sides 38, and fingers 38a on the cap are safeguards against the wire fouling in the cap or basket where the two join together.

The wires are lead upwardly through a guide and tension device, which has been developed for use with this type of reel, which is broadly composed of a frame 45 swiveled upon a vertical axis 46, from a stationary mounting 47. A plurality of tension sheaves 48 are journaled in the frame 45 upon horizontal axes 49 arranged in staggered, parallel relationship. A guide 50, having a vertical opening disposed in line with the vertical axis of one of the reels 30, is disposed at the bottom side of frame 45, adjacent to its swivel mounting, to direct a wire W, coming upwardly from a reel, to the tensioning sheaves. After passing thereabout the wire W is guided, along with the gang of wires, through common guides; such as, guides 24 carried by the structural member 22a, and on through tensioning rolls 25, mentioned hereinbefore, and thence down to the machine.

The guides 24 are of any suitable construction, but usually consist of a horizontal bar 24a having a plurality of evenly spaced, parallel pins 24b arranged in a straight line therealong and extending outwardly to an equal degree (see Figure 3). The pins 24b are spaced sufficiently to permit of a wire of any of the usual sizes employed in making wire fabrics of the class in question to pass freely therebetween.

Closely adjacent to this guide 24, between it and the tension rolls 25, and mounted upon the same brackets, is a broken wire motor stop 51, comprising a pair of horizontally disposed, parallel bars of metal 51a and 51b, placed so that all of the wires W being fed to the machine pass therebetween without touching except in case of a wire-break. These bars are energized electrically, and if contacted so as to cause a short-circuit therebetween, a circuit breaker (not shown) is instantly actuated to stop the machine motors. In this manner, broken wires are instantly detected and the danger of their being drawn into the machine unnoticed is obviated.

The tensioning device 25 is composed of three banks of uniformly sized sheaves, rotatably mounted upon shafts 25a in axial alignment. The central sheave unit is mounted for movement upward and downward in a vertical plane, whereby it may be set to decrease or increase the tension on the wires passing over the adjacent sheave units, and beneath itself, by adjusting the set screws 25b.

From the tension device 25, the wires W are lead downwardly in longitudinally diverging transverse planes, as illustrated in Figure 1, through another series of broken wire motor stops 52, to a series of guides 53 and 54. (See Figure 11.) The guides 53 and 54, likewise, are comprised of banks of sheaves mounted in alignment upon horizontal

axes, and are disposed, relative to each other, in stair-step fashion; i. e., one of the two sheave units 54 is higher and nearer the machine proper than are the other sheave units; the other unit 54 being at the lowest and most remote point from the machine proper. The two intermediate units 53 lie with their longitudinal axes within a plane defined by the positions of the longitudinal axes of the units 54, and all of the units are spaced equidistantly and are parallel to each other.

The guides 54 are for the accommodation of the selvage wires S, while the guides 53 direct the mesh wires in two groups, alternate mesh wires W₁ going to the uppermost of the guides 53, and the remaining mesh wires W₂ going to the lower of the guides 53. Thence, all wires are directed in converging transverse planes toward the twisting mechanism. The selvage wires S are led in directly to the twisters (the lower selvage wires being guided by another of the guides 24 of the bar pin type); but the two sets of mesh wires W₁ and W₂, issuing from their respective upper and lower guides 53, are passed through individual pipe guides 55 and 56, which are disposed in two transverse, parallel rows arranged one above the other, and which point directly at a common line extending horizontally across the twisting mechanism. There is a pipe guide for each mesh wire, and to insure that accurate alignment of these guides is had, they are adjustable in both horizontal and vertical directions in planes longitudinal of the machine by moving the mountings 57, and by loosening before, and tightening after, adjustment, the nuts and bolts 58.

The twisting mechanism and associated structures, referred to hereinbefore in a general way, and designated in Figures 1, 2 and 3 generally by A, will now be described in detail, with particular reference being had to Figures 11, 12, 13, 14, and 15 in the drawings.

Twister mechanism assembly

The fabric forming devices are mounted in a housing 20, which is comprised of a base portion 26 upon which are mounted side portions 27. The side portions have two shaft bearings 28 and 29, respectively, which accommodate sprocket shafts 60 and 61. The bearings in each of the sides are disposed relative to those in the opposite side to mount the shafts 60 and 61 in horizontal, parallel positions transversely of the machine; the shaft 60 being mounted lower in the housing than shaft 61.

An intermediate structural member, 63, similar to a double-web H beam, is disposed centrally of the shafts to extend between the sides 27 for strengthening the assembly, and to afford bearing for other machine elements as will be described hereinafter. The rearmost shaft 60, and its associated bearings 29 are movable toward and away from the beam member 63, but so that the axis of shaft 60 does not deviate from an inclined plane in which it, and the axis of shaft 61 lie, for reasons to appear hereinafter.

Splined concentrically in spaced relation upon each of the shafts 60 and 61 for rotation therewith are six collars or discs 70, each having its flat faces disposed normal to the axis of its respective shaft, and in vertical planes longitudinally of the machine, so that each disc on one shaft aligns with a disc on the other shaft. Each disc 70 is provided with a plurality of threaded lugs or bolts 71 which are adapted to engage a plurality of sprocket wheels 72, and to secure them for rotation with the shafts. Each

of the sprockets 72 is provided with a plurality of concentrically arcuate slots 73 for registration with the disc lugs or bolts 71, and through which the latter pass. Nuts and washers are screwed upon the lugs or bolts 71 to firmly secure the sprockets 72 upon the discs 70. The central shaft opening in each sprocket is of a size and shape as will afford no driving engagement between the sprockets and shafts independently of the discs 70, the lugs 71, and slots 73, since these latter are the only means by which the sprockets are secured for rotation with the shafts. This mode of attachment is positive and permanent, except when an adjustment becomes necessary, whereupon the nuts on the lugs of bolts 71 may be loosened, and the sprockets (any one or all of them) may be moved independently of their respective shafts to any desired position within the limits of the arcuate slots 73. This adjustment feature between each of the sprockets and the shafts is of extreme importance for reasons to appear hereinafter.

Six flexible, endless chains 80 of special construction are tautly suspended about each pair of longitudinally aligned sprockets, so as to extend parallel to each other for rotation about the axes of the shafts 60 and 61. By reference to Figures 16, 17 and 18, the novel and refined construction of these chains may be readily understood.

The chains are each comprised of a plurality of transverse, parallel link shafts 81 that function to connect the chain link units 82, which links are disposed in overlapping relationship to each other so as to place in axial alignment shaft perforations 83. The links 82 are threaded upon the various shafts 81, and are spaced relative to each other along each shaft by three small cylinders 84, which are concentrically bored to turn freely upon the shafts 81. These cylinders 84, are the elements of the chain which actually engage the teeth 74 of the sprocket wheels 72, and are instrumental in minimizing the friction between the driving and the driven elements. Certain of the links 82 are made with an integral outwardly extending ear or flange 85 upon one edge of their center portions, which flanges are bent 90° to overlie the chain assembly, and which are provided with perforations 86.

The assembly of links 82 and cylinders 84 upon each of the shafts 81 is retained in place by anti-friction rollers 87, which are journaled for rotation adjacent each end of each of the shafts 81, and are themselves retained upon the shafts by cotter pins 88 disposed through small transverse perforations in the shafts adjacent their extremities. These rollers 87 are provided with ball or roller bearings to minimize the modulus of friction between them and the shafts during relative rotary movement therebetween. The chain assembly is supported by the rollers 87 when positioned for operation, and may be moved easily by virtue of the anti-friction bearings, as will be fully described hereinafter. The chains are set up tautly between the longitudinal pairs of sprockets 72 by adjusting the shaft 60, and its associated sprockets, away from the stationarily journaled shaft 61, which adjustment is permitted by the movable bearings 29, wherein the shaft 60 is journaled.

The outwardly extending chain link flanges 85, which are bent over to form horizontal portions overlying the chain assembly, are arranged in transverse, co-planar alignment, and are formed in a direction so as to dispose each of

them in its entirety wholly within the margins of the chain proper defined by the inner end faces of the rollers 87. Thus, it is necessary to form the flanges carried by links adjacent to the left side of the chain assembly 90° to the right; those carried by links adjacent to the right side of the chain assembly, 90° to the left, and those intermediate the two former, 90° in the direction in which they may be better accommodated relative to spacing, clearances, etc. When positioned in this manner, the perforations 86 in each of the flanges 85 fall in parallel lines normal to the longitudinal axes of the chains 80.

Superposed upon each transverse row of the flanges 85 of each chain is a clevis 90 having a sizable extension 91 of its base portion integrally projecting from one of its ends. The bases of the clevises, including the extensions 91, are provided with a plurality of perforations 92, which, when the clevises are properly positioned, register with the perforations 86 in the transverse rows of flanges 85. Rivets are passed through these aligned perforations and are upset to firmly secure each clevis to its underlying set of flanges 85. Every other clevis thus carried by the chain assemblies, is faced to dispose its base extension 91 in a direction opposite to that of its neighbors, so as to provide a staggered arrangement of the clevises proper in longitudinal succession along the chains. This staggered order is carried out on the clevis arrangement of the four intermediate chains for reasons to be discussed later on, but, as will also appear, the outside chains do not have the clevises mounted thereon in this manner, since on the outside chains, alternate link flanges 85 and clevises 90 are absent altogether. Therefore, the remaining clevises are all disposed in the same direction. As this description proceeds, it will be noted that all clevises among the several chains, which fall upon any given transverse line (normal to the longitudinal axis of the machine and of each chain assembly), will follow a symmetrical arrangement so as to permit of a space conserving, interfitting relationship with adjacent devices of the same character. Each clevis is provided with bolt receiving openings 93, which extend through each of the arms thereof in horizontal alignment, parallel to the major axis of the chain assemblies.

Positioned to extend substantially across the entire machine in lines normal to the longitudinal axis thereof is a plurality of relatively flat, narrow bars 95 and 96 (see Figures 11, 12, 13, 19 and 20), rectangular in cross-section, and having substantially straight edges and flat surfaces. The bars 95 are mounted in alternate rows of the transversely aligned clevises 90, across the several chains, and extend from the extreme left hand side of the machine to a point adjacent to the chain next before the extreme right hand chain. Each bar 96 is mounted between each of the bars 95 by the remaining transversely aligned clevises, and extends from the extreme right hand side of the machine toward the left in an opposite manner corresponding to that in which the bars 95 are mounted. The bars 95 and 96 are provided with inverted L-shaped slots 97, which extend from their inner edges and register with the openings 93 in their respective sets of clevises when the bars are set edgewise between the arms thereof, which arms are spaced to receive them snugly. Bolts 98, having threaded shanks to accommodate nuts 98a, are positioned through the clevis openings and bar slots, 93 and 97, respectively, and nuts 98a are tightened

thereon to rigidly secure each bar to the clevises, and, consequently, to all chains across which it lies. The L slots 97, and the bolts 98, form what is commonly called a "gun barrel lock", which permits the bars to be removed without necessitating the withdrawal of the bolts from the clevises.

