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Applicant: **BONAS GRIFFITH LIMITED**
12a Southwick Industrial Estate
Sunderland Tyne & Wear SR5 3TX(GB)

Inventor: **Griffith, John Dalton**
16 Burdon Road Cleddon
Sunderland Tyne & Wear SR6 7RU(GB)

Representative: **Dealtry, Brian et al**
Eric Potter & Clarkson 14, Oxford Street
Nottingham NG1 5BP(GB)

Hand loom.

A weaving loom including a reed mounted on an oscillatable reed shaft, and a rapier for drawing weft yarn through a warp shed, the rapier having a rapier head mounted on the end of an elongate drive member which is capable of reciprocating the head through the warp shed, drive means for oscillating the reed shaft such that during said insertion and retraction strokes the reed is spaced from the fell to enable unhindered travel of the rapier head and such that the reed is advanced to urge the rapier toward the fell when the rapier is at its fully inserted position such that the rapier head is positively located for co-operation with weft yarn guide means for collection of weft yarn.

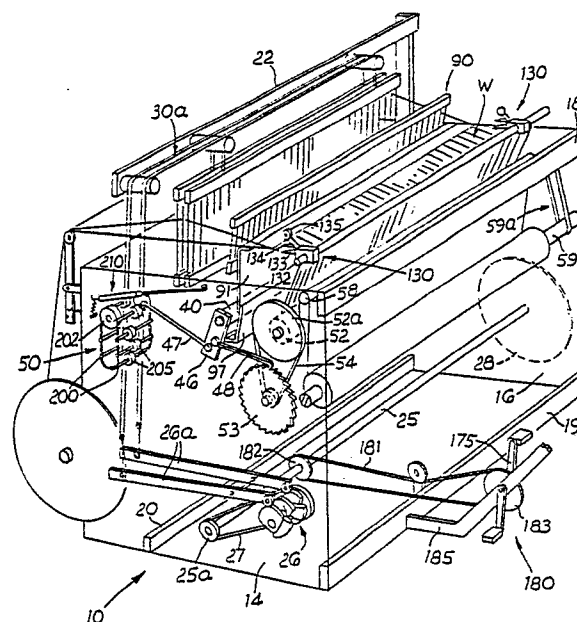


Fig. 1

EP 0 363 016 A2

WEAVING LOOM

The present invention relates to weaving looms.

In particular the invention relates to a weaving loom which is compact, light in weight and which is capable of being programmed to produce a variety of patterns by suitable choice of weft yarn selection and/or warp shed sequences.

Weaving looms with rapiers are well known and the majority have two flexible rapiers which meet in the centre and transfer the weft from one to the other. By transferring the weft in the centre, the ends of the rapiers have to be positioned accurately and, in this respect, it is usual for the rapiers to be guided by guide members which have to enter the warp yarn. These guides cause problems in that they add to the machine complexity, can mark some warp yarns, and can wear the rapiers.

It is an object of this invention to provide an improved weaving loom.

According to one aspect of this invention, there is provided a weaving loom comprising a reed, a flexible rapier capable of reciprocating movement through a warp shed between a first position at one side of the warp shed and a second position at the opposite side of the warp shed, said rapier having a rapier head adapted to grip a weft yarn when the rapier is at the first position, to draw the weft yarn through the warp shed and to release the weft yarn when the rapier is at the second position, wherein the reed is adapted to define a tunnel with the warp shed such that said rapier can be guided entirely by the tunnel as the rapier moves between said first and second positions.

According to another aspect of this invention there is provided a weaving loom including a reed mounted on an oscillatable reed shaft, and a rapier for drawing weft yarn through a warp shed, the rapier having a rapier head mounted on the end of an elongate drive member which is capable of reciprocating the head through the warp shed, drive means for oscillating the reed shaft such that during said insertion and retraction strokes the reed is spaced from the fell to enable unhindered travel of the rapier head and such that the reed is advanced to urge the rapier toward the fell when the rapier is at its fully inserted position such that the rapier head is positively located for co-operation with weft yarn guide means for collection of weft yarn.

A weaving loom according to the invention has the advantage that it enables the rapier to move through the warp unrestrained by any guide member projecting through the warp. A rapier loom with a single rapier does not have to be positioned

accurately in the warp shed; it merely has to pass through the shed. Consequently the provision of guides which project into the warp shed is not required.

In a particular embodiment of the invention, the weaving loom is a single rapier weaving loom.

