June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 1

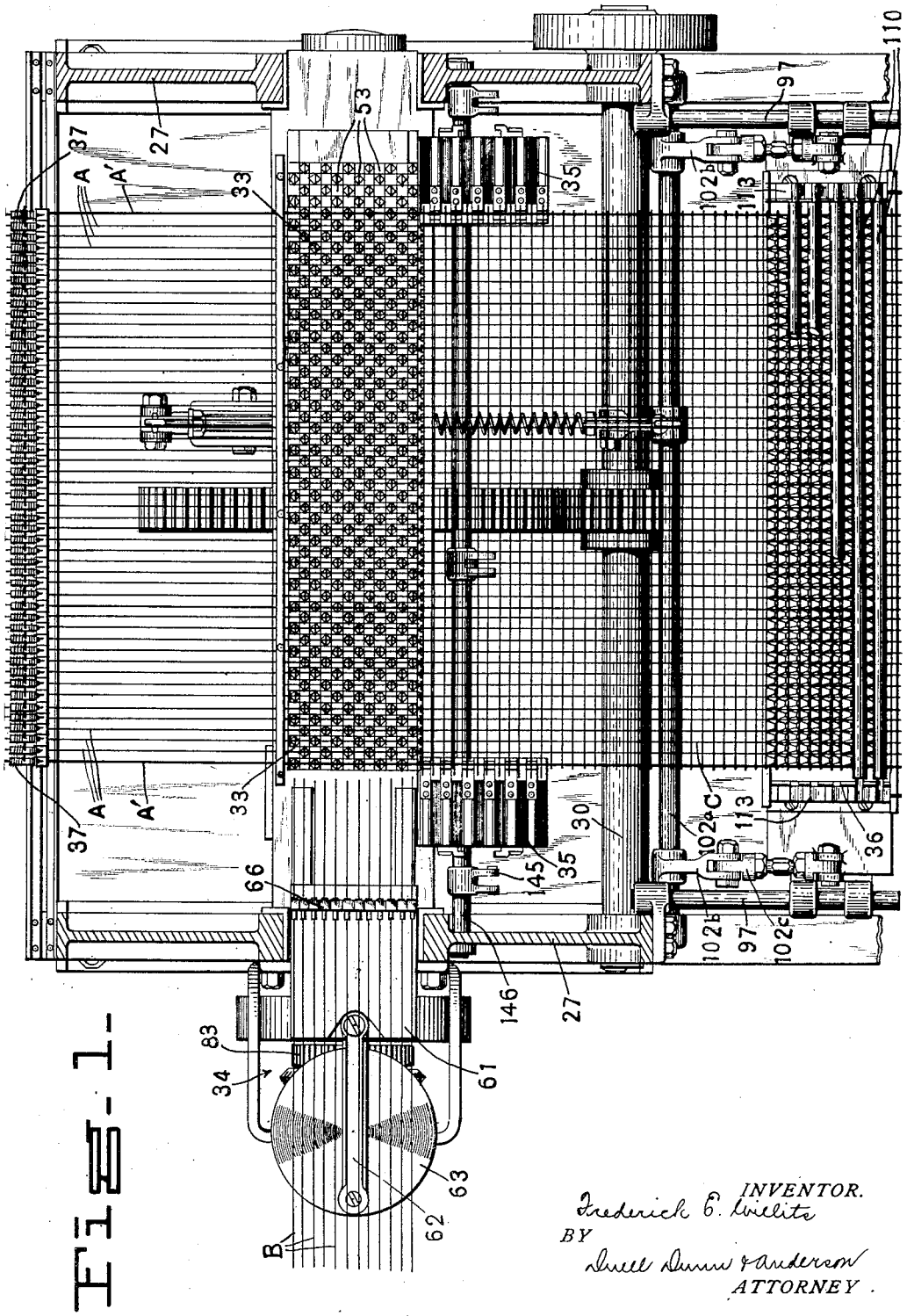


Fig. 1.

INVENTOR.
Frederick E. Willits
BY
Duell Dunn & Anderson
ATTORNEY.

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 2

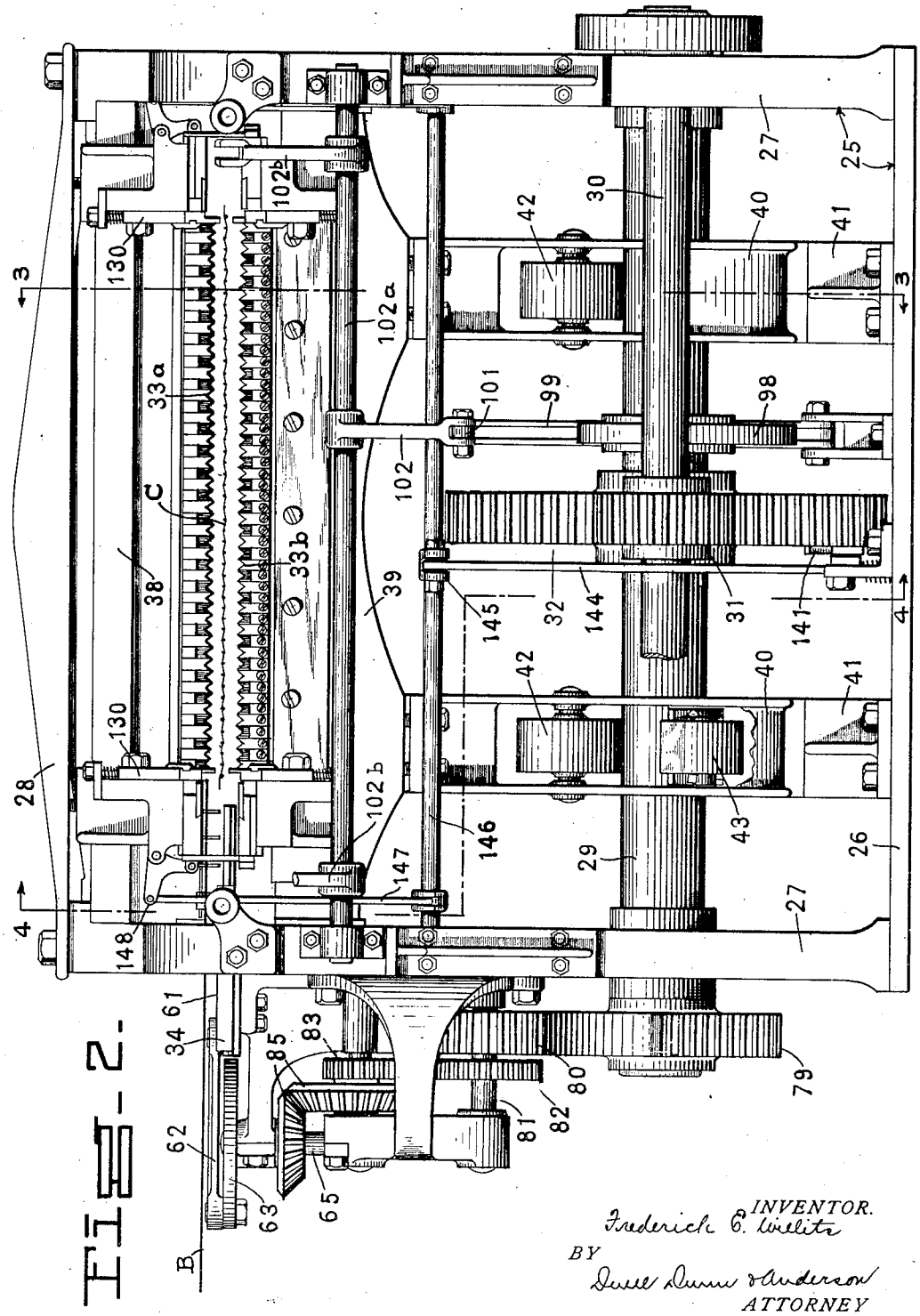


FIG. 2.

INVENTOR.
Frederick E. Willits
BY
Dunn & Anderson
ATTORNEY

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 3

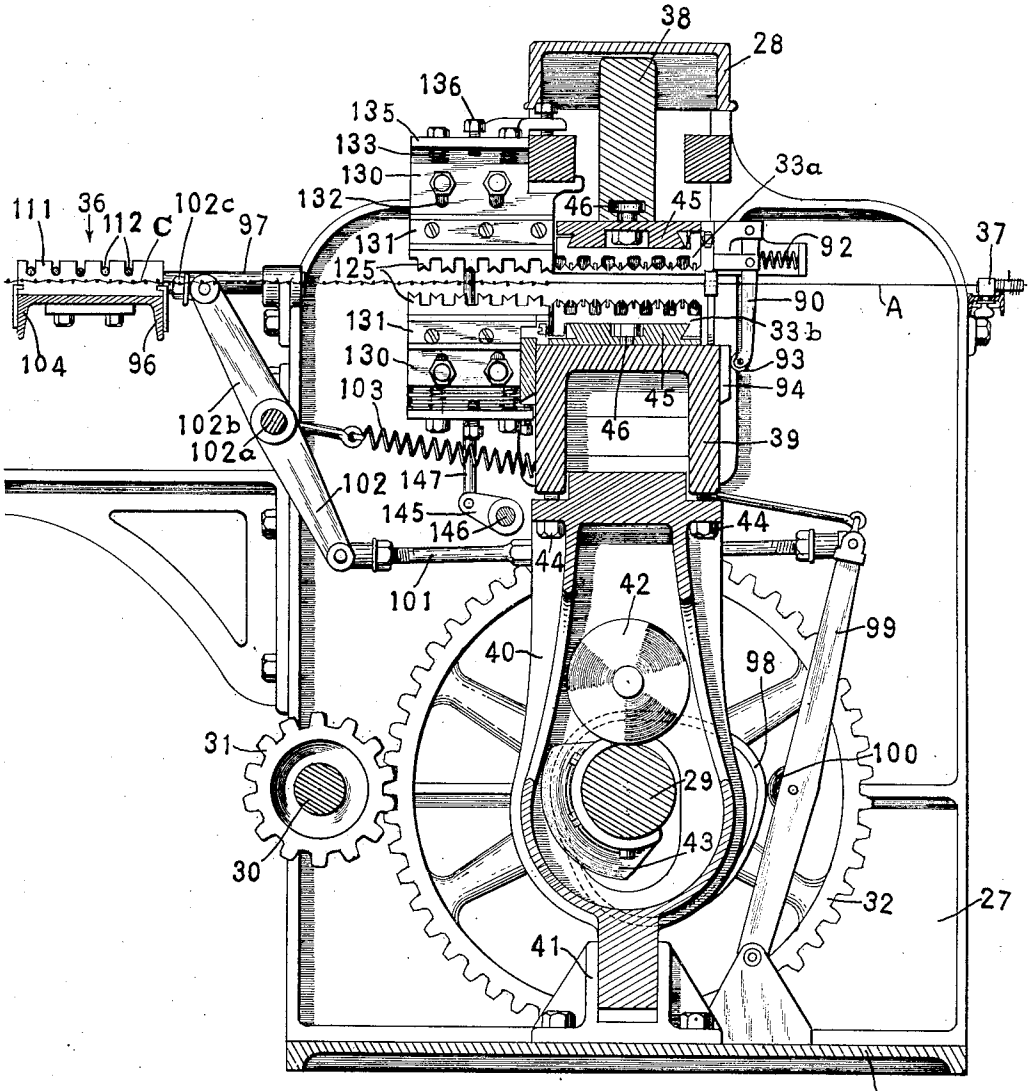


Fig. 3.