By referring to Figure 13, which shows a fragmentary plan view of this assembly, it will become apparent why the clevises are constructed and arranged to provide the staggered order longitudinally of the machine, described hereinbefore. The bolts and nuts, 98 and 98a, lie within the spaces between adjacent bars afforded by the staggered arrangement of clevises, whereby the bolt or a nut of one assembly lies within the plane of one of the clevis arms of the adjacent assembly, thus affording a highly compact, interfitting assembly of simple, rigid construction; while, at the same time, affording ready access to the nuts and bolts for adjustment purposes.

The advantage and necessity of providing for the circumferential adjustment of each of the sprocket wheels 72 upon the shafts 60 and 61 here becomes apparent. In order to insure that each transverse row of clevises is in a line normal to the longitudinal axis of the machine so as to carry the bars 95 and 96 normal thereto, and parallel to the shafts 60 and 61, the slip connection between the drive discs 70 and the sprocket wheels 72, through lugs or bolts 71, and arcuate slots 73, is provided. Thus, each longitudinal pair of sprocket wheels may be turned within the limits of the arcuate slots 73 until all chains are in such positions as to align the clevises transversely of the machines, as described above. In this manner, the bars 95 and 96 are maintained perfectly straight, parallel and equidistant throughout their lengths.

The outermost edge of each of the bars 95 and 96 is channeled to form a groove 99 of uniform width and depth throughout its length. Disposed for reciprocation in each of these grooves is a rack bar 100, which extends across the major part of the intermediate portion of each bar 95 and 96. (Refer to Figures 19, 20, 21 and 22, inclusive.)

Two composite side plates 101 and 102 of identical construction are secured to each vertical side of each of the bars 95 and 96. These side plates are composed of a plurality of sections, divided as at 103, which sections are aligned with each other on opposite sides of each bar. The innermost (bottom edge) portions 103a of these plates terminate adjacent to the inner (bottom) edge of the bars, but the outermost portions thereof project a substantial distance beyond the outer (upper) edges of the bars 95 and 96, and of the rack bars 100. The outermost edges of the side plates are serrated uniformly to provide a symmetrical arrangement of slots and apertures; there being two types of slots, 104 and 105, alternately positioned with respect to each other, and two different sets of apertures, 106 and 107, arranged in an alternate, staggered order in each plate. Each slot 104 and 105 extends vertically to the outer edge of the side plates, and is, therefore, open at its outermost end. The edges defining the outer limits of all of the slots are beveled and flared outwardly, though the slots 104 are flared to a greater degree than are the slots 105. The inner ends of each of the slots 104 terminate in circular apertures 106, so that the longitudinal axes of the slots, which are disposed in the ver-

tical, extend radially through the centers of the apertures.

The transverse sectional view of the side plates 101, illustrated in Figure 25, shows that the inner faces thereof are offset by shoulders 108, which permit the plates to overlie the narrow, marginal, edge portions of the bars 95 and 96 adjacent to the edges of the grooves 99, so as to dispose portions of the inner faces of the plates in proximity to the rack bars 100. Apertures 107 are arranged between and below the circular openings 106 in each plate, and are all arranged adjacent to the base of the teeth on their respective rack bar, to provide for the elimination of dirt particles, shavings, etc., that tend to collect between the side plates. The plates are secured upon each side of the bars 95 and 96, so as to align coaxially opposed openings 106, by means of nuts and bolts 109, which are disposed through aligned holes 109a in the plates and bars. The plate holes are counter-bored, as at 110, to accommodate the bolt heads and nuts of bolts 109.

Journalled for rotation in oppositely aligned openings 106 between the side plates 101 is a series of slotted pinions 111, having extended gudgeons 112 that bear in the side plate openings 106. A slot 113 is provided radially of each pinion from its center to its periphery, where it exists between adjacent pinion teeth so as not to disturb the peripheral continuity thereof. The slots 113 are flared outwardly to the vertical, and the gudgeons 112 adjacent to the slots are flared outwardly in the horizontal in conformity with the bevelled and flared serrations in the side plates to provide smooth, regular wire ingress and egress passages.

The pinion gudgeons 112 are hollowed out, as at 114, to reduce the breadth of the wire bearings, and to lighten the construction. Two vertical ribs 115, which flare away from each other adjacent to the ends in an outward direction, are formed in the side walls of each pinion slot, and are joined just below the axis of rotation of each pinion by a curved portion 116 to constitute a U shaped wire bearing. These U shaped bearings are narrower than the breadth of the pinion slots proper, and may be offset to one side of a median plane passing through the pinions to which the axes of rotation are perpendicular, for reasons appearing hereinafter. The spacing between the vertical ribs 115 of the U shaped bearings is but slightly greater than the diameter of the mesh wires that go into the fabrication of the netting. The obvious reason for this construction is to confine two or more wires, which are to be twisted together, in superposed relation so that they may be twisted about each other without slipping in the slots. However, the portions of the pinion slots that lie between the tapered extremities of the ribs 115 of the U shaped bearings and the outer peripheries of the gudgeons 112 are large enough to accommodate two diameters of wire so that the spliced portions of joined wires may be received within them without projecting outside of the limits of the side plate openings 106 in which the gudgeons 112 are journalled. It is evident that should any portions of the wires extend without the limits of the openings 106, upon rotation of the pinions, such portions would be instantly sheared between the side plate and pinion slots.

The pinions 111 are all engaged by their respective rack bars 100 for rotation thereby when the racks are reciprocated, and normally lie, before rotation, with their slots 113 in registra-

tion with the side plate slots 104. It should be noted that the pinion slots 113 and their cooperating side plate slots 104, as among adjacent assemblies, are not in longitudinal alignment; all those carried by the bars 95 (alternate bars) aligning with slots 105 of the assemblies carried by the bars 96, and vice versa.

The racks 100 are reciprocated through cross-heads 120, which are fastened to the racks by taper-headed, countersunk screws 121 and nuts 122. The cross-heads straddle the support bars 95 and 96 so as to slide relatively thereto, and also straddle a stiffening block or plate 94, which is secured to each support bar adjacent to the cross-head end; viz., the left-hand end of bars 95 and the right-hand end of bars 96. The cross-heads are closed beneath the support bars to provide a bearing for rollers 123, which are secured for rotation about vertical axes, and which serve to impart motion to the cross-heads to reciprocate the racks upon being actuated over cam surfaces fixed to the housing.

The chain assemblies 80, intermediate their respective sprocket wheels, are supported by complementary pairs of trackways 130 into which the side rollers 87 of the chains are directed by the sprockets. Each of the pairs of trackways 130 is composed of left and right-hand elements 131 and 132, respectively. Each of these elements, though actually composed of a plurality of sections, when assembled, constitutes a large elliptical member that is of open, ring-like form, which is disposed closely adjacent to one side of longitudinal pairs of sprockets to extend therebetween both above and below, and around, them at the ends. Each pair of sprockets rotates between a right and left hand trackway element. All but the outermost elements of the outside trackways, which are rigidly secured directly to the side portions 27 of the housing 20, are immovably mounted relative to the sprocket shaft 61 by the central girder or structural member 63. All are mounted so as to be disposed in vertical planes parallel to each other and to the planes of rotation of the sprocket wheels.

Each of the pairs of trackways 130 is constructed with inwardly facing grooves 133 across its upper extent, which are machined into the inner vertical faces of the upper extremities of the elements 131 and 132 to afford confined rollerways in which the chain rollers 87 may track. The grooves 133 in each of the pairs of trackways 130 are disposed relative to their respective sprocket wheels 72, carried by shaft 61, to intercept the rollers 87 at a point 134 adjacent to the vertical radii of the sprockets so as to tend to lift the chain assemblies clear thereof, and to direct them through an arcuate path of greater magnitude and of more gradual curvature, than that of the sprockets. This, in effect, serves to move the chains and their associated mechanisms through an arcuate path, as between points P—P₁, Figures 11, 27 and 28 for a greater distance than would be possible were they to follow a path straight across between the sprocket wheels. A path such as the latter would lie within a plane tangent to the tops of the dedendum circles of the longitudinal pairs of sprocket wheels mounted on shafts 60 and 61. The extreme importance of this particular arrangement will be more fully appreciated hereinafter when the description, relative to the spacing of adjacent sets of twisting mechanisms during the operation of the machine for a preferred distribution and association of wires, is given.

From points P¹ the roller grooves 133 are directed straightaway to a take-off slope 135 adjacent to the sprocket wheels of shaft 60, where the chain assemblies are picked up by those sprockets and directed around to the lower portions 136 of the trackways 130 upon which they roll back to the forward sprockets of shaft 61. Power is applied through the shaft 60, which is the main drive shaft for the entire fabric-forming part of the machine, by a suitable motor M, and the chains are caused to pass around and between the longitudinal pairs of sprockets, as will be more fully described hereinafter. The chain assemblies are afforded sufficient clearance, as at 137, between the sprockets 72 of shaft 60, and the outermost portions of trackways 130 extending thereabout, to permit of the shaft 60 and associated sprockets being set back to tauten the chains in a manner and for purposes as have been already explained herein. Such an adjustment will not disturb the relative positioning of the chain assemblies and the twister mechanisms passing about the sprockets of shaft 61 and through the trackway grooves 133 adjacent thereto.

The cams for reciprocating the rack bars 100, through cross-heads 120 and rollers 123, are disposed intermediately of each of the two pairs of the outermost chain assemblies, and are constituted of the facing inner edges 140 and 141 of adjacent chain trackway elements 132 and 131, respectively, which are specially shaped to form cam slots disposed entirely about the mechanism in ellipsoidal surfaces co-extensive with the paths of the chain assemblies. These cam slots are formed and disposed relative to each other so as to correspond identically throughout their extents, except that the cam contour of each is arranged in an opposite or converse order to that of the other. Thus, the cam slot at the left side of the machine reciprocates the rack bars carried by the support bars 95, and the cam slot at the right side of the machine reciprocates the rack bars carried by the support bars 96, whereby the twister gears 111 of adjacent assemblies, at any given position about the mechanism, are rotated to the same extent at the same rate but in opposite directions, as will be explained when the operation of the machine is discussed.

The support bars 95 and 96, at their ends adjacent to their respective rackactuating cam slots, are provided with ball-bearinged rollers 150, which are journaled for rotation about vertical axes so as to dispose surfaces of the rollers beyond the extreme end portions of the bars. These rollers 150 are brought to bear upon elliptical bearing blocks 151 at each side of the machine, and roll thereupon throughout their course about and between the sprocket wheels 72. This arrangement is provided to afford endwise bearing for each of the support bars 95 and 96, whereby the end thrusts exerted by the bars, due to the reciprocation of the racks and rotation of the twister pinions, are transmitted to the housing sides 27. The anti-frictional mountings of the rollers 150 insure ease of movement between the moving and stationary elements of the thrust bearings, while affording a strong and effective support for the bars. As will be inferred from the above, support bars 95 have these thrust bearings to the left side of the machine; support bars 96 have these bearings to the right side thereof, and each of their respective elliptical bearing blocks 151 are rigidly affixed to the opposite side portions 27 of the housing 20.

Having thus described the construction, ar-

rangement and assembly of the twister mechanism in detail, and having partially touched on its operation, the wire distributing devices, and the manner of their operation will now be described.