The weaving loom is particularly suited for being manually driven and able to weave fabrics up to about one metre in width.

Various aspects of the present are hereinafter described with reference to the accompanying drawings, in which:-

Figure 1 is a schematic perspective view of a loom according to the present invention as viewed from one end and the front;

Figure 2 is a view similar to Figure 1 showing part of the loom as viewed from the opposite end and the rear;

Figure 3 is a more detailed schematic perspective view showing emergence of the rapier from the warp shed to collect weft yarn; and

Figure 4 is a schematic front view showing emergence of the rapier from the warp shed at the rapier insertion side of the loom.

The loom 10 according to the present invention includes a frame having a pair of end walls 14, 16 spaced apart and secured to one another by cross-members 18, 19 located at the front of the loom and cross-members 20, 22 located toward the rear of the loom.

It will be appreciated that if needed, additional cross-members may be provided. The end walls 14, 16 are preferably made from a metal sheet.

The loom 10 includes a main drive shaft 25 which is rotatably mounted in the end walls 14, 16. The drive shaft 25 extends beyond end wall 14 and has a sprocket 25a mounted thereon. The Sprocket 25a drives a plurality of cams 26 via a chain 27. The cams 26 operate levers 26a for raising and lowering the heald frames 30 in a conventional manner via cables 30a. The opposite end of the main drive shaft 25 projects beyond the end wall 16 and has a flywheel 28 mounted thereon (see Figure 2.)

A reed shaft 40 is rotatably mounted at opposite ends in end walls 14, 16. The reed shaft 40 projects beyond end wall 14 and has a crank arm 46 mounted thereon. The crank arm 46 has a pair of pawls 47, 48 extending therefrom, pawl 47 being arranged to drive a weft yarn selection mechanism 50 and pawl 48 being arranged to index a toothed disc 53.

The loom includes a fabric tension take down roller 52 which has a toothed pulley 52a fixed thereto. A toothed belt 54 is trailed about the pulley

of the toothed disc 53 and pulley 52a so that indexing of disc 53 causes an indexing movement of the take down roller 52.

Woven fabric W extends from the fabric tension take down roller 52 over a guide shaft 58 to be wrapped onto a take-off roller 59. The roller 59 is located at either end in a cradle 59a formed on the side of respective end walls 14, 16 and is supported at each end by a belt 60 which is trained about roller 52.

The opposite end of the reed shaft 40 projects beyond each wall 16 and has bolted thereto a support bar 60 which extends longitudinally from the shaft 40. The support bar 60 has an arm 61 projecting laterally therefrom and is connected via a push rod 62 to a lever 63. The lever 63 extends from a shaft 64 which is rotatably mounted in a frame 65 secured to end wall 16. A bell crank 67 is secured to the shaft 64 and one arm 67a of the bell crank is connected via a push rod 69 to the flywheel 28.

Accordingly rotation of the flywheel 28 causes the shaft 64 to oscillate backwards and forwards due to the connection between push rod 69 and arm 67a.

Such oscillation of shaft 64 causes the reed shaft 40 to oscillate as determined by the lever 63 and push rod 62.

Lever 63 and push rod 62 can be set so that the reed moves rapidly from the front to the rear, and then moves forward and back a small amount from the rear before returning to the front.

This results in a dwell of the reed at its rear position and a movement to help support the rapier when it is through the shed and picking up a weft thread.

Figure 5 shows how this is done. The pivot 80 at the end of lever 63, moves from a position 80, past 80a to 80b. This causes the arm 61 to move from position 61 (reed at front) to 61a (reed at rear) and then to 61b (reed moved slightly forward again) before returning via the same route.

Also mounted on the support bar 60 is a rapier drive mechanism 70 which drives a rapier 72 (Figure 3) across the warp sheet.

The rapier 72 is connected to the end of a flexible drive strip 73, formed for instance from a suitable plastics material, which includes a series of regularly spaced apertures 74. The drive strip 73 is trained about a toothed drive wheel 76 which has regularly spaced projections 78 formed on its periphery for engagement in the regularly spaced apertures 74 of the drive strip.

A toothed drive belt 80 is trained about a drive pulley 82 attached to the drive wheel 76 and an idler pulley 83 rotatably mounted on the support bar 60.

A clamp head 86 is secured to the lower run of

the drive belt 80 and is connected via a push rod 88 to the other arm 67b of the bell crank 67.