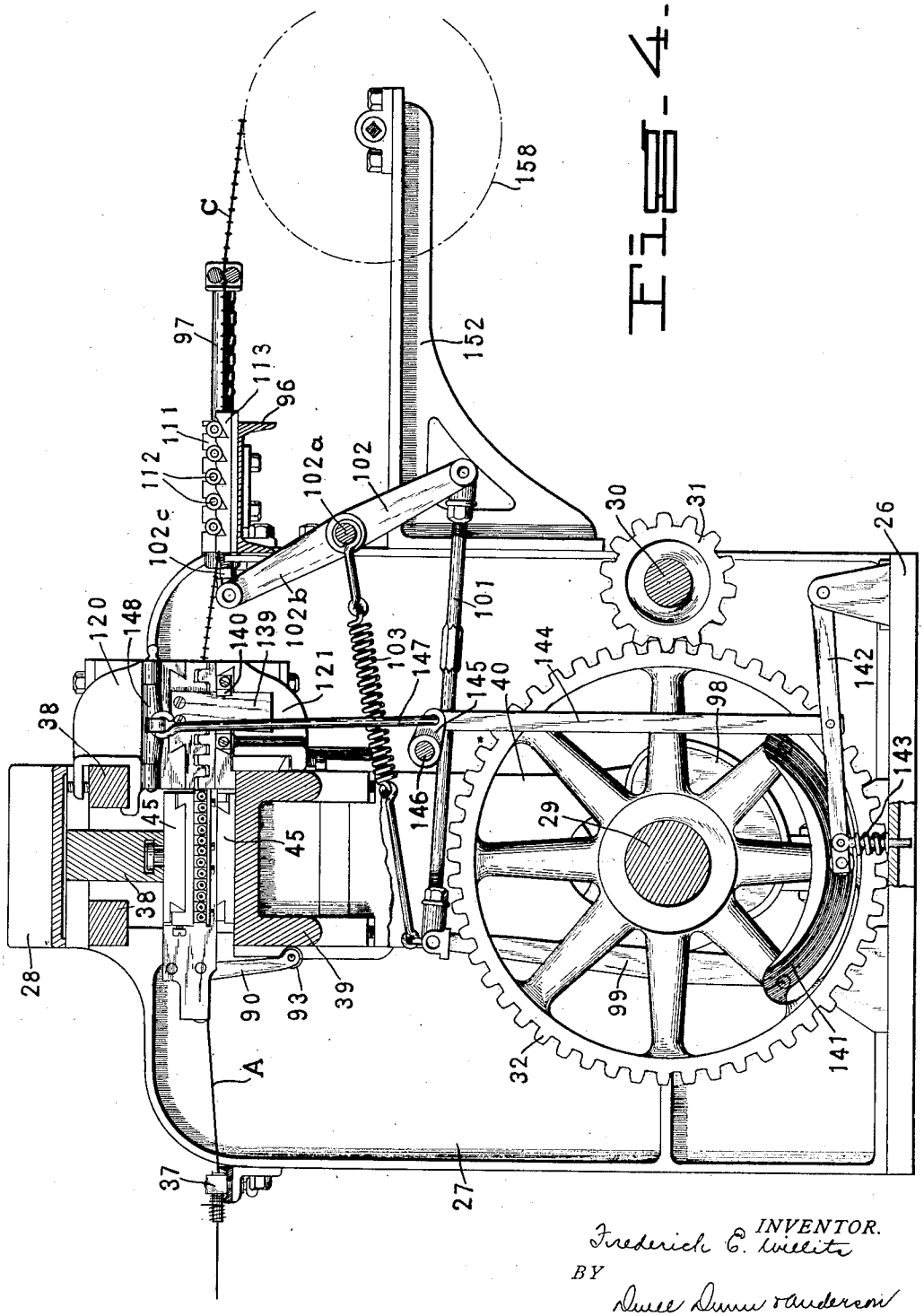
INVENTOR.
Frederick E. Willits
BY
Duell Dunn Vanderson
ATTORNEY

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 4

Fig. 4.



Frederick E. Willits INVENTOR.

BY

Dunn Dunn & Anderson

ATTORNEY

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 5

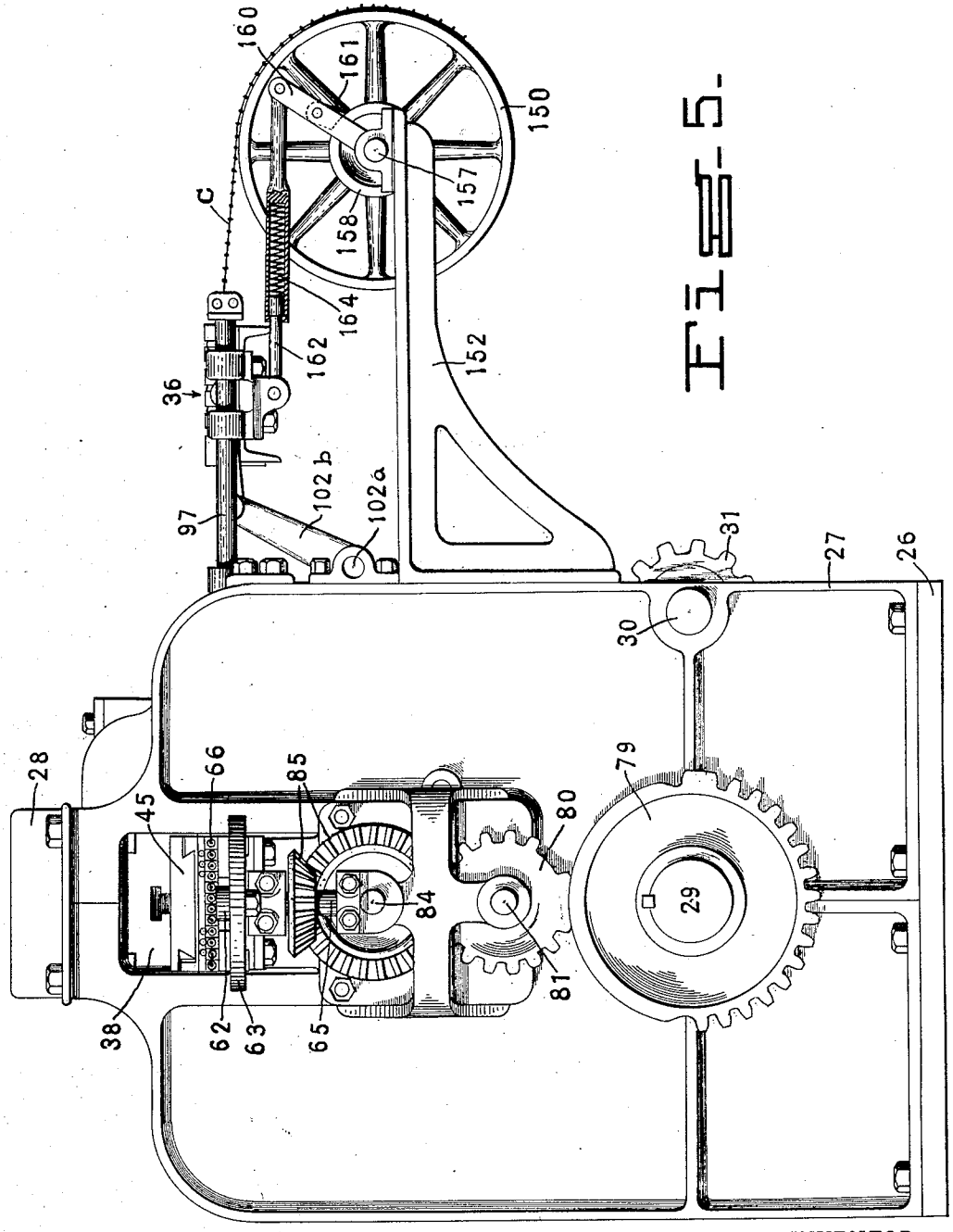


Fig. 5.

INVENTOR.
Frederick E. Willits
BY Duell Dunn & Anderson.
ATTORNEY

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 6

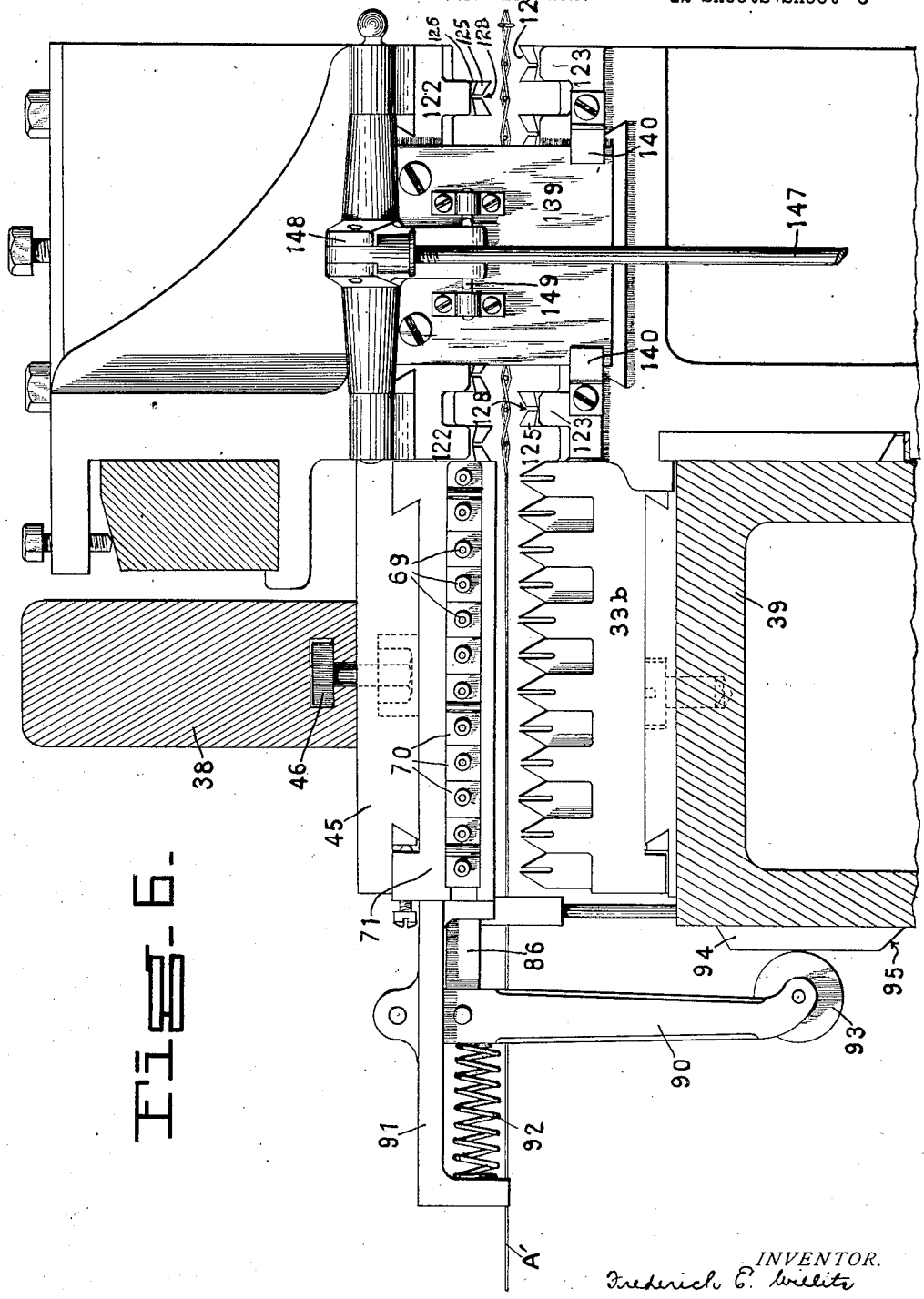


FIG. 6.

INVENTOR.
Frederick E. Willits
BY
Dunn Dunn & Anderson
ATTORNEY

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 7

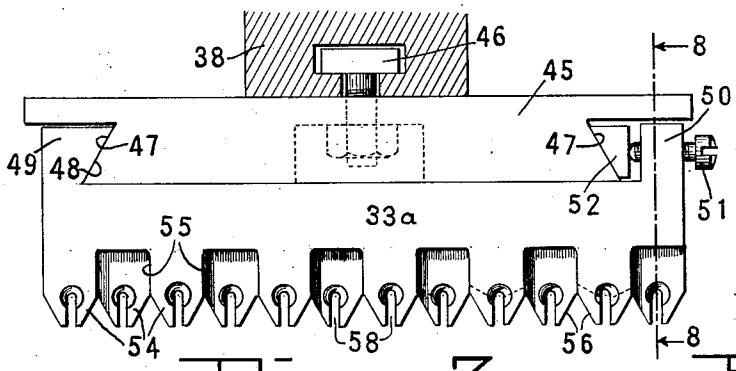


Fig. 7.

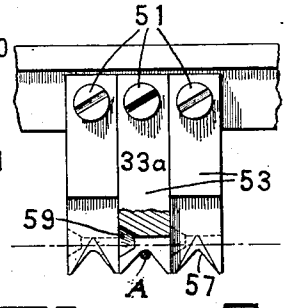


Fig. 8.

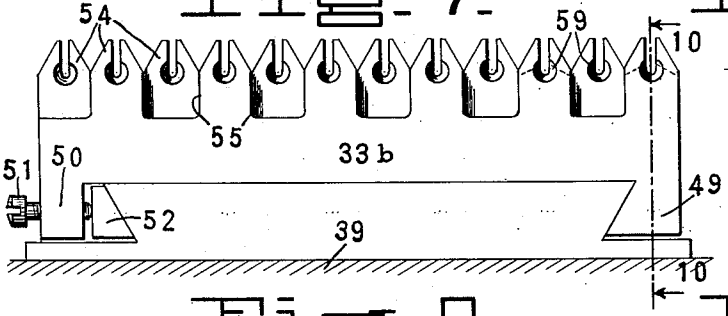


Fig. 9.