Distributing device, wire association and fabric forming for hexagon netting

The wire distributing mechanism D for forming hexagon fabric, either with or without line wires, is comprised of a cylindrical spider having a drive shaft 155 mounted for rotation above the twister mechanism adjacent to the wire approach end thereof by stationary bearings 153, which dispose the shaft parallel to sprocket shafts 60 and 61. Secured for rotation therewith, and extending substantially across the twister mechanism, is a sleeve member 156 (see Figures 29 and 30) having longitudinal grooves extending therein in equidistant spaced relation about its surface parallel to the shaft 155 and to each other. A plurality of bar members 157 is arranged in the grooves, one bar to each groove, being secured therein by screws extending from the inner surface of the sleeve 156. These bar members 157 are rigidly held to the sleeve, and radiate therefrom symmetrically in a manner so as to space their outer extremities to correspond to, and register with, the spacing of the adjacent rows of twister mechanisms, carried by the support bars 95 and 96.

The outer extremities of each of the distributor bars 157 are provided with a multiplicity of trilateral, pyramidal teeth 158 of equal size and shape, and which are arranged in close proximity to each other, as at 154, at their base line. The advance faces of these teeth, which are the sloping faces disposed at an obtuse angle to each other and at an equal angularity to the major axis of each of the distributor bars, and which converge in the direction of rotation of the distributor roll (counter-clockwise rotation when viewed from the right hand side of the machine, as in Figure 11), are somewhat similar to a plowshare from which this type of distributor takes its name. Each of the teeth 158 is slotted, as at 159, from its apex to its base line transversely of the bars 157, and perpendicularly to the major axes thereof. All exposed corners are beveled and highly polished so as to preclude disfigurement of the wires. The arrangement of the teeth among the several bars 157 is such as to place them in staggered order circumferentially of the distributor roll, whereby the slots 159 on any one bar are aligned circumferentially with the low points 158, between the teeth, of adjacent distributor bars. The purpose of this arrangement will become apparent shortly.

As was described in the forepart of this specification, the mesh wires W₁ and W₂ are fed to the twisting mechanism by the rows of pipe guides 55 and 56. These guides are secured with the axes of the individual pipes thereof in upper and lower converging planes, and are staggered relative to each other in the vertical. In each individual case, these guides are set so that the axis of anyone of the upper guides 55, if projected to the twister mechanism as an imaginary line, will fall on one side of a twister slot, while that of an adjacent lower guide 56, will fall on the other side of the same twister slot, and each will fall midway between that slot and the twister slots on each side thereof, respectively. The mesh wires W₁ are passed through the upper guides 55, while the mesh wires W₂ are passed through the lower guides 56.

The distributor bars "cog" with the twister mechanism, adjacent to the convergence of the two banks of mesh wires W_1 and W_2 , so that the base lines of the teeth of adjacent bars 157 fall in a plane that is slightly below the bottoms of the twister pinion slots, when straddling a row of twisters. The distributor bars that precede the twister mechanisms, in the order of operation, carried by support bars 95, in this relationship, have their low points 154 in alignment with the twister slots thereof, while those succeeding the assemblies of support bars 95, have points 154 aligned with the twister slots of the assemblies 96. The slots 159 of the distributor teeth are, therefore, aligned with preceding twister slots, and are also aligned with slots 105, which are intermediate the twister slots 104 in the twister side plates, of the twister assembly that succeeds them in rotation. This order of succession is invariably maintained throughout the operation of the machine.

Referring now more specifically to Figures 34 to 46 inclusive of the drawings, the distribution of wires to form hexagon netting is as follows:

The distributor rotates as the twisting mechanism moves, as described above, and the distributor teeth first engage the upper bank of wires W_1 to cause each of the wires thereof to shift (in this case) to the left, before the side plate slots 104, have been rotated into engagement therewith. This deflection positions wires W_1 at the base line of the teeth, where they are within the lateral limits of the flared slots 104 in the twister gear side plates, though above the same. By a cam action exerted by the deflecting surfaces of the teeth of the distributor, and by the flare of the slots 104, the wires W_1 are directed into the twister pinion slots. However, as the upper wires W_1 are deflected to the left, the lower wires W_2 are already in engagement with the flares of the side plate slots 104, which commence these wires in a rightward movement before the distributor contacts them, and before wires W_1 have contacted the flared slots 104. The distributor, upon further rotation, engages and completes the rightward deflection of the wires W_2 , and forcibly pushes them to the bottoms of the twister slots with the wires W_1 on top of them. Thus, all of the wires W_1 are deflected leftwardly as all of the wires W_2 are deflected rightwardly, and when adjacent wires W_1 and W_2 approach and attain substantial vertical alignment they are confined within a twister slot, with the wires W_2 , having been introduced from the lower position, always assuming the position at the bottom of the twister slot. Since these slots are less wide than twice the diameter of the wire, the wires are held in this relationship. In plan view, it will be observed that the wires W_1 are laid into the twister mechanism in a zig-zag order, as they pass between the twister slots of the assemblies carried by support bars 95 and 96. It will further be observed that these wires W_1 , which are always on top in the twister slots, are directed to the slots of the assemblies of the bars 95 from the left, and to those of the assemblies of bars 96 from the right, while the wires W_2 are directed exactly the opposite. This predetermined distribution is always maintained to insure that each joint in the fabric is given two full twists at each side of the pinion slots, since, to form the twists, the pinions of the assemblies 95 are always rotated in a clockwise direction, by virtue of the reciprocation of their respective racks 100 by the left-hand cam slots, and those pinions of the as-

semblies 96 are caused to rotate in a counter-clockwise direction by similar actuation through the right-hand cam slots. It will be apparent that should the order of rotation be reversed, or, alternatively, should the wires W_1 be placed at the bottom in the twister slots, only one and one-half twists would result at each side thereof. Also, should this order be variable, some joints would have two one-and-one-half twists each, while others would have two two-full twists each, thus making an irregular, asymmetrical fabric. Therefore, it is highly important that the order of distribution be invariable, and the machine of this invention, as described, will never permit a variation in this regard. From the above it will be seen that the wires W_1 and W_2 are, by virtue of the staggered order of alignment at adjacent twister assemblies among the bars 95 and 96, and by the cooperating arrangement of staggered distributor teeth, deflected in each case but half the distance of the width of one mesh in the fabric, and from this deflected position in the twister slots, are shifted back again by succeeding distributor teeth and side plate slots, which are staggered to deflect and receive same, respectively. Thus, a continuous association is effected, and the hexagon mesh is shaped.

As has already been mentioned above, the base lines of adjacent sets of distributor teeth, when straddling a row of twisters, fall in a plane that passes through the twister pinions below the bottoms of the slots therein. This relationship serves to force the wires W_1 and W_2 into the extremity of the twister slots, and to prevent their accidental withdrawal until the twisters have commenced their rotative movement.

The slots 105 in the twister side plates 101 and 102, and the slots 159 in the distributor teeth are to accommodate line wires and selvage wires, whereby they may pass directly through the twister mechanism without lateral deflection. In passing intermediately of side plate slots 105, the selvage, and line wires, if any, pass through twister slots of alternate rows of twister assemblies, and are twisted with the mesh wires occupying the same twister slots, thus becoming firmly incorporated in the fabric when the twister pinions are actuated to form the same.

The distribution of the wires takes place at a point approximately adjacent to the place where the chain assemblies leave the sprocket wheels and enter the trackway grooves 133. The sprocket wheels cause the twister assemblies to flare radially outward in a fan-shaped fashion, which effects a desired spacing of the twister assemblies, relative to each other, preparatory to receiving the wires. As the distributor forces the wires into the bottoms of the twister slots and retains them there for a brief interval of rotation, the cams actuate the rack bars to partially rotate the twister pinions. This movement locks the wires within the pinion slots, as the assemblies pass on beyond the distributor mechanism.

The supporting chains are, at this point, passing over the gradually curved portions of the trackway grooves 133 which are defined by points $P-P^1$ in the drawings. The adjacent twister mechanisms are brought into an ever lessening fan-shaped order when the supporting chain rollers are traversing these portions of the grooves 133, the contours of which gradually depart from an arcuate to a straight disposition. While the chains and twister assemblies are traversing the portions $P-P^1$ of the trackway

grooves 133, the rack bars 100, through co-action of the cross-heads 120 with collateral portions of the cams 140 and 141, are being actuated to rotate the twister pinions. Thus, the wires are twisted together as the spacing between the twister mechanisms is gradually diminished, whereby the increment of take-up obtained by the twisting operation is compensated for. By this construction and operation, an adequate amount of surplus wire is provided to form the twists, and a symmetrical, properly tensioned fabric is the result.

From the schematic plan view of Figure 28, which shows the rack reciprocating cams completely in a planar projection, it will be seen that the twist is started at 160, and progresses evenly by the contour of the cams to one-half twist, one twist, one and one-half twists, and two twists, at points 161, 162, 163 and 164 respectively. The positions of the racks 100 at cam points 164 are actually such as will rotate the pinions a fraction of a revolution in excess of two revolutions to overcome the normal resiliency of the twisted wires. Thus, the slight reactionary untwisting of the wires will be, when spent, such as to leave two full twists in the wires, which is permitted by a slight "untwisting" return movement of the pinions, to alleviate any torsional stress in the twister slots, such as would impair stripping the fabric therefrom. Hence from the slightly "over-turned" position at 164, the cams return the racks to points 165, at which position each pinion slot is in accurate alignment with its associated side plate slots, and the twisted wire portions lie inertly within them, whereby the twisted fabric can be removed without difficulty. During the removal of the fabric the twisters are maintained in this position, until at points 166 on the cams, the racks are started on a return movement to their original positions preparatory to twisting once more. When cam points 167 are reached, the twister pinion slots will be approximately aligned with their side plate slots to receive another charge of wires. The final aligning is accomplished at cam points 168, which is effected with great accuracy, and the twisters are again in position to repeat the cycle already explained, as at 160.

It has been mentioned that the U shaped wire bearings in the pinion slots may be offset to one side of the median plane passing through the pinions normal to the axes of rotation thereof, to which median plane the plane of the bearing is parallel. This arrangement may be desirable if, when the bearing is centered in the slot, the two twists formed on each side thereof are of uneven length and tightness. By shifting the bearing off-center toward the side of the longest, loosest twist, the disparity may be reconciled, and the two twists equalized.

Pull-out rolls for fabric removal

After the twister pinions have been rotated to twist the wires two full turns to form the fabric, and before a return, "untwisting" rotation is accomplished, the twister pinion slots and side plates slots are brought into alignment, as has been fully described above, to permit the fabric F to be withdrawn from the twisting mechanism. This withdrawal is accomplished by the "pull-out" rolls E, which are located above the twisters at points adjacent to where the twists are completed. The pull-out roll assembly is composed of four rolls, two of which

are driven, and the remainder of which are idler rolls.

A driven shaft 170 is journaled in bearings afforded by pillow blocks 171 at each side of the main housing. This shaft is mounted parallel to the sprocket wheel shafts, and has spiders 172 mounting bars 173 along its portions immediately overlying the twister mechanism. Each bar is tapered at its outermost edge, which edge is serrated to form V shaped notches 174 that are spaced longitudinally therealong to align with the twister slots immediately beneath them. The bars 173 are peripherally spaced about the shaft 170 to align with the tops of the rows of twister assemblies, which pass below them in close proximity so as to afford but a slight clearance therebetween.

