April 28, 1964 I. O. MOBERG 3,130,756

TERRY MOTION FOR LOOMS

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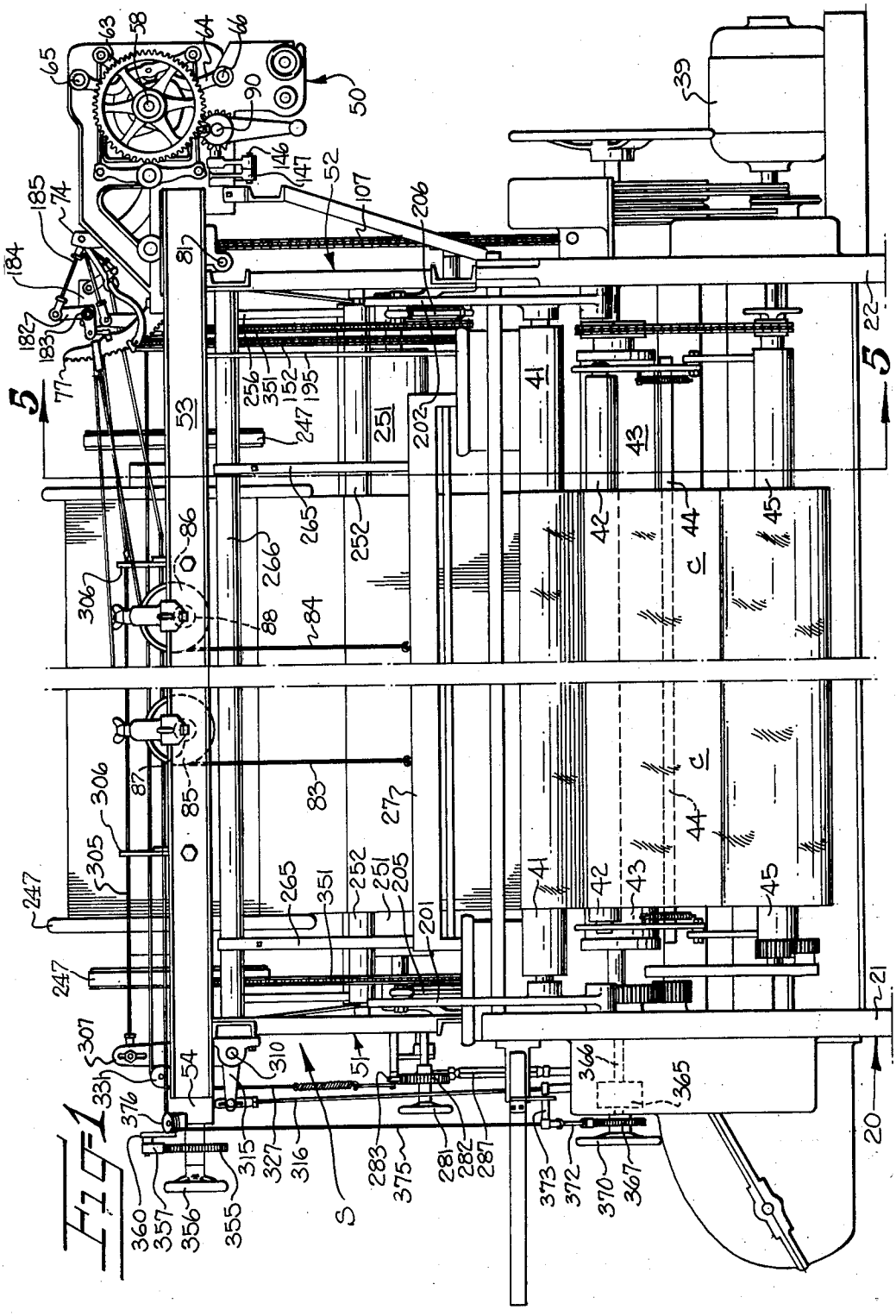
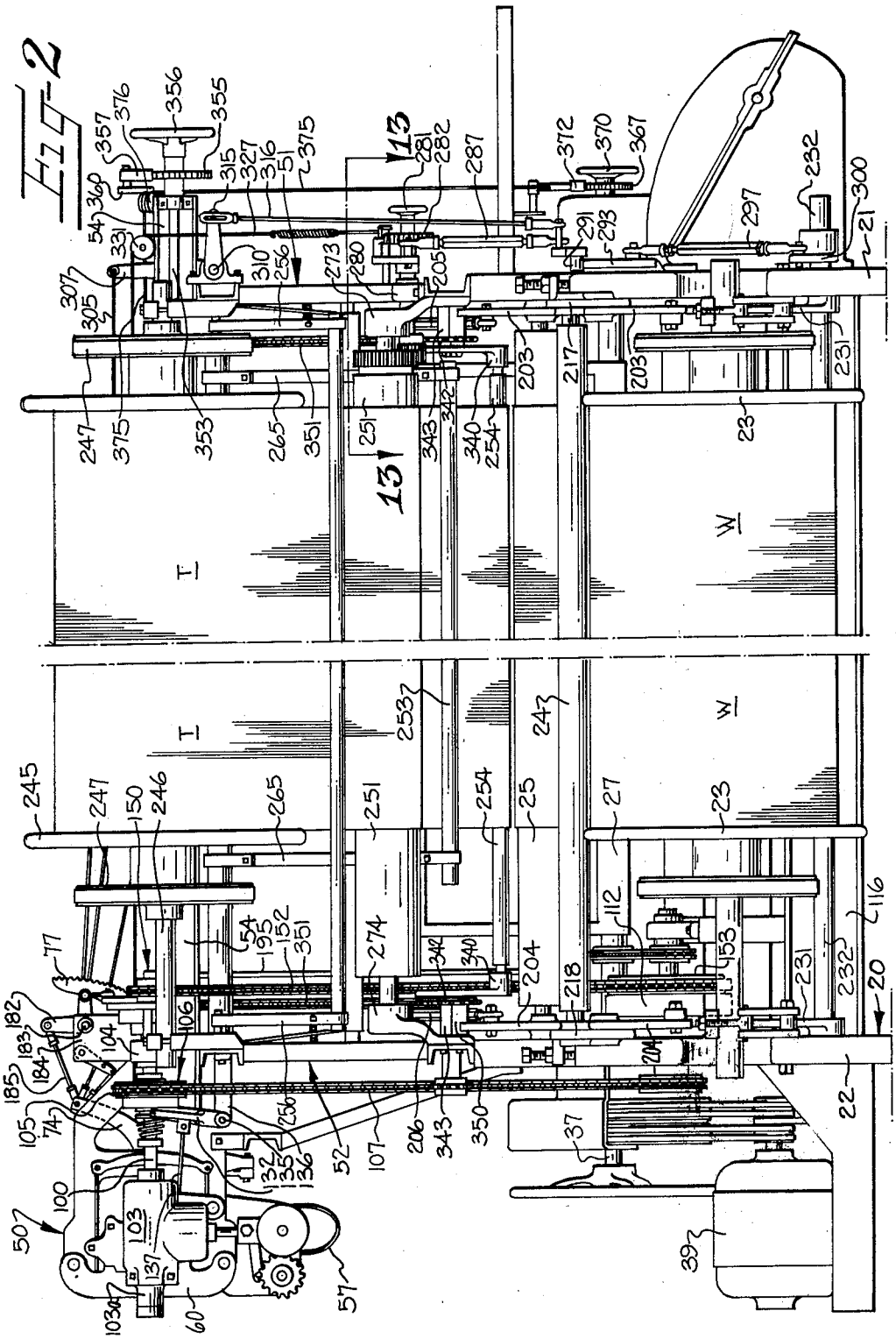


FIG 1

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TERRY MOTION FOR LOOMS

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TERRY MOTION FOR LOOMS

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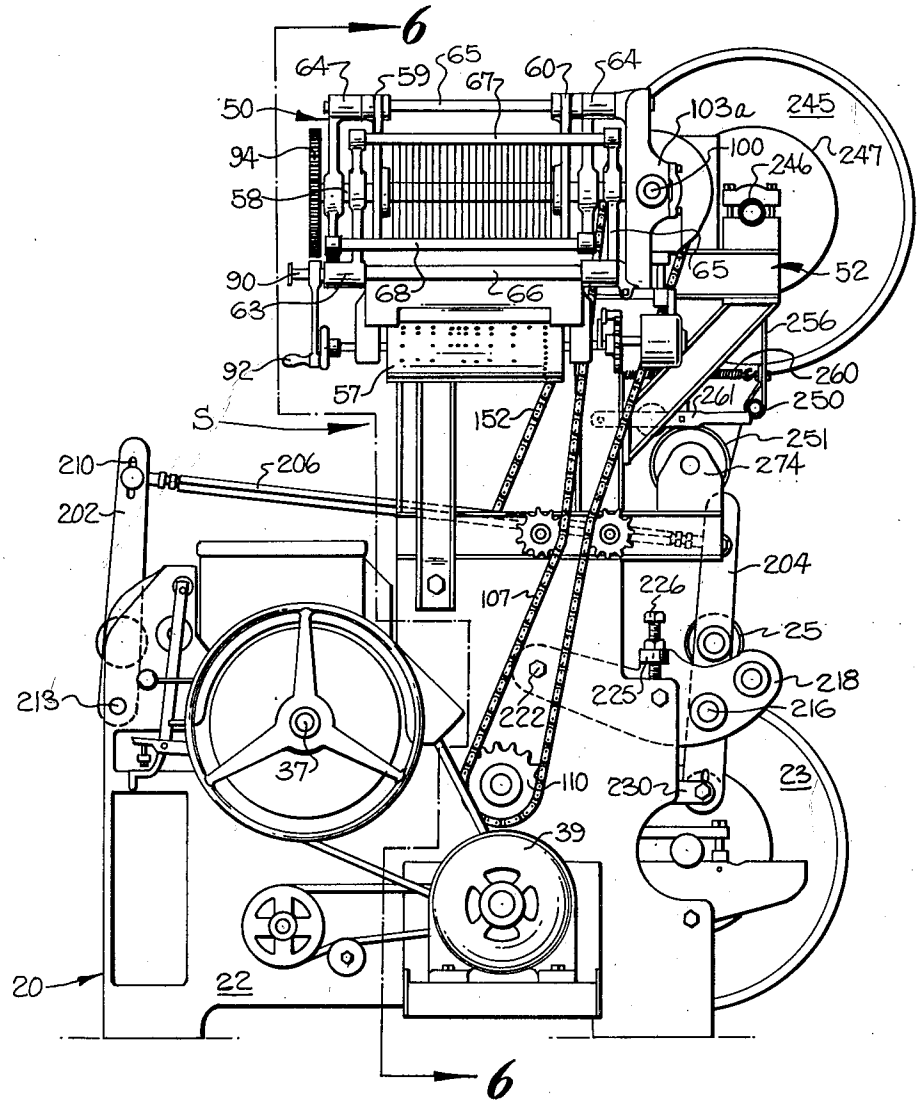


Fig-3

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April 28, 1964 I. O. MOBERG 3,130,756

TERRY MOTION FOR LOOMS

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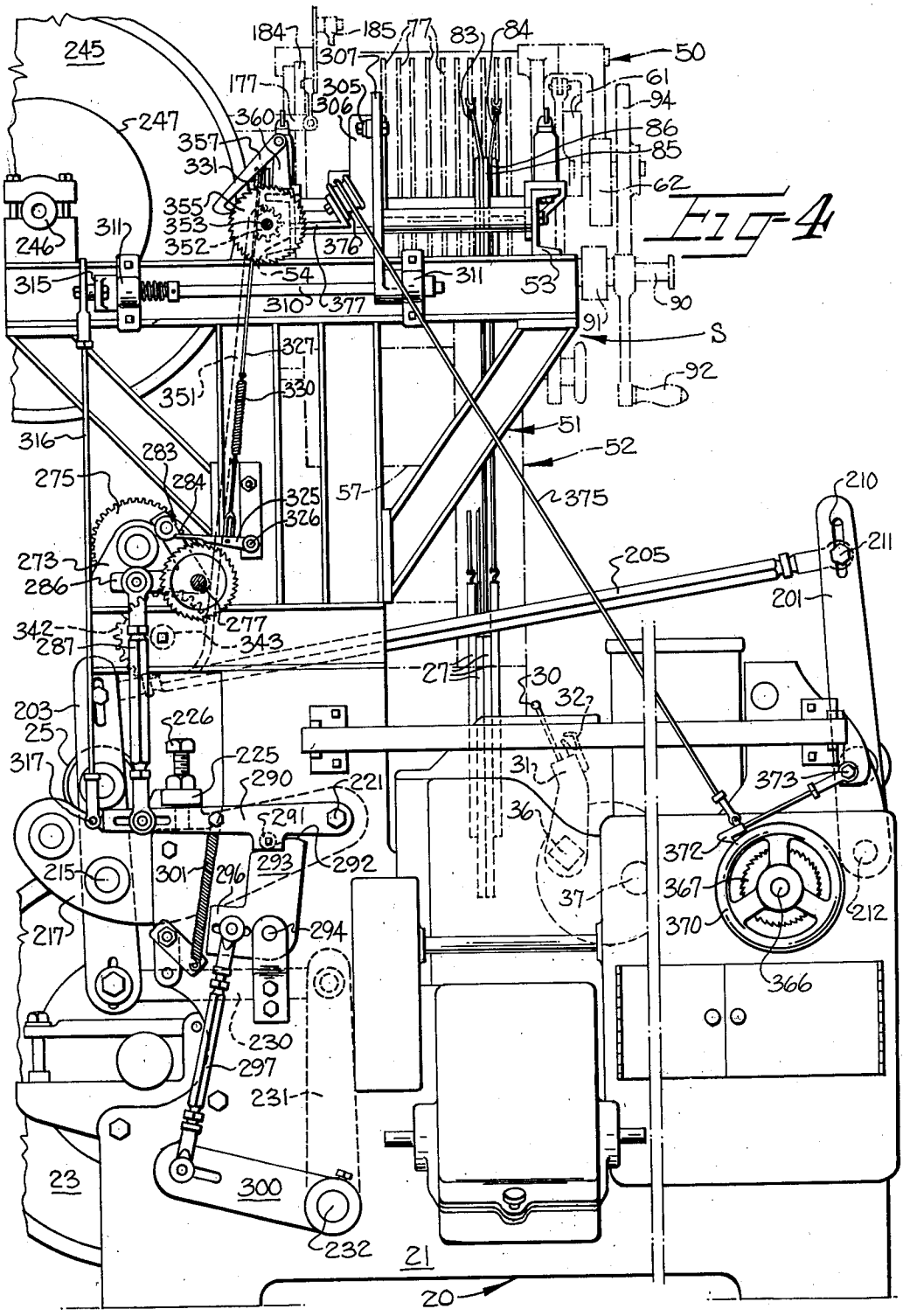