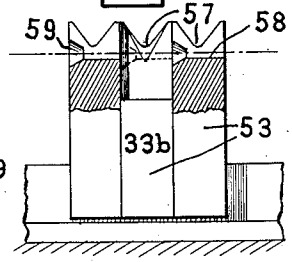


Fig. 10.

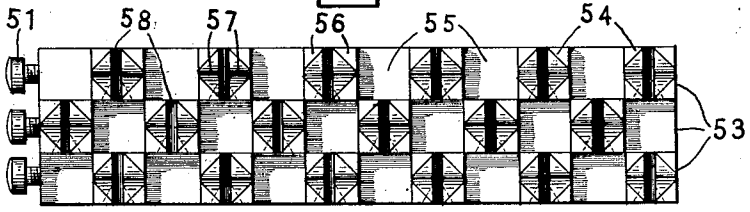


Fig. 11.

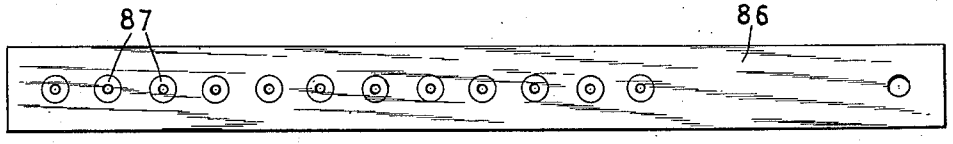


Fig. 12.



Fig. 13.

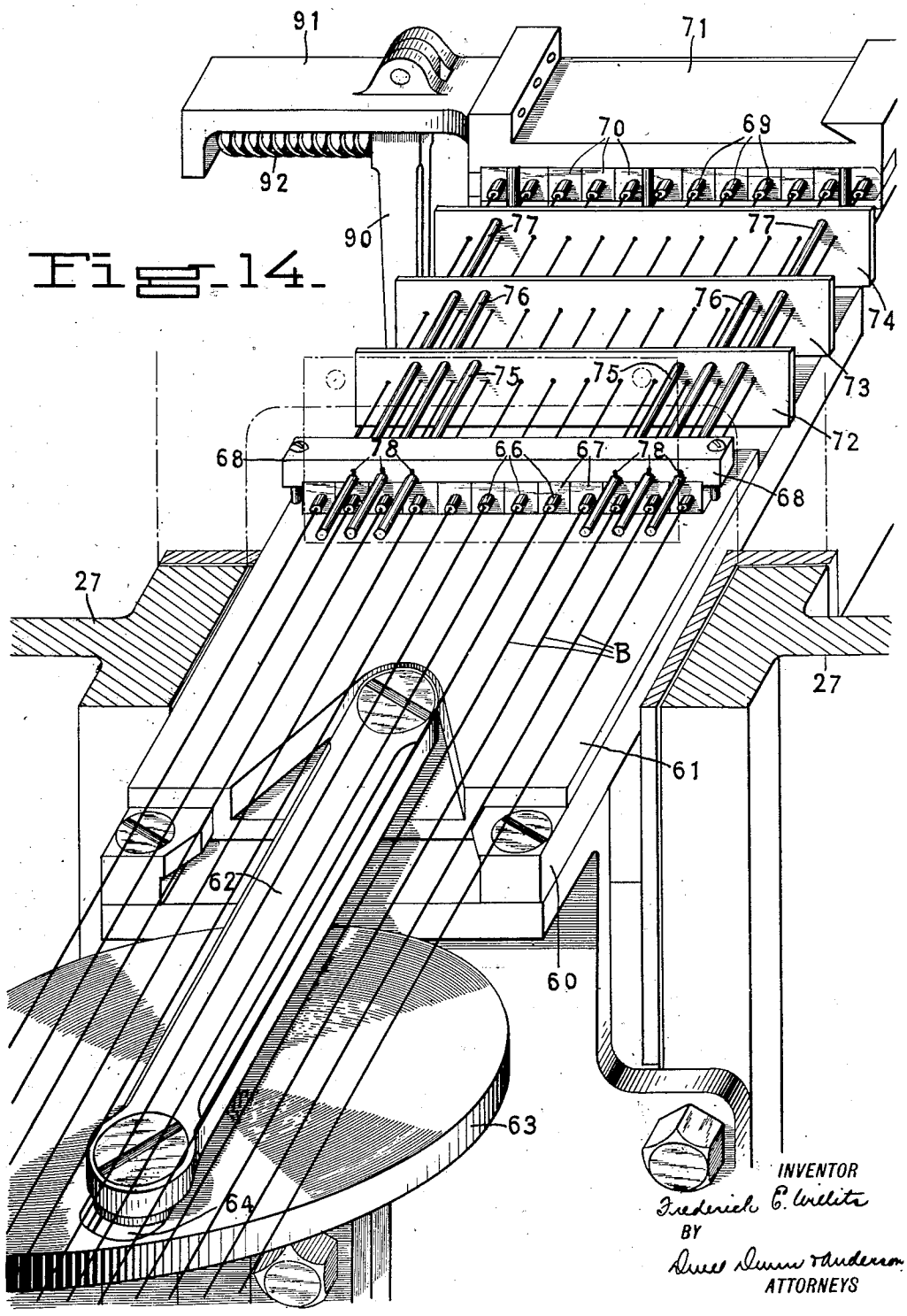
INVENTOR
Frederick E. Willits
BY
Dunn Dunn & Anderson
ATTORNEYS

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 8

Fig. 14.



INVENTOR
Frederick E. Willits
BY
Dunn Dunn & Anderson
ATTORNEYS

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 9

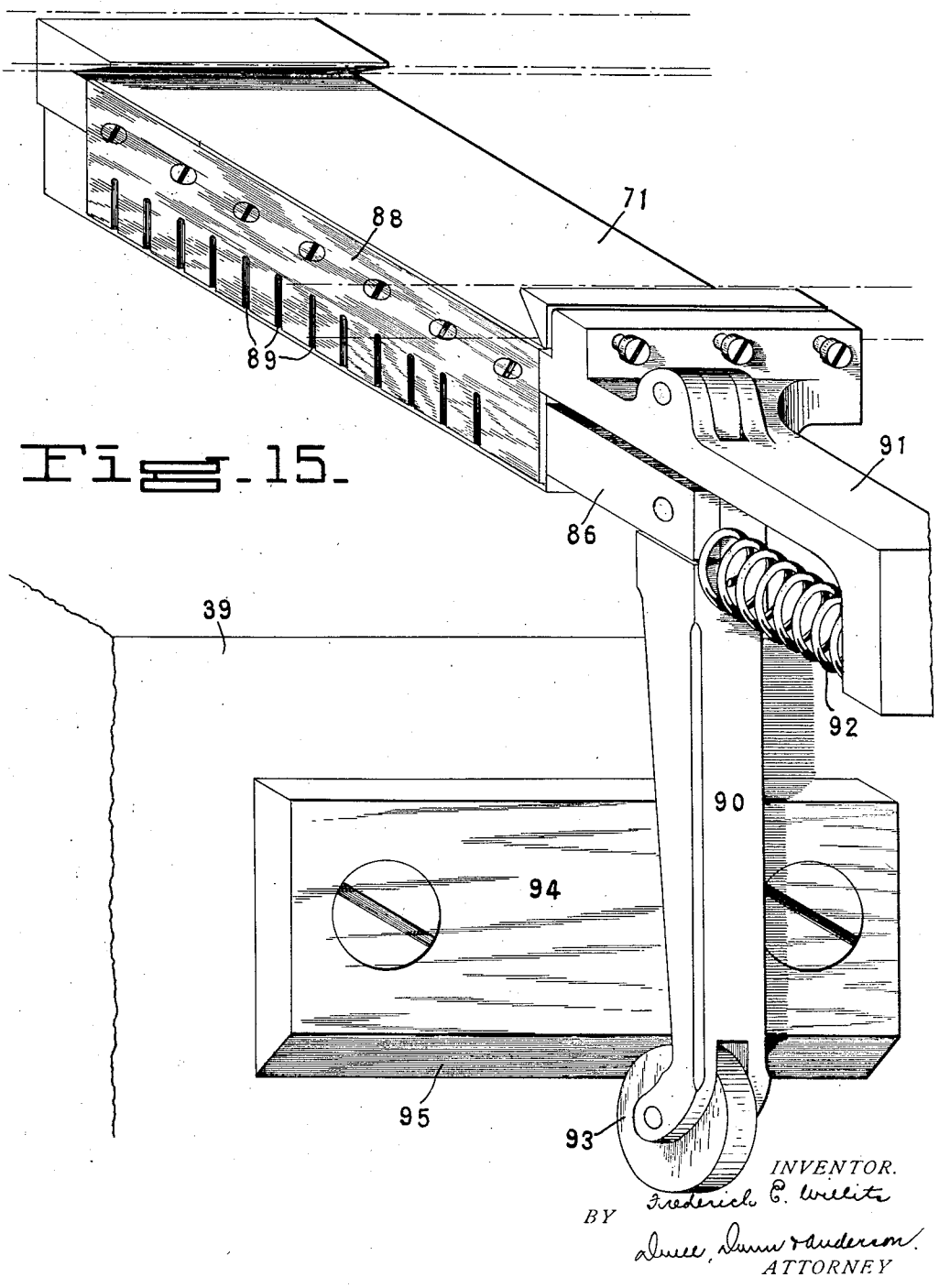


Fig. 15.

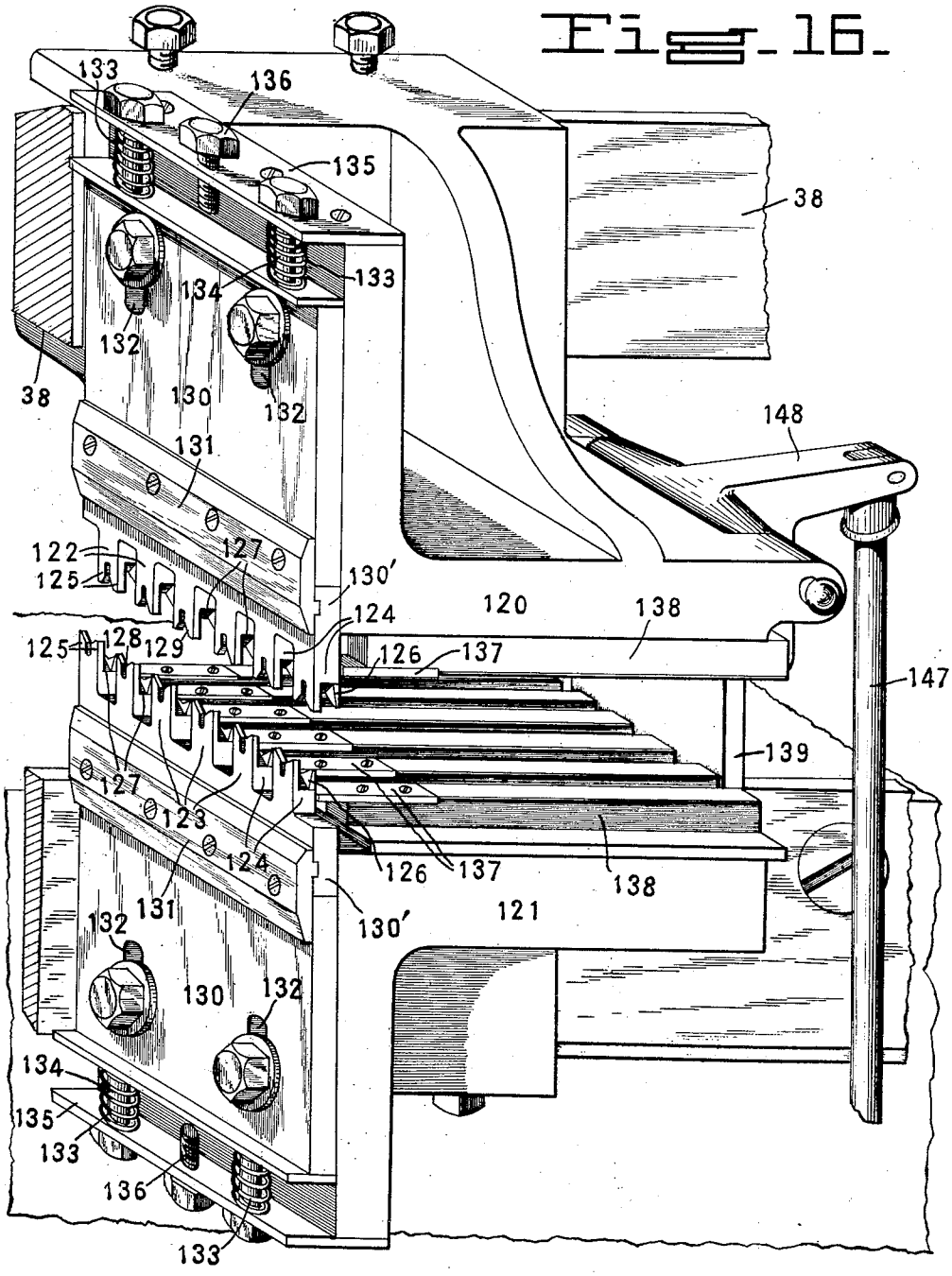
INVENTOR.
Frederick E. Willits
BY
Dunn & Anderson
ATTORNEY

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 10

Fig. 16.