Another roll, mounted by an idler shaft 175, is journaled for rotation directly above and parallel to the driven shaft 170 in the pillow blocks 171, and is provided with spiders 176 that mount bars 177 in uniform spaced relation thereabout. These bars 177 are perfectly plain in form, and are arranged to "cog" with certain sets of bars on the lower pull-out roll, in the order of rotation, to firmly press the fabric F against the latter. When viewed from the right hand side of the machine, the lower roll rotates counterclockwise so as to coincide with the movement of the twister mechanism assembly, while the upper roll rotates in a clockwise direction to coincide with the movement of the lower roll.

A similarly constructed and arranged pair of rolls 180 are journaled atop the longitudinal girders 22 of the main frame of the machine considerably above and forward of the pull-out rolls adjacent to the twister mechanisms. These rolls 180 are adapted to receive and direct the fabric F issuing from the lower set, and are comprised of a positively driven shaft 181 and an idler shaft 182, each having spiders, bars, notches, and a relative arrangement corresponding to the lower set, respectively.

The fabric is directed beneath and around the lowermost pull-out roll on shaft 170 for approximately 180° about its surface, and thence between it and the idler roll, whereby a general reversal in the direction of movement of the fabric is effected. The fabric F is then directed upwardly to the upper set of rolls 180, where it passes beneath and around the lower roll for approximately 180°, and between it and the topmost idler roll. The notched bars of the driven rolls of the respective upper and lower sets of pull-out rolls accommodate the twisted portions of the fabric in the bottoms of the V notches, while the bars of the idler rolls function to prevent the accidental withdrawal of the fabric therefrom.

It is desirable to be able to control the "set" of the fabric, or the lay of the mesh wires relative to each other therein, as it is finally formed. In other words, when the fabric has been formed of pre-galvanized wires, it is likely that a relatively taut, flat netting will be required. However, if the netting is formed of bare wires, and is to be galvanized after completion, it is desirable to have a less taut, less flat fabric, or one which is commonly spoken of in the trade as a "fluffy" fabric. By providing a simple adjustment (explained hereinafter) between the upper and lower sets of pull-out rolls, to vary the tension on the fabric as it passes therebetween, a fabric having any desired characteristics in this regard can be produced, ranging gradually from

maximum fluffiness (no tension) to an optimum of tautness and flatness (practicable maximum of tension).

In order to insure that the lower set of pull-out rolls E is properly spaced from the location at which the wires are completely twisted, where the resulting fabric is released from the twister pinions, it is mounted by movable pillow blocks 171. By loosening the fastenings that secure the pillow blocks 171 to the stationary main housing, and by resetting the nuts 187, the screw-threaded studs 185, each of which engages a pillow block at one of its ends, are made to move endwise in stationary bearings 186. The pillow blocks are correspondingly moved to any desired position, and are made fast by again tightening the fastenings by which they are anchored to the housing.

From the upper set of pull-out rolls 180 the fabric F is directed rearwardly adjacent to the upper frames 22 of the machine by means of horizontal, transverse pipe guides 189, which are borne by the upper frames to guide the fabric to a position overlying the collecting well B. Here the fabric F falls by gravity into the well B, where more or less of it may be allowed to accumulate pending the operation of the bundling mechanism C.

Fabric measurer and automatic machine stop

Provision is made to automatically keep track of the amount of fabric produced, and to automatically stop the machine after any predetermined amount thereof has been formed and sent to the bundling machine. This is effected by a fabric measuring and machine stopping mechanism 190, which is mounted at one side of the machine on one of the frame uprights 21, closely adjacent to one end of the lower pull-out idler roll shaft 175.

Secured for rotation with the idler shaft 175 is a spur gear 191, which meshes with an idler gear 192 to drive the same. An eccentric shaft 194 is rotated by the idler gear 192 through a third gear 193 fastened upon the end of the eccentric shaft. At the opposite end of the eccentric shaft 194 is a crank-like bearing adapted to accommodate a pitman 195, which, at its upper extremity, is provided with a ball element for a ball and socket union. A rocker arm 196, which is pivoted at its mid-section to a shaft 197 on which is secured a ratchet wheel 198, is provided at one of its ends with a socket element adapted to receive the ball element on the pitman 195. This ball and socket joint imparts the reciprocatory motion of the pitman, which motion is initiated by the rotation of the eccentric shaft 194, to the rocker arm 196, thereby causing it to rock about its pivot on shaft 197.

The rocker arm at its other end is provided with a pawl 199, which is arranged to engage the ratchet teeth of the ratchet wheel 198 by a suitable tension spring. Another pawl 199a is secured to the stationary mounting so as to engage the ratchet wheel 198 to limit the rotary movement thereof to one direction. The rocking of the arm 196 causes its associated pawl to rotate the ratchet wheel one tooth at a time. This, in turn, causes the shaft 197, upon which the ratchet wheel is secured, to rotate uniformly at recurrent intervals. Mounted for rotation with the shaft 197 is a cam disc 200, having a recess 201 carved out of its otherwise concentrically regular periphery. Mounted stationarily above this disc is an electric switch 202 having an actuating arm

203 arranged to oscillate upwardly and downwardly in the plane of the disc. The switch actuating arm 203 has a roller 203a pivoted upon a horizontal axis at its outer extremity, which roller engages the periphery of the cam disc 200 throughout its extent. The arrangement provides that so long as the roller is in engagement with the concentric and truly circular peripheral portions of the cam disc, the switch actuating arm is positioned to maintain the switch 202 in closed-circuit position. When the recess 201 is rotated to underlie the roller 203a, the roller and arm fall therein by gravital action, causing the switch mechanism to move to an open-circuit position. A stationary dial 204, calibrated in feet and inches, is disposed adjacent to the cam disc, and a pointer 205 is carried by the shaft 197 to indicate upon the dial how many lineal feet of fabric have been produced.

The switch 202 is in the line of a "stop button" circuit (not shown), which, when interrupted by the falling of the switch actuating arm 203 into the cam disc recess 201, causes the power current to the main machine motor M to be shut off, thereby stopping the machine. By pressing the starting button (not shown) of the "stop button" circuit, the main motor is again energized, and the operation is resumed. The ratio of the gearing involving the gears 191, 192 and 193, is such as to turn the eccentric shaft 194 one revolution for each foot of fabric produced. This causes the pitman to reciprocate once, in turn, causing the rocker arm to effect one complete see-saw movement, inducing the ratchet wheel to be moved one notch by the pawl 199. The pointer 205 may be set to predispose the cam disc recess 201 to any position relative to the switch arm roller 203a so that the operation of the machine will be stopped after the exact predetermined amount of fabric desired has been produced. This permits the machine operator to tag the fabric, so that a remote operator of the bundling machine may know where to cut the continuous, incoming web of netting to complete a bundle. The gears 191, 192 and 193 may be varied in size to provide a ratio suitable for the production of either hexagon or straight-line netting having a mesh of any desired size; one or two inch mesh being conventional.

Fabric handling and bundling

As has already been stated, the fabric, after leaving the upper set of pull-out rolls 180, is directed by guides 189 to a position overlying the accumulating well B, into which it then falls by gravity to await the bundling operation. Inasmuch as the bundling mechanism C is operated independently of the fabric forming elements A of the machine, and since the operation of the bundling machine must be suspended from time to time to remove bundles of netting, the accumulating well B is provided so that the fabric forming part of the machine may continue operating while the bundling mechanism is temporarily stopped.

The well B is comprised of end partitions 210 and 211, which separate the well from the fabric forming and bundling devices, respectively, and serve to define the longitudinal limits thereof. The partition 210 is slidably mounted so that it may be moved to provide access to the twister mechanism, while the partition 211 may be stationary. The side walls of the well are composed of two movable partitions 212 and 213, which are hung from stationary cross bars 214 and 215 by

hooks 216 so that the bottoms of the partitions are positioned closely to the floor line. By varying the distance between the side partitions 212—213, any width of fabric may be accommodated and closely confined against lateral displacement in the well to preclude its becoming entangled or twisted. It will, of course, be understood that as many of these longitudinal partitions 212 and 213 may be employed as may be necessary or desirable when more than one width of fabric are being produced; the same being removable and replaceable at will.

The bundling machine C is a device for rolling the netting into bundles, and which also acts upon the fabric to make it lay flat in after life. It is capable of winding bundles of netting rapidly and tightly without unduly pulling or distorting it. The bundler, per se, is composed of rolls and other devices carried by side frames 220, which frames also act as pedestals and give footing to the uprights 23 of the main machine structural framing. Arranged horizontally between the uprights 23 are bars 221, spaced and staggered in the vertical, and an adjustable tension roller 222; also rigid tension rollers 223, and a guide 224. These devices are arranged relative to each other to properly tension the netting F; the adjustable tension roller 222 permitting of the increase or decrease of tension on the fabric, and serving to give it a reverse bend sufficient to offset the tendency to curl when unwound after bundling, while guiding the netting to the bundler proper.

The netting is bundled on horizontal pole 225, which is positively driven through a universal coupling 226 by a shaft 227 journaled for rotation in one of the side frames 220. The pole 225 is held at its opposite end to an idler pivot shaft 228, which is journaled for rotation in the opposite side frame 220, by means of a withdrawable, sliding coupling 229. This latter coupling is adapted to be slid axially of the pivot shaft to disengage the bundling pole, but is normally held in engagement therewith by means of a compression spring 230 arranged between it and the side frame 220. By sliding the coupling 229 out of engagement with the bundling pole, the pole may be swung outwardly by virtue of the universal coupling 226, by which its other end is always made fast to shaft 227. This permits a bundle of fabric to be stripped off while the bundling devices are at rest. To facilitate the removal of a bundle in this manner, the pole 225 is slightly tapered from its larger end, adjacent to the universal coupling, to its smaller end adjacent to the sliding coupling 229. Also, a plurality of mesh engaging projections 231, which are provided along the periphery of the bundling pole for hooking onto the fabric at the commencement of the winding operation, are formed-over to dispose their ends toward the free end of the bundling pole so the fabric may easily be stripped therefrom.

In order to wind tight bundles of fabric without unduly tensioning it, an anti-friction roller 235 is provided, which, in addition to tensioning the fabric as it is being wound, is adapted to exert a forceful, unvarying pressure thereon to actually roll and flatten the same. Since the bundling pole rotates about a fixed axis, and the bundles of the netting grow in diameter as fabric is taken up thereon, the extreme outside portion of the bundle is ever expanding outwardly, and thereby shifting relative to any fixed point. Hence, the roller 235 must be so mounted as to continuously change position as the growing size of

the bundles demand. Accordingly, the shaft 236, upon which it rotates, is provided adjacent to each of its ends with pinions 237, which are adapted to track in stationary racks 238 carried by each of the side frame members 220. The pinions 237 and racks 238 are constructed and arranged to mount the roller shaft 236 horizontally and parallel to the bundling pole 225. The racks are of a length and disposition as will permit the roller 235 to abut the bundling pole (or any fabric taken-up thereon) throughout its length (or width), and will also permit of its recession to points sufficiently remote from the bundling pole as is necessary to accommodate the largest practicable bundle.