Fig-4

April 28, 1964 I. O. MOBERG 3,130,756

TERRY MOTION FOR LOOMS

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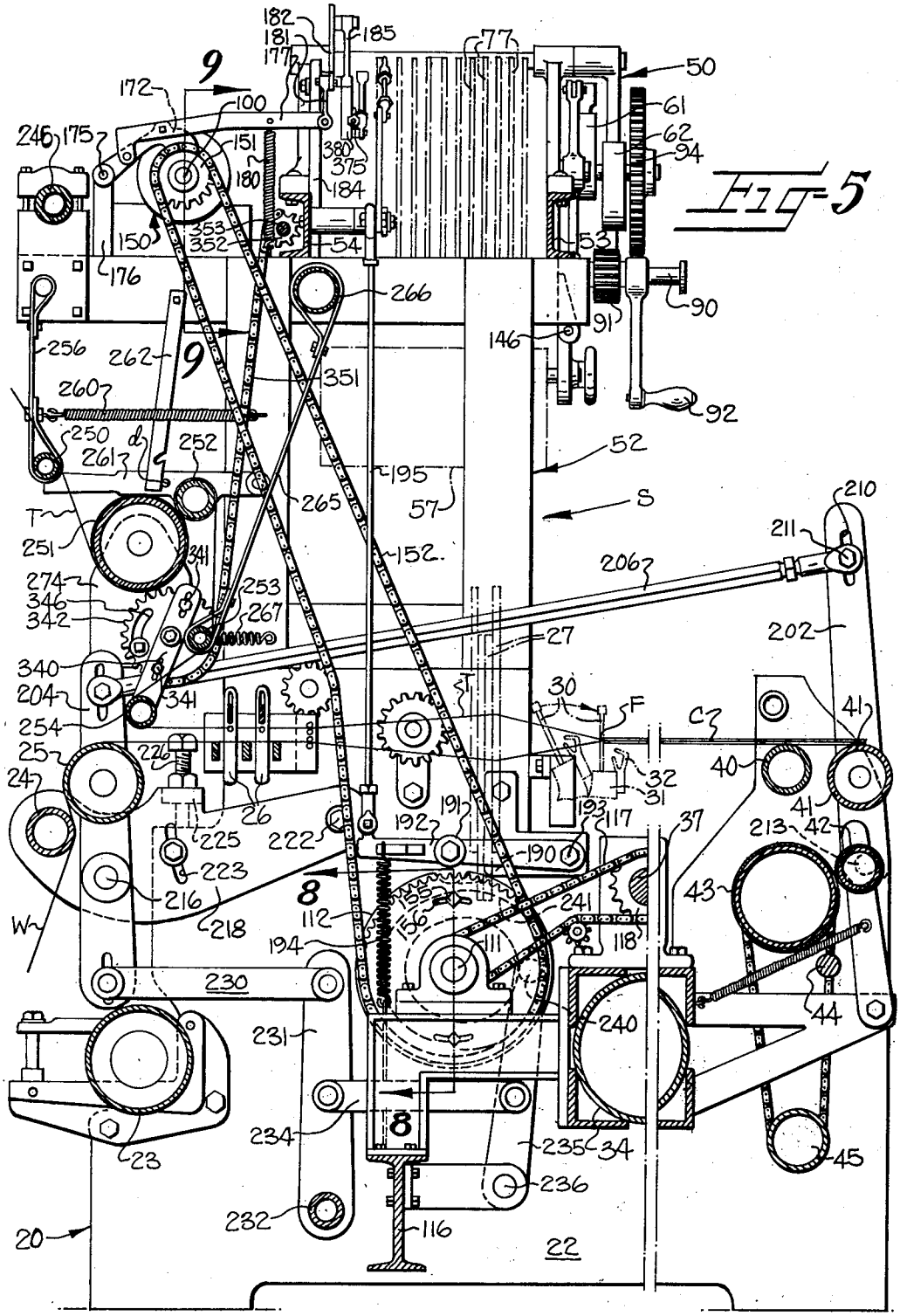


Fig-5

April 28, 1964 I. O. MOBERG 3,130,756

TERRY MOTION FOR LOOMS

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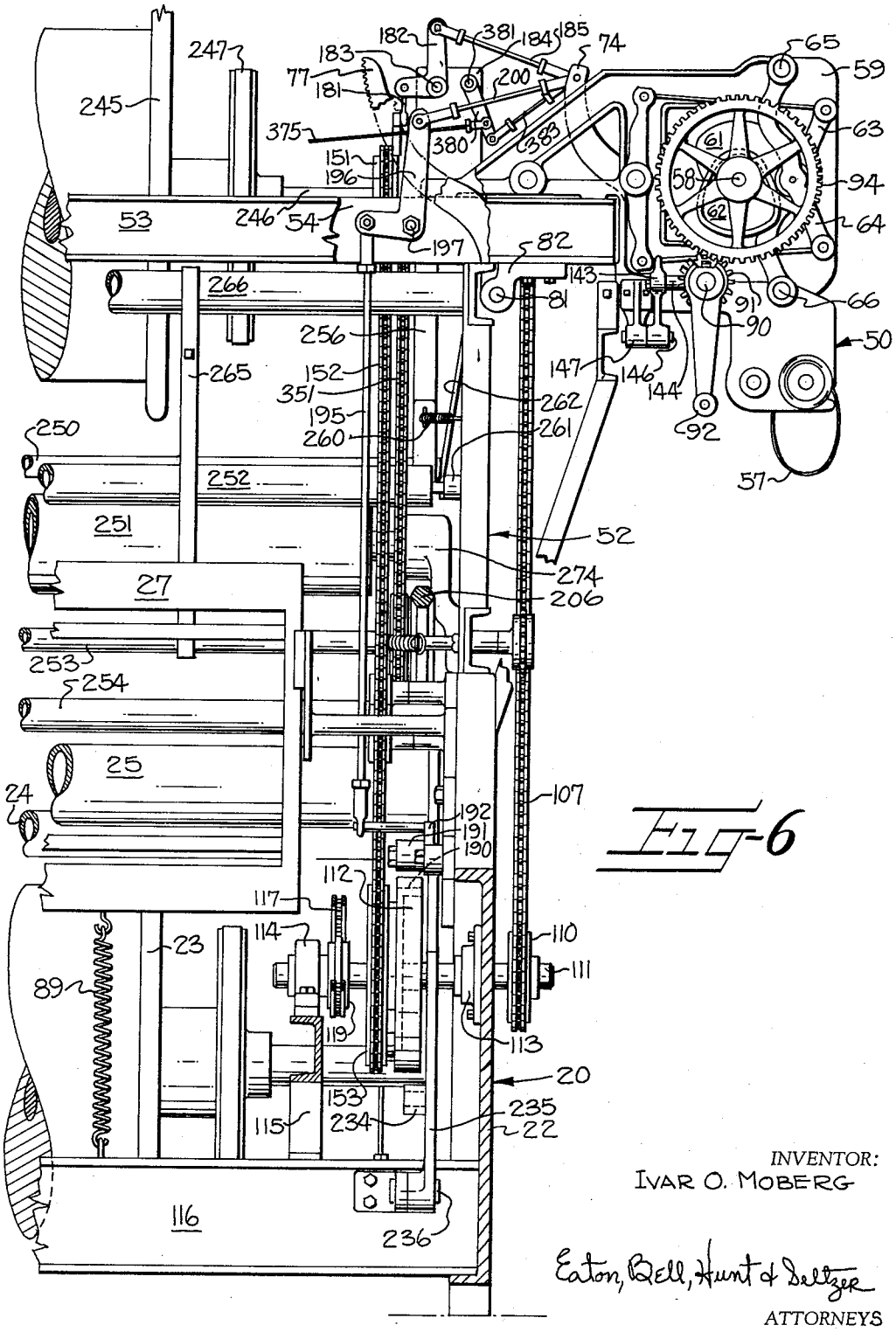


Fig-6

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TERRY MOTION FOR LOOMS

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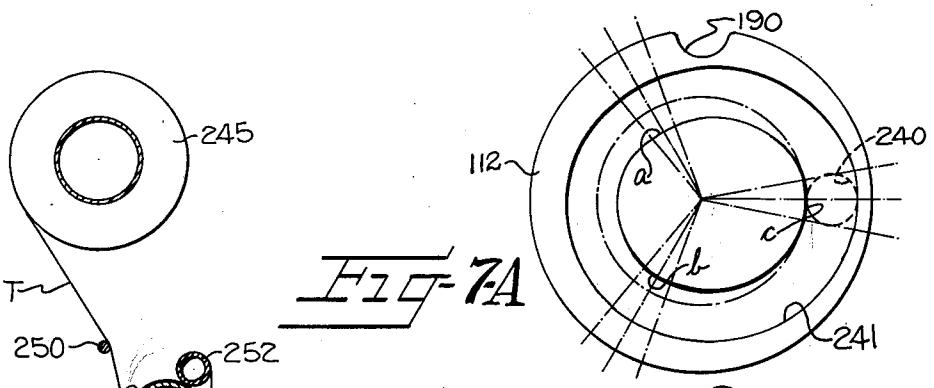


Fig-7A

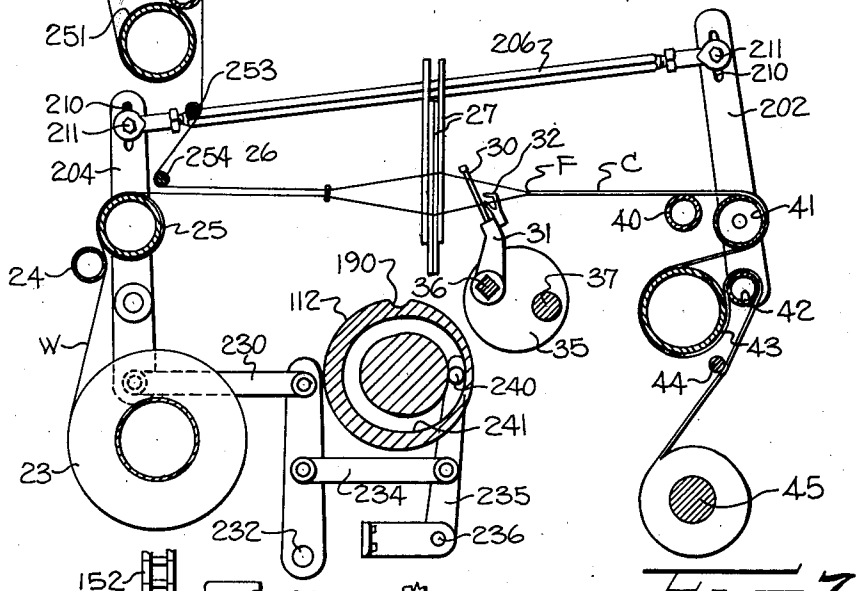


Fig-7

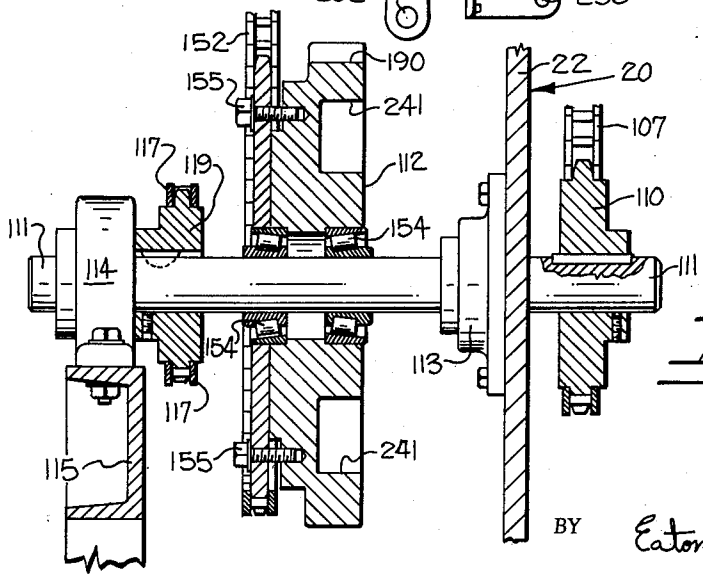


Fig-8

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April 28, 1964 I. O. MOBERG 3,130,756

TERRY MOTION FOR LOOMS

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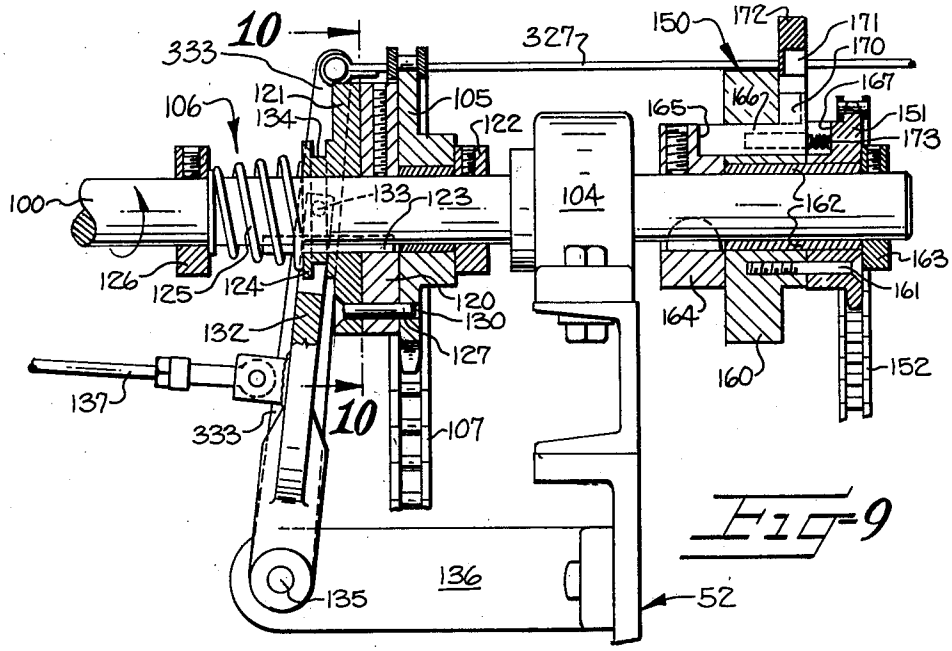


