Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 1

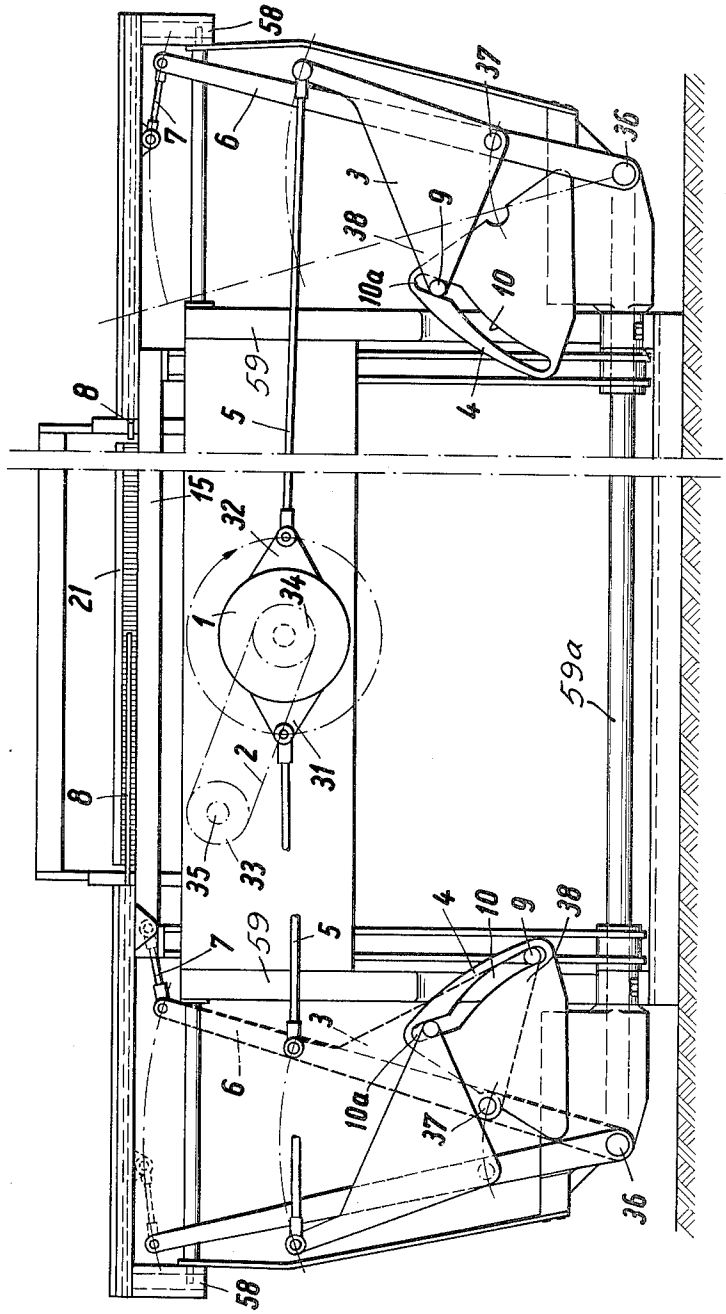


Fig. 1

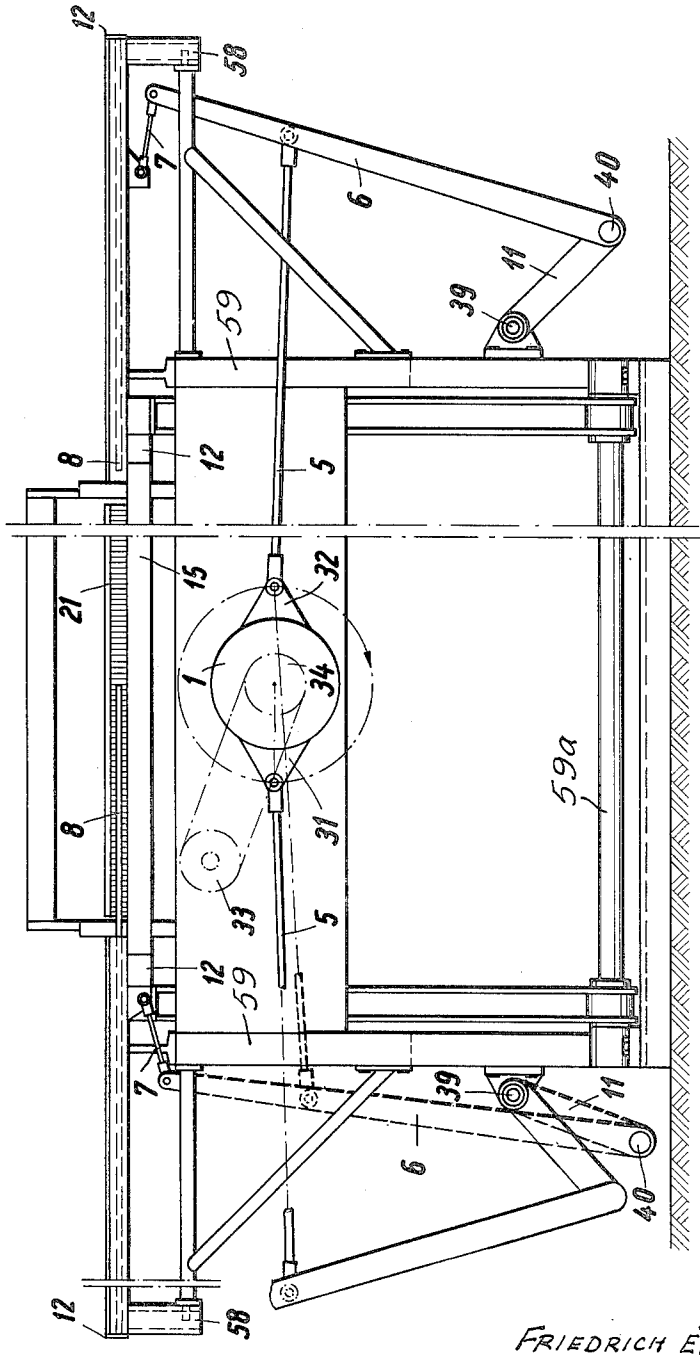
Inventor:
FRIEDRICH EILHAUER
By Hane and Nydick
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 2