Adjacent each roller pinion 237 on the roller shaft 236 is an idler roller 239, each of which engages the lower edge of two fixed upper guide bars 240, respectively, which are provided to constrain the pinions 237 to remain in proper relation with the teeth of their respective racks so as to insure against the malalignment of the roller 235 relative to the bundling pole. The roller proper is anti-frictionally mounted upon the shaft 236 by roller bearings 241 so that it may revolve freely thereabout.

In order to cause the roller 235 to bear forcefully upon the fabric being bundled, two cables or ropes 242 are secured at one of their respective ends to the hub portions 243 of the roller shaft 236, and are wound about the hubs so as to extend beneath them with their free ends running rearwardly (toward the well) away from the bundling pole. A sheave 244 is journaled for rotation in a longitudinal, vertical plane upon each side frame 220, at opposite points, substantially above the path of the roller 235 and near the bundling pole (front) end of the mechanism. The forwardmost portions of the perimeters of these sheaves fall in vertical lines that pass appreciably forward of the rearmost portions of the shaft hubs 243, necessitating that the cables 242 not only be directed upwardly, but forwardly as well, to pass beneath and around them. Thus, are the cables caused to effect an S turn around the hubs 243 and sheaves 244, and from the tops of the latter are directed rearwardly to pass over sheaves 245, and downwardly into weight guides 246.

The positioning of the sheaves 244 and 245, and the weaving of the cables 242 about them and the shaft hubs 243, is such as will induce the roller 235 to move toward the bundling pole when a pull is exerted downwardly on the free ends of the cables 242. Such a pull is arranged for by removably attaching one or more weights 247 to the ends of the cables disposed within the weight guides 246. By adding or removing weights, the tension and pressure to which the fabric is subjected by the anti-friction roller 235 may be increased or decreased in the amount desired. Thus, it will be seen that as fabric is accumulated on the bundling pole, the ever increasing size of the bundle displaces the roller 235 and causes it to recede from the bundling pole slowly against the force of weights 247, which, at such times, are being gradually hoisted by the cables 242 being taken up on the hubs 243 of the roller shaft.

At the completion of a bundle, the roller 235 is retracted to a position remote from the bundling pole, and it is while the several parts are in this positional relationship that it becomes necessary to strip the bundle from the pole. When the pole is swung outwardly, in a manner that has already been described to remove the

bundle of fabric therefrom, provision is made to prevent the roller 235 from being violently propelled forward toward the front of the machine by the force of the weights acting upon the cables, (as would happen, in the absence of provisions for preventing it, if the roller 235 were suddenly divested of all the support of the bundle of fabric). Accordingly, another rack 248 is provided adjacent to one of the roller support racks 238 in which a pawl 249, pivoted to the roller shaft 236, is adapted to engage. The head of the pawl lies toward the bundling pole so as to feather over the rack 248 when the roller is receding therefrom, but which engages the teeth of the rack to chock the roller against return movement. A tripping mechanism (not shown) is provided, which is actuated by a hand lever 250, by means of which the pawl 249 may be released from the rack 248 to permit the roller 235 to return to its starting position adjacent to the bundling pole after the bundle of fabric has been stripped therefrom and a new bundle commenced. The bundles of fabric are severed immediately above the bundling pole by manually operated shears, when the tags affixed thereto by the machine operator signify to the bundling machine operator that a prerequisite amount of fabric has been reeled. The netting is cut on the line of these tags.

On the type of hexagon netting wherein no line wires are incorporated, the mesh will not stand much pull without distorting. Since the bundling machine must be fed from the top, necessitating that the fabric F be pulled from the bottom of the accumulating well B for introduction to the staggered guides and tensioning devices 221, 222, etc., it is desirable to provide a powered roll to aid the bundling pole in boosting the fabric from the well B, whereby the fabric may be spared undue tensional stresses. Accordingly, atop the upper main frame structural members 22 a belt driven wooden drum 251 is positioned so as to overlie the bundling pole end of the well B. The fabric passes over this roll, which, being of wood, exerts a frictional pull thereon, and which is driven so as to have a peripheral speed in excess of the speed of the fabric being collected on the bundling pole. Thus is the fabric easily induced out of the well and forwarded to the take-up with a minimum pull being exerted thereon, whereby any distortion thereof is wholly precluded.

Distributing device, wire association and fabric forming for straight-line netting

The description thus far has been concerned with the machinery and method for producing hexagon netting, either with or without line wires. The manufacture of straight-line, or "herring-bone", netting will now be described. To make this latter type of fabric, the machine as described for hexagon netting is employed in every particular, as has already been set forth, with the principal exception of the type of distributor used. It is true that certain guides and auxiliary elements are brought into use in the manufacture of the straight-line netting, which guides and elements are not necessary in the fabrication of hexagon netting, although their presence on the machine, to render the machine convertible to the manufacture of either type of fabric, is not undesirable, nor do they interfere with nor affect the proper operation of the hexagon mesh forming elements. The converse is likewise true, since all of the machine elements utilized in the fabrication of hexagon netting are

not needed in the production of straight-line fabrics. However, the only element that must actually be removed and replaced is the wire distributor in converting the machine from a hexagon netting fabricator to a straight-line netting fabricator, and vice versa.

Referring now specifically to Figures 56, 57 and 58 of the drawings, the straight-line mesh distributor is illustrated at D¹, and is composed of a drive shaft 355 journaled for rotation adjacent to its ends in the same stationary bearings 153, which have already been mentioned in connection with the hexagon mesh distributor D. Secured for rotation with the drive shaft 355 so as to overlie the twister mechanism across its entire width is a plurality of grooved collars or cylindrical spiders 356, having a number of evenly spaced, parallel-edged, recesses 356a disposed longitudinally about their periphery. Disposed for reciprocation across these collars in rows of aligned recesses 356a are substantially channel-shaped members 357, having their free edges 354 disposed outwardly so as to terminate beyond the peripheral edge portions of the recesses 356a. The channel edges 354 are perfectly straight; their disposition being such as to place them in parallelism with the shaft about which they lie, and almost flush with the cylindrical surfaces defined by the portions of the collars 356 between the recesses 356a, although they extend slightly therebeyond.

The edges 354 of each channel member are provided with small, integral projections 358 positioned directly opposite one another on their respective edges, and spaced longitudinally therealong at intervals of distance equal to the spacing of the line wires in the finished fabric.

Each channel member 357 is slotted, as at 360, at the bottom of a groove 361, which runs along the inner face of the web portion of the channel. The channels are secured in the recesses 356a of the cylindrical spiders or collars 356 by bar members 362, lying within the channel grooves 361, and fastenings 363 extending through the bars 362 into the collars 356. In order to insure that the bars and fastenings do not bind the channels, and to insure that the latter can reciprocate freely in the collar recesses, a spacer element 364 is arranged about the fastenings 363 within the slots 360 to hold the bars 362 in spaced relation from the channels to a slight degree.

The channel-members 357 are reciprocated by cam slots 365, 365a which are formed in the outer cylindrical surfaces of two annular members 366, respectively, that are arranged snugly and concentrically upon shaft 355 adjacent to the extremities of the channel-members, and between the latter and the fixed shaft bearings 153. The center bore of the annular cam members 366 is such as to permit of relative rotary movement between them and the shaft 355 in order that they may be removably affixed against rotation to the stationary bearings 153 while the shaft rotates therein. Though these annular cam members are not adapted to rotate with the distributor elements per se, they are nevertheless, permanently associated therewith, and are installed or removed unitarily with the entire straight-line distributor assembly.

Alternate channel members are provided with extensions 367, the ends of which overlie the cam slot 365, and which have slot engaging rollers 368 depending into the cam slots. The remaining alternate channel members have ex-

tensions 367a, equivalent to those on the adjacent bars, except that they are disposed at the opposite ends thereof so as to overlie the cam slots 365a, in which corresponding rollers 368 are disposed. The configuration of the cam slots is such as to reciprocate the channel members in a predetermined fashion as will be fully discussed hereinafter.

The mesh wires W are fed to the straight-line distributor from positions overhead and rearward thereof, instead of from forward and beneath as in the case of the hexagon mesh wire distributor. Accordingly, the mesh wires are directed from the tension rollers 25 to a bar and pin guide 24; around a roller sheave guide 370; past a vibrator 371 (explained later), and about a roller sheave guide 372 to the distributor D¹. The line and selvage wires L and S, however, are directed through the regular guides 53, 54 and 24, already explained hereinbefore in connection with the manufacture of hexagon netting; only the lowermost sets of these guides being used for this purpose. After passing through the broken wire stops 52 and about the lower banks of the roller guides 53, 54, the line and selvage wires are directed through the guide 24 directly to the twister slots on a straight line, and assume positions in the bottoms of the slots before the distributor delivers the mesh wires therein.

From the guide 372, the mesh wires are directed forwardly over top of the distributor and downwardly around the remote side thereof in the direction of its rotation (counter-clockwise when viewed from the right hand side of the machine, as in Figure 56). The distributor channel members 357, when passing through the upper segments of the rotational arc where the incoming wires W are initially contacted, are positioned, relative to each other, to dispose the pairs of projections 358 (on the opposite edges of each channel) of adjacent channel members 357 in close proximity to their respective wire lines, but on opposite sides thereof, respectively. The wires always fall upon the side of the projections nearest that position into which the movement of the channel members 357 ultimately form them. Thus, when the cam slot 365 is traversed by the actuating rollers 368 on alternate channel members 357, those alternate members are, by virtue of the special contour of the cam slot, made to move longitudinally. This movement pulls the portions of the mesh wires extending between the adjacent, relatively stationary channel members on each side thereof out of their normal lines of travel, and disposes the deflected portions substantially on a line corresponding to the original line of travel of the neighboring wire, and also in a vertical plane of a line-wire within the twister mechanism below.

The wires are retained in this deflected position, and the deflected portions, as well as the portions that remain on the original line, are laid into the twister slots atop the line wires. To accomplish this, the channel members 357 actually are inverted upon each row of twistors so that the channel edges 354 lie on each side and below the bottoms of the twister slots, whereby the mesh wires that are tautly stretched to bridge the channels between opposed projections are firmly pushed into the depths of the twister slots. At this point, the movable channel members 357, and, also, the other alternate channel members,

which are thus far stationary in the operation, are actuated by the cam slots to move inwardly (a partial return movement for the deflecting channels), in opposite directions, to a slight degree, to move the projections 358 from the relatively deflected portions of the mesh wires, that are now positively held within the twister slots, in order to permit the distributor to disengage and rotate clear thereof. The operation of the twister mechanism is identical to that which has already been described.

The manufacture of two-inch mesh fabric may require a driven hold-down roll 375 for maintaining the fabric wires securely in the twister slots between the distributor and pull-out rolls. The hold-down roll is provided with radially extending bars 376 that run along its length across the twister mechanism. These bars are adapted, by projecting between the rows of twisting mechanisms, to hold the wires in the twister slots until the twisting operation is completed or, at least, well initiated.

The fabric is then stripped by the pull-out rolls, handled and bundled in the same manner as is hexagon fabric. In straight-line fabrics, however, as well as in hexagon netting wherein line wires have been incorporated, it is not possible to alter the predisposition of the wire elements after twisting, by tensioning or slackening the fabric between the pull-out rolls, because of the line wires. Therefore, varying the tension between the upper and lower sets of pull-out rolls to optionally produce "fluffy" or "tight" netting is applicable only to plain hexagon mesh fabrics, and is inapplicable to nettings embodying line wires.