Fig-9

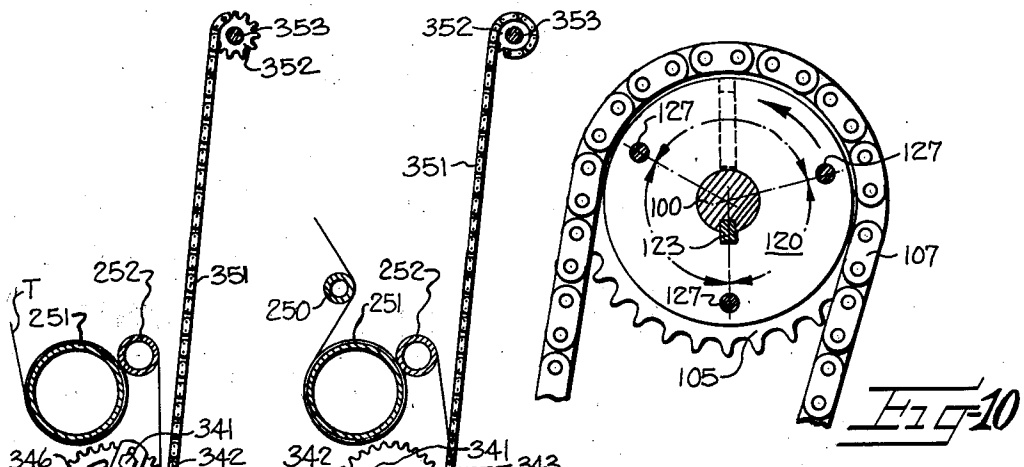


Fig-10

Fig-11

Fig-12

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TERRY MOTION FOR LOOMS

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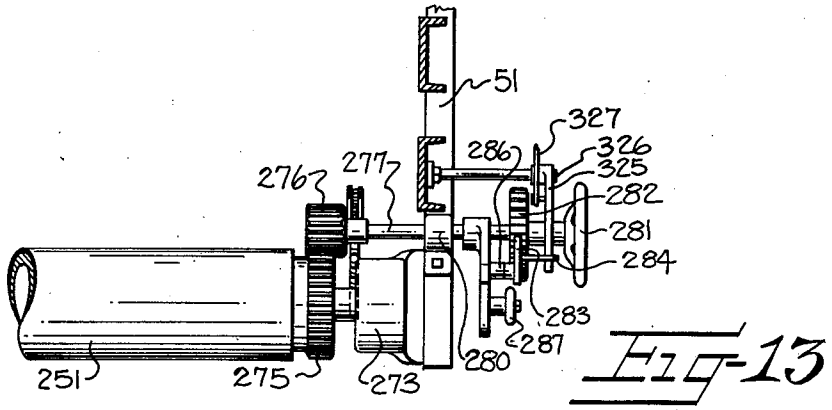


Fig-13

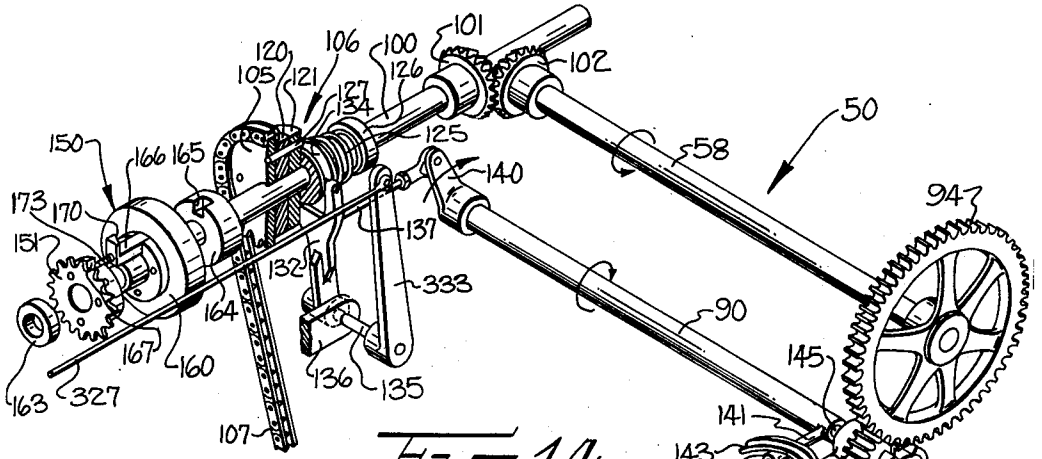


Fig-14

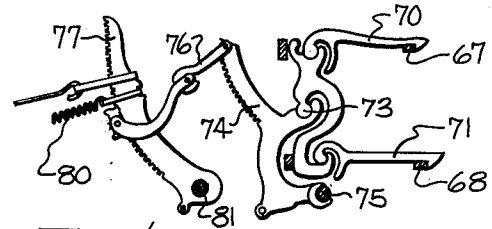


Fig-15

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United States Patent Office 3,130,756 Patented Apr. 28, 1964

3,130,756

TERRY MOTION FOR LOOMS

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Filed Jan. 5, 1961, Ser. No. 80,867
49 Claims. (Cl. 139—25)

This invention relates to terry looms and more especially to an improved pattern controlled terry motion particularly adapted for converting a plain weave Warner & Swasey Sulzer weaving machine for the weaving of terry cloth thereon.

In most terry looms, a terry motion cam rotates one revolution during the weaving of every loop-forming cycle, a cycle being three revolutions of the main drive shaft in weaving a three-pick terry cloth, for example. The terry motion cam controls the relative positions of the fell of the cloth and the reed to effect the loop-forming function of the loom. Such looms generally include a dobby or other pattern device which controls the shed-forming heddles, the pile or terry warp feed means, the warp stop motion, the terry motion and other mechanisms. Due to various reasons, such as malfunction of the loom, improper warp tensions, and warp "smashes," it becomes necessary to pick out some of the wefts and adjust or let back the cloth and warps, which in turn, requires that the pattern device be manually adjusted or reset. Such manual resetting of the dobby or pattern device is generally known as "pick-finding."

When resetting the pattern device of prior art looms, a clutch is released to relieve the pattern device from the load of the main drive of the loom, including the terry motion cam. Thus, it has been necessary, heretofore, to adjust the terry motion cam and terry warp feed means independently of the pattern device so that the changes in the relative positions of the fell of the cloth and the reed, and the feeding of the terry warps, would occur in proper timed relationship and at the proper time with respect to the instant portion of the cloth being woven. This has not only been time-consuming, but it has often resulted in the loom being started without the terry motion cam being in proper timed relation to the pattern device.

It is therefore a primary object of this invention to provide a terry loom of the character described with means for automatically resetting the terry motion cam whenever the pattern device is adjusted or reset and during which the pattern device and the terry motion cam are relieved from the load of the main drive of the loom.

As is generally known, a Warner & Swasey Sulzer weaving machine or loom is equipped with a shuttle race in the form of a row of hooks which are located closely adjacent to, and move with, an oscillating reed. The arrangement of the shuttle race and the reed, and the space limitations of the Sulzer loom are such that the usual types of variable beat-up reed shifting mechanisms are impractical for use on such looms. Therefore, in my conversion of a Sulzer loom for terry weaving, means are provided for shifting warpwise the cloth and ground warps to vary the position of the fell of the cloth relative to the reed under control of a terry motion cam.

It is therefore a more specific object of this invention to provide an improved terry motion drive for looms of the character described in which a driving connection is provided between the pattern device and the terry motion cam with normally engaged or active clutch means interposed between the main drive and said driving connection; that is, between the main drive and the pattern device in this instance, and wherein means are provided for releasing said clutch means and for rendering

the pile warp feed inoperative whenever an operating hand crank is manipulated for adjusting or resetting the pattern device. Thus, during manual resetting of the pattern device, the harnesses, the terry motion cam and the fell of the cloth are adjusted therewith independently of the main drive shaft, the reed, the shuttle drive, the pile warp feed, the ground warp let-off, the cloth take-up and various other elements of the loom. This is particularly important in instances in which no picking out of wefts is required, since the reed may remain stationary during resetting of the pattern device to thus avoid unintentional pulling-out of the terry loops adjacent the fell, notwithstanding the fact that this also relieves the pattern device of the load on the main drive during resetting thereof.

It is also an object of this invention to provide an improved loom which may be quickly changed over from weaving 3-pick terry, for example, to form 4, 5, 6 or 7-pick terry, or more, as desired.

It is another object of this invention to provide novel means, embodied in the terry motion cam, for effecting the beat-up, of those wefts which are spaced from the fell (loose picks) during each terry-loop-forming cycle, in such a manner as to tightly crowd such loose pick wefts together and cause them to tightly engage the warps to an extent heretofore unattainable, and to thereby obviate slippage of the wefts relative to the terry warps during the subsequent full beat-up or fast pick stroke of the reed.

It is still another object of this invention to provide an elevatory whip roll for the terry or pile warps, wherein the whip roll is so mounted rearwardly of the drop wires that it may be raised a substantial distance above the ground warps to facilitate access to the drop wires and other elements forwardly of the whip roll, but adjacent the rear portion of the loom, and wherein the whip roll may be readily returned to a lowered position closely adjacent and above the ground warps.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

FIGURE 1 is a front elevation of a Sulzer-type loom as converted to include a preferred embodiment of the improved terry motion drive, some parts being omitted or broken away for purposes of clarity;

FIGURE 2 is a rear elevation of the loom shown in FIGURE 1;

FIGURE 3 is a right-hand side elevation of the loom looking at the right-hand side of FIGURE 1 and also looking at the left-hand side of FIGURE 2;

FIGURE 4 is an enlarged left-hand side elevation of the loom looking at the left-hand side of FIGURE 1 and also looking at the right-hand side of FIGURE 2, with parts broken away and other parts being omitted;

FIGURE 5 is an enlarged longitudinal or warpwise vertical sectional view, mostly in elevation, taken substantially along line **5—5** in FIGURE 1, with portions of the loom broken away, and showing the warps and cloth, but omitting the harnesses;

FIGURE 6 is an enlarged fragmentary elevation similar to the right-hand portion of FIGURE 1, with parts in section and being in somewhat greater detail than FIGURE 1, and being taken substantially along line **6—6** in FIGURE 3, between the reed and the harnesses;

FIGURE 7 is a schematic view taken longitudinally of the loom illustrating the preferred arrangement of the terry and ground warps and their relationship to the fell-shifting mechanism;

FIGURE 7–A is an enlarged somewhat schematic view of the novel terry motion cam shown in the central portion of FIGURE 7;

FIGURE 8 is an enlarged fragmentary vertical sectional view taken substantially along line 8—8 in FIGURE 5, showing the terry motion cam, adjacent sprocket wheels and the shaft on which they are mounted;

FIGURE 9 is an enlarged vertical sectional view looking toward the front of the loom substantially along line 9—9 in FIGURE 5, showing a portion of the shaft and clutch mechanisms which connect the main drive with the dobby pattern device and which connect the dobby with the terry motion cam;

FIGURE 10 is a fragmentary transverse vertical sectional view taken substantially along line 10—10 in FIGURE 9;

FIGURE 11 is a schematic elevation of the structure in the central left-hand portion of FIGURE 5, partially in section, and showing a device for elevating the rear portions of the pile warps to facilitate access to the drop wires and other adjacent elements of the loom, the pile warps being shown in lowered position;

FIGURE 12 is a view similar to FIGURE 11 showing rear portions of the pile warps in elevated position;

FIGURE 13 is a fragmentary plan view, partially in section and with portions broken away, taken substantially along line 13—13 in FIGURE 2, and showing parts of the pile warp feed mechanism;

FIGURE 14 is a somewhat schematic, exploded and isometric view of the main shaft of the dobby and its resetting hand crank shown in the upper right-hand portion of FIGURE 6, and also showing the adjacent jack shaft and clutch mechanisms as though looking toward the rear of the loom and at the opposite side of the structure shown in FIGURE 9;

FIGURE 15 is a somewhat schematic view of the hooks, knives and jacks of the dobby pattern device shown in the upper right-hand portion of FIGURE 6.

Introduction

The present apparatus is embodied in the conversion of a plain-weave loom, of the type known as a Warner & Swasey Sulzer weaving machine, to a terry pile weaving loom, many elements of which are constructed and operated in substantially the manner disclosed in U.S. Patent No. 2,099,627 granted to Rudolph Rossmann on November 16, 1937, and in other patents mentioned therein. Since many of the elements shown in the accompanying drawings are usual parts of a Warner & Swasey Sulzer loom, only so much of such usual parts will be described as is necessary to a clear understanding of the present invention.

A conventional Warner & Swasey Sulzer loom is equipped with a shuttle guide or race in the form of a row of closely spaced hooks which are located closely adjacent to and move with an oscillating reed. The reed and shuttle race are oscillated by conventional enclosed mechanisms which are actuated by the drive shaft of the loom. Thus, the reed could not be shifted relative to the fell of the cloth to vary the beat-up strokes thereof, as is desirable in the weaving of terry cloth.

In converting a Sulzer loom for weaving terry cloth, I have equipped the loom with a pattern device in the form of a dobby and have replaced the conventional harness-controlling cam devices with connections from the harnesses to the dobby so the positions of the harnesses are pattern controlled. Further, I have provided novel means for shifting the cloth and the ground warps forwardly and rearwardly relative to the reed to vary the position of the fell of the cloth during weaving, so the fell is spaced forwardly of the beat-up point of the reed during the insertion and beating-up of so-called loose picks of weft through the shed during weaving, and so the fell of the cloth occupies a normal position, rearwardly of the previous position, during the insertion and beating-up of so-called fast picks of weft and the consequent formation of terry loops.