Fig. 2



Inventor:
FRIEDRICH EILHAUER
By Hane and Nydick
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 3

Fig. 3

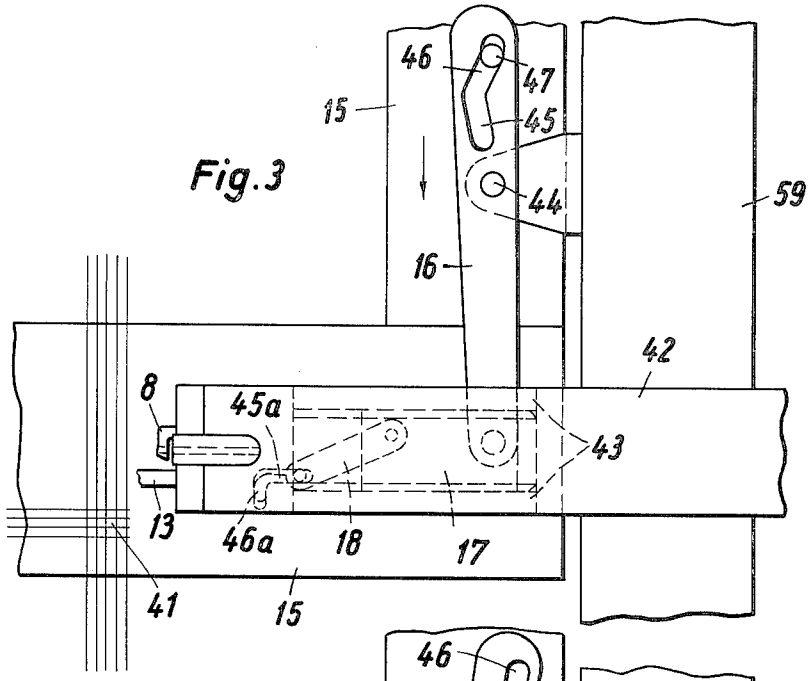
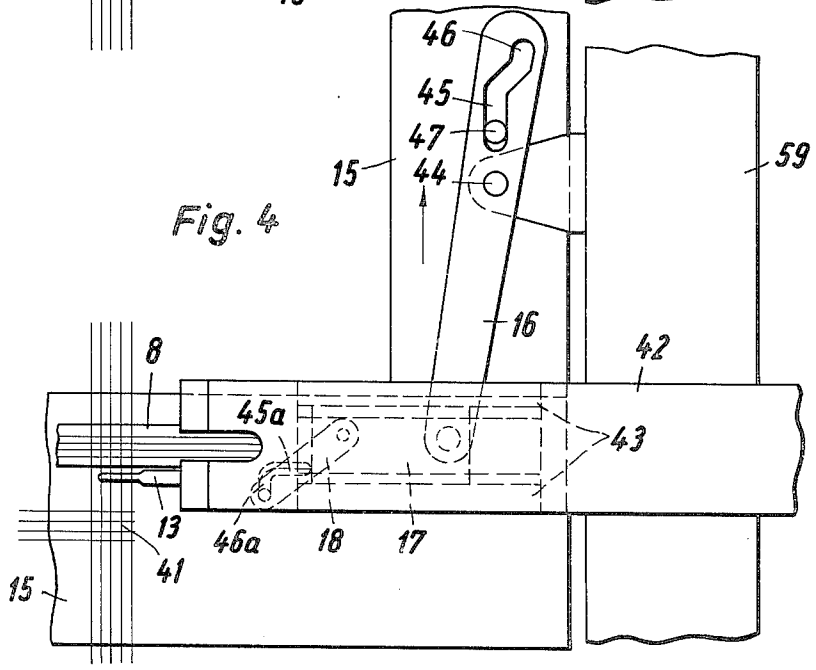


Fig. 4



Inventor:
FRIEDRICH EILHAUER
BY Hane and Baird
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 4