The vibrator 371 is a driven rotary shaft 377 having radially extending vanes 378 disposed about its periphery and running along its length. The disposition of the shaft is such as to rotate the vanes so that the extremities thereof describe a cylindrical path between the guides 370 and 371. A segment of this path is subtended by the normal (straight) line of travel of the wires between these guides. Thus, since the edges of the vanes are imperforate, upon being rotated, they serve to depress the bank of mesh wires intermittently as shown, and thereby create a recurrent slack in the wires between the guides 370 and 372. The rotation of the vibrator is synchronized with the operation of the distributor D¹ to provide intervals of slack in the wires, which slack is immediately taken up in the deflection of each mesh wire by the shifting of the distributor channel members 357 in forming the mesh. In this way, no undue strains of pull and bending result from the deflection of the wires by the distributor.

It will be understood that the distribution of wires to form straight-line nettings is accomplished in the same order already explained in connection with the hexagon netting distribution of wires; viz., to deliver the mesh wires to the successive rows of clockwise and counterclockwise rotating pinions in such a manner as to insure two full turns being effected at each twist. Since the straight-line mesh wires are always laid on top of the line wires in the pinion slots, the relatively rightwardly-deflected portions will always be placed in the rows of clockwise-rotating twistors (95), while the relatively leftwardly-deflected portions will always be placed in the rows of counterclockwise-rotating twistors (96), without variation.

Operation of machines

All of the wires that enter into the finished fabrics are pulled from the supply reels 30, through the tensioning guides 44, and through the other guides and tensioning means 24, 25, 53 and 54, to the distributor D or D¹ and twisting mechanism A, by the movement and operation of the last named device. Power is applied to the twister mechanism assembly through the rear, lowermost sprocket shaft 60, to which an electric motor M is connected through a reduction gear unit 400. The distributor D or D¹ is motivated by a spur gear 401, which is fixed to rotate with the front or uppermost sprocket shaft 61, and which is in driving engagement with another spur gear 402 affixed to the end of the distributor shaft 155—355. The ratio of this gearing is such as will permit the distributors and twisting mechanism to coact in forming the fabric in a manner already described.

The lower pull-out rolls E are powered from the rear sprocket shaft 60 through gears 403 and 404, which are immovably secured to the sprocket shaft 60 and lower pull-out roll shaft 170, respectively. The upper set of pull-out rolls E¹ are powered by a chain drive embodying a chain 405, passing between a sprocket 406, disposed upon the end of the lower pull-out idler roll shaft 175, and another sprocket 407 fastened to the end of the lower roll shaft 181 of the upper pull-out assembly. The adjustment for varying the tension on the fabric between the upper and lower sets of pull-out rolls is effected by loosening the sprocket 406 upon the end of the lower pull-out idler roll shaft 175, and by turning the sprocket relative to the shaft, which, through the chain 405, induces the upper driven roll on shaft 181 to either tauten or slacken the fabric between the upper and lower sets of pull-out rolls, depending on the direction in which the sprocket 406 is adjusted.

The bundling machine C is powered independently of the fabric forming and associated devices, all of the latter receiving their motive force from the motor M. An electric motor M¹ is arranged to drive the bundling pole 225, through the stub shaft 227 and reduction gear unit 408. The bundling machine is started and stopped independently of the fabric forming devices by any suitable manually operated switch (not shown). A flange pulley 409 is secured for rotation with the stub shaft 227, which accommodates an endless belt 410. This belt extends to another flange pulley 411 that is arranged to drive the wooden friction drum 251 for boosting the fabric out of the accumulating well B and forwarding it to the bundling machine. The diameters of the flange pulleys 409 and 411 are such as to make the peripheral speed of the roller 251, in operation, exceed that of the fabric being wound upon the bundling pole, as has already been mentioned. The remaining moving parts of the bundler are idle, and perform their respective functions by cooperating with the driven parts in a manner that has already been described.

The fabric forming devices are started by energizing the electric motor M through the operation of circuit control devices (not shown). The machine is automatically stopped by the fabric measuring device 190, after a predetermined amount of fabric has been produced; or by the short-circuiting of the broken-wire motor stops 51 and 52; or by the manipulation of a foot treadle 412, which is conveniently disposed adja-

cent to an operator's platform 413, by the operator. In any case, the power to the motor M remains off until a "push-button" starting circuit is energized, already mentioned hereinbefore, which closes the power circuit to the motor M inducing it to resume its operation.

An oil pan 414 is provided about and beneath the twister mechanism assembly in which a level of oil can be maintained for thoroughly flushing dirt and foreign matter from the twisters and conveyor chains, and for thoroughly lubricating the same, while the machine is in operation. The pan is provided with sloping bottom portions, adjacent to the convergence of which is a closed drainage hole 415 for drawing off the oil. Oil is only maintained in the pan as necessity demands, and it may be drained and stored for re-use.

It is claimed:

1. A wire fabricating machine comprising, in combination, a material supply depot composed of a plurality of stationary coil holders, a wire fabricating means, guides, a tensioning device for directing wires from said depot to said fabricating means, means for winding the fabric delivered from said fabricating means, and storage means adapted to continuously receive and accumulate said fabric and to continuously deliver the same to said winding means without entanglements.

2. A wire fabricating machine comprising, in combination, a material supply depot, a wire fabricating means, guides and tensioning devices for directing wires from said depot to said means, a source of power to actuate said fabricating means, and means rendered effective by the failure of one or more wires between said depot and fabricating means to alienate said source of power from the latter to stop the actuation thereof, said means comprising an exposed electrical conductor adjacent all of the wires, from which the latter are normally spaced when under operating tension, and against which any wire free of tension will fall.

3. A wire fabricating machine comprising, in combination, a material supply depot, a wire fabricating means, a motor to actuate the latter, guides and tensioning devices for directing wires from said depot to said fabricating means, and a motor-stop device intermediate certain of said guides rendered automatically effective upon the breakage of a wire to stop the actuation of said fabricating means, said motor stop device comprising a pair of proximate, parallel, electrically-energized conductors between which wires for the fabric are fed.

4. In a wire fabricating machine, a twisting mechanism comprising a plurality of rows of twisters, means for distributing a plurality of wires to each twister, means for actuating said twisters to twist the wires, and means for reducing the spacing between said rows of twisters during the twisting operation.

5. In a wire fabricating machine, a twisting mechanism comprising a plurality of rows of twisters, means for distributing a plurality of wires to each twister across certain of the several rows thereof, means for actuating said twisters to twist the wires, and means for reducing the spacing between said certain rows of twisters during the actuation thereof.

6. In a wire fabricating machine, a twisting mechanism comprising rows of rotary twisters, said twisters in alternate rows being aligned transversely of said rows in positions intermedi-

ate the twistors of adjacent rows, means to rotate all the twistors in alternate rows clockwise, and those of intermediate rows adjacent thereto counterclockwise, means for distributing a plurality of wires across said rows to each twister thereof in superposed relation, and means for reducing the distance between each of said rows during the rotation of the twistors thereof.

7. In a wire fabricating machine, a twisting mechanism comprising rows of rotary twistors, said twistors in alternate rows being aligned transversely of said rows in positions intermediate the twistors of adjacent rows, means to rotate all the twistors in alternate rows clockwise, and those of intermediate rows adjacent thereto counterclockwise, means for distributing a plurality of wires across said rows to each twister thereof in superposed relation, every other one of the said wires being delivered to each of the said twistors atop the adjacent wires therein, and means for reducing the distance between each of said rows during the rotation of the twistors thereof.

8. In a wire fabricating machine, a twisting mechanism comprising rows of rotative twistors, said twistors in alternate rows being in alignment transversely of said rows and intermediate the transverse alignment of the twistors in adjacent rows, respectively, means to rotate all the twistors in alternate rows clockwise and the twistors of intermediate rows adjacent thereto counterclockwise, means for directing a plurality of wires to said twisting mechanism in substantially parallel planes passing intermediately of all the lines of twistors transverse to the said rows thereof, means for deflecting portions of each wire issuing from said directing means in opposite lateral directions so as to vertically align with deflected portions of adjacent wires and with said twistors, all rightwardly-deflected portions of said wires to said clockwise-rotated twistors being delivered thereto beneath the vertically aligned deflected portions of an adjacent wire, and means for reducing the distance between each of said rows during the rotation of the twistors thereof.

9. In a wire fabricating machine, a twisting mechanism comprising a plurality of rows of twistors, means for distributing a plurality of wires to each twister, means for actuating certain of said twistors to twist the wires in one direction and for actuating the remaining twistors to twist the wires in the opposite direction, and means for reducing the spacing between said rows of twistors during the twisting operation.

10. In a wire fabricating machine, a twisting mechanism comprising a plurality of rows of twistors, means for distributing a plurality of wires to each twister across certain of the several rows thereof, means for actuating said twistors to twist the wires in adjacent rows in opposite directions, and means for reducing the spacing between said certain rows of twistors during the actuation thereof.

11. In a wire fabricating machine, wire delivering and distributing means, a twisting mechanism comprising a plurality of rows of rotary twistors, means for mounting and moving said rows of rotary twistors in endless succession, guide means adjacent to, and, in the cycle of operation, past said delivering and distributing means for directing said rows of twistors through an arcuate path.

12. In a wire fabricating machine, wire delivering and distributing means, a twisting mechanism

comprising a plurality of rows of rotary twistors, revolving means for mounting and moving said rows of rotary twistors in endless succession, stationary guide means adjacent said delivering and distributing means for directing said rows of twistors through an arcuate path.

13. In a wire fabricating machine, wire delivering and distributing means, a twisting mechanism comprising a plurality of rows of rotary twistors, revolving means for mounting and moving said rows of twistors through an endless elliptical path, and guide means for directing said rows of twistors through an arcuate path having greater magnitude of arc than any segment of the elliptical path aforesaid.

14. In a wire fabricating machine, wire delivering and distributing means, a twisting mechanism comprising rows of rotary twistors, means for mounting and moving said rows of twistors in endless succession comprising a plurality of wheel devices, and guide means for directing said rows of twistors through an arcuate path having greater magnitude of arc than the arcature of said wheel devices.

15. In a wire fabricating machine, a twisting mechanism comprising a plurality of rows of rotary twistors, wire delivering and distributing means and fabric-removal means mounted in spaced relation adjacent said twisting mechanism, means for mounting and moving said rows of twistors in endless succession past and between said wire delivering and distributing means and said fabric removal means, means for rotating said twistors, and means for reducing the spacing between said rows of twistors adjacent said delivering and distributing means.

16. In a wire fabricating machine, a twisting mechanism comprising a plurality of rows of rotary twistors, wire delivering and distributing means and fabric-removal means mounted in spaced relation adjacent said twisting mechanism, means for mounting and moving said rows of twistors in endless succession past and between said wire delivering and distributing means and said fabric-removal means, means for rotating said twistors, means for reducing the spacing between said rows of twistors adjacent said delivering and distributing means, and means for maintaining said rows in said spaced relationship while the latter travel between said distributing and fabric-removal means aforesaid.