The present invention includes novel means for shifting

the cloth to vary the position of the fell relative to the beat-up point of the reed along with novel means for imparting rotation to the terry motion cam which effects the shifting of the fell of the cloth. The means for transmitting rotation from the main drive of the loom to the terry motion cam includes a power transmission interposed between the main drive and the terry motion cam. The power transmission is embodied in a shaft which drives the dobby and the terry motion cam, with pattern controlled clutch means interposed in the latter shaft for rendering inoperative the terry motion cam during plain or so-called "drop-terry" weaving, such as in the weaving of borders and headers between adjacent portions of terry fabric.

Also, a novel terry let-off or feed mechanism is provided for pile warps which is rendered operative and inoperative in timed relation to, and under control of, the operation of the terry motion cam. The present apparatus also includes another clutch means for unitarily relieving the dobby, the terry motion cam and its cloth shifting mechanism, and the pile warp feed mechanism from the load of the main drive, the reed and shuttle race, the shuttle drive, the pile warp beam, the ground warp let-off, the cloth take-up and various other elements of the loom, so that the dobby may be manually adjusted for finding the proper pick, when necessary, and the terry motion cam, the harnesses and the terry warp feed mechanism are synchronously adjusted with the pattern device and are thus maintained in proper timed relation to each other and to the pattern device embodied in the dobby.

General Arrangement

Referring to FIGURES 1 through 7, the loom comprises a frame broadly designated at 20 including left-hand and right-hand main side frame members 21, 22 between which are mounted a ground warp beam 23, upwardly from which ground warps W are drawn past an idler or rear compensating roll 24, over a rear fell shifter roll 25, and through warp stop motion feelers or drop wires 26 to shed forming heddles or harnesses 27 (FIGURES 4, 6 and 7).

The ground warps W pass from harnesses 27 through an oscillating reed 30 carried by arms 31 which arms also support a positive guide or race 32 for gripper-type projectile shuttles, not shown in the present drawings, but being of a type substantially as shown in Rudolph Rossmann's U.S. Patent No. 2,090,703. The positive guide is in the form of a row of closely spaced hooks disposed closely adjacent to the front surface of reed 30 and being movable therewith, said hooks collectively defining the guide or shuttle race, for example, as shown in Albert Moessinger's U.S. Patent No. 2,316,703.

The frame 20 includes a main girt 34 extending between side frame members 21, 22 and which supports a plurality of casings 35, only one of which is shown in FIGURE 7. Casings 35 contain shafts 36 on which arms 31 are supported. Shafts 36 are connected with and oscillated by conventional mechanisms inside casings 35, which mechanisms are actuated by a main drive shaft 37 extending across the loom. Main drive shaft 37 is journaled in side frame members 21, 22 and is driven by suitable connections with an electric motor 39 (FIGURES 1 and 2).

Forwardly of the harnesses 27 and reed 30, the ground warps converge to the fell F of the cloth or fabric C formed therefrom, which fabric extends across and above an idler roll 40, then over and partially around a front fell shifter roll 41, then rearwardly and substantially around a positively driven sand roll or cloth take-up roll 43, and then partially around a pressure roll 42. Fabric C then passes beneath and against a guide bar 44 and thence to a cloth roll 45.

With the exception of the arrangement of the rolls 24, 25, 40, 41 and the means for operating the harnesses 27, to be later described, the parts of the loom heretofore

described are substantially as disclosed in Nicholas P. Darash's U.S. Patent No. 2,693,830. In fact, the gripper shuttles used with this particular type of loom may be projected through the shuttle race **32** by means such as that disclosed in the latter patent, and the loom may be provided with shuttle picking, guiding and conveying mechanism of the general type illustrated in Moessinger's Patents Nos. 2,160,338; 2,160,339; 2,316,703; and 2,420,-380 and in Rossmann's Patent No. 2,099,627. Accordingly, a further detailed description of the shuttle propelling, picking, guiding and conveying mechanism is deemed unnecessary.

The Dobby

As heretofore stated, in order to weave terry pile fabrics, it is necessary to selectively control the operation of the heddles or harnesses **27**. Accordingly, the loom is provided with a superstructure S for supporting a pattern device broadly designated at **50** for controlling the harnesses **27** and other elements of the loom. The pattern device **50** is shown in the form of a so-called Staubli dobby of the general type disclosed in Staubli's U.S. Patents Nos. 1,672,434 and 1,892,323, and in Lanz Patent No. 2,465,689, although other types of pattern devices may be used.

The superstructure comprises a pair of built-up side frame extensions **51, 52** suitably secured to and extending upwardly from the respective side frames **21, 22**. Front and rear, upper transverse beams or channel bars **53, 54** (FIGURES 1, 4, 5 and 6) extend between and are supported upon side frame extensions **51, 52**. The right-hand ends of beams **53, 54** extend outwardly beyond frame extension **52** for supporting the dobby **50** thereon. Dobby **50** includes an endless pattern selector element **57** in the form of a pattern card or strip (FIGURE 3) which is driven, by means substantially as shown in FIGURE 9 of said Patent No. 1,672,434, in timed relation to a main dobby shaft or dobby cam shaft **58** journaled in front and rear dobby frame members **59, 60**.

Referring to FIGURE 6, cam shaft **58** has diametrically opposed cams **61, 62** fixed thereon which alternate in moving outwardly respective pairs of knife rockers **63, 64** (FIGURE 6). Cams **61, 62** are omitted from cam shaft **58** in FIGURE 14 for purposes of clarity. In FIGURES 3 and 6, the upper ends of knife rockers **64** are fixed on a shaft **65**, and the lower ends of knife rockers **63** are fixed on a shaft **66**. Shafts **65, 66** are journaled in frame members **59, 60** of dobby **50**.

The free ends of knife rockers **63, 65** carry respective knives **67, 68** (FIGURES 3 and 15) adapted to engage respective sets of tie hooks **70, 71** which happen to be in the paths of knives **67, 68**, it being well known that the tie hooks **70, 71** which are not to be engaged by the knives **67, 68** are raised by means under control of pattern strip **57**. One example of preferred means for raising selected tie hooks is disclosed in said U.S. Patent No. 1,892,323.

The inner ends of each pair of upper and lower tie hooks **70, 71** are carried by a balancing pivot member **73** supported by a respective main jack **74** (FIGURES 6 and 14) pivotally supported by a shaft **75**. Each of some of the jacks **74** is connected by link members **76** to a corresponding harness jack **77**. Certain of the jacks may be urged away from bobby **50** by a spring **80**. The lower ends of harness jacks **77** are pivoted on a rod **81** carried by blocks **82** suitably secured to the transverse beams **53, 54**, only one of the blocks **82** being shown in FIGURES 1 and 6.

It is apparent that cam shaft **58** of dobby **50** transmits intermittent step-by-step movement to the pattern strip **57**, in a conventional manner, to maintain the pattern strip **57** in proper timed relation to the movement of the knife rockers **63, 64** and the knives **67, 68**. The manner in which the main shaft or cam shaft **58** of dobby **50** is driven will be later described.

Each harness **27** is controlled by a separate movable member or harness jack **77** (FIGURE 1), as is usual in many looms. To this end, the frame of each harness has a pair of spaced cables **83, 84** attached to its upper portion and extending upwardly over respective pulleys **85, 86** rotatably mounted on respective shafts **87, 88** carried by beams **53, 54**. Each pair of cables extends from pulleys **85, 86** and is connected to a corresponding harness jack **77**. The harness jacks **77** are longer than jacks **74** so as to effect the desired range of movement to the harnesses **27**. As any harness jacks **77** are released from dobby **50**, any suitable means, such as springs **89** (FIGURE 6), may be used to assist in lowering respective harnesses **27**.

In order to manually adjust or reset the dobby **50** for the usual pick-finding or other purposes, the frame members **59, 60** have a reset shaft **90** journaled therein, one reduced end of which has an axially movable pinion or gear **91** journaled thereon, and on the hub of which a hand crank **92** is fixedly mounted. Gear **91** is normally positioned inwardly or rearwardly of a relatively large gear **94** fixed on the corresponding end of cam shaft **58**. Thus, in order to reset dobby **50**, the operator grasps the hand crank **92** and pulls outwardly thereon to move gear **91** into meshing engagement with gear **94**, whereupon hand crank **92** is manually rotated in the desired direction. Such outward movement of hand crank **92** and gear **91** also releases a clutch mechanism connecting the cam shaft **58** with the main drive of the loom, as will be later described.

Dobby Power Transmission

A power transmission is provided to drive the cam shaft **58** of dobby **50** and the terry motion. The power transmission comprises a dobby jack shaft **100** connected in driving relation to dobby cam shaft **58** by bevel gears **101, 102** (FIGURE 14) fixed on the respective shafts **100, 58**. Dobby jack shaft **100** extends through a protective guard **103** (FIGURES 2 and 3), within which gears **101, 102** are positioned, and shaft **100** is jounaled in bearing blocks **103***a* and **104** (FIGURE 2). Bearing block **103***a* is carried by frame member **60** of dobby **50**, and bearing block **104** is spaced inwardly from guard **103** and is suitably secured to the upper frame extension **52** of side frame member **22**.

Loosely mounted on dobby jack shaft **100** is a sprocket wheel **105** which is normally connected, by a drive releasing clutch mechanism **106**, to the dobby jack shaft **100**. Sprocket wheel **105** (FIGURES 2 and 14) is connected, by an endless sprocket chain **107**, to a sprocket wheel **110** (FIGURES 3, 6 and 8) fixed on an auxiliary drive shaft **111**. Auxiliary drive shaft **111** also serves as a support for a novel terry motion cam **112** to be later described. Thus, the auxiliary drive shaft **111** is a partial embodiment of auxiliary drive means, driven by the main drive, for driving the pattern device, and thus the terry motion, in parallel relation to the reed, the shuttle feeding and expelling means, and the cloth take-up means. Of course, the reed, the shuttle feeding and expelling means, and the cloth take-up means are driven by direct connections to the main drive embodied in main drive shaft **37**.

As best shown in FIGURES 5, 6 and 8, auxiliary drive shaft **111** is journaled in bearings **113, 114** carried by said frame member **22** and an inverted substantially L-shaped bracket or frame member **115**. It will be observed in FIGURE 5 that the front end of frame member **115** is suitably secured to the main girt **34** and the rearward downwardly projecting portion of frame member **115** is suitably secured to an auxiliary girt **116** which is, in turn, suitably secured to the side frame members **21, 22**. Auxiliary drive shaft **111** is continuously driven, during operation of the loom, by the main drive shaft **37**. The main drive shaft **37** is connected with auxiliary drive shaft **111** by means of a sprocket chain **117** mounted on

sprocket wheels 118, 119 (FIGURES 5, 6 and 8) fixed on the respective main and auxiliary drive shafts 37, 111.

It is thus seen that, since auxiliary drive shaft 111 is continuously driven by main drive shaft 37 during operation of the loom, the normally active clutch mechanism 106 (FIGURES 2, 9, 10 and 14) normally causes sprocket wheel 105 to transmit rotation to the dobby jack shaft 100 and the dobby cam shaft 58 for driving the dobby 50. The clutch mechanism 106 is provided so as to release the dobby head from the load of the main drive shaft 37 and elements directly driven thereby, such as the cloth take-up roll 43, the reed 30 and shuttle guide 32, and the shuttle feeding and propelling means, whenever the reset gear 91 (FIGURE 14) is manually moved into engagement with the gear 94 on dobby cam shaft 58.

The clutch mechanism 106 is a positive type clutch and comprises a pair of disks 120, 121, disk 120 being fixed on dobby jack shaft 100 (FIGURE 9) in close proximity to or in engagement with one face of sprocket wheel 105. Sprocket wheel 105 is restrained from axial movement away from disk 120 by a collar 122 fixed on shaft 100.

Disk 121 is keyed, as at 123, for axial sliding movement on shaft 100, and the hub 124 of disk 121 is engaged by one end of a compression spring 125. The other end of compression spring 125 engages a collar 126 adjustably secured on dobby jack shaft 100. Thus, spring 125 normally urges disk 121 against disk 120. Movable disk 121 has a plurality of unequally circular spaced pins 127 projecting axially therefrom and loosely penetrating fixed disk 120. The sprocket wheel 105 has circularly spaced holes or cavities 130 therein which are arranged to correspond to the unequally spaced relationship of the pins 127, and which normally receive the respective pins 127.

During manual adjustment of the dobby 50, clutch disk 121 is moved outwardly relative to clutch disk 120, by means to be presently described, thus removing pins 127 from the cavities 130 in sprocket wheel 105. Accordingly, the pins 127 and corresponding cavities 130 are unequally circularly spaced to insure that the pins 127 enter the same cavities 130 when the movable clutch disk 121 is subsequently returned to operative position, and thus insuring that the dobby is subsequently driven in proper timed relation to the main drive shaft 37 and auxiliary drive shaft 111.

It will be observed in FIGURES 9 and 14 that disk 121 is actuated or moved axially of shaft 100 by a yoke or shifting element 132 whose arms have shifter pins 133 thereon which engage in a groove 134 formed in the periphery of the hub 124. Yoke 132 is fixed on a relatively short pivot shaft 135 journaled in a bracket 136 suitably secured to and extending outwardly from the extension 52 of right-hand side frame member 22 (FIGURES 2, 9 and 14).

One end of a link 137 is pivotally connected to a medial portion of yoke 132, and its other end is connected to one end of a crank 140 (FIGURE 14) fixed on the end of shaft 90 opposite from the reduced end thereof on which reset gear 91 is mounted. Suitably secured to or formed integral with reset shaft 90 is a follower arm 141 (FIGURE 14) which projects radially from shaft 90 and has a follower 142 thereon which rides in a grooved cam 143.

The grooved cam 143 has a shifting arm 144 suitably secured thereto and projecting inwardly therefrom, whose inner end engages in a groove 145 formed in the periphery of the hub of reset gear 91. Cam 143 is shown as being substantially L-shaped, this being desirable because of space limitations. However, it may be of any desired shape and it will be noted that cam 143 is journaled, as at 146, on a bracket 147 carried by frame member 59 of dobby 50 (FIGURE 6).