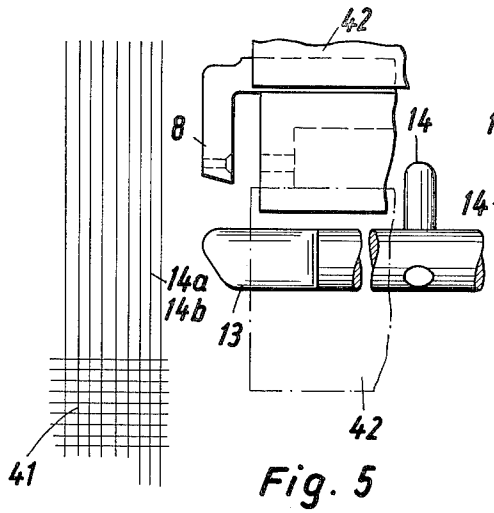


Fig. 5

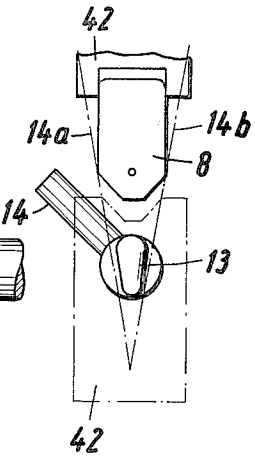


Fig. 6

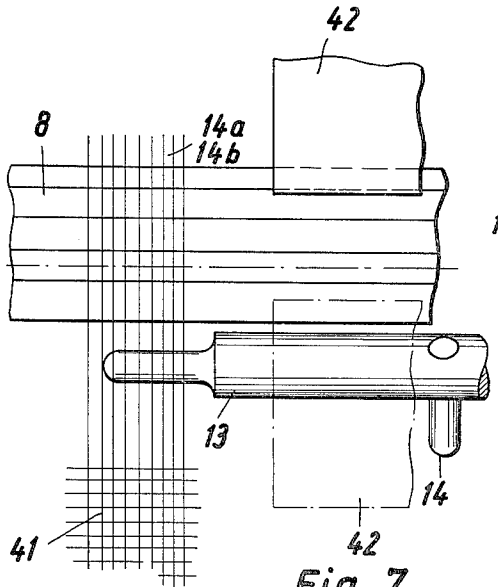


Fig. 7

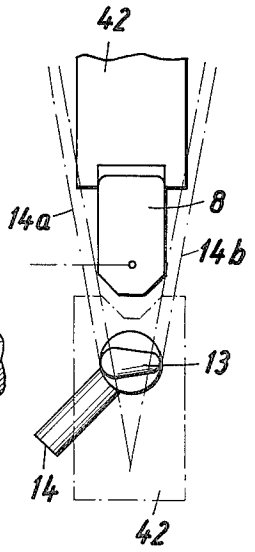


Fig. 8

Inventor:
FRIEDRICH EILHAUER
By Hane and Yudick
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 5

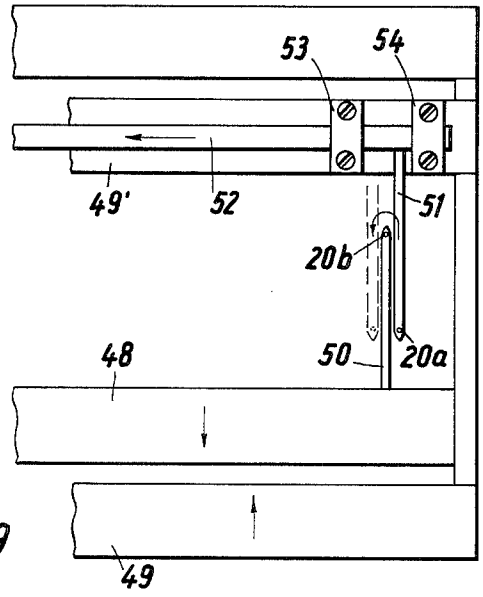


Fig. 9

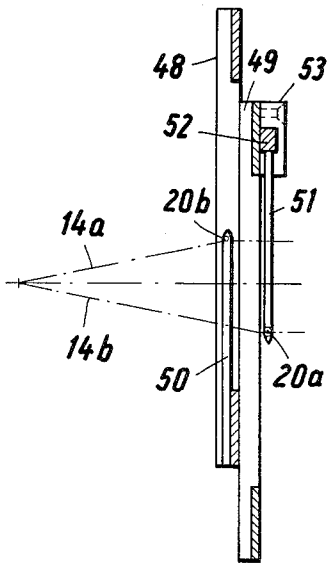


Fig. 10

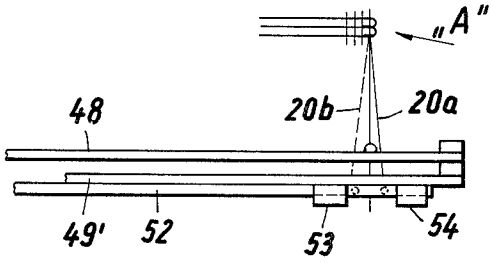


Fig. 11

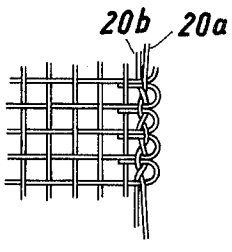


Fig. 12

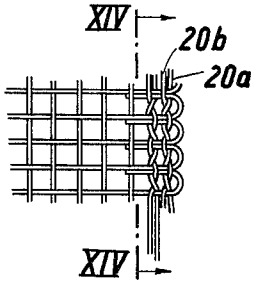


Fig. 13



Fig. 14

Inventor:
FRIEDRICH EILHAUER
By Haase and Kyle
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 6