17. In a wire fabricating machine, a twisting mechanism comprising a plurality of twisting devices, flexible supporting means for retaining said twisting devices, rotary means mounting said flexible supporting means and being adapted to move the same in a substantially circular path, stationary supporting means disposed adjacent said path for at least a portion of the extent thereof, and anti-friction means carried by said flexible support means in engagement with said stationary supporting means.

18. In a wire fabricating machine, a twisting mechanism comprising a plurality of twisting devices, a flexible chain carrying said twisting devices, a plurality of sprocket wheels mounting said chain and being adapted to rotate the latter together with its associated twisting devices, a stationary support coextensive with portions of said chain and adjacent thereto, and anti-friction rollers journaled on said chain and being adapted to engage said stationary support at the portions thereof that are adjacent to and coextensive with said chain.

19. In a wire fabricating machine, a twisting

mechanism comprising a housing, a plurality of shafts journaled in said housing, sprocket wheels carried by said shafts, chains supported about said shafts by said sprocket wheels, twister mechanisms carried by said chains, one of said shafts being mounted for bodily movement toward and away from another of the shafts thereof.

20. In a wire fabricating machine, a twisting mechanism comprising a housing, a plurality of shafts journaled in said housing, one of said shafts being bodily adjustable toward and away from another of said shafts, a plurality of sprocket wheels carried by each of said shafts, and means for varying the position of each of said sprocket wheels about the axis of its respective shaft relative to the other sprocket wheels thereof.

21. In a wire fabricating machine, a twisting mechanism comprising a housing, shaft bearings in said housing, certain of said bearings being adapted to mount a shaft in a horizontal position, certain other of said bearings being adapted to mount another shaft parallel to said first mentioned shaft and being further adapted for movement toward and away from the bearings of the latter.

22. In a wire fabricating machine, a twisting mechanism comprising a housing, a plurality of shafts journaled in said housing, a plurality of sprockets carried by said shafts, a plurality of chains supported by said sprockets, clevises carried by each of said chains, and adjustment means between said sprockets and said shafts to permit the alignment of said clevises in a direction transverse to the axis of said chains.

23. In a wire fabricating machine, a twisting mechanism comprising a housing, a plurality of shafts journaled in said housing, a plurality of sprockets carried by said shafts, a plurality of chains supported by said sprockets, clevises carried by each of said chains, adjustment means between said sprockets and said shafts to permit the alignment of said clevises in lines transverse to all of said chains, and twister supporting means disposed in said transversely-aligned clevises and secured against movement therein.

24. In a wire fabricating machine, a twisting mechanism comprising a housing, a plurality of shafts journaled in said housing, a plurality of sprockets carried by said shafts, a plurality of chains supported by said sprockets, clevises carried by each of said chains, adjustment means between said sprockets and said shafts to permit the alignment of said clevises in lines transverse to all of said chains, twister supporting means disposed in said transversely-aligned clevises and secured against movement therein, and thrust bearings disposed adjacent the ends of said twister supporting means.

25. In a wire fabricating machine, a twisting mechanism comprising a housing, a plurality of sprockets journaled for rotation in said housing, a plurality of endless chains supported by said sprockets, bar members extending across said chains normal to the longitudinal axes thereof, a bearing member coextensive with said chains adjacent to an extremity of said bar members, and anti-friction means disposed between said bar members and said bearing member in engagement with the latter.

26. In a wire fabricating machine, a twisting mechanism comprising a housing, a plurality of sprocket wheels journaled for rotation in said housing, a plurality of chains supported by said sprocket wheels, bar members rigidly secured to each of said chains in positions normal to

the longitudinal axes thereof, a bearing member coextensive with said chains and disposed adjacent the ends of said bar members, means on said bar members for engaging said bearing member, a rack bar carried by each of said bar members, and cam means coextensive with said bearing member for reciprocating said rack bars.

27. In a twisting mechanism for a wire fabricating machine, a chain device comprising a plurality of side-links disposed in overlapping relation, bars extending through said overlapped portions of said side-links to pivotally secure the same together, a projection on said side-links being disposed to overlie said side-links and bars, and a plurality of support-engaging means rigidly secured to said projections.

28. In a twisting mechanism for a wire fabricating machine, a chain device comprising a plurality of side-links disposed in overlapping relation, bars extending through said overlapped portions of said side-links to pivotally secure the same together, roller means journaled for rotation at the opposite ends of certain of said bars, a projection on said side-links being disposed to overlie said side-links and bars, and a plurality of support-engaging means rigidly secured to said projections.

29. In a twisting mechanism for a wire fabricating machine, a plurality of link devices, a projection extending from each of said link devices, bar-supporting means secured to each of said projections, each of said bar-supporting means being provided with fastening elements, the said fastening elements of adjacent bar-supporting means being offset to lie upon opposite sides of the central axis of said chain.

30. In a twisting mechanism for a wire fabricating machine, a plurality of link devices, a projection extending from each of said link devices, a plurality of clevises comprising base portions and outwardly extending arms secured to said base portions, each of said clevises being provided with an extension of its base portion to one side thereof, said base portion including said extensions being rigidly secured to said projections, and said clevises being positioned to dispose their respective base extensions in opposite directions.

31. In a wire fabricating machine, a twisting mechanism comprising a plurality of shafts mounted in spaced parallel relation, sprocket wheels carried by each of said shafts, endless chains disposed about opposite pairs of said sprocket wheels, a plurality of bars mounted across said chains parallel to said shafts, a plurality of side-plate elements secured upon opposite sides of each of said bars in contiguous relationship to constitute a unitary twister-supporting assembly, means in said side-plates for journaling a plurality of twister pinions, and a rack bar disposed for reciprocation upon each of said bars intermediate the side-plates secured to each side thereof.

32. In a wire fabricating machine, a twisting mechanism comprising a plurality of endless chains, bars carried by said chains, side-plates secured to said bars, each of said side-plates being provided with a plurality of twister-journaling openings therein, and a rack bar carried by each of said bars between the side-plates thereof, said side plates having a plurality of apertures adjacent the teeth of said rack bars and intermediate the twister-journaling openings therein.

33. In a twisting mechanism, a support bar, side-plates fastened upon opposite sides of said

support bar and having oppositely aligned openings, twister pinions journaled for rotation in said openings, said twister pinions each having a slot extending from a point below the axis of rotation thereof outwardly to a point of exit intermediate adjacent peripheral teeth thereon, and a constricted wire bearing disposed within said slot terminating a substantial distance below the limits of said side-plate openings.

34. In a twisting mechanism, a support bar, side-plates fastened upon opposite sides of said support bar and having oppositely aligning openings a plurality of twister pinions each comprising a peripheral toothed-portion and gudgeons extending to each side thereof, said gudgeons being adapted for journaling in said oppositely aligned side-plate openings, a slot in each of said pinions extending from a point adjacent the axis of rotation thereof outwardly to a point of exit upon its periphery intermediate adjacent teeth thereon, a substantially U-shaped wire bearing disposed in said slot having its base portion positioned about said axis of rotation, and having its arms extending outwardly along the opposite side walls of said slot to points of termination intermediate said axis of rotation and the outer peripheries of said gudgeons.

35. In combination with a wire fabricating mechanism, a twister pinion comprising a cylindrical body, pinion teeth disposed about the periphery thereof, portions of said cylindrical body upon each side of said teeth constituting gudgeons, said cylindrical body having a slot disposed from its axis outwardly to a point of exit between adjacent pinion teeth on the periphery thereof, a portion of said slot between said axis and the peripheral portions of said gudgeons being constricted to receive but a single diameter of wire therein, the remaining portions of said slot between said constricted portion and said peripheral portions of said gudgeons being adapted to receive two diameters of such wire.

36. The invention recited by claim 35, wherein said constricted portion of said slot lies in a plane to one side of and parallel to the median plane of said pinion to which the said axis thereof is perpendicular.

37. In a fabricating machine, a twisting mechanism, means for feeding a plurality of wires to said twisting mechanism, means for actuating said twisting mechanism to form said wires into fabric, means for removing said fabric from said twisting mechanism, said last named means comprising a pair of rotatable elements adapted to rotate in unison, a common drive means for effecting said rotation, and an adjustable means associated with said common drive means to vary the peripheral disposition of said elements relative to each other for increasing and decreasing the tension on said fabric.

38. In a fabricating machine, a twisting mechanism, means for feeding a plurality of wires to said twisting mechanism, means for actuating said twisting mechanism to form said wires into fabric, means for removing said fabric from said twisting mechanism comprising two sets of rotatable elements, each of said sets including a driven element and an idle element adapted for rotation with said driven element, the driven element of one of said sets receiving its power from an outside source, and the driven element of the other of said sets receiving its power from the idle element of the first-named set aforesaid.

39. In a fabricating machine, a fabric handling device comprising two sets of rolls, the rolls of

each of said sets having fabric engaging means disposed about the peripheries thereof, one roll of each set being a driven roll, the other roll of each set being an idle roll, said idle rolls being positioned to bring their fabric engaging means into registration with those on said driven rolls, a sprocket wheel adjustably carried by one of said idle rolls, a sprocket-wheel fixedly mounted to said driven roll of the other set thereof, and a chain disposed between said sprockets to effect driving engagement therebetween.

40. In a fabricating machine, a fabric handling means comprising a pair of rolls adapted to receive and grip a web of fabric therebetween, a second pair of rolls similar to said first pair being adapted to receive and grip said fabric in like manner, one of the rolls of said first pair being driven and the other thereof being idle and adapted to rotate with said driven roll, drive means extending between said idle roll to one of the rolls of said second pair, and means for adjusting said driving means to vary the peripheral disposition of said second set of rolls relative to the first set thereof.

41. In a fabricating machine, a twisting mechanism, means for feeding a plurality of wires to said twisting mechanism, means for actuating said twisting mechanism to form said wires into fabric, means for removing said fabric from said twisting mechanism, and means for indicating the amount of fabric removed from said twisting mechanism by said last named means.

42. In a fabricating machine, a twisting mechanism, means for feeding a plurality of wires to said twisting mechanism, means for actuating said twisting mechanism to form said wires into fabric, means for removing said fabric from said twisting mechanism, means for indicating the amount of fabric removed from said twisting mechanism by said last named means, including means for automatically discontinuing the operation of said twisting mechanism after a predetermined amount of fabric has been removed therefrom.

43. In a fabricating machine, a mechanism for making a plurality of wires into fabric, means for removing the fabric from said mechanism, power means to actuate said mechanism and said fabric removing means, a device actuated by the latter for automatically measuring the amount of fabric produced by said mechanism, and means associated with said device for automatically rendering ineffective said power means after a predetermined amount of fabric has been produced.

44. In a fabricating machine, in combination, pull-out rolls, a measuring device associated with said pull-out rolls comprising an indicator and power switch, means associated with said indicator to actuate said power switch, and means associated with said last named means to move said switch to open-circuit position after a predetermined amount of fabric has been received by said pull-out rolls.

45. In a fabricating machine, in combination, means for making and delivering fabric, a roller in engagement with said fabric, a fabric measuring device comprising a ratchet-wheel, a pawl in driving engagement with said ratchet-wheel adapted to rotate the same, means for oscillating said pawl including a gear train having driving connection with said roller, the ratio of the gearing involved in said gear train being such as to actuate said pawl and ratchet-wheel one movement for each foot of fabric passed in contact with said roller.