It is thus seen that cam 143 is moved inwardly and outwardly with respective inward and outward axial movements of pinion 91. The groove in cam 143 is so formed that shaft 90 is rotated in a clockwise direction in FIGURES 6 and 14 whenever pinion 91 is moved outwardly so that reset shaft 90 is rotated in a counterclockwise direction with each inward movement of pinion 91. If so desired, the enlarged portion of shaft 90 may be in the form of a tube within which the reduced portion thereof is journaled. Gear 91 could then be keyed on said reduced portion.

As pinion 91 is moved outwardly into engagement with gear 94, crank 140, link 137 and yoke 132 move from left to right in FIGURE 14 and from right to left in FIGURE 9, thus moving disk 121 against spring 125 to withdraw pins 127 from the respective cavities or holes 130 in sprocket wheel 105. In follows, therefore, that cam shaft 58 and jack shaft 100 may be rotated by manipulation of crank 92, independently of sprocket wheel 105 and, thus, independently of the auxiliary and main drive shafts 111, 37.

Upon resetting of the dobby 50 being completed, it is apparent that inward pressure may be applied to hand crank 92 and pinion 91 to move the same inwardly, during which hand crank 92, pinion 91 and gear 94 may be rotated slightly to insure that the pins 127 (FIGURES 9 and 10) are alined with the proper holes 130 in sprocket wheel 105 as the clutch mechanism 106 is again rendered active.

Drive for Terry Motion

In order to insure that terry motion cam 112 (FIGURES 5, 6 and 8) is maintained in accurately timed relationship to the pattern device or dobby 50, the terry motion cam 112 is driven by the main drive shaft 37 through the medium of the power transmission embodied in the dobby jack shaft 100 which is provided with a terry motion clutch mechanism 150. It will be observed in FIGURES 2, 5, 9 and 14 that a sprocket wheel 151, loosely mounted on the inner end of dobby jack shaft 100, is disposed adjacent the clutch mechanism 150. Sprocket wheel 151 has thereon an endless sprocket chain 152 which extends downwardly, inwardly of frame extension 52 and side frame member 22, and is mounted on a relatively large sprocket wheel 153 suitably secured to one face of terry motion cam 112 (FIGURES 5 and 8). Terry motion cam 112 is mounted for free rotation on shaft 111, preferably by means of bearings 154.

In order to facilitate relative adjustment between terry motion cam 112 and sprocket wheel 153, sprocket wheel 153 is preferably secured to the terry motion cam 112 by screws 155 which loosely penetrate arcuate slots 156 (FIGURES 5 and 8) formed in sprocket wheel 153.

The clutch mechanism 150 normally maintains sprocket wheel 151 is fixed relation to dobby jack shaft 100. However, clutch mechanism 150 is provided so as to permit stopping rotation of terry motion cam 112 during plain or drop-terry weaving of borders and headers between successive terry pile portions of fabric. The terry motion clutch mechanism 150 comprises a disk 160 (FIGURES 9 and 14) to one face of which sprocket wheel 151 is suitably secured, as by screws 161. The disk 160 and sprocket wheel 151 are preferably journaled on the dobby jack shaft 100 by means of a sleeve bearing 162 (FIGURE 9).

Sprocket wheel 151 is retained on shaft 100 by means of a collar 163 fixed on shaft 100. A collar 164 is also suitably secured to shaft 100 adjacent the face of disk 160 opposite from sprocket wheel 151. Collar 164 is provided with a notch 165 in its periphery (FIGURES 9 and 14) which is adapted to be engaged by one end of a clutch dog 166. Clutch dog 166 is mounted for axial movement in disk 160 and in a notch 167 formed in the periphery of the hub of sprocket wheel 151.

Clutch dog 166 has a radially extending and inclined or beveled projection 170 integral therewith which projects outwardly from notch 167 in the hub of sprocket wheel 151 and whose inclined surface is adapted to be engaged by an inclined or beveled surface 171 on a clutch release lever 172. Clutch dog 166 is normally urged toward col-

lar 164 and, thus, into notch 165, by a compression spring 173 positioned in the notch 167 in the hub of the sprocket wheel 151. Since collar 164 is fixed on dobby jack shaft 100, it is apparent that it transmits rotation from shaft 100 to sprocket wheel 151 whenever clutch dog 166 is in engagement with the notch 165 in the collar 164.

Referring to FIGURE 5, it will be observed that clutch release lever 172 is pivotally connected, as at 175, to a post 176 carried by the extension 52 of the right-hand side frame member 22. Clutch release lever 172 has an extension 177 fixedly connected thereto which is normally urged downwardly by a spring 180, which thus normally urges the inclined surface 171 of clutch release lever 172 (FIGURE 9) into the path of the radially extending portion 170 of clutch dog 166.

The free end of extension 177 (FIGURE 5) is connected, by means of a link 181 (FIGURES 2, 5 and 6), to one arm of a bell crank 182. Bell crank 182 is oscillatably mounted, as at 183, on a bracket 184 fixed to the front side of transverse beam 54. The other arm of bell crank 182 is connected, by means of a link 185, to one of the main jacks 74. Thus, operation of the clutch release lever 172 is controlled by the patterning on the strip 57 (FIGURE 3) of dobby 50.

Since the terry motion cam 112 is quite large and heavy, means are provided to prevent unintentional rotation of terry motion cam 112 which may be effected by vibration of the loom during drop-terry weaving. To this end, it will be observed in FIGURES 5 and 8 that terry motion cam 112 is provided with a notch or groove 190 in the periphery thereof which is so located that, whenever clutch release lever 172 (FIGURES 5 and 9) is lowered to operative position and releases clutch dog 166 from engagement with notch 165 in collar 164, the notch 190 is accurately alined with a locking element or follower 191 having a configuration substantially the same as that of notch 190 and being carried by a locking lever 192 (FIGURE 5). Locking lever 192 is pivotally connected, as at 193, to the inner portion of side frame member 22 and is normally urged toward terry motion cam 112 by tension spring 194.

During terry weaving, follower 191 is held out of engagement with cam 112 by the dobby 50. To this end, locking lever 192 has one end of a link 195 connected thereto, whose other end is connected to one arm of a bell crank 196 pivotally connected, as at 197, to transverse beam 54. The other arm of bell crank 196 is connected, by means of a link 200 (FIGURE 6), to one of the main jacks 74. The patterning on pattern strip 57 of dobby 50 should be so arranged that spring 194 (FIGURE 5) may move locking lever 192 downwardly to where follower 191 will engage the periphery of terry motion cam 112 slightly ahead of the lowering of clutch release lever 172 into operative position and so that, upon clutch release lever 172 moving clutch dog 166 out of engagement with the notch 165 in collar 164 (FIGURE 9), follower 191 (FIGURE 5) will drop into notch 190 in terry motion cam 112.

It is apparent that the patterning on pattern strip 57 (FIGURE 3) should also be such as to cause link 195 to raise lever 192 and move follower 191 out of engagement with notch 190 in terry motion cam 112 at substantially the same time as, or immediately before, the clutch release lever 172 is raised out of engagement with the projection 170 (FIGURE 9) on the clutch dog 166 when terry weaving is to be resumed.

Fell Shifting Means

As heretofore stated, the terry motion cam 112 varies the position of the fell F of the cloth C (FIGURE 7) during terry weaving, this being effected by moving the fell shifter rolls 25, 41 forwardly and rearwardly at predetermined intervals.

To this end, the front fell shifter roll 41 is journaled in a medial portion of a pair of front fell shifter levers 201, 202 (FIGURES 1, 3, 4, 5 and 7) and opposed ends of the rear fell shifter roll 25 are journaled in medial portions of rear fell shifter levers 203, 204. The upper portions of fell levers 201, 203 are interconnected by a link 205, and the upper portions of fell shifter levers 202, 204 are interconnected by a link 206. The links 205, 206 straddle the harnesses 27.

Each end of each link 205, 206 is connected to the corresponding lever by a slot and pin connection so the extent of movement of the rolls 25, 41 may be accurately adjusted. To this end, each lever 201–204 is provided with a longitudinal slot 210 therein in which a suitable bolt, such as a shoulder bolt 211, is secured and on which the corresponding end of the respective link 205 or 206 is pivotally mounted (FIGURE 4). The lower ends of front fell shifter levers 201, 202 are respectively pivotally connected, as at 212, 213 (FIGURES 4 and 5), to proximal portions of the respective main side frame members 21.

The rear fell shifter levers 203, 204 may be pivotally connected directly to the frame 20 of the loom. However, in order to facilitate locating the ground warps W in proper relation to the harnesses, the drop wires 26 and the terry warps, medial portions of the rear fell shifter levers 203, 204 (below the roll 25) are pivotally connected, as at 215, 216 (FIGURES 4 and 5), to respective brackets 217, 218 whose front portions are pivotally connected, as at 221, 222, to the inner portions of respective main side frame members 21, 22.

A medial portion of each bracket 217, 218 has an arcuate slot 223 which is penetrated by a screw for securing the same to the corresponding main side frame member of the loom. The upper portion of each bracket 217, 218 has a boss portion 225 integral therewith which is penetrated by an adjustment screw 226 whose lower end bears against a corresponding portion of the main side frame member, as shown in the left-hand central portions of FIGURES 4 and 5. It is apparent that screws 226 may be adjusted for varying the height of the rear shifter roll 25. It should be noted that compensating roll 24 is also journaled at opposite ends thereof in the rear portions of the brackets 217, 218 so that it is maintained in the same position with respect to the rear fell shifter roll 25 whenever the brackets 217, 218 are adjusted in the aforesaid manner.

The lower end of each rear fell shifter lever 203, 204 (FIGURES 2, 3, 4, 5 and 7) has the rear end of a link 230 pivotally connected thereto and extending forwardly therefrom. The rear end of each link 230 should be adjustable relative to the corresponding rear fell shifter lever, substantially as shown in FIGURES 3, 4 and 5, so the length of stroke of the shifter rolls may be adjusted in accordance with the maximum height of any terry loops to be formed. The front end of each link 230 is pivotally connected to the upper end of a crank 231.

The lower ends of cranks 231 are fixed to a common transverse rocker shaft 232 journaled in main side frame members 21, 22. One of the cranks 231 (FIGURE 5) has a link 234 pivotally connected to a medial portion thereof. Link 234 extends forwardly and is pivotally connected to a medial portion of a follower arm or lever 235 whose lower end is pivotally connected, as at 236, to the auxiliary girt 116 (FIGURES 5 and 6). The upper portion of follower arm 235 has a cam follower 240 thereon which engages an irregularly shaped cam groove 241 (FIGURE 5) in one face of the novel terry motion cam 112.

In the weaving of so-called three-pick terry, in which a transverse row of terry loops is formed with every third beat-up stroke of reed 30, for example, sprocket wheel 153 and terry motion cam 112 rotate one revolution with every three revolutions of the main and auxiliary drive shafts 37, 111. Thus, two loose picks of weft and one fast pick of weft are inserted through the warp

shed during each terry-loop-forming cycle. As is well known, the two loose picks are beat up at points spaced rearwardly of the fell of the cloth, and each fast pick is beat up, along with the preceding loose picks, against the fell and thus carry the then slackened pile warps therewith relative to the ground warps to form terry loops.

Heretofore, in the weaving of three-pick terry on conventional looms, the two loose picks of each terry-loop-forming cycle have been beat up at the same point relative to the nominal location of the fell of the fabric, but the fabric has been taken up or advanced the equivalent of one pick with each beat-up stroke of the reed, thus causing the second loose pick of each such cycle to be spaced rearwardly of the first loose pick. When the succeeding fast pick was inserted and beat up with the loose picks against the fell of the fabric, instead of all three picks of weft being moved to beat-up position at the same speed, the lack of friction between the pile warps and the three picks would often result in the first loose pick being forced toward the fell ahead of the second loose pick. Hence, there was a larger gap between the first and second loose picks during the fast-pick beat-up stroke of the reed than that called for by the number of picks per inch.

When this occurs, the taking up of the slackness in the pile warps is delayed until all three picks are heavily pressed or crammed together when the reed reaches full beat-up position. This delay in taking up the slackness in the pile warps has frequently caused incomplete pile formation, resulting in primary pile loops of lesser height than that intended and producing objectionable shorter secondary loops between the first and second loose picks. The formation of the objectionable secondary loops has become more of a problem as the speed of the looms have been increased and, more especially, as the speed of the beat-up strokes of the reed have been increased, since the faster the reed moves in a fast-pick beat-up stroke, the greater is the tendency for the pile warps to slip relative to the fast and loose picks and the lesser the time permitted for relaxation of the pile warps between successive beat-up strokes of the reed.

The problem of secondary loops being formed between the first and second loose picks has not been as serious in weaving terry fabric on conventional looms as it is on the Warner & Swasey Sulzer weaving machine of the type disclosed herein, because conventional terry looms are operated at a speed of approximately 185 picks per minute and the beat-up stroke of the reed occurs during approximately a one-half revolution of the main drive shaft or crank shaft of the conventional loom. On the other hand, the beat-up stroke of the reed of a Warner & Swasey Sulzer weaving machine or loom occurs during approximately one-sixth of a revolution of the main drive shaft and the loom operates at a speed of approximately 230 picks per minute.

It has been determined that the closer the second loose pick is beat up relative to the first loose pick and prior to the fast pick being beat up in effecting each terry-loop-forming cycle, the tighter the pile or terry warps will be gripped by the first and second loose picks and the closer the first and second loose picks will be maintained relative to each other during the subsequent fast-pick beat-up stroke of the reed, thus reducing the size of said secondary loops or eliminating the secondary loops altogether.

Now, in order to insure that the first and second loose picks are in closer proximity to each other than they could be on any prior art terry looms of which I am aware, means are provided for effecting more than two changes in the relative positions of the fell of the cloth and the beat-up point of the reed independently of the cloth take-up means; that is, the distance between the nominal fell and the beat-up point of the reed is less during formation of the second or subsequent loose picks of a loop-forming cycle than it is during the formation of the first loose pick in the corresponding cycle. The term "nominal fell" is used herein to identify the point at which a pick of weft is disposed when the reed occupies full beat-up position relative to the loom and the cloth, disregarding the distance the fabric may have been taken up prior to the instant full beat-up of the weft.