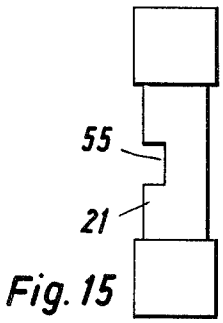


Fig. 15

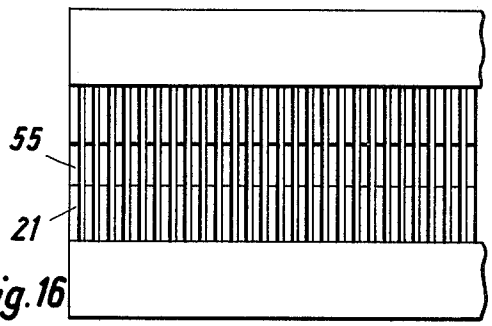


Fig. 16

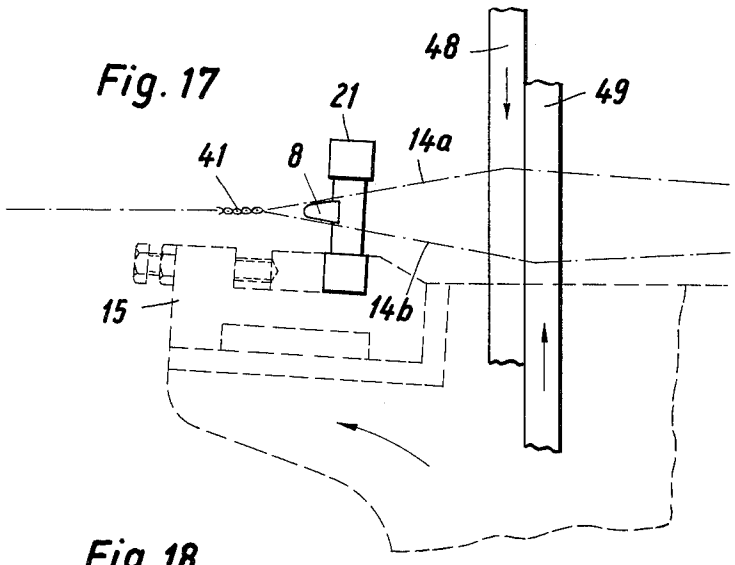


Fig. 17

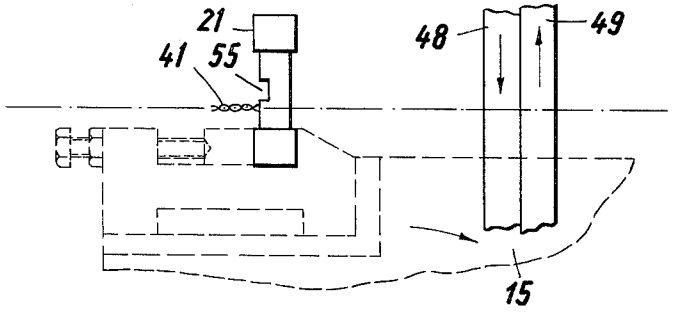


Fig. 18

Inventor:
FRIEDRICH EILHAUER
By Hane and Gudik
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 7

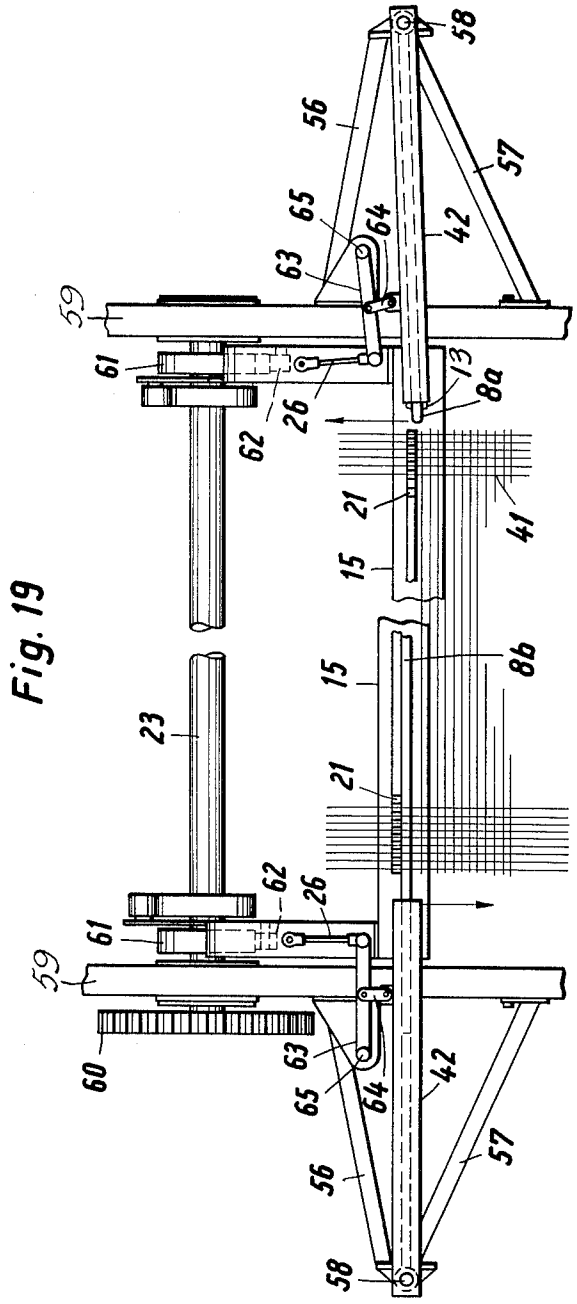


Fig. 19

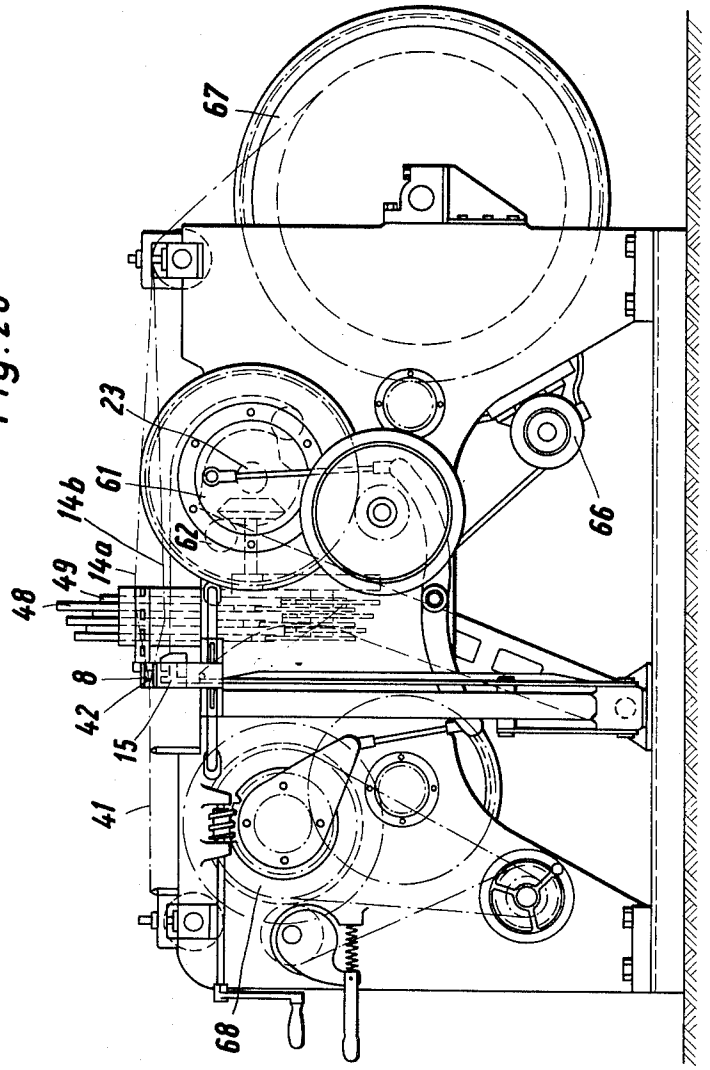
Inventor:
FRIEDRICH EILHAUER
By Haseltine Lake & Co
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 8