INVENTOR.
Frederick E. Willits
BY
Dunn & Anderson
ATTORNEY

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 11

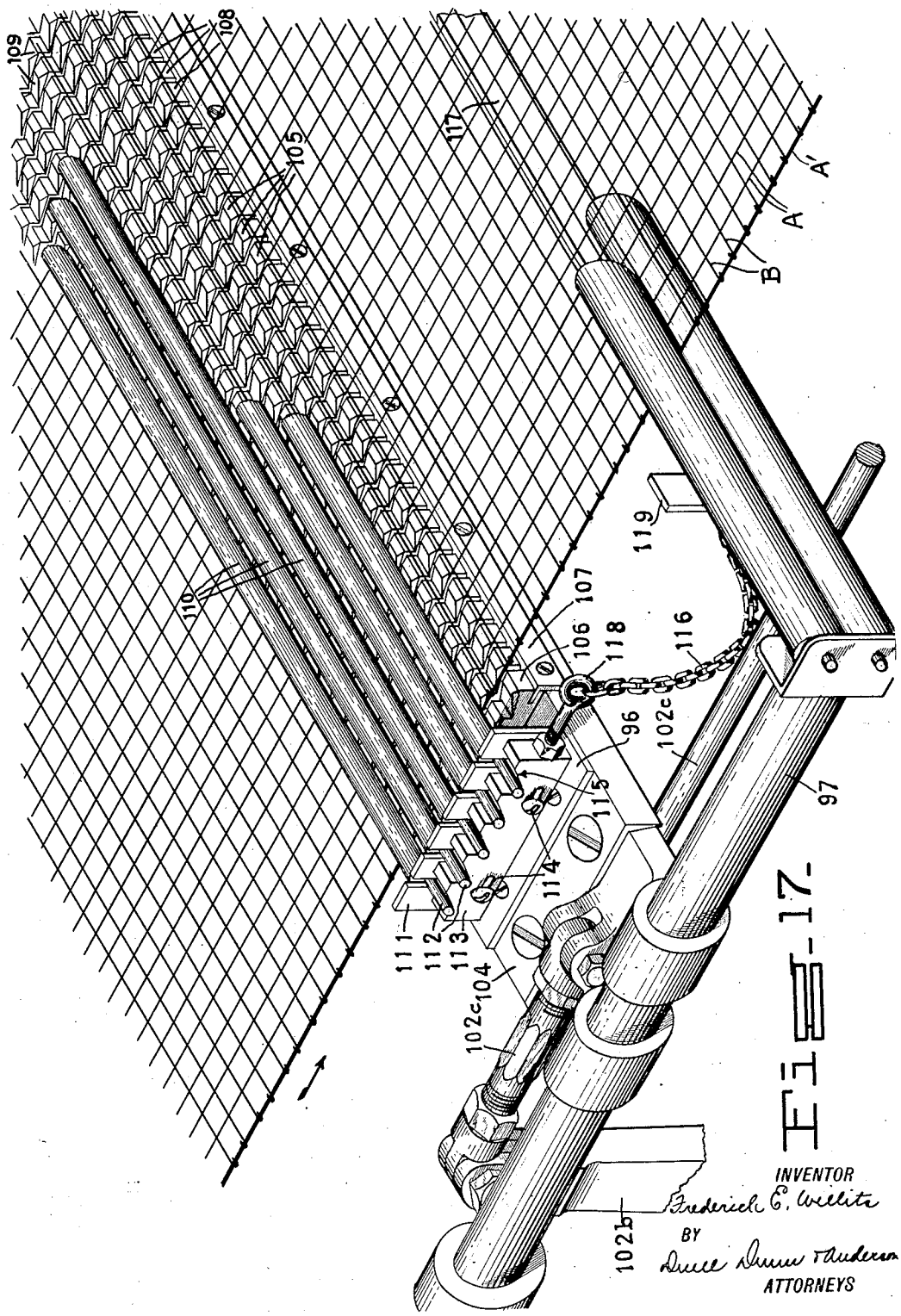


FIG. 17.

INVENTOR
Frederick E. Willits
BY
Dunn Thurston
ATTORNEYS

June 30, 1931. F. E. WILLITS 1,812,506

WOVEN WIRE FABRIC MACHINE

Filed Nov. 15, 1927 12 Sheets-Sheet 12

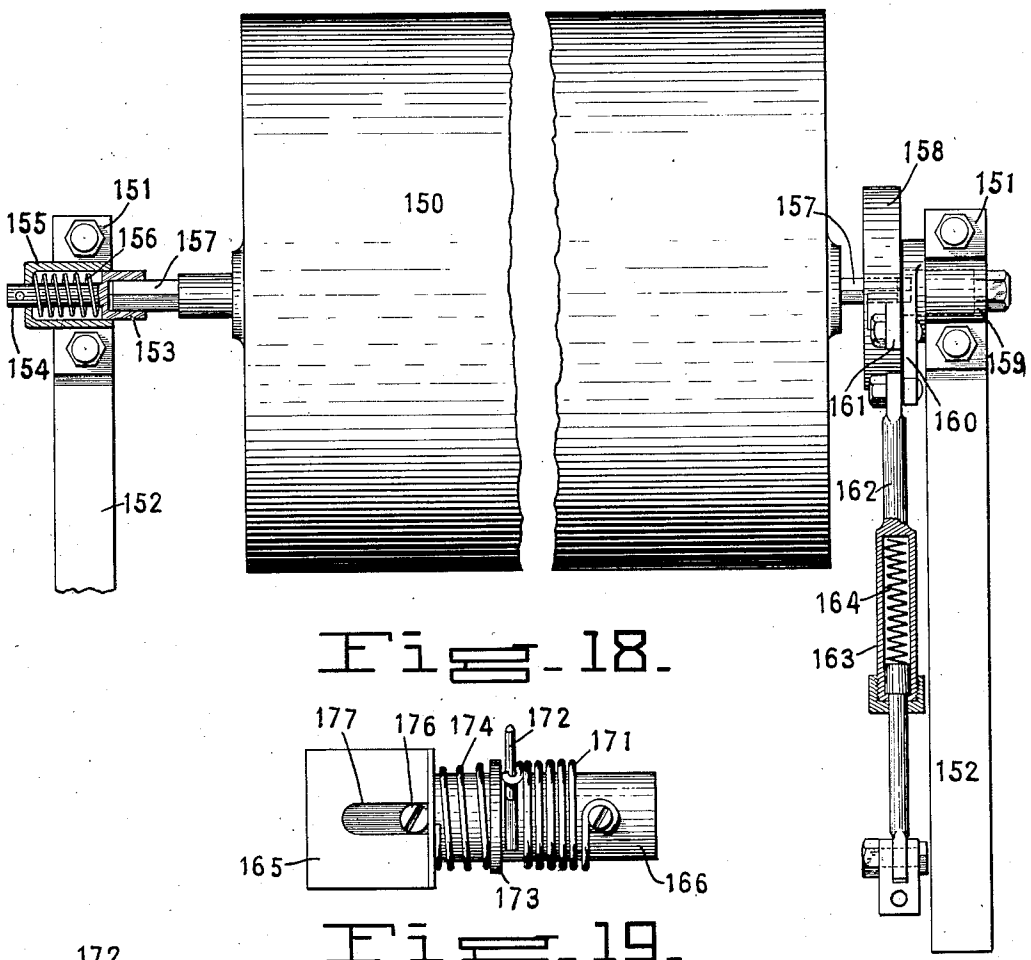


Fig. 18.

Fig. 19.

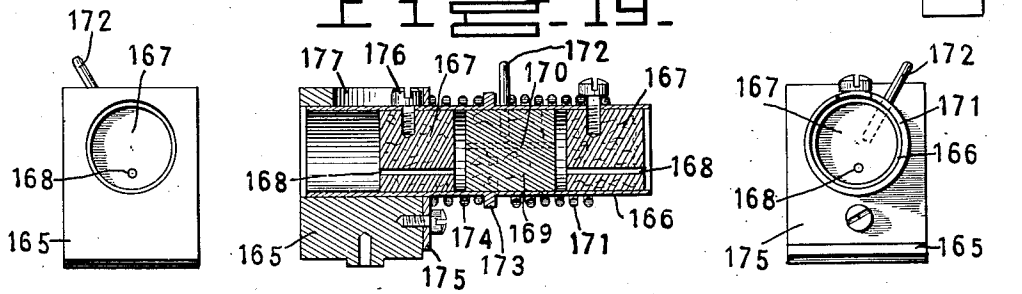


Fig. 20. Fig. 21. Fig. 22.

INVENTOR
Frederick E. Willits
BY
Dunn & Anderson
ATTORNEYS

Patented June 30, 1931 1,812,506

UNITED STATES PATENT OFFICE

FREDERICK E. WILLITS, OF FAIRPORT, NEW YORK

WOVEN WIRE FABRIC MACHINE

Application filed November 15, 1927. Serial No. 233,354.

This invention relates to improvements in machines for making woven fabrics and, more particularly, with reference to some of its details, it relates to improvements in automatic machines for making woven wire fabric, or netting.

It is a general object of the invention to provide a machine of the class mentioned which is of such an improved construction as to produce a fabric of superior qualities at an increased rate of production thereby minimizing production costs.

A further object is to provide a machine of the class mentioned having an improved construction and arrangement of parts whereby it operates substantially automatically and requires very little adjustment or attention during operation.

A further object of the invention is to provide, in a machine of the class mentioned, an improved mechanism and method of assembling the warp and filler, or weft strands in intermeshing relation to form the woven fabric.

Another object is to provide, in a machine of the class mentioned, an improved mechanism for deflecting the warp strands from their normal plane under tension in such a manner as to provide a plurality of transversely extending longitudinally related passage ways, or sheds, through which the filler strands may be fed into intermeshing relation.

Another object of the invention is to provide an improved die construction for fabric machines, constructed and arranged to deflect or crimp warp strands at longitudinally spaced points thereof and to hold said strands in deflected position during placing of the filler strands, the die being constructed, furthermore, to guide the filler strands into position and arranged to provide free passage ways or sheds for said filler strands.

A further object is to provide, in a machine of the class mentioned, an improved mechanism for simultaneously feeding a plurality of filler strands into intermeshing relation with the warp strands and embodying, in its construction, an improved mechanism for supporting the filler strands while being fed, assuring correct placing thereof with reference to the warp strands, even in cases where the filler strands are quite fine and subject to easy bending, such, for example, as that used in window screen fabrics.

A further object is to provide, in a machine of the class mentioned, an improved mechanism for feeding the filler strands into intermeshing relation with the warp strands and embodying an improved intermittent or step-by-step action and a strand-gripping arrangement whereby the strands are advanced in relatively short stretches at each step, thus assuring accurate feeding of the strands and, furthermore, assuring feeding of correct lengths of filler strands to reach across the warp strands and provide extending ends for turning about the selvage warp strand to provide the selvage edge of the fabric.

A further object of the invention is to provide, in a machine of the class mentioned, an improved severing device for simultaneously severing a plurality of filler strands, when fed into position so as to provide slightly projecting end portions, positioned for bending the selvage warp strand to provide a selvage edge.

Another object is to provide, in a machine of the class mentioned, an improved selvage turner for bending or turning the free ends of the filler strands about the selvage warp strands so as to provide the opposite selvage edges of the fabric.

A further object is to provide, in a machine of the class mentioned, an improved selvage turner operating to turn simultaneously a plurality of filler strand ends about the selvage warps and to turn them in opposite directions.

A further object is to provide, in a machine of the class mentioned, an improved fabric feeding device, devised in such a manner as to engage the fabric at a multiplicity of points in the meshes thereof, so as to exert distributed pressure over the fabric surfaces in feeding the fabric forwardly, thus avoiding distortion to the fabric and preventing dislocation of the filler or warp strands.

A further object is to provide, in a machine of the class mentioned, a fabric feeding

device having an improved arrangement for maintaining the fabric-engaging member in engaging relation with the fabric and for automatically engaging and disengaging it.

A further object is to provide, in a machine of the class mentioned, an improved gripping device for engaging each of the warp strands, and exerting a yielding frictional engagement therewith at points spaced longitudinally so as to exert a resistance or drag to warp advancement, thus tensioning the warps for advantageous operation.