In the present embodiment, the reed 30 has a constant range and extent of reciprocatory movement throughout the weaving of both terry and plain or drop terry portions of the cloth C and, therefore, means are provided for shifting the fell of the fabric a relatively small amount toward the reed after the first loose pick of each terry loop-forming cycle has been beat up so that the second or subsequent loose pick is beat up against, or in very close proximity to, the first loose pick and in closer relationship to the actual fell of the cloth than the first loose pick was beat up. Thereafter, the cloth and ground warps are shifted rearwardly to the above-identified nominal fell position and relative to the terry or pile warps, and the fast pick of weft is then inserted and beat up into crammed relation with the loose picks and so that the combined friction or gripping ability of the three crammed picks against the terry warps will cause them to start taking up the slackness in the terry warps the instant that the reed moves the fast pick of weft forwardly against or in close proximity to the last inserted loose pick of weft. It is apparent that this will result in all of the slackness in the terry warps being absorbed by the primary terry loops formed as the fast pick reaches full beat-up position, thus eliminating the objectionable secondary loops.

To this end, it will be observed in FIGURE 7–A that the walls of the groove 241 in one face of terry motion cam 112 are provided with three equally circularly spaced and serially arranged low, intermediate and high dwell points *a*, *b* and *c*, each of which may extend through an arc of approximately 20°. Adjacent dwell points may be interconnected by harmonically curved surfaces. The center and extent of each dwell point *a*, *b*, *c* are defined in broken lines in FIGURE 7–A. Dwell point *c* engages follower 240 during the weaving of each fast pick, in which the fell shifter rolls 25, 41 occupy rearmost positions and the fell F (FIGURE 7) of the cloth C occupies a position corresponding to the full beat-up point of the reed 30. The follower 240 occupies the latter position only during the beat-up stroke of the reed 30 against the fell F.

The dwell points *a*, *b* engage follower 240 during the formation of respective first and second loose picks. However, it should be noted that dwell point *a* is disposed in slightly closer proximity to the axis of terry motion cam 112 than the dwell point *b*, although the dwell point *a* engages follower 240 prior to the dwell point *b* during each terry-loop-forming cycle. Thus, as the terry motion cam 112 rotates in a clockwise direction in FIGURES 7 and 7–A, it will be noted that the low surface or dwell point *a* of the cam groove 241 engages follower 240 and causes the follower to dwell in its rearmost position during the weaving of the first loose pick. The fell shifter levers 201–204 and the fell shifter rolls 25, 41 will have thus moved forwardly so the fell F is spaced a predetermined distance forwardly of the beat-up point of reed 30 in accordance with the maximum length of any loops to be formed when the high point *c* of the groove 241 in cam 112 subsequently moves into engagement with follower 240.

Upon further rotation of terry motion cam 112, the cam follower 240 gradually moves forwardly until it is engaged by the dwell point *b* which is located slightly higher or further from the axis of terry motion cam 112 than the surface or dwell point *a*. Thus, the fell shifter rolls 25, 41 are moved slightly rearwardly; moving the fell F and the previously inserted first loose pick slightly rearwardly therewith.

Since the second loose pick is beat up by reed 30 while the follower 240 dwells in engagement with intermediate dwell point *b*, it is apparent that the second loose pick may be tightly crowded against the first loose pick and

may, if desired, be beat up at the same point with respect to the ground warps as the first loose pick. Of course, in the latter instance, it is apparent that the second loose pick might then advance the previously beat-up first loose pick to a small extent, As is usual, there is a shed change following the beating up of each pick of weft to insure that the terry warps are tightly clamped by the three picks of weft of each cycle and during the beating up of the fast pick.

Additional picks of weft may be inserted through the warps between adjacent rows of terry loops by intermittent actuation of clutch release lever **172** (FIGURES 5 and 9) so as to form 4-, 5-, 6-, or 7-pick terry, or more, as desired. For example, in weaving 5-pick terry, terry motion cam **112** would remain stationary for two out of each five picks.

It is also apparent that the groove **241** of cam **112** may be formed with one or more additional surfaces similar to the dwell points *a, b* and rotated at a different speed corresponding to the number of such dwell points if a 4- or 5-pick terry is to be formed without stopping rotation of the terry motion cam **112**. However, since the present embodiment includes means for stopping the terry motion cam at predetermined intervals, such additional dwell points would not normally be required or desired.

Pile Warp Guide Means

The terry loops or pile loops are formed from terry or pile wraps T which are drawn from a terry or pile warp beam **245** mounted on a transverse shaft **246** carried by the upper frame extensions **51, 52** and being spaced rearwardly of the transverse beams **53, 54** and the dobby **50**. The opposed ends of pile warp beam **245** are provided with suitable friction brakes **247** (FIGURES 2, 3, 4 and 6) which may be of conventional or other construction. The brakes **247** may be of the adjustable band-drum type as generally disclosed in U.S. Patent No. 778,668, for example, and therefore, a detailed description thereof is deemed unnecessary.

The pile warps T pass downwardly from pile wrap beam **245**, in front of a tension rod **250**, then substantially around a pile warp feed roll **251**, then upwardly and over an idler or press roll **252**, then downwardly, forwardly of and in engagement with a guide rod or roll **253**, and then rearwardly and downwardly and partially around an elevatory whip roll **254**. The pile warps T pass forwardly from whip roll **254** in substantially parallel relation to the ground warps W, through certain of the harnesses or heddles **27**, and through reed **30** to the fell F of the cloth C.

Guide roll **250** is suspended, by means of strap-like arms **256**, from suitable studs projecting inwardly from the rear portions of the extensions **51, 52** of main side frame members **21, 22**. The lower portion of each arm **256** (FIGURE 5) has one end of a tension spring **260** connected thereto whose other end is connected to the corresponding frame extension **51** or **52**. Thus, roll **250** is lightly urged against the rear surfaces of the pile warps T so as to minimize vibration or "whipping" of the terry warps T and to assist in maintaining the pile warps in engagement with the pile feed roll **251**.

Press roll **252** is preferably covered with a resilient material such as felt, and opposed ends thereof are journaled in hand levers **261** whose front ends are pivotally connected to the side frame extensions **51, 52** and whose medial portions each has a pin *d* projecting inwardly therefrom which is adapted to be engaged in the hooked lower end of a respective suspension arm **2**. Suspension arms **262** extend upwardly and are pivotally secured to the upper portions of the respective side frame extensions **51, 52**. Hand levers **261** may be raised so the pins *d* engage the hooked lower ends of suspension arms **262** and to thereby elevate and suspend press roll **252** to facilitate threading the pile wraps T beneath the pile feed roll **251** and over the press roll **252**. Thereafter, the press roll **22** may be lowered to press the terry warp T against feed roll **251**.

The idler roll **253** is also mounted in a manner similar to the idler roll **250**, in that opposed end portions thereof are connected to strap-like rigid arms **265**, which arms extend upwardly and are connected to a cross-frame member **266** which is shown as being circular in cross-section. Opposed ends of cross-frame member **266** are suitably secured to the upper portions of the side frame extensions **51, 52** beneath the rear transverse beam **54**. Tension springs **267** (FIGURE 5) are connected to the idler roll **253** or to the arms **265** for lightly urging the roll **253** against the rear surface of the pile warps T.

Pile Warp Feed Mechanism

The pile feed roll **251** is a part of a pile feed mechanism for intermittently overfeeding the terry or pile warps T relative to the ground warps W during forward shifting movements of the fell F (FIGURE 7) of the cloth C. Feed roll **251** should preferably be covered with an abrasive or gritty material to prevent slippage of the terry warps T relative to roll **251**.

As best shown in FIGURES 2 through 6, reduced opposite ends of the pile warp feed roll **251** are journaled in bearings **273, 274** suitably secured to the lower portions of the respective main side frame extensions **51, 52**. One reduced end of feed roll **251** has a gear **275** fixed thereon which engages a gear **276** fixed on the inner end of a relatively short shaft **277** (FIGURES 4 and 13) whose medial portion is journaled in a bearing **280** carried by the lower portion of the side frame extension **51**. The outer portion of shaft **277** has a hand wheel **281** and a ratchet wheel **282** fixed thereon. Ratchet wheel **282** is engageable by a ratchet pawl **283** having a pin **284** projecting outwardly from one side thereof.

Ratchet pawl **283** is pivotally mounted on one arm of a bell crank **286** which is oscillatably mounted on the shaft **277**. The other arm of bell crank **286** has the upper end of a link **287** pivotally connected thereto, whose lower end is pivotally and adjustably connected to the rear portion of an intermediate pile feed lever **290** (FIGURE 4). Adjustment of link **287** along lever **290** varies the strokes of pawl **283** so as to let off the terry warps varying amounts according to the range of movement of shifter rolls **25, 41** and the desired height of the terry loops. Lever **290** is pivotally mounted on the pivot **221** on which bracket **217** is also mounted.

A lower medial portion of intermediate lever **290** has a cam roller **291** thereon which is adapted to be engaged by a cam surface or lobe **292** on the upper end of a pile feed rocker member **293** pivotally mounted at its lower end, as at **294**, on the main side frame member **21**. The pile feed rocker member **293** has an arm or projection **296** extending rearwardly therefrom to which the upper end of a link **297** is pivotally and adjustably connected.

The lower end of link **297** is also pivotally and adjustably connected to the rear portion of a crank **300** whose forward portion is fixed on the outer portion of rocker shaft **232**. A spring **301** normally urges the cam roller **291** on the intermediate pile feed arm **290** into engagement with the upper end of the pile feed rocker member **293**.

Since the rocker shaft **232** is oscillated by the terry motion cam **112** during terry weaving, whenever the fell F of cloth C (FIGURE 7) is shifted rearwardly to normal position by movement of the high surface of the groove **241** in cam **112** into engagement with follower **240**, the terry warps remain stationary so the ground warps W and the fell F of the cloth C move rearwardly relative to the pile warps T and the corresponding fast pick beat-up stroke of the reed **30** thus forms a row of terry loops as the slackened amount of terry warps or pile warps are bunched up against the fell of the cloth C. This may be realized by referring to FIGURES 4

and 5 wherein it will be noted that, as the high point *c* of the groove 241 in terry motion cam 112 moves into engagement with follower 240, this imparts clockwise movement to the shaft 232 in FIGURES 4 and 5.

This causes crank 300 to move in a clockwise direction in FIGURE 4, thus raising link 297 and moving the cam surface 292 of pile feed rocker member 293 away from the cam roller 291 on the intermediate pile feed arm 290. In so doing, spring 301 moves lever 290 downwardly and rocks bell crank 286 and pawl 293 in a counterclockwise direction on shaft 277. Thus, pawl 283 is moved in an inactive stroke relative to ratchet wheel 282.

On the other hand, as the lower, intermediate, surface *a* of groove 241 in terry motion cam 112 moves into engagement with follower 240 (FIGURE 5), this imparts counterclockwise movement to shaft 232 in FIGURES 4 and 5, and thus imparts counterclockwise movement to pile feed rocker member 293 at the same time that the rolls 25, 41 shift forwardly the fell of the cloth C. Thus, as the fell F is shifted forwardly, cam surface 292 rides against cam roller 291 on the intermediate pile feed arm 290 to impart an active stroke to pawl 283, thus rotating ratchet wheel 282 and shaft 277 in a clockwise direction in FIGURE 4.

It is apparent by referring to FIGURE 13 that gear 276 will then rotate gear 275 and feed roll 251 in the opposite direction from ratchet wheel 282 and shaft 277; that is, feed roll 251 will then rotate a partial revolution in a counterclockwise direction in FIGURE 5 so the pile warps T may advance by forward movement of the fell shifter rolls 25, 41.

The cam surface 292 and roller 291 are used, instead of pivotally interconnecting the corresponding members 293 and 290, so that the shape of the cam surface 292 may be so formed as to complete the feeding of the terry warps before the succeeding first loose pick is beat-up in each instance.

From the foregoing, it is apparent that, whenever the clutch release lever 172 (FIGURES 5 and 9) is rendered operative by the dobby 50 to stop rotation of the terry motion cam 112, the pile warp feed mechanism, including the connections between the rocker shaft 232 and the pawl 283 (FIGURE 4), is also rendered inoperative or inactive, thus insuring that the pile warp feed mechanism is maintained in the proper timed relation to the fell shifting mechanism.

During drop terry weaving, such as during the weaving of headers and borders across the cloth C, the pile warp feed mechanism is inactive, as stated heretofore. Accordingly, the pile warps T are withdrawn from the pile warp beam 245 solely by the action of the take-up roll 43. Thus, the tension in the pile warps T becomes somewhat greater during plain or drop terry weaving than it is during terry weaving. Consequently, upon going into terry weaving following drop terry weaving, it is necessary to relieve the pile warps T of at least some of the tension therein, since otherwise, the first weftwise row of terry loops, and probably a few additional weftwise rows of terry loops, formed upon initiating terry weaving would be somewhat shorter than subsequent loops of normal or desired height.

Therefore, means, under control of the dobby 50 advances the terry warps during the last one or two picks of weft which are woven at the terminus of each plain woven fabric portion preceding the initiation of terry weaving. To this end, it will be observed in FIGURES 5 and 6 that one of the main jacks 74 of dobby 50 has one end of a cable or pliable element 305 connected thereto which extends across the loom, through suitable guides 306 (FIGURE 1) carried by upper transverse beams 53, 54, and whose other end is adjustably connected to a crank 307. Crank 307 is fixed on a relatively short forwardly and rearwardly extending shaft 310 (FIGURES 1, 2 and 4) journaled in bearings 311 suitably secured to the upper portion of frame extension 51.

Shaft 310 also has a crank 315 fixed thereon (FIGURES 1, 2 and 4) to which the slotted upper end of a link 316 is pivotally connected (FIGURE 2). The lower end of link 316 is pivotally connected, as at 317 (FIGURE 4), to the free end of the intermediate pile feed lever 290.

The patterning on the strip 57 of dobby 50 (FIGURE 2) may be such that link 316 moves intermediate arm 290 upwardly to impart rotation to the overfeed roll 250 during one or two picks of the loom immediately preceding the movement of the clutch release lever 172 (FIGURES 5 and 9) out of engagement with the projection of clutch dog 166, at which time terry weaving is resumed. It should be noted that the slot in the upper end of rod 316 (FIGURE 2) permits vertical reciprocation of the intermediate arm 290 (FIGURE 4) during terry weaving without imparting movement to the corresponding jack 74.