Accordingly as the shaft 64 oscillates the rapier drive mechanism 70 is driven simultaneously with oscillation of the reed shaft 40. Since the rapier drive strip 73 is driven via a toothed wheel 76 which is itself driven by a toothed drive belt 80 the movement of the rapier 72 is synchronised with movement of the reed shaft 40.

The reed 90 is attached to a reed support plate 91 which extends along the reed shaft 40. A guide channel 93 is secured at one end to the reed support plate 91 and is attached at its other end to a support plate 94 at a location adjacent to the toothed drive wheel 76. The guide channel 93 provides support and guidance for the drive strip 73 between the drive wheel 76 and its entry into the shed. A support sleeve 96 is secured to the support plate 94 and to a drive strip support plate 97 which is secured to the reed shaft 40. The support plate 97 includes a flange 98 on which is mounted a guide channel 99 for guiding movement of the drive strip 73.

The movement of the reed shaft 40 is arranged so as to provide as much clearance as possible during insertion and retraction of the rapier 72. Accordingly for the majority of the duration of movement of the rapier 72 the reed 90 is located at a rearward position.

In order to ensure that the rapier 72 is accurately positioned to pick up weft yarn as it emerges from the shed the reed 90 is advanced to an intermediate forward position whereat it urges the rapier drive strip 73 against the fell.

This situation is schematically illustrated in Figure 3.

The weft yarn 100 from the previous pick extends from the weave through a weft yarn guide eye 101. A combined guide and knife device 103 is provided which is movable between a lower position and a raised position. The guide and knife device 103 includes an angled support plate 106 having a substantially vertical arm 106a to which a knife blade 107 is attached. The plate 106 has a substantially horizontal arm 106b which is hinged attached to part of the loom from LF. The support plate 106 has an upper edge 108 which engages the weft yarn 100 as it is moved to its upper position. Such movement causes the weft yarn 100 to wrap about the underside of the rapier 72 so that when the rapier 72 begins to retract the weft yarn 100 is trapped between the spring wire 110 and the body of the rapier 72. Raising and lowering of the support plate 106 is effected by a push rod 150 which is operated upon by a cam (not shown) mounted on the main drive shaft.

As the rapier 72 begins to retract further the weft yarn 100 between the rapier and the weave is

pulled taught across the knife blade 107 and is cut thereby. In addition as the rapier 72 begins to retract the reed 90 is also retracted toward its rearward position.

When the rapier 72 is near to emergence from the rapier insertion side of the weave, the reed 90 beings to advance. As the rapier 72 emerges the upper portion of the spring wire 110 engages a cam block 120 mounted on the reed 90 which causes the lower portion of the spring wire to move away from the body of the rapier and thereby release the weft yarn. As the rapier 72 continues to retract the reed 90 advances to beat-up.

A pair of cutters 130 are provided for trimming the edges of the weave. The cutters 130 are mounted on a fabric guide bar 132 and include a static blade 133 and a movable blade 134 which is biased to an open position and closed by a roller 135 being engaged by the reed 90 when it is moved to its beat-up position.

The weft yarn selection mechanism 50 preferably comprises a series of laterally spaced rods 200 inter-connected to form a continuous belt. The belt is supported on a roller 202. The pawl 47 is arranged to successively engage each rod 200 so that during each weaving cycle the belt is advanced by one rod spacing. Each rod 200 carries a cam wheel 205 which, dependent upon its axial position along its associated rod engages with a weft yarn guide arm 210 (only one of which is shown for clarity). When a guide arm 210 is engaged by a cam wheel 205 it is raised to an upper feed position whereat it presents weft yarn to the rapier 70. When not engaged by a cam wheel 205 each guide arm 210 is located at a lower stowed position whereat weft yarn guided thereby is not presented to the rapier 70.

Programming of weft selection is simply achieved by sliding each cam wheel 205 to an appropriate axial position along its associated rod 200. The pattern repeat is determined by the number of rods 200 making up the belt and this may be changed as desired.

The main drive shaft 25 is rotatably driven in the embodiment illustrated by means of a manually operated drive means 180 in the form of a continuous chain 181 entrained about a sprocket wheel 182 mounted on the drive shaft 25 and a drive sprocket wheel 183 rotatably mounted on a frame 185. The drive sprocket wheel 183 is rotated by means of a pedal crank assembly 175. The frame 185 preferably extends upwardly to support a seat (not shown) for an operative.

It will be appreciated that a motorised drive means may be incorporated for rotating the main drive shaft 25.