Fig. 20



Inventor:
FRIEDRICH EILHAUER
By Haase and Nydick
ATTORNEYS

Feb. 1, 1966 F. EILHAUER 3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Filed April 11, 1963 9 Sheets-Sheet 9

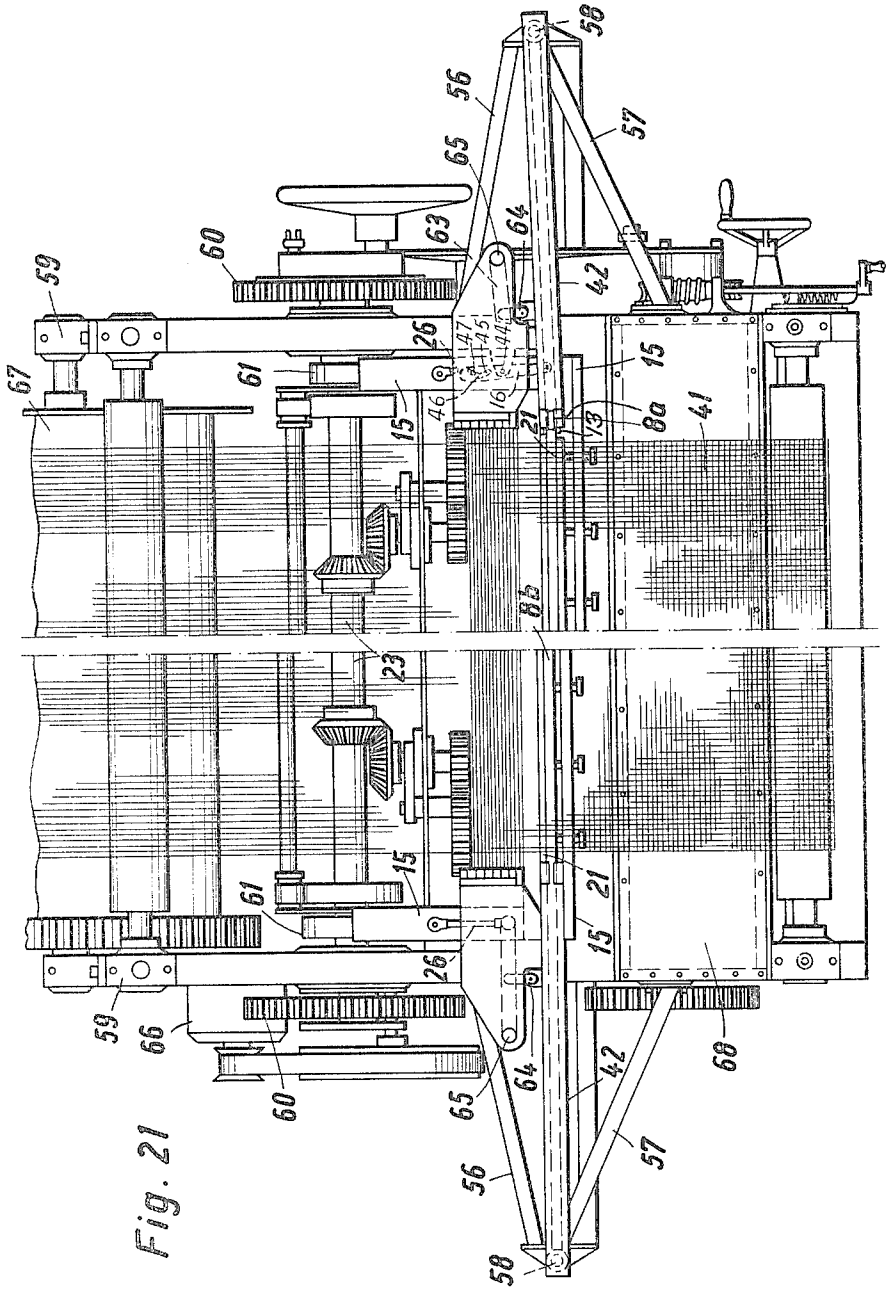


Fig. 21

Inventor:
FRIEDRICH EILHAUER
By Howard and Howard
ATTORNEYS

United States Patent Office

3,232,320

Patented Feb. 1, 1966

3,232,320

SHUTTLE-LESS WIRE WEAVING LOOM

Friedrich Eilhauer, Bernauer Str. 69, Berlin, Germany

Filed Apr. 11, 1963, Ser. No. 272,459
Claims priority, application Germany, Apr. 13, 1962, E 22,730
8 Claims. (Cl. 139—122)

The present invention relates to a shuttle-less wire weaving loom having slides which hold the weft thread and shoot or guide it into the shed.

Wire weaving shuttle-less looms as heretofore known are suitable only to a very limited extent, if at all, to meet the requirements which are made, in view of the great diversity of wire fabric employed today, with respect to the number of mesh to be produced per unit of area, the size of the free screen surface, uniformity and mechanical strength.

It is a broad object of the invention to provide devices for wire weaving shuttle-less looms which can be used either alone or in combination in order to make possible a suitable advantageous manufacture of the most different kinds of wire fabrics on shuttle-less looms.

The drive of the slides which conduct the weft or filling wires through the shed is obtained in the known constructions of shuttle-less looms either by eccentric cams or by crank gears, the drive of which changes the direction of rotation after each stroke of the lay. The use of cams has the disadvantage that it is difficult to transmit large forces, since the transmission ratio between the cam and the slider movement is very large. This makes itself felt particularly when heavy wires are to be shot-in under tension.

A construction which uses a crank gear which changes its direction of rotation entails that considerable inertia forces are caused by the change in the direction of rotation. This has a disadvantageous effect on the permissible maximum speed of the machine.