A further object is to provide, in a machine of the class mentioned, an improved take-up device, or drum, for winding up the fabric as it is woven, and having an improved automatic operating mechanism to drive it at the correct speed to take up the fabric as fast as it is woven.

Other objects and advantages of the improved machine will be in part pointed out in connection with the following detailed disclosure of an illustrative but preferred embodiment of the invention, and will be in part obvious in connection therewith.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the claims.

For a more complete understanding of the nature, objects and advantages of the invention, reference is had to the following detailed description of the preferred embodiment and to the accompanying drawings, in which

Fig. 1 is a partially diagrammatic plan view of a wire fabric machine constructed in accordance with the invention, parts being removed and in section to facilitate the disclosure;

Fig. 2 is an enlarged front elevation thereof;

Fig. 3 is a vertical transverse section taken approximately on the line 3—3 of Fig. 2, looking in the direction of the arrows;

Fig. 4 is a transverse vertical section taken approximately on the line 4—4 of Fig. 2, looking in the direction of the arrow;

Fig. 5 is an end elevation looking at the left end of Fig. 2 and showing a detail of the intermittent drive for the filler strand feeding mechanism;

Fig. 6 is an enlarged sectional detail taken substantially upon the same plane as Fig. 4;

Fig. 7 is an enlarged elevation of the upper crimping die;

Fig. 8 is a fragmentary end elevation of Fig. 7, parts being in section substantially on the line 8—8 of Fig. 7;

Fig. 9 is a side elevation of the lower crimping die;

Fig. 10 is a fragmentary end elevation of Fig. 9, parts being in section substantially on the line 10—10 of Fig. 9;

Fig. 11 is a face view of a section of one of the dies;

Fig. 12 is an elevation of a cutting plate for the filler strands;

Fig. 13 is an edge view of the cutter of Fig. 12, parts being in central longitudinal section;

Fig. 14 is a fragmentary enlarged partially diagrammatic view of the feeding mechanism for feeding the filler strands into intermeshing relation with the warp strands;

Fig. 15 is an enlarged fragmentary perspective view showing the cutter mechanism for the filler strands;

Fig. 16 is a fragmentary enlarged perspective view of the selvage turner;

Fig. 17 is an enlarged fragmentary perspective view of the fabric feeding mechanism;

Fig. 18 is a fragmentary plan of the fabric take-up drum and the operating mechanism therefor;

Fig. 19 is a detail enlarged plan view of one of the warp tensioning grippers;

Fig. 20 is a left end elevation of Fig. 19;

Fig. 21 is a longitudinal central section of Fig. 19; and

Fig. 22 is a right-hand elevational view of Fig. 19.

Referring to the drawings for a detailed description of the preferred embodiment of the invention, as disclosed in the accompanying drawings, a framework 25 is provided, supporting the main operative elements of the machine. This framework may be of any preferred construction, but is preferably of cast or pressed metal and, as shown, includes a horizontal base member 26 with upright spaced end frames secured thereto and a yoke or upper spacing frame member 28 bolted to the upper terminals of the end frames. The main driving shaft 29 is shown as mounted for rotary movement in the lower part of the end frames 27 and may be driven by suitable driving connections, such, for example, as the shaft 30 carrying a pinion 31 intermeshing with the main driving gear 32 mounted upon the main shaft 29. The shaft 30 may be connected to an electric motor or other motive means.

The principal operative functions in making the woven wire fabric are carried out in two major stages. At the first stage the die indicated generally at 33 in Fig. 1 cooperates with the warp strands of the fabric to prepare them for reception of the filler or weft strands, which are then fed into position by the weft feed mechanism, indicated generally at 34. As soon as the filler strands are completely fed into intermeshing relation with the warp strands, a cutting mechanism is operated to sever the filler strands adjacent

to the selvage warp strand. At the second stage in the operation of the machine the selvage turner indicated generally at 35 turns the ends of the filler wires over the selvage warp strand so as to form the selvage edge of the fabric. There are two of these selvage turners, one located adjacent each selvage edge of the fabric, and they are preferably operated at the same time to turn the ends of the filler strands which project slightly beyond the respective selvage warp strands. In the interval between these two successive main stages, the fabric feeding mechanism 36 is operated to feed the fabric forwardly in the machine a sufficient distance to bring the filler strands which have just been fed into position in operating registry with the selvage turners.

The warp wires or strands indicated at A in Fig. 1 and other parts of the drawings, and the selvage warp strands A′, which may be slightly larger than the other warps, are held in position in the machine during the fabric forming operations by the feeding mechanism 36, and a bank or series of gripping elements 37, which are preferably arranged for individually gripping each of the warp strands, thus exerting a drag or resistance to forward movement thereof, and imparting the desired tension to hold them in correct operative position in the machine. The filler or weft strands are designated B, and the fabric C. The gauge or size of wire may vary widely with this type of machine, as the mechanism is particularly adapted for satisfactory operation with large or small sizes of wire and the filler strand feeding mechanism will operate in a satisfactory manner upon light flexible wires, as special provision is made to prevent buckling thereof when fed into position, as more fully hereinafter described.

The die construction

The die 33 is constructed of complementary mating parts or sections, preferably arranged one above another, forming an upper die part 33^a and a lower die part 33^b, as shown best in detail in Figs. 7 to 11, inclusive. The upper die part is supported upon a bed 38 (see Figs. 2, 3, and 4), which may be of any preferred construction appropriately supported upon the frame of the machine and the lower die is supported upon a bed 39. These beds are mounted for relative lateral bodily movement so that the dies may be closed upon the fabric and subsequently opened. Although either one or both of the beds may be mounted for such bodily movement, only the lower bed is so mounted in the embodiment shown while the upper bed is mounted in stationary position. In the embodiment shown the lower bed 39 is constructed in the form of a movable carriage slidable up and down in appropriate supporting guideways of the framework, while the upper bed 38 is mounted upon the framework in stationary position thereon.

The carriage 39 is reciprocated upwardly and downwardly in its supporting guideways by means of driving connections to the driving shaft 29, embodying a pair of spaced cam arms, or links, 40 attached at their upper ends to the lower side of the carriage 39 which is shown as embodying a channel bar with downwardly directed flanges. A supporting and guiding mounting 41 is provided for the lower ends of each of the cam arms 40 to maintain them in correct driving position during operation. The cam arms 40 as shown are preferably looped about the shaft 29, and each carries a cam roller 42 positioned to rest upon the main shaft 29, so as to support the die carriage and being engageable with an eccentric cam 43 upon the shaft 29 as the latter rotates. The lower die is thus reciprocated, and thus periodically brings the lower die part 33^b into cooperative relation with the upper die part 33^a. The carriage 39 is preferably connected to the operating links 40 for vertical adjustment by means of the set screws 44, whereby the cooperative engaging action of the die parts may be radially adjusted.

Both upper and lower die parts are preferably removably clamped in position upon the respective supporting beds by means of clamping brackets 45, secured to the beds by bolts or screws 46. The die supporting and clamping brackets 45, as shown in Fig. 7, may be formed with grooved edges having inclined laterally disposed faces 47 engaging at one side a complementary inclined surface 48 of lugs 49 formed upon the die. At the other end the die is formed with lugs 50, each provided with set screws 51 adapted to engage a clamping bar or key 52 having an inclined face cooperating with the inclined face 47 bracket 45 so as to firmly secure the die in position when the set screws are tightened. By means of this clamping arrangement both upper and lower dies are firmly held in operative position and may also be readily removed, adjusted or replaced.

As clearly seen in Figs. 7 to 11, inclusive, both upper and lower dies are of similar construction, each embodying a plurality of separate die bars or plates 53 having flat lateral sides adapted to contact with each other to build up the complete die part. At one edge each die bar 53 has a series of spaced projections 54 forming the active or working parts of the die and forming intervening recesses 55 substantially equal in cross sectional area with that of the projections. As clearly seen in Fig. 11, adjacent die bars have their projections and recesses in staggered or alternate arrangement so as to provide a checker-board formation when the die bars

are completely assembled. Each projection 54 is specially formed to provide an outwardly disposed work or wire engaging face including anticlinal surfaces 56 and longitudinally extending grooves or seats 57 aligned with each other in each die bar, whereby the warp strand may be seated in the series of warp seats thus formed. Each die projection 54 is also provided at its work face with a groove or slot 58 positioned transversely of the respective warp seat 57 and also transversely of the die bar, and is arranged to intersect and open through the warp seat. These slots 58 are adapted for the reception of the filler strands and their bottoms are positioned somewhat beneath the bottom of the respective warp seats, as clearly shown in Figs. 8 and 10; that is, the filler strand receiving slots are somewhat deeper than the seats for receiving the warp strands. The slots 58 open through the respective work faces of the die, thus permitting the die parts to separate from each other after the filler strands have been fed into position. Also each die projection 54 is provided at its forward lateral side toward which the filler strands are fed with a small cup shaped depression 59 positioned adjacent the bottom of each slot and functioning as a guide for guiding the respective filler strands into correct position during feeding thereof into intermeshing relation with the warp strands.

It will now be readily understood that the upper and lower die members, or parts, by virtue of the checker-board arrangement described, are of complementary formation and arranged to mate with each other so that the respective projections 54 of one die part may enter the respective recesses 55 of the other die part when the lower part is moved against the upper part by action of the operating mechanism. When one die part is moved against the other the anticlinal surfaces 56 may engage with each other, thus functioning as guiding surfaces. It will be clear that as many individual die bars 53 are employed as there are warp wires, and the number may be varied in accordance with the number of warp wires. Also the length of each die bar, and the number of individual work faces will be dependent upon the spacing and number of weft wires which are to be simultaneously fed into intermeshing relation with the warp wires, and both the length of the die bars and the number of work faces may be varied in accordance with requirements.

The filler strand feeding

As best shown in Figs. 1, 2, and 14, the feeder for the filler strands is mounted laterally adjacent to the die or warp crimping mechanism so as to feed the desired number of filler strands into intermeshing relation with the warp strands. The embodiment shown provides for simultaneously feeding 12 filler wires into position and, of course, the number may be varied as desired. A supporting guideway, or plate, 60 (Fig. 14) is mounted upon the framework, extending transversely of the machine and carries a sliding reciprocatory crosshead 61, to which is pivotally connected a crank arm 62 connected at its opposite end to a rotary disk 63 provided with a radial adjusting slot 64 for adjusting the stroke. The rotary disk is carried by a shaft 65, mounted in vertical position in bearings carried by a part of the framework. The reciprocating crosshead 61 provides a carriage for a plurality of grippers 66, arranged in a series transversely of the cross-head and providing an individual gripper for each filler wire B. These grippers are mounted upon the carriage in series of blocks 67, held in place by a clamping bar 68, secured in position upon the carriage. Spaced from the bank of grippers 66 are similar grippers 69 also arranged in a series extending approximately parallel to the series of grippers 66. Grippers 69 may also be mounted in individual supporting blocks 70, mounted in a supporting plate 71, carried by the framework. Each filler strand B extends through a gripper 66 and a gripper 69, these grippers thus cooperating to form a pair of grippers which are arranged to feed the respective wires B forwardly as the grippers 66 are reciprocated with their supporting carriage. The grippers 66 and 69 may be of known construction, but it is of special importance that they are of such a nature as to engage the wires with a firm non-yielding, non-slipping grip, to prevent relative movement of the wires in one direction, but to permit free and unresisted relative movement thereof in the opposite direction. For this purpose grippers of the nature disclosed in Patent 1,103,316, issued to W. M. Roop on July 14, 1914, are found satisfactory. The grippers 66 of the movable bank will be reversely arranged to the grippers 69 of the other bank. The first mentioned bank when reciprocated functions intermittently to grip the wires B, and feed them forwardly while the other bank grips the wires to prevent any retraction thereof while permitting free and unobstructed advancement.

It is advantageous that the stroke of the crosshead 61 be relatively short as compared with the width of the fabric, and therefore in the embodiment shown the stroke is of such length as to require four complete forward strokes of the crosshead in order to feed a length of the wires B sufficient to extend across the fabric. It will, therefore, be seen that the wires B will be fed forwardly in an intermittent or step-by-step action in relatively short stretches, the grippers 66 engaging the wires B at each advancement of the crosshead and pushing them forwardly through

the grippers 69. This short stroke step-by-step action assists in minimizing the tendency of the wires B to buckle incident to the compressional thrust thereon imparted by the feeding action.