Claims

1. A weaving loom comprising a reed, a flexible rapier capable of reciprocating movement through a warp shed between a first position at one side of the warp shed and a second position at the opposite side of the warp shed, said rapier having a rapier head adapted to grip a weft yarn when the rapier is at the first position, to draw the weft yarn through the warp shed and to release the weft yarn when the rapier is at the second position, wherein the reed is adapted to define a tunnel with the warp shed such that said rapier can be guided entirely by the tunnel as the rapier moves between said first and second positions.

2. A weaving loom according to Claim 1 wherein the reed is oscillatable and when the rapier is at the first position, the reed urges the rapier toward the fell, and when the rapier is moving between the first and second positions, the reed is spaced from the fell.

3. A weaving loom according to Claim 1 or 2 wherein the rapier comprises a flexible strip member upon which strip member the rapier head is mounted, and said oscillatable reed being mounted on a reed shaft.

4. A weaving loom including a reed mounted on an oscillatable reed shaft, and a rapier for drawing weft yarn through a warp shed, the rapier having a rapier head mounted on the end of an elongate drive member which is capable of reciprocating the head through the warp shed, drive means for oscillating the reed shaft such that during said insertion and retraction strokes the reed is spaced from the fell to enable unhindered travel of the rapier head and such that the reed is advanced to urge the rapier toward the fell when the rapier is at its fully inserted position such that the rapier head is positively located for co-operation with weft yarn guide means for collection of weft yarn.

5. A weaving loom according to Claim 4 wherein the elongate drive member comprises a flexible strip member.

6. A weaving loom according to any of Claims 3 to 5 wherein the flexible strip member is drawn longitudinally by a drive wheel mounted on the reed shaft at a location axially spaced from the reed, a first guide member mounted on the reed shaft being provided for guiding the flexible strip between the drive wheel and the reed.

7. A weaving loom according to Claim 6 wherein the flexible strip member is guided beneath the warp sheet by a second guide member mounted on said reed shaft.

8. A weaving loom according to Claim 6 or 7 wherein the drive wheel and reed shaft are driven in synchronism by a common drive transmission.

9. A weaving loom according to Claim 8

wherein the common drive transmission includes a bell crank having one arm connected to a rotating main drive shaft so as to be oscillated thereby, the other arm of the bell crank being drivingly connected to said drive wheel to cause oscillatory rotation thereof, the bell crank being mounted on a shaft to cause oscillatory rotation thereof, a drive lever extending from said shaft and being drivingly connected to said reed shaft to cause oscillation thereof.

10. A weaving loom according to Claim 9 wherein the driving connection between said drive lever and the reed shaft includes an arm projecting from the reed shaft and a push rod located between the arm and the drive lever, the drive lever and push rod being arranged so that during the insertion stroke of the rapier the reed is moved from a front beat-up position to a fully retracted position and then advanced to an intermediate front position, and then during the retraction stroke of the rapier the reed is moved from the intermediate front position to the fully retracted position and then from the fully retracted position to the front beat-up position.

11. A weaving loom according to any preceding claim wherein the rapier head includes a rapier body supporting a loop of spring wire for latching weft yarn, the weft yarn guide means being operable to urge weft yarn about the rapier body prior to retraction of the rapier and cause it to be drawn into the shed.

12. A weaving loom according to Claim 11 wherein a cam in the path of the rapier engages the loop of spring wire to cause release of the weft yarn during the retraction stroke.

13. A weaving loom according to any preceding claim including a main drive shaft extending in the direction of weft insertion across the width of the loom, the drive shaft having at one end a flywheel in driving connection with the reed shaft.

14. A weaving loom according to Claim 13 wherein the loom includes a plurality of heald frames and the main drive shaft is drivingly connected to the heald frames via pattern selection means.

15. A weaving loom according to Claim 14 wherein the pattern selection means comprises a plurality of cams which operate a plurality of levers arranged to raise and lower said heald frames, the cams being rotatably driven by the main drive shaft.

16. A weaving loom according to any of claims 13 to 15 wherein manually operated drive means are provided for rotating the main drive shaft.

17. A weaving loom comprising a flexible rapier capable of reciprocating movement through a warp shed between a first position at one side of the warp shed and a second position at the opposite

side of the warp shed, said rapier having a rapier head adapted to grip a weft yarn when the rapier is at the first position, to draw the weft yarn through the warp shed and to release the weft yarn when the rapier is at the second position, wherein no guide means are provided which project into the warp shed to guide the rapier as said rapier moves between the first and second position.