The disadvantages of the known wire weaving shuttle-less looms are overcome in accordance with the present invention by providing a shuttle-less loom having slides which hold the weft thread and shoot it into the shed and are swingable with their guides around axes arranged substantially perpendicular to the picking or shooting direction. The slides are driven by a continuously rotating crank with the interposition of an intermittently acting standstill gearing, in which connection the shed which is reinforced at its outermost ends by crossing of the edge threads, is equalized and enlarged by a spreader introduced into it, while the reed is provided on its beating-up side with a groove or recess which at least partially guides the slides.

The wire weaving shuttle-less loom in accordance with the invention may be advantageously provided with a standstill gearing comprising a cam groove having a block or roller guided therein, which is interposed between the crank and the drive of the slide in a manner such that the slide, after leaving the shed, stops temporarily at a predetermined point along its path.

In this connection, the standstill gear can, in accordance with the invention, comprise a lever system with buffer interposed between the crank and the drive.

A particularly simple and suitable development of the spreader is obtained in accordance with the invention by providing a spreader in the form of a flat-oval structural part which, after its introduction into the shed, is turned around its longitudinal axis which coincides with the direction of its inward movement.

Before the slide enters the shed, the spreader in accordance with the invention is inserted into the shed to orient the last threads of the warp as the same tend to be at an unequal height so that the slide can be introduced more dependably and at an earlier moment into the shed.

Spreaders for enlarging the shed are already known in textile looms in which they have the purpose of forming the selvage together with the selvage former. These spreaders are not suitable for wire looms, since in contradistinction to textile fabrics, wire fabrics are produced under high tension. The known spreaders used for better formation of the edges are introduced immediately with their entire width into the shed. This is possible due to the low tension of the textile fabric, but it is not possible in the case of wire looms, since in such looms the edge threads would be shifted or even damaged. The spreader in accordance with the invention, designed in the form of a flat-oval structural part, is first guided into the shed in parallel position in reference to the wires forming the shed, that is, in flat position, and then turned by about 90° in order to control the edges of the shed. This movement, in contradistinction to the aforementioned known device in textile looms is carried out shortly before the entrance or emergence of the slide and is directly connected with the formation of the shed. The shed is therefore opened somewhat earlier at the edges and upon emergence of the slide, closed somewhat later at the edge. In this way, the passage of the slides through the shed is facilitated and the time available for this passage is increased somewhat.

It is furthermore known for the better development of the edge, to cross the edge threads somewhat or to give the edge threads a different shape, for instance to develop them flat. In such arrangement, the last edge thread is on top and upon the next passage of the thread on the bottom, whereby the shed is varied in height. The weft threads are bent one time upward and one time down. As a result, the introduction of the spreader or of the slide can be easily impeded.

In accordance with the invention, the wire weaving loom is designed in a manner such that the movement of the last two or more edge threads is so controlled that these threads are always either in the upper or in the lower part of the shed and that during the passage through the thread they are in one case twisted half-way in pairs but then returned to their starting position.

The effect of these half-twisted edge threads can be further improved in accordance with the invention by giving the edge threads, which are controlled in pairs, different shapes or tension, for instance by using for one edge thread a flat wire and for the other a round wire.

Several embodiments of the invention are shown by way of example in the drawing in which:

FIG. 1 is an end view of the drive device for the slide movement,

FIG. 2 shows another embodiment of the drive device for the slides in end view,

FIG. 3 shows the drive mechanism for the spreader in top view for a flat position of the spreader outside the warp,

FIG. 4 is the same view as FIG. 3, the spreader being in the fabric and having turned 90° around its longitudinal axis,

FIG. 5 shows the spreader in top view and on a larger scale in the position of its drive shown in FIG. 3,

FIG. 6 shows the spreader of FIG. 5 in side view, the flat-oval shape in longitudinal direction of the shed being shown,

FIG. 7 shows the spreader in the position of its drive shown in FIG. 4,

FIG. 8 shows the spreader of FIG. 7 in side view, the equalized and spread shed being shown in its longitudinal direction,

FIG. 9 shows the mechanism for twisting the edge threads in front view,

FIG. 10 shows the mechanism of FIG. 9 in side view,

FIG. 11 shows the mechanism of FIG. 9 in top view,

FIG. 12 shows a portion, on an enlarged scale, of an embodiment of the warp edge produced by the use of the mechanism shown in FIGS. 9 to 11,

FIG. 13 shows another embodiment, in an enlarged partial view, of the fabric edge produced with the use of the mechanism shown in FIGS. 9 to 11,

FIG. 14 is a section on enlarged scale along the line XIV—XIV of FIG. 13,

FIG. 15 is a side view of the reed in accordance with the invention,

FIG. 16 is a front elevation of the reed of FIG. 15,

FIG. 17 is a side elevation of the shed with the slide and the reed,

FIG. 18 shows the reed of FIG. 17 upon the beating-up,

FIG. 19 is a top view of the slide with movable slide guide which is shown in the right in swung position upon striking of the weaving batten and on the left side in straight position upon the passage of the slide through the shed,

FIG. 20 is a diagrammatic overall side view of the shuttle-less wire weaving loom in accordance with the invention, and

FIG. 21 is a top view of the loom shown in FIG. 20.

Referring first to FIG. 1 in detail, in this figure the crank gear with the corresponding transmission members for the driving of the slide **8** is shown, the slide **8** being shown on the righthand side of the figure in the position withdrawn from the warp or shed and in the lefthand side of the figure in dotted lines inserted into the warp or shed and in full lines withdrawn from the shed.