The buckling tendency is still further minimized by an improved guiding and supporting mechanism for supporting and directing strands B at spaced points therealong between the two banks of feeding grippers. In the illustrative embodiment this guiding and supporting mechanism is shown in the form of bars 72, 73, and 74, provided with apertures for the reception of the strands and slidably supported by the guideway 60 for lateral sliding movement. These guiding and supporting bars are arranged substantially parallel with each other and with the two banks of grippers, and when the crosshead is in retracted position the bars will be about equally spaced from each other, and from the banks of grippers, as shown in Fig. 14. The unsupported stretches of wire will, at all times, be very short, and the buckling tendency will accordingly be negligible. In order to support the guiding and supporting bars in operative position, sliding rods 75, 76, 77 are connected in pairs at the ends thereof, respectively, to the supporting bars 72, 73 and 74, their opposite ends extending in sliding relation through apertures in the bar 68 carried by the crosshead. Limiting lugs 78 may be mounted on these supporting bars, positioned to engage with the forward face of the bar 68, so as to limit the relative retraction of the guiding and supporting bars during retraction of the crosshead. When the crosshead is moving forwardly from the position shown in Fig. 14, it advances to contact the supporting bar 72, which then moves forwardly with the crosshead, the guiding rods 75 sliding through the guiding apertures in the crosshead. In a similar manner the bar 72 moves forwardly until it contacts with bar 73, and the latter then moves forwardly to contact with bar 74, which may also be mounted for slidable movement toward the inner bank of grippers 69. During retraction of the crosshead, the lugs 78 of the guiding rods 75 contact with the bar 68 to retract the bar 72, and the other guiding bars 73 and 74 are similarly retracted by their respective guiding and supporting rods.

An intermittent stop movement is provided for driving the shaft 65, and through it crosshead 61, a form of such stop movement being shown in Figs. 2 and 5. This stop movement embodying the mutilated gears 79 and 80 is driven from the main shaft 29. The gear 80 is connected to a shaft 81 carrying a toothed gear 82, meshing with gear 83 on a shaft 84, and power is transmitted from the gear 84 through the beveled gears 85 to the shaft 65. These driving connections are proportioned so as to turn the shaft 65 exactly four revolutions to feed the strands B forwardly in four strokes, whereupon the shaft 65 will be stopped for a period by the stop movement, during which period the fabric under construction will be fed forwardly to another operative stage, as more fully described below:

The filler stand cutter

An automatic cutter is provided for severing the filler wires B when they have been fed into intermeshing relation with the warp strands. This cutter, as best shown in Figs. 6, 14, and 15, embodies a cutter bar 86 (Figs. 12 and 13) having hardened steel thimbles 87 with centrally disposed openings or passageways through them for receiving the strands. These passageways may be flared at one end of the thimbles so as to guide the strands in their passage, and the opposite ends of the thimbles are provided with sharp corners at the ends of the passageways, providing cutting edges against which the strands are severed. The cutter bar 86 is mounted for longitudinal sliding, reciprocating movement in a groove or channel formed in the lower inner edge of the plate 71, which is supported in stationary position upon the framework. Adjacent to this cutter bar 86 is a hardened steel stationary cutter plate 88 having vertically disposed slots 89 spaced to correspond with the spacing of the thimbles 87, and respectively positioned for alignment therewith. The adjacent face of the cutter bar 86 slides in contacting relation with the inner face of the plate 88, whereby the filler wires B may all be severed when the cutter bar is longitudinally projected. The cutter is positioned so as to cut the wires B, with the severed ends thereof projecting, adjacent to and just outside of the selvage warp strand A', the importance of which will soon be seen.

The cutter bar 86 is automatically operated by means of a lever 90 pivoted to a bracket 91 which may be secured to the plate 71. This lever depends from the stationary bracket 91, and is biased into one extreme position by means of a coil compression spring 92. At its lower end the operating lever 90 carries a cam roller 93 positioned to engage a cam plate 94 mounted upon the movable carriage 39, carrying the lower die member. It will, therefore, be seen that severance of the wires B takes place as the carriage 39 descends, bringing the inclined cam edge 95 of the cam plate into contact with the roller 93, thus projecting the cutter bar 86 and severing all the wires at a single stroke. The cutter bar moves quickly, severing the wires abruptly before complete downward movement of the carriage 39. As soon as the wires are severed the ends thereof may move downwardly through the open-ended slots

89 of the cutter plate, thus freeing the ends from the slots and avoiding obstruction to the forward feeding movement of the fabric.

The fabric feed

Intermittent feeding mechanism, indicated generally at 36 is arranged to feed the fabric forwardly in intermittent steps of definite lengths, whereby sections of the fabric partly completed at one operative stage are fed forwardly and correctly positioned in the next operative stage for operation thereon by the machine mechanisms. As best shown in Figs. 1, 3, 4 and 17, this feed mechanism comprises a feed bar, or table 96, extending transversely of the fabric under construction and mounted by rails or supporting bars 97 for reciprocation parallel to the plane of the fabric longitudinally of the machine. This feed bar is longitudinally reciprocated in timed relation by means of a cam 98, mounted upon the main shaft 29 and cooperating to oscillate a pivoted lever 99 through a cam roller 100 carried by the lever. An adjustable link 101 connects the free end of lever 99 with one end of a rock arm 102, the opposite end of which is connected to a rock shaft 102^a, carrying near opposite ends thereof spaced crank arms 102^b, which are connected at their free ends to the feed table 96, through connecting links 102^c. A tensioned spring 103 is connected to the feed driving connections to retract the feed table after it has been advanced by the cam 98.

The reciprocating feed table 96 is of improved construction, arranged to engage and cooperate with the meshes of the fabric at points thereof distributed over a considerable area. The lower supporting base plate 104 of the feed table is preferably in the form of a channel with downwardly directed flanges, and carries upon its upper face a multiplicity of fabric engaging lugs, or dogs 105, arranged in a series extending transversely of the fabric and in longitudinal rows, arranged and proportioned to respectively engage in the meshes of the fabric. The longitudinal rows of dogs 105 are preferably formed on individual bars 106, each having slotted ends for the reception of an inwardly disposed flange of an angle bar 107, which is secured to the base plate 104, thus locking the dog bars 106 in correct position. The bars 106 are preferably spaced apart slightly so as to provide intervening longitudinal channels for the reception of the warp strands of the fabric. Each dog 105 is provided with an abrupt forward face 108 positioned to positively engage with the adjacent filler wire and the top surface 109 thereof inclines rearwardly at such an angle as to permit the fabric to slide thereover when the feed table is reversely moved or the fabric is forwardly moved relatively to the feed table. The upper corners, both forwardly and laterally of the dogs 105, are preferably chamfered so as to facilitate engagement with the fabric meshes.

Above the dogs 105 are positioned holding bars, or rollers 110, arranged in parallel relation with each other and extending transversely of the fabric, as many of these holding bars being provided as required for the particular class of service. These holding bars are spaced to correspond to the longitudinal spacing of the transverse series of dogs 105 so as to engage the fabric adjacent to each series of dogs. The holding bars are biased as by gravity in the embodiment shown, so as to hold the fabric in engaged position with the feed dogs. The holding bars are shown as mounted in spaced slots formed in plates 111 carried by the base plate 104, the extensions or spindles 112 of the rollers extending into these slots, thus permitting free and unobstructed up-and-down movement of the individual holding bars 110. It will, therefore, be seen that the fabric is engaged by the feed dogs 105 at a large number of points distributed over a large section of the fabric, and the dogs are maintained in engagement by the action of the holding bars 110. By means of this arrangement of the dogs, the feeding stress upon the fabric is effectually distributed, and the tendency to distort the fabric, or to displace the filler wires B during feeding, is practically eliminated. This feature is of especial importance in wire fabric machines of this class, inasmuch as there is considerable tension upon the warp strands occasioned by action of the strand grippers 37, in order to impart the desired tension for effective operation, and therefore considerable force is required to be exterted by the feed mechanism to feed the fabric forwardly.

A cam plate 113 is mounted for sliding movement upon the base plate 104 of the feed table adjacent to the projecting spindles 112 of the holding bars 110, one of these cam plates preferably being positioned at each end of the holding rollers. The cam plate 113 may be mounted adjacent to the supporting plate 111 by means of pin and slot connections 114, and the upper face of the cam plate is provided with cam notches 115 having rearwardly inclined cam faces disposed for engagement with the protruding spindles 112. A flexible connection 116 connects the cam plate with a stationary part 117 of the frame, a projecting lug 118 being mounted upon the cam plate to which the connection 116 may be attached, as shown. A stop 119 is mounted upon the frame part 117 in position to engage with the lug 118 as the feed table is moved forwardly. By means of this arrangement it will be seen that the lug 118 engages the stop 119 upon forward feeding movement of the feed table, thus relatively retracting the cam bar 113 and simul-

taneously raising all the holding bars 110 through engagement of their spindles 112 with the cam faces of the cam notches 115. The result of this is that the holding action of the holding bars is terminated, and the fabric may then freely disengage the feed dogs, thus permitting unobstructed retracted movement of the feed table with reference to the fabric, which may then slide over the inclined surfaces 109 of the feed dogs. At the end of the retractive stroke of the feed table the flexible connection 116 will be tightened to move the cam bar 113 to its normal position, as shown in Fig. 117, thus permitting the holding bars 110 to fall again into their holding position.

The selvage turner

As above described, the filler strands B are fed into intermeshing relation with the warp strands with their forward ends spaced a short distance beyond the far selvage warp, and the strand severing mechanism cuts the strands so the opposite ends thereof lie adjacent to and just outside the near selvage warp, as can be seen in Fig. 1. The selvage turners 35 are positioned adjacent opposite edges of the fabric, this mechanism being substantially duplicated at both sides of the machine and cooperating with the projecting filler strand ends to turn them sharply about the adjacent selvage warp, thus binding the filler strands to the selvage warp and forming the selvage edge of the fabric. This mechanism, as best shown in Figs. 1, 3, 4, 6, and 16, includes upper and lower jaw members 120, 121, mounted respectively on the upper die bed or frame 38 and the lower die bed or carriage 39, these jaws being appropriately carried by brackets, which may be secured to the respective beds, as desired, and the lower jaw therefore being movable up and down as a unit with the lower carriage 39.

The upper jaw 120 carries a series of lugs or teeth 122 aligned with each other longitudinally of the machine and positioned for engaging the adjacent selvage warp strand, and the lower jaw is provided with similar selvage teeth 123, similarly arranged but opposing the upper set and in staggered or alternate relation therewith whereby the upper teeth are aligned with the spaces between the lower teeth, and vice versa, and alternate upper and lower teeth engage the selvage warp at successive consecutive points therealong. These teeth are of similar construction each having a longitudinally extending warp engaging face 124, covering the complete width of each tooth, while laterally disposed warp guiding and holding fingers 125 and 126 are laterally spaced apart slightly to provide longitudinally extending grooves 127 in longitudinal alignment for the reception of the warp strand. These warp engaging faces are preferably anticlinal, as shown, sloping longitudinally from a central high point toward either edge. Each tooth also has a transverse groove 128, with its bottom approximately at the level of the central high point of the longitudinal warp groove 127 and extending entirely across the tooth, while each guiding and supporting finger is provided at its outer or end face with inwardly inclined guiding surfaces 129, sloping inwardly toward the adjacent transverse groove 128. As the jaws are closed it will therefore be seen that the filler strand ends which are positioned to overlie the respective adjacent selvage teeth will be engaged by these guiding surfaces as the jaws close so as to guide them into the respective slots 128, while the selvage warp strand will be seated in the longitudinally aligned grooves 127. Due to the fact that the selvage warps are tensioned and, furthermore, that the teeth are staggered, said warps will be tightly drawn across the apices of the respective anticlinal surfaces 124 and the filler strand ends which lie against these apices and underneath the selvage warp strands at these points will be forced to seat firmly in the respective slots 128. Each set or series of selvage teeth is preferably removably mounted upon an appropriate support such as a supporting plate 130 by means of a removable clamping plate 131, having a rib engaging in a groove formed in the side of the plate 130′ with which the teeth are integrally formed, and each plate 130 is in the form of a carriage mounted for retractive movement upon the respective supporting jaw, as by means of pin and slot connections 132. Each carriage is also resiliently urged into its advance position by means of compression springs 133, shown as surrounding the guide rods 134 mounted upon each carriage and adapted to slide in apertures in the supporting plates 135. Adjustable stops 136 are also mounted in the supporting plates 135 in position to limit the retractive movement of each carriage. The closing of the jaws upon the fabric will, therefore, cause automatic retraction of the carriages and the selvage teeth thereon, so that each set of teeth will be retracted a distance limited by the stops 136.