18. A method of weaving a material comprising defining a warp shed, providing a reed, defining a tunnel between the reed and the warp shed, providing a flexible rapier capable of reciprocating movement between a first position at one side of the warp shed and a second position at the opposite side of the warp shed, providing a rapier head on said rapier, gripping a weft yarn with said rapier head when said rapier is at said first position, drawing said weft yarn through the warp shed releasing the weft yarn when the rapier is at the second position, and guiding the rapier entirely by said tunnel as said rapier moves between said first and second position.

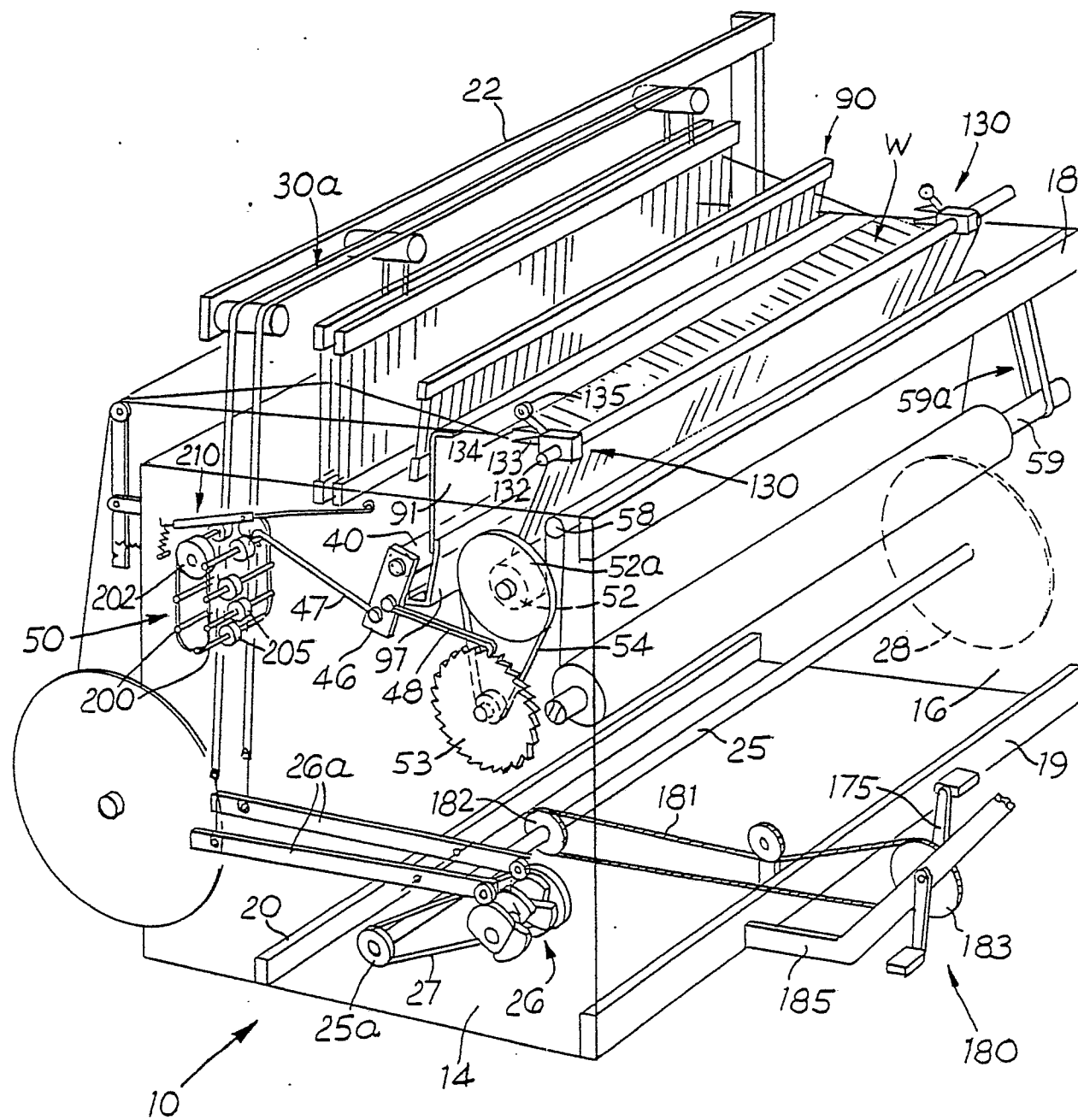