The crank **1** mounts two extensions or arms **31**, **32** and is driven, for example, via a chain **2** and sprocket wheels **33**, **34** from a shaft **35** which is connected with the main drive of the loom. Arms **31** and **32** are rotatably mounted and axially spaced and also circumferentially staggered so that they can pass each other when rotated. A pair of connecting rods **5** pivoted to arms **31**, **32** transmit the movement to single-armed levers **6**, which are swingable about rock shafts **36** arranged in fixed positions in the machine frame **59**. Rock shafts **36** are supported by a cross bar **59***a* secured in frame **59**. Accordingly, levers **6** pivot in a plane parallel to bar **59***a*, that is, in a plane at a right angle to frame **59**. The connecting rods **5** are coupled to levers **6** by means of angle levers **3** which are swingable about pins **37** on the levers **6**. Each lever **3** mounts at its end **38** a slide block or a roller **9** which engages in a guide groove **10** in the plate shaped part **4** fastened stationarily in the machine frame. The groove **10** has an arcuate portion, the center point of which coincides with the axis of the rock shaft **36** of the lever **6** and an arcuate portion **10***a*, disposed at an angle with the arcuate portion **10**. The center point of said arcuate portion **10***a* coincides with the axis of the pivot pin **37** on the lever **6**. When roller **9** moves along arcuate groove portion **10**, the rotation of crank **1** is transmitted to levers **6** by connecting rods **5**. Since levers **6** must remain stationary when slide **8** leaves the shed even though the rotation of crank **1** continues, the angular movements of the levers must be controlled and such control is effected by guiding angle levers **3** pivoted to levers **6** in arcuate groove portions **10** and **10***a*. The control by arcuate groove portion **10***a* is such that the levers **6** are stationary while angle lever **3** together with connecting rods **5** is displaced. Such displaced position is shown for both sides of the loom in FIG. 2.

The free end of each lever **6** is pivotally connected via a connecting rod **7** with the slide **8**.

In FIG. 1 it can be seen on the righthand side that during the initial movement inward of the arm **32** of the crank **1**, the lever **6** remains in its outermost swung position, in which the slide **8** is retracted from the warp, because the slide roller **9** is moving in the part **10***a* of the groove **10** which causes only a swinging movement of the angle lever **3** around the pin **37** on the lever **6** without rocking lever **6**.

To the left in FIG. 1, the roller **9** is in the arcuate part **10** of the groove provided in the part **4**, so that the horizontal component of the movement of the connecting rod **5** will result in a rocking of the lever **6** without relative movement of the angle lever **3** with respect to it.

The control of the movements of the slides **8** and the dwell thereof when withdrawn from the shed can also be obtained with the lever arrangement shown in FIG. 2 in which, instead of the guide groove **10** of FIG. 1, there is employed a lever **11** which, at its one end, is swingable around a pin **39** arranged in fixed position in the machine frame, while at its free end, it bears the lever **6** pivoted at **40**. To the right in FIG. 2, the slide **8** is shown in its dwell position withdrawn from the warp shed whereby the further movement of the crank **1** and arm **32** results merely in a swinging of the lever **11** around the pin **39** without the connecting rod **7** being lengthwise displaced thereby by the lever **6**. In this arrangement, the further movement of the crank **1** and arm **32** by the lever **11** is halted by causing the slide **8** to strike against a buffer **12** at the end of its stroke which buffer is stationarily mounted on the machine frame in the path of the slide.

The spreader **13** used for widening and equalizing of the shed is shown in FIG. 3 in its flat position outside the shed **41**, while in FIG. 4, it is shown introduced into the shed and rotated through 90°. Such rotation is effected by a mechanism which will now be described. While the spreader **13** is operated by mechanism described hereinafter, the said spreader coacts with the slide **8** in that the weft threads are tensioned and spread by the spreader **13** just prior to the insertion of the slide **8** so as to permit the said slide to be conveniently inserted into the shed **21**. The mechanism operating the slide **8**, as clearly described above, is shown in FIGURES 1 and 2.

On the slide guide **42** which extends transverse to the longitudinal axis of the machine, there is arranged on the bottom a guide **43** which may comprise two tracks located opposite in parallel to each other. Between them, a slide member **17** is lengthwise guided. A two-arm lever **16** is linked to slide **17** and is swingable around a pin **44** fastened in fixed position on the machine frame **59**. At one end of the lever **16** there is an angular slot, **45**, **46**. A pin **47** arranged on the lay **15** of the loom engages the slot in a manner such that upon forward movement of the weaving batten **15** from the position shown in FIG. 3 into the position shown in FIG. 4, the lever **16** carries out a swinging motion which results in a displacement of the slide member **17** towards the left in the guide **43**. The spreader **13** is first displaced by means of a link **18** axially in a slot **45***a* until a lug **14** on the spreader **13** strikes against a right-angle bend **46***a* of the slot **45***a* which forces the lug **14** under the action of the link **18** to effect a swinging motion in circumferential direction, which is transmitted to the spreader **13** as can be seen in FIG. 4, which shows the spreader **13** in the straightened or swung position and advanced into the shed and opening and equalizing the shed.

The spreader is shown greatly enlarged in FIGS. 5 to 8, in which can be seen that its outline is generally wedge-shaped in cross-section so that, as can be noted in particular from FIG. 6, the spreader can adapt itself to the shape of the shed as it is defined by the warp sheets **14***a*, **14***b* when it is pushed between same.

In FIGS. 9 to 11, the mechanism for producing the half turning of the edge warp threads **20***a*, **20***b* is shown. To the harness frames **48**, **49** there are fastened needles **50**, **51** provided with eyes at their ends through which the warp threads **14***a* and **14***b* are passed. By a suitable

eccentric cam drive of the warp carriers **48, 49**, there is produced a movement of threads **20***a* with respect to threads **20***b* from the position shown in solid line in FIG. 9, into the position shown in dashed line. By means of a connecting rod **52** and a preferably electromagnetic driving device acting on it, a transverse displacement of the needles **51** is effected, the connecting rod **52** moving in guide bearings **53, 54** fastened to the harness frame **49', 49**.

In order to impart to the slides **8** a better guidance, a reed **21** has at its edges, which effect the beating, a preferably rectangular cutout **55** (FIG. 15–16), which engages the slide **8** (FIG. 17) upon its movement between warp sheets **14***a*, **14***b* over a part of its periphery and thus guides it. This additional guidance of the slide reduces the power consumption of the machine, makes possible quieter operation of the slides and a higher operating speed and contributes to reducing the possibilities of failures. The swingability of the slide guides **42** produces similar advantageous results. The structure of the guides and the associated drive mechanism are apparent from the top view of the slides in FIG. 19 and FIG. 21.