Adjacent to each selvage tooth 122 and 123 is a lug or plate 137, positioned to engage the respective ends of the filler strands which project slightly from left to right in Fig. 16 beyond the adjacent face of the tooth so as to slightly overlap at its end with the lug 137, the latter thus functioning as a turner to bend the filler strand ends transversely adjacent the selvage warp upon retraction of the respective carriages 130, as above described. During this turning action it will be understood that, as above described, the warp strands will be firmly engaged and tensioned by the engaging selvage teeth and that

the filler strand ends will be firmly bound in the respective seats or slots 128 by engagement of the warp strands with the respective filler strand ends during bending action of the respective deflectors or turner plates 137. When this relation obtains it will be seen that the warp strands function as abutments for each adjacent filler strand end, against which it is pressed by action of the deflector plates 137, the result being that the filler strand ends are bent or deflected laterally close to the outside of each warp strand.

The deflectors 137 on both upper and lower jaws 120, 121 are mounted on respective supporting carriages 138 carried by the respective jaws and mounted thereon for lateral bodily movement toward and away from the selvage teeth. These upper and lower supporting carriers are operatively connected by means of a connecting plate 139 (Fig. 6), bolted to the upper carriage and slidably engaging guideways 140 on the lower carriage whereby both carriages are constrained to move laterally in unison. Lateral movement of carriages 138 is effected by driving connections to a cam 141 shown as mounted upon the main driving gear 32 upon the main shaft 29. A pivoted lever 142 carries at its free end a cam roller engaging in the cam groove of cam 141 and normally held in cam-engaging position by means of a spring pressed guiding rod 143 pivoted to the lever 142 and slidably engaging an aperture in the base plate 26. A link 144 connects lever 142 with a crank arm 145 on a rock shaft 146 having spaced crank arms connected by links 147 to oppositely disposed bell-crank levers 148. These bell-crank levers are mounted on the adjacent respective upper selvage jaws 120 at opposite sides of the machine, and the lower or depending arm thereof is connected to the plate 139 by a link 149, thereby effecting inward and outward oscillatory movement of the carriages 138, as the bell-crank levers rock by the operative connection described. The movement of the carriages will be timed to project the deflector plates 137 outwardly toward the respective selvage teeth when the latter are in engagement with the selvage warp and filler strand ends, as above described. The effect of this action is that said deflector plates will be projected over the tops of the respective adjacent guiding fingers 126 of the selvage teeth, thus carrying the engaging strand ends inwardly around the warp strands in such a manner as to form a close gripping bend of the respective filler strand ends over the selvage warps. Due to the alternating arrangement of the selvage teeth 122, 123, as above described, and to the corresponding alternating arrangement of the projecting ends of the filler strands, with reference to the warp strands, it will be observed that the ends of the filler strands are reversely bent about the warp strands, and that these reversals are in alternate relation in the embodiment disclosed. The guiding fingers 126 are slightly shorter than the fingers 125, allowing ample room for the entry of the plates 137 and permitting the latter to be projected quite closely to the surface of the selvage warp so as to form a close loop in the filler strand ends. Retraction of the deflator plates 137 is effected at the appropriate period by the operating mechanism.

It will be observed that the upward movement of the lower selvage jaw 121 will carry the fabric C upwardly with it into cooperative engagement with the upper selvage jaw, and when the jaw 121 is retracted the fabric C will disengage the upper selvage teeth due to fabric tension, and when the fabric reaches its normal plane intermediate the upper and lower wide open jaws, the lower selvage teeth will retract from engagement with the fabric, thus leaving the latter free to be forwardly fed or otherwise manipulated. The upper and lower carriages 130 are projected to normal positions by action of the springs 133 and the selvage teeth therefore resume normal position with reference to the deflector plates 137 as the jaw 121 descends.

Fabric take-up divice

As best shown in Figs. 5 and 18, a take-up mechanism is provided for the fabric C, as weaving thereof is completed, embodying a reel or drum 150, rotatably mounted in bearings 151 carried by brackets 152 mounted upon the machine frame. These bearings are arranged to permit convenient insertion or removal of the drum, and to this end a retractable rotary bearing member 153 is provided with a stem 154 extending through the rear end of the bearing sleeve 155, while a coiled compression spring 156 normally projects the rotary bearing member 153 outwardly. The reel shaft has opposite squared ends 157, one end engaging in a corresponding seat in the bearing member 153 and the other engaging in a similarly formed seat in a ratchet member or friction drum 158. This friction drum has a laterally extending circular lug 159, rotatably engaging in the bearing 151 and rotatably mounted upon this lug is the reciprocating arm 160, carrying a friction pawl 161 adapted to engage the surface of the friction drum 158 to move it in one direction as the arm 160 is oscillated. If desired any convenient known holding device may also be provided to prevent reverse rotation of the reel 150. For oscillating the arm 160 a yielding link 162 is connected to the oscillating feed table 36. This link 162 is provided with a longitudinally yieldable joint 163 having a compression spring 164, which is of the desired strength to drive the take-up reel to keep the fabric at the desired tension and also to drive the reel at different speeds to compensate for the different

winding surface diameters as the fabric is wound thereon. It will be seen, therefore, that the fabric is constantly wound on the reel, and slack thereof is prevented at all times, no matter what the winding diameter of the drum may be, because the driving mechanism is proportioned to accomplish this result, whether the drum or reel is completely empty or is filled up to maximum diameter with the woven fabric C.

Warp strand gripper

Referring to Figs. 19 to 22, inclusive, a preferred form of gripper for the warp strands is there shown. This gripper includes a base or supporting plate 165 constructed for mounting in appropriate position upon the machine frame, as indicated in Fig. 1. A metallic supporting tube 166 is mounted in the base 165, having mounted therein stationary friction strand engaging members 167, spaced apart longitudinally, secured in position in the tube 166 by means of set screws or the like. These friction members 167 are provided with longitudinally aligned passageways 168 for receiving the warp strand therein and are constructed of some suitable wear resistant friction material such, for example, as fiber board, or the like. Interposed in the supporting tube between the stationary friction blocks 167 is a rotary friction block 169 of similar material and having therethrough a longitudinally disposed aperture 170 adapted to be moved into longitudinal alignment with the passageways 168, but normally yieldingly held out of alignment therewith by means of a coiled spring 171 anchored at one end to the supporting casing 166, and at the other end to an operating lever 172 connected to the rotary friction block 170 and extending through a peripheral slot in the casing 166. When it is desired to place a warp strand in position in the gripper, the rotary gripping block 169 is rotated to bring its passageway 170 into alignment with passageways 168, whereupon the warp is inserted and the rotary block is released to the influence of spring 170 whereby frictional pressure is exerted upon the strands through the frictional walls of the passageways.

The supporting housing 166 is supported in the base 165, so as to slide longitudinally thereof, the end of the tube preferably extending loosely into an opening in the supporting base, as shown in Fig. 19. A lug or rib 173 is formed externally upon the supporting casing engaging a compression spring 174 which, at its opposite end, engages an abutment plate 175 attached to the base 165. A screw 176, mounted upon the supporting casing, runs in a slot 177 formed in the base 165 so as to limit longitudinal movement of the supporting casing in either direction. The spring 174 may be appropriately and initially tensioned, and any undue stress upon the warp wire will be eased by means of this longitudinally yielding connection. Such stress may, for example, be exerted upon the warp strands during engagement thereof by the warp crimping members, thus permitting slight warp yielding during the crimping action and preventing undue stress either upon the warp strands or upon the machine frame, or structural parts.

Operation

A full description of the detail operation of the machine and its various operative elements is included in the above disclosure so as to enable those skilled in the art to operate the machine, but for clearness and emphasis a general description of the operation may be summarized as follows: The warp strands being placed in position as described and properly tensioned, the upper and lower die members 33^a and 33^b are relatively moved together by upward movement of the lower carriage 39, thus bringing the work faces of the die respectively into engagement with the warp strands at points spaced longitudinally of each strand. The effect of this action is to crimp or deflect each strand from its normal plane oppositely at longitudinally spaced parts thereof, the deflections at adjacent parts of adjacent strands being oppositely disposed whereby a series of transversely extending sheds or passageways is provided entirely across the warp strands, these passageways being spaced longitudinally of the strands. Under this condition the feeding mechanism is operated to project a filler strand individually in each of the transverse passageways through the step-by-step action of the feeding mechanism, thus preventing buckling tendency as the filler strands are fed forwardly. Also the gripper arrangement of the feeding mechanism and the length of stroke thereof is so adjusted as to feed the filler strands into intermeshing position so the forward ends thereof project slightly beyond the far selvage warp strands, while the opposite ends of the filler strands are formed in similar position by action of the cutter mechanism.

Since the crimping dies and the selvage turners are similarly mounted, that is, mounted upon the same stationary frame and the same movable carriage, they move and cooperate as a unit. Therefore, when the crimping dies move together for an operation upon the fabric, the selvage turners similarly move together for cooperation. Therefore the fabric feeding mechanism feeds the fabric section just operated upon by the crimping dies forwardly into position to exactly register with the operative elements of the selvage turner which forms the next operative stage of the machine; that is, at the first operative stage the filler strands are fed into

intermeshing relation with the warp strands, and in the next operative stage the selvage turners operate to form the selvage edge as described. The fabric feeding mechanism is constructed and arranged so as to accurately synchronize the forward feeding movement of the fabric to bring the filler strands in correct registry with the operative elements of the selvage turner. For this reason, fabric feeding must be accurate and the type of feeding mechanism is designed for accomplishing this end, the forward feed always being of such an extent that the selvage turner operates surely and satisfactorily.

Since certain changes may be made in the above construction, and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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

1. In a wire fabric machine, in combination, means for supporting a plurality of warp strands, means for simultaneously positioning a plurality of filler strands in intermeshing relation with the warp strands with their ends projecting adjacent to a selvage warp strand, and means for looping said projecting strand ends over said selvage warp strand.

2. In a wire fabric machine, in combination, means for placing a plurality of warp strands under tension, mechanism for simultaneously deflecting or crimping said warp strands at a plurality of longitudinally spaced parts thereof, so as to provide a plurality of longitudinally spaced, transversely disposed linear passageways or sheds extending between deflected parts of the warp strands, mechanism for transversely feeding a filler strand in each of said linear passageways, and turning means longitudinally spaced from said crimping mechanism for turning the filler strands about a selvage warp strand.

3. In a wire fabric machine, in combination, means for placing a plurality of warp strands under tension, mechanism for simultaneously deflecting or crimping said warp strands at a plurality of longitudinally spaced parts thereof, so as to provide a plurality of longitudinally spaced, transversely disposed linear passageways or sheds extending between deflected parts of the warp strands, mechanism for transversely feeding a filler strand in each of said linear passageways, means for severing the filler strands beyond a selvage warp strand so as to provide turning ends and means for turning said turning ends over said last mentioned warp strand to form the selvage.

4. In a wire fabric machine, in combination, means for placing a plurality of warp strands under tension, mechanism for simultaneously deflecting or crimping said warp strands at a plurality of longitudinally spaced parts thereof so as to provide a plurality of longitudinally spaced, transversely disposed widely open loops forming linear passageways or sheds extending between deflected parts of the warp strands, and a step-by-step feeding mechanism for feeding a filler strand with a step-by-step action in each of said linear passageways.

5. In a wire fabric machine, in combination, means for placing a plurality of warp strands under tension, mechanism for simultaneously deflecting or crimping said warp strands at a plurality of longitudinally spaced parts thereof so as to provide a plurality of longitudinally spaced, transversely disposed linear passageways extending between deflected parts of the warp strands, mechanism for transversely feeding a filler strand in each of said linear passageways, and supporting means automatically adjustable by said feeding mechanism for supporting said filler strands during the feeding action thereof.

6. In a wire fabric machine, in combination, means for supporting a plurality of warp strands, means for simultaneously placing a plurality of filler strands in intermeshed relation with said warp strands, means for severing said filler strands whereby the ends thereof are positioned beyond a selvage warp strand, and means for simultaneously turning the severed ends of said filler strands about said selvage warp strand so as to form a selvage edge.

7. In a wire fabric machine, in combination, means for supporting a plurality of warp strands, means for simultaneously placing a plurality of filler strands in intermeshed relation with said warp strands and at opposite sides of the selvage warp strands, and means for turning the ends of said filler strands in opposite directions about the selvage warp strands to form the selvage edge.

8. In a wire fabric machine, in combination, means for supporting a plurality of warp strands, means for placing a plurality of filler strands in intermeshed relation with said warp strands, means for severing said filler strands whereby the ends thereof are positioned adjacent to a selvage warp strand, and a selvage turner having warp engaging lugs adapted to engage a selvage warp strand at a plurality of points therealong adjacent respective filler strands, and having deflec-

tors for bending said filler strands to form the selvage edge.

9. In a wire fabric machine, in combination, movably mounted lugs for engaging a selvage warp strand of the fabric at a series of oppositely disposed points therealong located adjacent to the respective filler strands, means for relatively moving said lugs toward each other so as to oppositely deflect said warp strand, and means for bending the ends of the filler strands adjacent said warp strand when the latter is deflected by said lugs.