In order to render the pile warp feed mechanism inoperative during manual resetting of the dobby 50 for finding the pick or any other reason, the free end of a pawl lifter arm 325 (FIGURES 4 and 13) is positioned beneath the pin 284 projecting outwardly from pawl 283. The other end of pawl lifter arm 325 is pivotally connected, as at 326, to the upper frame extension 51 of main side frame member 21. The lower end of a pliable element or cable 327 is connected to a medial portion of pawl lifter arm 325. Cable 327 preferably has a tension spring 330 interposed therein to permit extending cable 327 beyond the limits to which it may be extended with upward movement of the pawl lifter arm 325.

Cable 327 extends over a pulley 331 (FIGURES 2 and 4) suitably supported by and journaled on the rear, top transverse beam 54. Cable 327 extends across the loom from pulley 331 to a crank 333 (FIGURE 14) fixed on the pivot shaft 135 on which the yoke 132 of clutch mechanism 106 is mounted.

Thus, whenever pinion 91 (FIGURE 14) is manually moved outwardly into engagement with gear 94 and shifts movable clutch 121 and pins 127 (FIGURES 9, 10 and 14) to inoperative position with respect to sprocket wheel 105, crank 333 is also moved outwardly from left to right in FIGURE 14 or from right to left in FIGURE 9, to thus cause lifter arm 325 (FIGURE 4) to move against pin 284 and raise pawl 283 out of engagement with ratchet wheel 282. It is apparent that this prevents overfeeding of the pile warps T whenever the dobby 50 is manually reset or adjusted.

Of course, when adjustment of the dobby 50 has been completed and gear 91 is again moved inwardly relative to dobby 50 and out of engagement with gear 94, it is apparent that clutch mechanism 106 is again actuated to establish a fixed connection between sprocket wheel 105 and dobby shaft 100, and that pawl lifter arm 325 is also lowered to, in turn, lower pawl 283 into engagement with ratchet wheel 282.

Elevatory Pile Warp Whip Roll

The present loom is of substantially greater width than conventional terry looms. Thus, in order to facilitate access to the drop wires 26 and the portions of the warps W, T adjacent the central rear portion of the loom, I have mounted the lower guide roll or whip roll 254 for the terry warps T in a novel manner facilitating an upward movement thereof to give free access to the drop wires 26 from the rear of the loom, when new ground warps are drawn-in or retied, when drop wires are placed on the ground warps, etc.

To this end, it will be observed in FIGURES 2, 4 and 5 that reduced opposite ends of whip roll 254 are each journaled in an adjustable bearing bracket 340. Each bracket 340 extends upwardly and is adjustably secured, as by screws 341 (FIGURES 5, 11 and 12), to a sprocket wheel 342, and is in eccentric relation to the sprocket wheel 342.

Each sprocket wheel 342 is journaled on a stud 343 (FIGURE 2). The studs 343 extend outwardly from

the respective sprocket wheels **342** and are suitably secured to proximal lower portions of the respective side frame extensions **51**, **52**.

Referring again to FIGURES 5, 11 and 12, each sprocket wheel **342** has an arcuate slot **346** therethrough which is generated about the shaft **343** and is penetrated by a screw **347** threaded into a corresponding bracket **350** (FIGURE 2). One end of a sprocket chain **351** is attached to each sprocket wheel **342**. Each sprocket chain **351** extends upwardly and is connected to a sprocket wheel **352**.

Sprocket wheels **352** are fixed on a common shaft **353** suitably journaled on the rear portion of the rear upper transverse beam **54** (FIGURES 4 and 5). The end of shaft **353** opposite from dobby **50** (FIGURES 2 and 4) has a hold-back ratchet wheel **355** and a hand wheel **356** fixed thereon. Ratchet wheel **355** is engaged by a hold-back pawl **357** pivotally mounted on a bracket **360** suitably secured to and projecting upwardly from the corresponding outermost portion of the rear top transverse beam **54**.

During normal operation of the loom, whip roll **254** occupies the position shown in FIGURES 5 and 11, in which position whip roll **254** is maintained by the screw **347** associated with each sprocket wheel **342**. Whenever the central portions of drop wires **26**, adjacent warps W, T or other adjacent elements require the attention of the operator, the loom may be stopped and the operator loosens each of the screws **347** to permit freedom of rotation of sprocket wheels **342** in a counterclockwise direction in FIGURES 4, 5 and 11.

The operator may then rotate hand wheel **356**, along with shaft **353**, ratchet wheel **355** and sprocket wheels **352** in a clockwise direction in FIGURES 4 and 11, thus moving the sprocket wheels **342**, bearing brackets **340** and whip roll **254** in a counterclockwise direction, from the position shown in FIGURE 11 to that shown in FIGURE 12. It is apparent that this causes a slackening of the terry or pile warps T which may be taken up by turning feed roll **251** counterclockwise and transferring the slackness rearwardly of feed roll **251**, where it will be taken up by the tension bar **250** and springs **267**. This permits ready access to the drop wires **26** (FIGURE 5) or other adjacent elements at the central rear portion of the loom.

The hold-back pawl **357** (FIGURE 4) maintains whip roll **254** in the desired raised position of FIGURE 12 until such time as the operator wishes to resume weaving. Prior to again starting the loom, the operator lifts pawl **357** out of engagement with ratchet wheel **355** (FIGURE 4), and then turns feed roll **251** in feeding direction to restore the amount of pile warp let back following elevation of whip roll **254**. The whip roll **254** is then returned to substantially the position shown in FIGURES 4, 5 and 11, whereupon the nuts **347** are tightened to lock the whip roll **254** in the operative position.

Varying Picks Per Inch

Warner & Swasey Sulzer weaving machines are equipped with a positively driven cloth take-up roll, such as the roll **43** of FIGURES 1 and 5, such cloth take-up roll being driven through the medium of pick change gears and through the medium of an overriding clutch mechanism connected with the main drive, such as the main drive shaft **37**. The pick change gears and overriding clutch mechanism are not shown in the present drawings, but are of known construction and need not be described in detail.

In order to weave headers and other drop terry portions of cloth of proper density, it is necessary to reduce the rate at which the cloth C is taken up by take-up roll **43** during drop terry or plain weaving as compared to the rate at which the cloth is taken up during the weaving of terry cloth. Accordingly, means are provided herein for intermittently stopping rotation of cloth take-up roll **43** (FIGURES 1 and 5) during the weaving of every fourth pick, for example, during drop-terry weaving so that four picks of weft occupy the same space in the weaving of plain fabric as that occupied by three picks of weft and corresponding terry loops in the weaving of loop pile portions of the fabric.

To this end, the overriding clutch mechanism which transmits rotation from the main drive shaft **37** to the change gearing which, in turn, drives the cloth take-up roll **43** is shown somewhat schematically in FIGURE 1 and is indicated at **365**. The overriding clutch mechanism **365** is mounted on a shaft **366** on which a ratchet wheel **367** and hand wheel **370** are also mounted. The overriding clutch mechanism **365** and hand wheel **370** are usual parts of a loom of this character, and the ratchet wheel **367** is so arranged as to normally rotate with the overriding clutch during terry weaving.

However, during drop-terry or plain weaving, ratchet wheel **367** is intermittently engaged by a hold-back pawl **372** pivotally connected to the left-hand side frame member **21**, as at **373**, so as to delay movement of take-up roll **43** (FIGURE 5), the equivalent of a pick of weft during certain spaced beat-up strokes of reed **30** (FIGURE 7), which may be every third, fourth or fifth pick, depending upon the desired density to be maintained in the plain woven portions of the fabric.

Hold-back pawl **372** has the lower end of a cable or pliable element **375** connected thereto (FIGURES 1 and 4) which extends upwardly and partially around a pulley **376** rotatably mounted on a bracket **377** (FIGURE 4), carried by the rear transverse beam **54** of the loom superstructure. Cable **375** extends from pulley **376**, across the loom, to where it is connected to the medial portion of a crank **380** (see upper central portion of FIGURE 6). Crank **380** is pivotally mounted, as at **381**, on the plate **184** heretofore described. The lower end of crank **380** is connected, by means of a link **383**, to one of the main jacks **74** of dobby **50**.

It is apparent that the latter jack **74** is controlled by pattern strip **57** of dobby **50** so as to raise and lower hold-back pawl **372** at the desired intervals, and the overriding clutch mechanism **365** (FIGURE 1) is such that, when pawl **372** engages ratchet wheel **367**, overriding clutch mechanism **365** then becomes ineffective to transmit rotation from the main drive shaft **37** to the conventional change gearing and thence to the take-up roll **43**.

It is thus seen that I have provided an improved high-speed terry loom whose terry motion and harnesses are controlled by a dobby or other pattern device and wherein the terry motion is driven at predetermined intervals through connections with the dobby and the main drive. The connections are so arranged that the terry motion may be adjusted in synchronism with the dobby and harness while being relieved of the load on the main drive. It is seen further that I have provided means for letting off or feeding the terry warps, not only through the medium of the pattern controlled terry cam, but also under control of the dobby and independently of the terry cam. Among other novel features of my improved terry loom are, the pattern controlled means for locking the terry cam against accidental rotation during drop-terry weaving, the fell shifting means operated by the novel terry cam in conjunction with the pile warp feeding means and the reed, the means for automatically rendering the pile warp feeding means inoperative during manual adjustment of the dobby, the device for elevating the pile warps to facilitate access to parts of the loom normally shielded by the pile warps, the pattern controlled means for controlling the number of picks of weft per given length of fabric, and other features set forth in the annexted claims.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes

of limitation, the scope of the invention being defined in the claims.

I claim:

1. In a loom for weaving terry cloth having a main drive, an oscillatable reed operatively connected to said main drive, shed-forming heddles, a pattern device, and said device including movable members connected to and imparting vertical movement to said heddles; the combination of a terry motion comprising a terry cam, means responsive to rotation of said cam for moving said cloth toward and from pile forming position, means operatively connecting said main drive to said pattern device and to said cam, and means for disconnecting said main drive from said cam while maintaining the operative connection between the main drive and said pattern device whereby vertical movement of said heddles may be effected while said cam remains stationary.

2. A structure according to claim 1, in which said means for disconnecting said main drive from said cam comprises a normally engaged clutch, and means under control of said pattern device for disengaging said clutch.

3. A structure according to claim 1, including means supporting said terry cam for free rotation on the loom, and locking means engageable with said cam whenever said main drive is disconnected from said cam to thereby prevent accidental rotation of said cam during weaving.

4. A structure according to claim 3, in which said locking means is controlled by said pattern device.

5. In a loom for weaving terry cloth having a main drive, an oscillatable reed and a cloth take-up operatively connected to said main drive, shed-forming heddles, a pattern device and said device including movable members connected to and imparting vertical movement to said heddles; the combination of a terry motion comprising a terry cam, means responsive to rotation of said cam for moving said cloth relative to the reed toward and from pile forming position, means operatively connecting said main drive to said pattern device and to said cam, and means for disconnecting said main drive from said pattern device and said cam, while maintaining the operative connection between said main drive and the reed and cloth take-up.

6. A structure according to claim 5, including means under control of said pattern device for disconnecting said pattern device from said cam.

7. A structure according to claim 5, in which said means for disconnecting said main drive from said pattern device and said cam comprises a normally engaged clutch, and manually operable means for disengaging said clutch to facilitate manual simultaneous adjustment of said pattern device and said cam independently of said main drive.

8. In a loom for weaving terry cloth from ground warps, terry warps and picks of weft, said loom having a main drive, an oscillatable reed and a cloth take-up connected in fixed driving relation with said main drive, means for starting and stopping said main drive, heddles for said warps and a pattern device controlling said heddles; the combination therewith of a terry motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth during weaving, a power transmission for transmitting rotation from the main drive to the pattern device and terry motion, and means for disconnecting said main drive, reed and cloth take-up from driving relation with said transmission during stoppage of the loom while maintaining the pattern device and terry motion in driving relation to said transmission whereby said pattern device is relieved from the load on the main drive to facilitate simultaneous adjustment of the pattern device and the terry motion while maintaining the terry motion in proper timed relation to said pattern device.

9. In a loom for weaving terry cloth from ground warps, terry warps and picks of weft, said loom having a main drive, an oscillatable reed and a cloth take-up connected in fixed driving relation with said main drive, heddles for said warps and a dobby controlling said heddles; the combination therewith of a terry motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, a power transmission for transmitting rotation from the main drive to the dobby and the terry motion, and means for disconnecting said main drive, reed and cloth take-up from driving relation with said transmission while maintaining the dobby and terry motion in driving relation to said transmission whereby said dobby is relieved from the load on the main drive to facilitate adjustment of the dobby while adjusting the terry motion and maintaining the terry motion in proper timed realtionship to said dobby.

10. In a loom for weaving terry cloth from ground warps, terry warps and picks of weft, said loom having an auxiliary drive shaft, an oscillatable reed and a cloth take-up connected in fixed driving relation with said auxiliary drive shaft, heddles for said warps and a pattern device controlling said heddles; the combination therewith of a terry motion having means including a terry cam journaled on said auxiliary drive shaft for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, a power transmission for transmitting rotation from the auxiliary drive shaft to the pattern device and the terry cam, and manually operable clutch means for disconnecting said auxiliary drive shaft, reed and cloth take-up from driving relation with said transmission while maintaining the pattern device and terry cam in driving relation with said transmssion whereby said pattern device is relieved from the load on the auxiliary drive shaft to facilitate adjustment of the pattern device while adjusting and maintaining the terry cam in proper timed relationship to said pattern device.

11. Structure according to claim 10, including second clutch means interposed between the power transmission and the terry cam, means under control of said pattern device for rendering said second clutch means active and inactive, and locking means engageable with said terry cam whenever said second clutch means is inactive to thereby prevent accidental rotation of said terry cam.