46. In combination with the wire fabricating machine, a twisting mechanism, a fabric collecting well, means for removing fabric from said twisting mechanism and for delivering it to said well, a bundling machine for winding the fabric delivered to said well, and means interposed between said well and said bundling machine for facilitating the transfer of said fabric therebetween.

47. In combination with the wire fabricating machine, a twisting mechanism, a fabric collecting well, means for removing fabric from said twisting mechanism and for delivering it to said well, a bundling machine for winding the fabric delivered to said well, means interposed between said well and said bundling machine for facilitating the transfer of said fabric therebetween including a rotatable drum, and a common means for driving said bundling machine and said drum.

48. In combination with the wire fabricating machine, a twisting mechanism, a fabric collecting well, means for removing fabric from said twisting mechanism and for delivering it to said well, a bundling machine for winding the fabric delivered to said well, means interposed between said well and said bundling machine for facilitating the transfer of said fabric therebetween including a rotatable drum, a motor for actuating said bundling machine, means associated with said motor to drive said drum, said last named means being adapted to maintain the peripheral speed of the latter in excess of the speed at which the fabric is taken up by said bundling machine.

49. In combination with a wire fabricating machine, a fabric reeling device, guides and tensioning means for delivering fabric to said reeling device, including means for tensioning and bending said fabric in a reverse curvature from that at which it is wound upon said reeling device, and means for adjusting said tensioning and bending means to vary the degree of tension and reverse curvature to which the fabric is subjected thereby.

50. In combination with a wire fabricating machine, a reeling device comprising a positively driven bundling roll, a tension roller coextensive with said bundling roll being adapted to bear thereupon, said tension roller being movably mounted to recede from said bundling roll as fabric is taken up on the latter, and means to retain said tension roller in the receded position to permit the bundle of fabric to be removed from said bundling roll.

51. In combination with a wire fabricating machine, a reeling device comprising a positively driven bundling roll, a tension roller coextensive with said roll being adapted to bear thereupon, said tension roller being mounted to recede from said bundling roll as fabric is taken up on the latter, means for retaining said tension roller in receded position, and a release mechanism for rendering ineffective said retaining means to permit said roller to resume engagement with said bundling roll after the bundle of fabric has been removed therefrom.

52. In combination with a wire fabricating machine, a bundling machine comprising guides and tension devices, a bundling roll for receiving fabric thereon, a universal swivel joint at one end of said bundling roll, a releasable coupling at the other end of said bundling roll, and a plurality of fabric engaging means disposed along the periphery of said roll and being adapted to release said fabric when the latter is pulled along

the axis of the roll in the direction of said release coupling.

53. The invention as recited by claim 52 wherein said bundling roll is of greater cross section at its end adjacent the universal swivel joint than at its end adjacent said releasable coupling, said roll being gradually tapered therebetween.

54. In combination with a wire fabricating machine, a fabric bundling device comprising a bundling roll, a tension roller disposed adjacent to and parallel with said bundling roll, said tension roller normally lying against said bundling roll and being adapted for displacement by fabric being taken up on the latter, mounting means for said tension roller being adapted to maintain it parallel to said bundling roll in all positions relative thereto, and means for forcefully impelling said tension roller toward said bundle roll.

55. In a combination with a wire fabricating machine, a bundling roll for winding fabric thereon, a tension roller coextensive with and parallel to said bundling roll, pinions rigidly affixed to said tension roller concentrically with the axis thereof, a pair of stationary racks for receiving each of said pinions, a flexible member having one of its ends made fast to said tension roller and being served therearound so as to pass upwardly therefrom on a side remote from said bundling roll, the free end of said flexible member being directed over sheaves substantially above said bundling roll and rearwardly to a point remote therefrom, and a plurality of weights removably associated with the free end of said flexible member.

56. In combination with a wire fabricating machine, a fabric bundling device comprising a plurality of guides and tension devices, a bundling roll for winding fabric thereupon, means adjacent said guides and tensioning devices for bending said fabric in a direction opposite to that at which it is wound upon said bundling roll, means for forceably rolling said fabric upon said bundling roll to flatten the same thereon, and means for varying the rolling force to which said fabric is subjected.

57. A wire fabricating machine comprising a twisting mechanism, means for delivering a plurality of wires to said twisting mechanism in parallel relation, a distributing device disposed adjacent said twisting mechanism to substantially overlie the same, means for delivering a plurality of wires to said distributing device in vertical planes in common with the wires in said twisting mechanism, means on said distributor for engaging the wires delivered thereto, including means for retaining portions of said wires in the vertical planes aforesaid and for deflecting other portions of said wires into the vertical planes of wires adjacent thereto.

58. A wire fabricating machine comprising a twisting mechanism, means for delivering a plurality of wires to said twisting mechanism in parallel relation, a distributing device disposed adjacent said twisting mechanism to substantially overlie the same, means for delivering a plurality of wires to said distributing device in vertical planes in common with the wires in said twisting mechanism, means on said distributor for engaging the wires delivered thereto, including means for retaining portions of said wires in the vertical planes aforesaid and for deflecting other portions of said wires into the vertical planes of wires adjacent thereto, and means for producing slack in each of the wires being de-

livered to said distributing device immediately preceding the deflection of the wires thereby.

59. In a wire fabricating machine, a wire distributing mechanism comprising stationary bearings, a shaft mounted for rotation in said bearings, mounting means rigidly secured to said shaft, a plurality of reciprocable elements carried by said mounting means in spaced parallel relation about said shaft, a plurality of wire engaging projections disposed along each of said reciprocable elements, means for sliding every other one of said elements in the same direction, and means for holding the remaining elements intermediate the latter stationary during the sliding movement of adjacent elements aforesaid.

60. In a wire fabricating machine, a wire distributing mechanism comprising stationary bearings, a shaft mounted for rotation in said bearings, mounting means rigidly secured to said shaft, a plurality of reciprocable elements carried by said mounting means in spaced parallel relation about said shaft, a plurality of wire engaging projections disposed in equidistant spaced relation along each of said reciprocable elements, means for sliding every other one of said elements in the same direction, means for holding the remaining elements intermediate the latter stationary during the sliding movement thereof, and means for moving all of said elements alternately in opposite directions subsequent to, and as a reversal of, said sliding movement.

61. In a wire fabricating machine, a wire distributing mechanism comprising stationary bearings, a shaft mounted for rotation in said bearings, mounting means rigidly secured to said shaft, a plurality of reciprocable elements carried by said mounting means in spaced parallel relation about said shaft, a plurality of wire engaging projections disposed in equidistant spaced relation along each of said reciprocable elements, means for sliding every other one of said elements for a distance substantially equal to the distance between said wire engaging projections, and means for holding the remaining elements intermediate the latter stationary during the sliding movement of adjacent elements aforesaid.

62. In a wire fabricating machine, a wire distributing mechanism comprising stationary bearings, a shaft mounted for rotation in said bearings, mounting means rigidly secured to said shaft, a plurality of reciprocable elements carried by said mounting means in spaced parallel relation about said shaft, means for rotating said shaft and said reciprocable elements carried thereby, means rendered effective by said rotation to reciprocate every other one of said reciprocable elements and to retain the adjacent elements, intermediate the latter, stationary during an interval of rotation thereof.

63. In a wire fabricating machine, a wire distributing mechanism comprising stationary bearings, a shaft mounted for rotation in said bearings, mounting means rigidly secured to said shaft, a plurality of reciprocable elements carried by said mounting means in spaced parallel relation about said shaft, means for rotating said shaft and said reciprocable elements carried thereby, means rendered effective by said rotation to reciprocate every other one of said reciprocable elements and to retain the adjacent elements, intermediate the latter, stationary during an interval of rotation thereof, and means for moving all of said elements alternately in

opposite directions during a subsequent interval of rotation thereof.

64. In a wire fabricating machine, a wire distributing mechanism comprising stationary bearings, a shaft mounted for rotation in said bearings, mounting means rigidly secured to said shaft, a plurality of channel bars reciprocally mounted by said mounting means in spaced parallel relation about said shaft, a plurality of wire engaging projections disposed in spaced relation along each of said channel members, in combination, a twisting mechanism comprising a plurality of rows of twisters, said rows being positioned parallel to said channel members and being adapted for movement adjacent thereto, means for rotating said distributing mechanism and said twisting mechanism simultaneously, the relationship between the said mechanisms causing each of said channel members to be inverted upon successive rows of twisters, and means rendered effective by the rotation of said distributing mechanism to reciprocate alternate channel members in the same direction for a distance substantially equal to the distance between said twisters in any of the rows thereof.

65. In a wire fabricating machine, a rotary twisting mechanism comprising a plurality of twisters mounted for rotation through an endless path, means for maintaining a level of oil about a portion of said path, and means for rotating said twisting mechanism to completely immerse successive twisters in said oil.

66. In a wire fabricating machine, a rotary twisting mechanism comprising a plurality of rotary twisters, means for mounting said twisters, said mounting means being provided with clean-out apertures adjacent said twisters, means for maintaining a level of oil about a portion of said twisting mechanism, and means for rotating said mechanism to successively immerse said twisters in said oil whereby said clean-out apertures are thoroughly flushed thereby.

67. A wire fabricating machine comprising a housing, a plurality of shafts journaled for rotation in said housing, a plurality of sprockets carried by said shafts for rotation therewith, each of said sprockets on one of said shafts aligning with a sprocket on the other thereof, chains suspended between said aligned sprockets, mounting means extending across all of said chains substantially normal to the longitudinal axis thereof, twistlers carried by said mounting means including oil-receiving apertures, an oil pan disposed about said sprockets and associated chains, an oil draining aperture disposed adjacent the bottom of said pan, and a closure for said aperture.

68. A wire fabric machine including traveling rows of twistlers, means for interchangeably journaling any one of different rotary wire distributors in operative association with said twistlers, and means for intergearing said rows of twistlers and any one of said distributors journaled by the first named means, to effect their synchronous operation.

69. A wire fabric machine including mechanism for fabricating wires into a fabric strip, a coiler spaced from said mechanism for coiling said strip and requiring operating interruptions to permit removal of fabric strip coils successively formed thereby, said mechanism being adapted to produce strip in lengths exceeding that coiled into a single coil by said coiler, and means between said mechanism and said coiler for confining in loop-form strip produced by said mechanism during said operating interruptions of said

coller, whereby said mechanism may operate continuously during said operating interruptions of said coiler.

- 5 70. A wire fabric machine including mechanism for fabricating wires into a fabric strip and spaced devices for placing a span of said strip under tension after it leaves said mechanism, said devices restricting said tension to said span and isolating said tension from the portions of said
- 10 strip beyond both ends thereof including the portion in said mechanism in its fabrication phase.

71. A wire fabric machine including mechanism for fabricating wires into a fabric strip and

spaced devices for placing a span of said strip under tension after it leaves said mechanism, said devices restricting said tension to said span and isolating said tension from the portions of said strip beyond both ends thereof including the portion in said mechanism in its fabrication phase, said machine including means for controlling the tension applied said span of strip by said devices to enable the production of either fluffy or flat fabric strip.

ANGELIQUE KILMER,
Administratrix to collect of the Estate of William A. Kilmer, Deceased.