10. In a wire fabric machine, in combination, means for placing a plurality of warp strands under tension, mechanism for simultaneously deflecting or crimping said warp strands at a plurality of longitudinally spaced parts thereof so as to provide a plurality of longitudinally spaced transversely disposed linear passageways extending between deflected parts of the warp strands, a step-by-step feeding mechanism for feeding a filler strand with a step-by-step action in each of said linear passageways, and guiding and supporting mechanism automatically adjustable by said feeding mechanism for supporting said filler strands during feeding action thereof.

11. In a selvage turner for wire fabric machines, in combination, a plurality of warp engaging warp supporting lugs arranged in oppositely disposed sets and positioned so as to engage and support a selvage warp strand at a plurality of oppositely disposed points therealong.

12. In a selvage turner for wire fabric machines, in combination, a plurality of warp engaging warp supporting lugs arranged in oppositely disposed sets and positioned so as to engage and support a selvage warp strand at a plurality of oppositely disposed points therealong, and a retractable carrier for each set of warp-engaging lugs.

13. In a selvage turner for wire fabric machines, in combination, a plurality of warp engaging lugs arranged in oppositely disposed sets and positioned so as to engage a selvage warp strand at a plurality of oppositely disposed points therealong, a retractable carrier for each set of warp-engaging lugs, and strand turning members respectively positioned adjacent to said lugs and adapted to bend the ends of filler strands when the respective carriers are retracted.

14. In a selvage turner for wire fabric machines, in combination, means for oppositely crimping a longitudinal section of the fabric along a warp strand and adjacent to the filler strands thereof, and means for turning the ends of said filler strands during such crimping by said crimping means.

15. In a strand feeding device for wire fabric machines, in combination, a plurality of sets of strand grippers, one set being mounted for reciprocatory movement with reference to another, said reciprocatory set gripping filler strands to push them into position between warp strands, and one or more strand supports interposed between said sets of grippers.

16. In a strand feeding device for wire fabric machines, in combination, a plurality of sets of strand grippers, one set being mounted for reciprocatory movement with reference to another, one or more strand supports interposed between said sets of grippers, and connections between said reciprocatory strand gripper set and said strand supports, for reciprocating the latter.

17. In a strand feeding device in wire fabric machines, in combination, a plurality of sets of strand grippers, a reciprocatory carrier for one of said sets of grippers, a strand supporting bar interposed between said sets of grippers and mounted for bodily movement with reference thereto, and means for effecting bodily movement of said supporting bar, including a link connecting said bar with said reciprocatory carrier.

18. In a wire fabric machine, in combination, a fabric feed device having a plurality of series of fabric engaging dogs mounted on a unitary support and disposed in the plane of the fabric, engageable in the meshes of the fabric, the dogs of each series being longitudinally spaced so as to simultaneously engage weft strands of the fabric thus to exert feeding effort thereon.

19. In a wire fabric machine, in combination, a fabric feed device having a plurality of series of fabric engaging dogs, engageable in the meshes of the fabric, holding means including a holding bar mounted for engagement with the fabric and biased to maintain engagement between said dogs and fabric, and means for automatically operating said holding bar to terminate and re-establish holding cooperation with the fabric.

20. A process of making woven wire fabric which includes placing longitudinal tension on a plurality of warp strands, applying pressure simultaneously in opposing directions upon the longitudinally tensioned warp strands to reversely deflect them at a plurality of points spaced longitudinally thereof, projecting a filler strand transversely of the warp strands between the reversely deflected parts of the latter at each of the longitudinally spaced deflected parts thereof so the forward ends of the filler strands lie adjacent to a warp strand, severing the filler strands adjacent to another warp strand and then bending the filler strands at each end thereof over the adjacent warp strands to form the selvage edges.

21. In a selvage turner for wire fabric machines, in combination, a plurality of warp engaging lugs arranged in oppositely disposed sets and positioned so as to engage a

selvage warp strand at a plurality of oppositely disposed points therealong, a retractable carrier for each set of warp engaging lugs, strand turning members respectively positioned adjacent to said lugs and adapted to bend the ends of filler strands during retracting movement of the respective carriers, said turning members being movably mounted, and means for moving said strand turning members after retraction of said carriers so as to effect further bending of said strand ends.

22. In a wire fabric machine, in combination, movably mounted lugs for engaging a selvage warp strand of the fabric at a series of oppositely disposed points therealong located adjacent to the respective filler strands, means for relatively moving said lugs toward each other so as to oppositely deflect said warp strand, means for bending the ends of the filler strands adjacent said warp strand during relative movement of said lugs, and means movable relatively to said lugs when the latter are in engagement with said filler strands to further bend the ends thereof about said warp strand.

23. In a selvage turner for wire fabric machines, in combination, means for oppositely crimping a section of a warp strand at points adjacent the filler strands, deflectors engaging the filler strand ends to deflect them, and means for operating said deflectors so as to further deflect said filler strand ends while said warp strand is held in crimped position by said crimping means.

24. In a wire fabric machine, in combination, means for simultaneously supporting a selvage warp strand at a plurality of points therealong, respectively adjacent the filler strands and means for turning the ends of the filler strands, about said warp strands while said supporting means functions as a supporting abutment adjacent the several filler strands during turning of the latter.

25. In a wire fabric machine, in combination, means for supporting a selvage warp strand at a plurality of points therealong, respectively adjacent the filler strands said supporting means including opposing sets of relatively staggered supporting members.

26. In a wire fabric machine, in combination, means for supporting a selvage warp strand at a plurality of points therealong, respectively adjacent the filler strands, said supporting means including opposing sets of relatively staggered supporting members, one of said sets of supporting means being mounted for movement relatively to the other set so as to engage and disengage the selvage warp and a retractable carriage for one of said sets.

27. In a wire fabric machine, in combination, means for supporting a selvage warp strand at a plurality of points therealong, respectively adjacent the filler strands, said supporting means including opposing sets of relatively staggered supporting members having anti-clinal warp surfaces and being grooved for reception of the filler strands.

28. In a wire fabric machine, in combination, a selvage turner including opposing sets of relatively staggered warp supporting members.

29. In a wire fabric machine, in combination, a selvage turner including opposing sets of relatively staggered warp supporting members each having anti-clinal warp engaging surfaces.

30. In a wire fabric machine, in combination, a selvage turner including oposing sets of relatively staggered warp supporting members and a retractable carriage for each of said opposing sets.

31. In a wire fabric machine, in combination, a selvage turner including opposing sets of relatively staggered warp supporting members and a retractable carriage for each of said opposing sets, means for relatively moving said sets to engage and disengage the selvage warp and means for turning the filler strands over said warp when the latter is engaged by said warp supporting members.

32. In a wire fabric machine, in combination, means for binding filler strands in position on opposite sides of a selvage warp and means for turning the filler strands in opposite directions about said warp when the strands are bound by said binding means.

33. In a wire fabric machine, in combination, means for supporting a plurality of warp strands, means for feeding the warp strands forwardly intermittently, whereby they may be operated upon at different stages, means for placing a plurality of filler strands in intermeshed relation with the warp strands at one stage, and means for crimping the filler wires around a selvage warp strand at another stage.

34. In a wire fabric machine, in combination, a fabric feed device having a plurality of series of fabric engaging dogs, engageable in the meshes of the fabric, each of said dogs having a forwardly disposed abrupt fabric engaging face and a rearwardly inclined face over which the fabric may slide, channels being provided between adjacent dogs for the reception of the fabric warps, means for holding said dogs in engagement with the fabric, means for imparting reciprocatory movement to the feed device so as to cause said dogs to engage the fabric at successive longitudinal points thereof, and automatic means for releasing said holding means at the end of a feed stroke and then resetting it for another feed stroke.

35. In a wire fabric machine, in combination, means for supporting a plurality of warp strands, means for simultaneously positioning a plurality of filler strands in in-

termeshing relation with the warp strands with their ends projecting adjacent to a selvage warp strand, means for simultaneously looping said projecting strand ends over said selvage warp strand, and means for operating said looping means in sequence with operation of said strand positioning means.

36. A die for wire fabric machines, including mating die members, each having raised work faces arranged in checkerboard formation with intervening depressions, whereby the work faces of each die member may register with the respective depressions of the companion die member, said work faces being provided with transverse V-shaped warp engaging seats and angularly disposed strand engaging grooves beneath said seats and opening through the respective work faces, said die including a plurality of independently removable bars each carrying a series of said work faces.

37. In a strand feeding device for wire fabric machines, in combination, a strand gripper, means whereby said gripper engages a filler strand to push it into position between warp strands and means for operating said gripper to feed the filler strand with a step by step movement.

38. In a strand feeding device for wire fabric machines, in combination, a strand gripper, means whereby said gripper engages a filler strand to push it into position between warp strands, means for operating said gripper to feed the filler strand with a step by step movement and automatically adjusting means for supporting the feed filler strand in advance of said gripper.

39. In a strand feeding device for wire fabric machines, in combination, a plurality of sets of strand grippers arranged in tandem with reference to strand feeding direction and means whereby the relatively rearwardly positioned set feeds the strands forwardly while the forward set checks reverse strand movement.

40. In a strand feeding device for wire fabric machines, in combination, a plurality of sets of strand grippers arranged in tandem with reference to strand feeding direction, means whereby the relatively rearwardly positioned set feeds the strands forwardly while the forward set checks reverse strand movement and adjustable supporting means for supporting the strands between said sets.

41. In a strand feeding device for wire fabric machines, in combination, a plurality of sets of strand grippers arranged in tandem with reference to strand feeding direction, means whereby the relatively rearwardly positioned set feeds the strands forwardly while the forward set checks reverse strand movement, adjustable supporting means for supporting the strands between said sets and means dependent upon feed actuation for automatically adjusting said supporting means.

42. In a strand feeding device for wire fabric machines, in combination, a plurality of sets of strand grippers arranged in tandem with reference to strand feeding direction, means whereby the relatively rearwardly positioned set feeds the strands forwardly while the forward set checks reverse strand movement, and means to reciprocate said rearward set to effect step by step feeding movement of the strands.

43. In a strand feeding device for wire fabric machines, in combination, a plurality of strand grippers arranged in tandem with reference to the direction of strand feed and means whereby a relatively rearwardly positioned gripper feeds a strand forwardly while the forward gripper checks reverse strand movement.

44. In a strand feeding device for wire fabric machines, in combination, a plurality of strand grippers arranged in tandem with reference to the direction of strand feed, means whereby a relatively rearwardly positioned gripper feeds a strand forwardly while the forward gripper checks reverse strand movement, a strand support positioned between the forwardly and rearwardly disposed grippers and means for automatically adjusting said support.

45. In a wire fabric machine, in combination, a fabric feed device having a plurality of longitudinal and transverse series of fabric engaging dogs mounted on a unitary support and disposed in the plane of the fabric, means for engaging and disengaging said dogs in the fabric meshes and means for reciprocating said dogs.

46. In a wire fabric machine, in combination, a fabric feed device, including a multiplicity of fabric engaging dogs arranged in longitudinal and transverse series, said dogs being mounted together in a unitary group and positioned in the plane of the fabric.

47. In a wire fabric machine, in combination, a fabric feed device, including a multiplicity of fabric engaging dogs arranged in a unitary group in the plane of the fabric and in longitudinal and transverse series, said dogs having forwardly disposed faces for feeding engagement with the fabric and rearwardly inclined faces to prevent feeding coaction in the opposite direction.

48. In a wire fabric machine, in combination, a fabric feed device, including a multiplicity of fabric engaging dogs arranged in longitudinal and transverse series, said dogs having forwardly disposed faces for feeding engagement with the fabric and rearwardly inclined faces to prevent feeding coaction in the opposite direction, holding means for retaining said dogs in said feeding engagement with the fabric and automatic means for releasing said holding means.

49. In a wire fabric machine, in combina-

tion, a fabric feed device, including a multiplicity of fabric engaging dogs arranged in longitudinal and transverse series, said dogs having forwardly disposed faces for feeding engagement with the fabric and rearwardly inclined faces to prevent feeding coaction in the opposite direction, a plurality of holding bars cooperating to hold the fabric in feeding engagement with said dogs and means for moving said bars into releasing position.

50. In a wire fabric machine, in combination, means for holding the warp strands in tensioned condition, means for forming a plurality of sheds simultaneously on the tensioned warps, means for feeding a filler strand in each of said sheds, means for subsequently feeding the warps and fabric forwardly a distance equal to the combined width of said sheds in which the filler strands have been simultaneously fed and means for turning said filler strands subsequently to said fabric feed to form the selvage edge.

In testimony whereof I affix my signature.

FREDERICK E. WILLITS.