Fig. 1

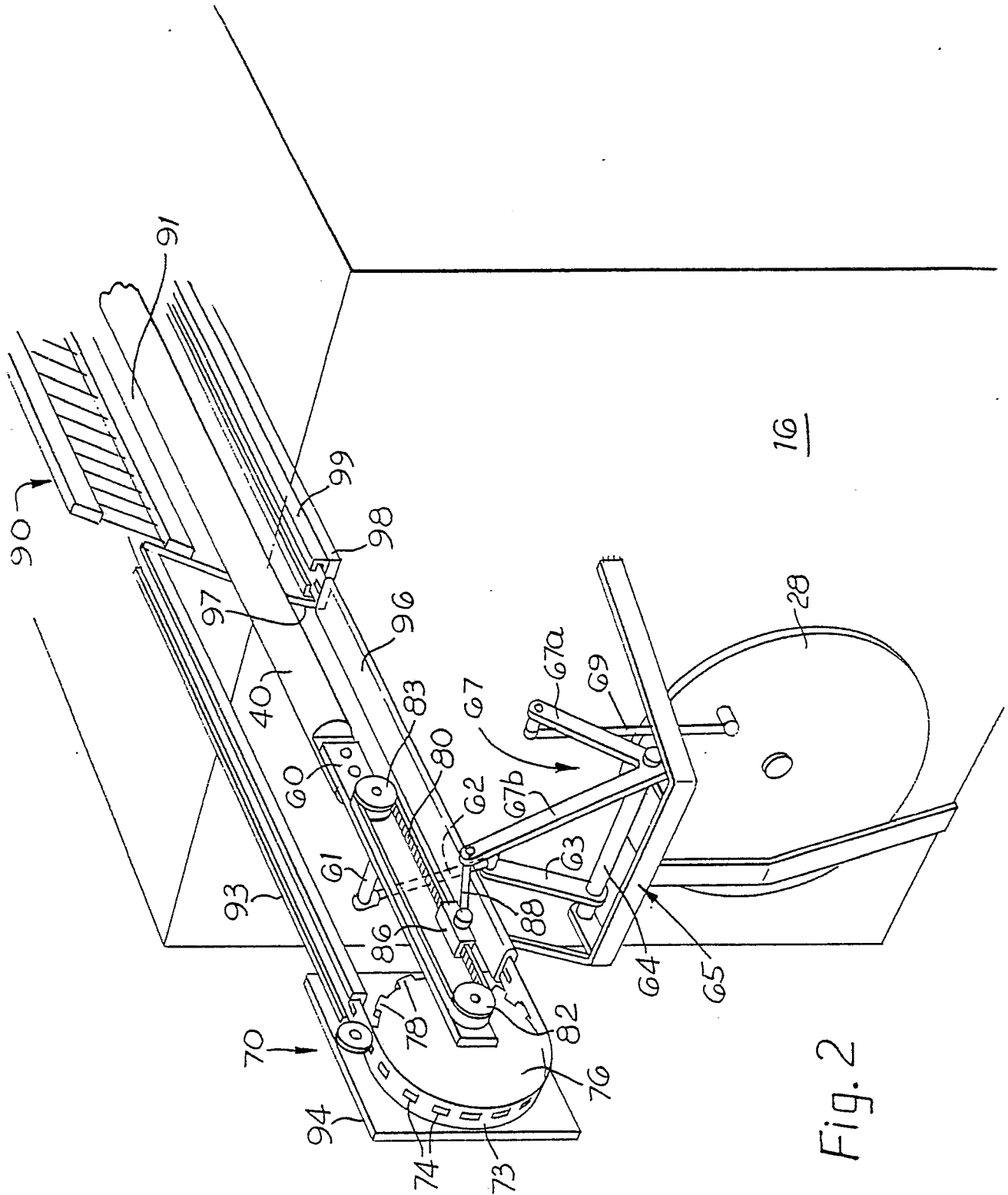


Fig. 2

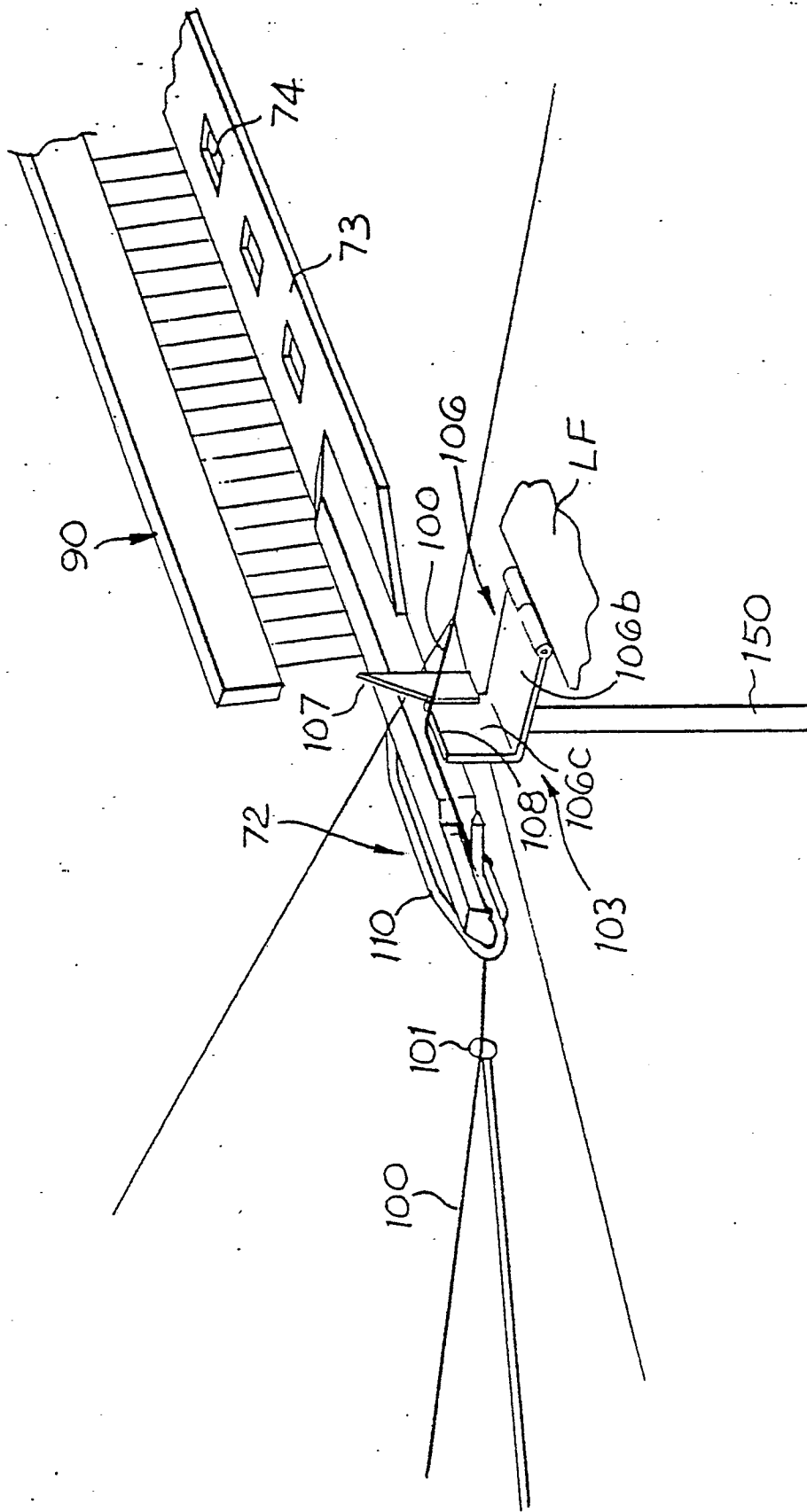


Fig. 3

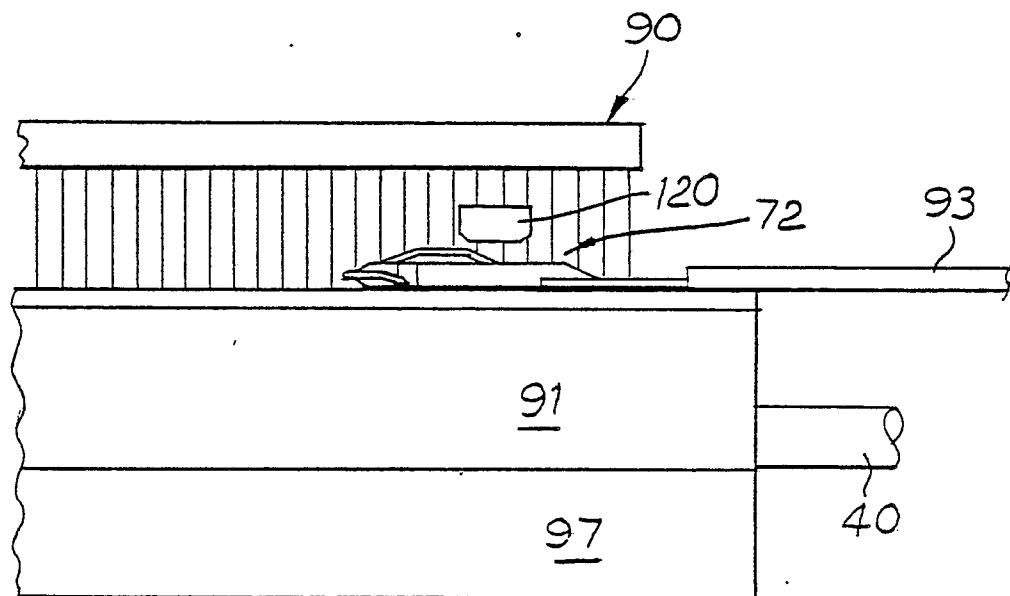


Fig. 4

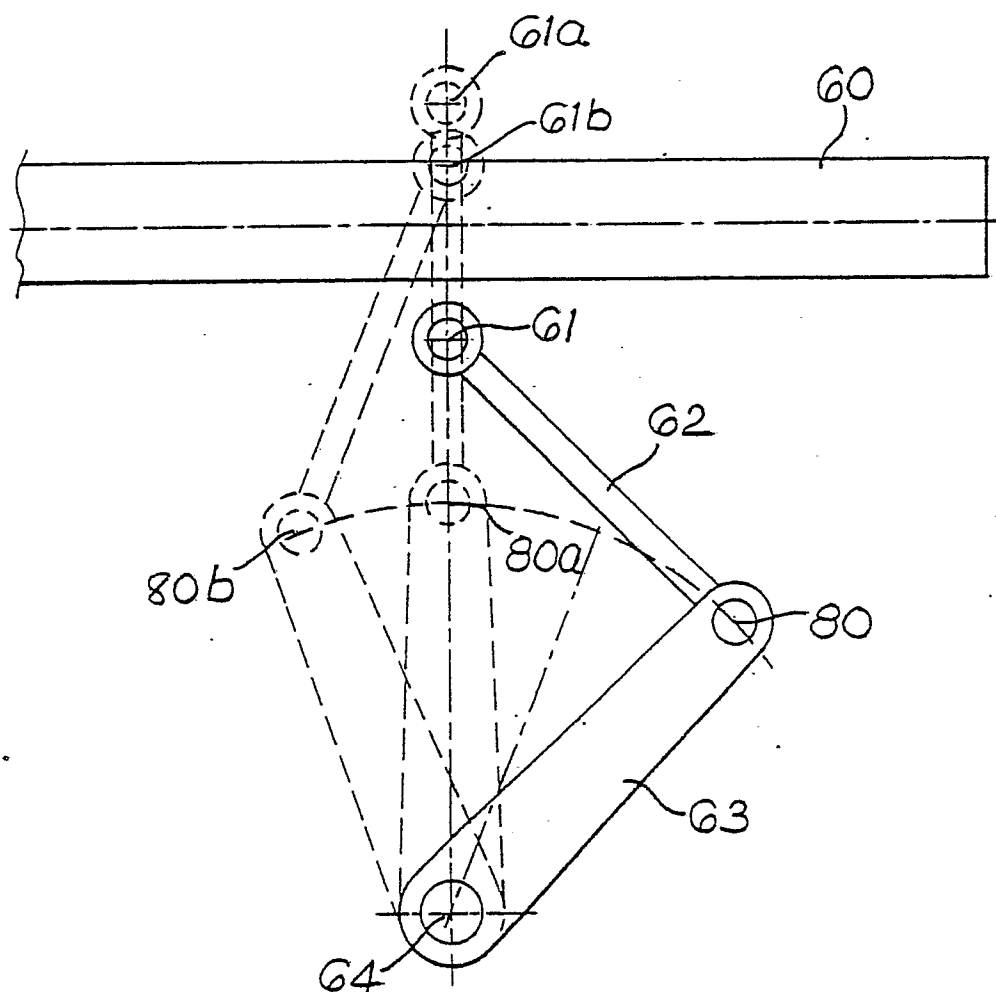


Fig. 5