As shown in FIG. 19, on supporting struts **56, 57**, fastened laterally to the machine frame **59** carry a pivot pin **58** around which the slide guides **42**, which may be tubular, can pivot. The drive of the guides is obtained from a shaft **23** supported in the machine frame **59**, which shaft is driven via a gear **60** from the drive motor **66** of the loom. On the shaft **23**, there are fastened the cams **61** which via slide rollers **62** or the like cause the reciprocating motion of the weaving batten **15** and of the connecting rods **26** pivoted to the weaving batten. The rods are connected via levers **63** and connecting links **64** with the slide guides **42**. The levers **63** are swingable around supporting pins **65** fastened to the machine frame. In FIG. 19, the slide **8** is shown on the right in a position retracted from the warp or shed, the slide guide **42** carrying out a swinging motion and thereby moving the weft thread which is held under tention taut into the shed so that the reed **21** can effect a better beating-up. In FIG. 19 on the left, the corresponding parts are shown with the reed **21** retracted and slider **8***b* advanced into the shed, the slider guide **42** being in the straight position and not yet swing out.

The cooperation of the swingable slide guide, the harness frames and the beating up mechanism can also be seen from the overall view of the machine in FIG. 20 and the corresponding top view in FIG. 21 in which the parts of the loom which are not essential for the invention have also been included for the sake of completeness, in particular the warp beam **67** and the cloth beam **68**. The loom is driven by a motor **66**.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

I claim:

1. A shuttle-less wire weaving loom for weaving a wire fabric, said loom comprising a frame structure, a pair of lengthwise and pivotally reciprocatory sliders for inserting weft threads into a shed formed by warp threads, said sliders being disposed on opposite sides of the frame structure, guide means supported on the frame structure guiding the sliders during reciprocatory movements thereof, pivot means pivotally supporting said guide means and said sliders for pivoting about an axis transverse of the direction of the lengthwise reciprocatory movement of the sliders, a rotary crank means, driving means for rotating said crank means, linkage means coupling said crank means to each of said sliders, said linkage means including link members for imparting to alternate sliders lengthwise and pivotal reciprocatory movements of the sliders into the shed and withdrawal therefrom, and spreader means on each side of the shed for enlarging and controlling the outer edges of the shed, each of said spreader means including a spreading member, means for moving the spreading member into and out of the shed, and a reed member, said reed member including a recessed guide portion engageable with the sliders for guiding the same.

2. A loom according to claim **1**, wherein said linkage means comprises for each slider a link member including a curved guide groove, a pin guided in said groove along the length thereof, link members coupling said pin to said crank and the respective slider to impart to the latter said reciprocatory movements, said link members and the curvature of said guide groove being correlated so that the reciprocatory movement of the slider is temporarily arrested in a predetermined position of the pin in the groove.

3. A loom according to claim **1**, wherein said linkage means comprises pivotally coupled link members for transmitting rotation of the crank to the sliders to effect the reciprocatory movements thereof, and stop means coacting with said sliders for temporarily arresting the same in a predetermined position thereof while permitting continued pivotal movements of said coupled link members in reference to one another.

4. A loom according to claim **1**, wherein said spreading means comprise an elongated member of generally oval cross section and tiltable about its lengthwise axis, and drive means lengthwise reciprocating said spreading member to introduce the same into and withdraw the same from the shed, and tilting said spreading member about its lengthwise axis while being at least partly within the shed.

5. A loom according to claim **4**, wherein said drive means comprises a lever pivotally supported on said frame structure, said lever including a lengthwise extending angular groove, a pin engaging said groove, a weaving batten supporting the pin for moving the same along said groove to pivot the lever in accordance with the configuration of said groove, a slidably guided spreader-control member pivoted to said lever for displacement of said control member by pivotal movements of said lever, a link coupling said control member to said spreading member for imparting to the latter said reciprocatory lengthwise movement, a stationarily mounted member including an angular groove having a portion lengthwise of the direction of movement of the spreading member and a portion at an angle thereto, and a lug extending from said spreading member and engaging the groove in the stationary member for movement along the same, whereby the spreading member is tilted about its lengthwise axis when the lug reaches the angled portion of said groove.

6. A loom according to claim **1** and comprising selvage-forming means on each side of said shed for bending the marginal threads in the shed to form a selvage, said selvage-forming means including a plurality of pairs of needles, each of said needles having an eye for receiving a thread to be crossed, the needles of each pair being parallel and oppositely positioned, and an upper and a lower warp carrier, each carrier supporting one of the needles of each pair, one of the needles of each pair being transversely movable in reference to the respective carrier from one side of the second needle of the pair to the other side thereof.

7. A loom according to claim **6**, wherein said movable needle is supported on the upper warp carrier.

8. A loom according to claim **1** and comprising a rectilinearly reciprocatory weaving batten, said pivot means for the guide means and the sliders including rock shafts mounted on the frame structure and links linking

the batten and the guide means to the rock shafts for pivoting the guide means in response to movements of the batten.

References Cited by the Examiner

UNITED STATES PATENTS

1,563,305	11/1925	Ambler	139—130
1,564,506	12/1925	Ambler	139—130
1,584,680	5/1926	Ambler	139—130
1,762,393	6/1930	Hein	139—141
2,170,770	8/1939	Sullivan	139—127
2,501,982	3/1950	Zerbee	139—127
2,702,566	2/1955	Houghton	139—127
2,849,029	8/1958	Webber et al.	139—127
3,047,027	7/1962	Svaty et al.	139—54
3,133,560	5/1964	Arnold et al.	139—54

DONALD W. PARKER, *Primary Examiner.*

RUSSELL C. MADER, *Examiner.*

H. S. JAUDON, *Assistant Examiner.*