12. In a loom for weaving terry cloth from ground warps, terry warps and picks of weft, said loom having a main drive, an oscillatable reed and a cloth take-up connected to said main drive, heddles for said warps and a pattern device controlling said heddles; the combination of a terry motion comprising a rotatable cam journaled on said loom, first driving connections between said main drive and said pattern device, second driving connections between said cam and said pattern device, first normally active clutch means interposed in said first driving connections, and means to inactivate said clutch means to relieve the pattern device from the load on the main drive and whereby the pattern device may be manually adjusted and the cam and heddles will be synchronously adjusted with the pattern device and independently of said main drive.

13. A structure according to claim 12, including second clutch means interposed in said second driving connections, and means under control of said pattern device for rendering said second clutch means active and inactive.

14. A structure according to claim 13, including locking means for said cam, means operable in timed relation to said second clutch means being rendered active and inactive for respectively rendering said locking means inactive and active thereby to prevent rotation of said cam when it is relieved from the load of said pattern device.

15. In a loom for weaving terry cloth from ground warps, pile warps and picks of weft, said loom having a main drive, an oscillatable reed driven by said main drive, heddles for said warps, a pattern device operating said heddles and a driving connection between said main drive and said pattern device; the combination therewith of a terry motion driven by and in synchronism with said pat-

tern device, said terry motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, manually operable means for adjusting said pattern device, and means for interrupting the driving connection between the main drive and said pattern device during adjustment of the pattern device to relieve the same from the load of the main drive and whereby the terry motion is adjusted in synchronism with adjustment of said pattern device and independently of said main drive.

16. In a loom for weaving terry cloth having an oscillatable reed, a main drive driving said reed and a pattern device; the combination therewith of a terry motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, a power transmission coupled to said pattern device, first driving connections between said main drive and said transmission, second driving connections between said transmission and said terry motion, manually operable means for adjusting said pattern device, said transmission including means for disconnecting the pattern device from the main drive during adjustment of the pattern device while maintaining the pattern device in driving relationship with said terry motion, whereby said terry motion is adjusted simultaneously with adjustment of the pattern device and the pattern device is relieved from the load of the main drive during adjustment thereof.

17. In a loom for weaving terry cloth having an oscillatable reed, a main drive driving said reed and a pattern device; the combination therewith of a terry motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, a power transmission coupled to said pattern device, first driving connections between said main drive and said transmission, second driving connections between said transmission and said terry motion, manually operable means for adjusting said pattern device, and means to disconnect the pattern device from said main drive while maintaining the pattern device in coupled relation to said transmission whereby said terry motion is adjusted simultaneously with adjustment of the pattern device and the pattern device is relieved from the load of the main drive during adjustment thereof.

18. In a loom for weaving terry cloth from ground warps, pile warps and wefts, said loom having a drive shaft, an oscillatable reed and a cloth take-up operatively connected to said shaft, heddles for said warps, and a pattern device controlling said heddles; the combination of a terry motion comprising a terry cam mounted for free rotation with respect to said shaft, first means transmitting rotation from said shaft to said pattern device, front and rear spaced pairs of cloth shifting levers pivoted on said loom, front and rear rolls carried by respective front and rear levers and over which the cloth and ground warps are respectively entrained, follower means operatively connected with said levers and engaging said cam for shifting the levers, the rolls and thus the fell of the cloth relative to the beat-up point of the reed for forming fast and loose picks in alternation, pattern controlled clutch means for transmitting rotation from the pattern device to said cam at predetermined intervals, a normally inactive pile warp feed mechanism, and means under control of said cam for actuating said feed mechanism during each fast pick.

19. A structure according to claim 18, in which said pile warp feed mechanism includes a feed roll engaged by said pile warps at a point rearwardly of said heddles, a ratchet wheel operatively connected to said feed roll, said means under control of said cam for actuating said feed mechanism including a ratchet pawl engageable with said ratchet wheel and normally bearing against said ratchet wheel, and means under control of said pattern device for actuating said pawl to actuate said feed mechanism a predetermined amount immediately preceding initiation of each of said intervals of rotation transmitted from the pattern device to said cam by said pattern controlled clutch means.

20. A structure according to claim 18, in which said means under control of said cam for actuating said feed mechanism comprises a pile feed rocker member operatively connected to said cam and having a lobe thereon, a lever pivoted on the loom and having a surface thereon normally urged against said rocker member, a feed roll for said pile warps, a ratchet wheel coupled to said feed roll, a ratchet pawl normally bearing against said ratchet wheel, a pawl carrier for said pawl, link means connecting said carrier to said lever, and said lobe being engageable with said surface on said lever during each fast pick for moving the lever, the link means, the pawl carrier and the pawl to thus impart a step in movement to said feed roll.

21. A structure according to claim 20, including means under control of said pattern device for imparting at least one movement to said lever relative to said rocker member preceding initiation of each of said intervals of rotation transmitted from the pattern device to said cam by said pattern controlled clutch means to thereby feed said pile warps a predetermined amount in advance of each interval of rotation of said cam.

22. A structure according to claim 18, including a second normally engaged clutch means interposed in said first means transmitting rotation from the drive shaft to the pattern device, and manually operable means for disengaging said second clutch means and for rotating said pattern device independently of said drive shaft.

23. A structure according to claim 22, in which said pile warp feed mechanism includes a roll engaged by said pile warps at a point rearwardly of said heddles, a ratchet wheel operatively connected to said feed roll, said means under control of said cam for actuating said feed mechanism including a ratchet pawl engageable with said ratchet wheel and normally bearing against said ratchet wheel, and means operable automatically upon disengaging said second clutch means for moving said ratchet pawl out of engagement with said ratchet wheel.

24. In a loom for weaving terry cloth from ground warps, pile warps and picks of weft, said loom having a main drive, an oscillatable reed driven by said main drive, heddles for said warps, and a pattern device for controlling said heddles; the combination of a terry motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, a power transmission including a jack shaft operatively connected to said pattern device, normally active clutch means on said jack shaft for connecting the jack shaft with said main drive and thereby driving said pattern device, said pattern device including a movable pattern selector element, a manually rotatable member shiftable between active and inactive positions and being operable to rotate said pattern selector element when rotated while occupying active position, means responsive to shifting of said rotatable member from inactive to active position for releasing said clutch to disconnect said jack shaft from said main drive, and a driving connection between said jack shaft and said terry motion whereby, upon said manually rotatable member being shifted to said active position, the pattern device is relieved of the load of the main drive during rotation of the pattern element and the terry motion is maintained in driving relation to said jack shaft and is thus maintained in timed relationship to said pattern device.

25. In a loom for weaving terry cloth from ground warps, pile warps and picks of weft, said loom having a main drive, an oscillatable reed driven by said main drive, heddles for said warps, a pattern device operating said heddles and a main shaft in said pattern device; the combination therewith of a terry motion comprising a rotatable cam and including means responsive to rotation of said cam for relatively varying the displacement between

the beat-up point of the reed and the fell of the cloth, a jack shaft, a first wheel rotatable with respect to said jack shaft by said main drive, driving connections between the jack shaft and the main shaft of the pattern device, first normally active clutch means for connecting said first wheel and said jack shaft, driving connections between said jack shaft and said cam whereby the jack shaft normally rotates both the main shaft of the pattern device and the terry motion cam, means for manually adjusting said pattern device including a gear on said main shaft, a manually axially movable and rotatable pinion normally inactively positioned relative to said gear and being movable into active position in engagement with said gear, means operatively connecting said pinion with said first clutch means and being responsive to movement of said pinion from inactive to active position to disconnect said first wheel with respect to said jack shaft whereby said pinion may be rotated to rotate said gear and main shaft without being encumbered by the load of said main drive and while rotating said terry motion cam in fixed relation to the rotation of said main shaft.

26. A structure according to claim 25, including second clutch means normally connecting said driving connections between the jack shaft and the terry motion cam, and means under control of said pattern device for disconnecting said last-named driving connections and said second clutch means.

27. A structure according to claim 25, including feeding means for said terry warps, means operatively connecting said terry motion cam with said feeding means, and means for rendering inoperative said means operatively connecting said cam with said feeding means when said pinion is moved from inactive to active position whereby said pattern device may be adjusted without operating said feeding means.

28. In a loom for weaving terry cloth from ground warps, pile warps and wefts, said loom having a drive shaft, an oscillatable reed and a cloth take-up connected to said shaft, heddles for said warps, and a dobby having a movable pattern selector element for controlling said heddles; the combination of a terry motion comprising a terry cam mounted for free rotation with respect to said shaft, a second shaft operatively connected to said pattern element, first means for transmitting rotation from said drive shaft to said second shaft, front and rear spaced cloth shifting levers pivoted on said loom, front and rear rolls carried by the respective front and rear levers and over which the cloth and ground warps are respectively entrained, follower means operatively connecting said levers and with said cam for shifting the levers, the rolls and, thus, the fell of the cloth relative to the beat-up point of the reed for forming fast and loose picks in alternation, pattern controlled clutch means for transmitting rotation from the dobby to said cam, a normally inactive pile warp feed mechanism, and means under control of said cam for actuating said feed mechanism during each fast pick.

29. In a loom for weaving terry cloth from ground warps, terry warps and picks of weft, said loom having a main drive, an oscillatable reed and a cloth take-up connected to said main drive, heddles for said warps and a pattern device controlling said heddles; the combination of a terry motion comprising a rotatable cam, first driving connections between said main drive and said pattern device, second driving connections between said cam and said pattern device, means responsive to rotation of said cam for varying the displacement between the fell of the cloth and the beat-up point of the reed, means under control of said cam for feeding said terry warps at predetermined spaced intervals to form terry loops, clutch means interposed in said second driving connections, means to engage and disengage said clutch means under control of said pattern device, and means under control of said pattern device for feeding said terry warps a predetermined amount immediately preceding each engagement of said clutch means and independently of said cam.

30. In a loom for weaving terry cloth from ground warps, pile warps and wefts, said loom having a drive shaft, an oscillatable reed and a cloth take-up operatively connected to said shaft, heddles for said warps, and a pattern device controlling said heddles; the combination of a terry motion comprising a terry cam mounted for free rotation with respect to said shaft, first means transmitting rotation from said shaft to said pattern device, follower means engaging said cam for shifting the fell of the cloth relative to the beat-up point of the reed for forming fast and loose picks in alternation, pattern controlled clutch means for transmitting rotation from the pattern device to said cam at predetermined intervals, a normally inactive pile warp feed mechanism, and means including a ratchet mechanism under control of said cam for actuating said feed mechanism during each fast pick.

31. A structure according to claim 30, including manually operable means for adjusting said pattern device, normally engaged second clutch means interposed in said first transmitting means, means under control of said manually operable means for disengaging said second clutch means and for rendering said ratchet mechanism inoperative whereby said cam and pattern device may be adjusted in synchronism without feeding said terry warps and while releived from the load on said drive shaft.

32. In a loom for weaving terry cloth from ground warps, terry warps and wefts, said loom having a main drive, an oscillatable reed operatively connected to said main drive, shed forming heddles, and a pattern device conrtolling said heddles; the combination therewith of a terry motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, means operatively connecting said main drive to said pattern device and to said terry motion, means for disconnecting said main drive from said pattern device while the loom is stopped and while maintaining the operative connection between the terry motion and said pattern device, a feed roll for overfeeding said terry warps and being spaced above the level of said ground warps, a terry warp whip roll engaging and normally maintaining tension in the terry warps at a point between said feed roll and said ground warps during operation of the loom, means supporting said whip roll for movement toward and away from said terry warps, and means releasably securing said supporting means in position whereby said whip roll may be adjusted away from the terry warps during stoppage of the loom and while said main drive is disconnected from said pattern device to facilitate access to various parts of the loom through the terry warps.

33. A structure according to claim 32, in which said means for supporting said whip roll comprises a pair of arms on which opposite ends of the whip roll are mounted, a pair of wheels journaled on the loom adjacent opposite ends of said whip roll, means securing said arms to proximate faces of the respective wheels, each of said wheels having an arcuate slot therein generated about its respective axis, and said means for releasably securing said whip roll in position including screw means penetrating each of said slots and being connected to a fixed part of the loom.

34. A structure according to claim 33, in which at least one of said wheels is a sprocket wheel, a sprocket chain engaging said sprocket wheel, a shaft spaced from and extending parallel with said sprocket wheel and having a second sprocket wheel fixed thereon, said sprocket chain being connected to said second sprocket wheel, and crank means connected to said shaft whereby said screw means may be loosened and the crank means rotated for moving said whip roll in either direction, and the screw means may then be tightened to secure the whip roll in the desired position.

35. In a loom for weaving terry cloth from ground warps, terry warps and wefts; the combination of a terry

motion including means for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, a feed roll for overfeeding said terry warps and being spaced above the level of said ground warps adjacent a rear portion of the loom, a terry warp whip roll engaging the front surfaces of and normally maintaining tension in the terry warps at a point between said feed roll and said ground warps during weaving, means supporting said whip roll for forward and upward movement away from said terry warps, and means releasably securing said supporting means in position whereby said whip roll may be adjusted forwardly away from the terry warps during stoppage of the loom to thereby move forwardly the portions of the terry warps between the feed roll and the ground warps to facilitate access to various parts of the loom through the terry warps.

36. A structure according to claim 35, wherein said loom includes a source of terry warp supply for letting off said terry warps under tension and being spaced above the level of said feed roll, a lateral tension bar located between said source and said feed roll, and means yieldably urging the tension bar against said terry warps whereby the slack produced in the terry warps by raising said whip roll may be removed by said tension bar.

37. A structure according to claim 35, in which said means for supporting said whip roll comprises a pair of arms on which opposite ends of the whip roll are mounted, a pair of wheels journaled on the loom adjacent opposite ends of said whip roll, means securing said arms to proximal faces of the respective wheels, each of said wheels having an arcuate slot therein generated about its respective axis, and said means for releasably securing said tension roll in position including screw means penetrating each of said slots and being connected to a fixed part of the loom.

38. A structure according to claim 37, in which at least one of said wheels is a sprocket wheel, a sprocket chain engaging said sprocket wheel, a shaft spaced from and extending parallel with said sprocket wheel and having a second sprocket wheel fixed thereon, said sprocket chain being connected to said second sprocket wheel, and hand-crank means connected to said shaft whereby said screw means may be loosened and the hand-crank means rotated for moving said whip roll in either direction, and the screw means may then be tightened to secure the whip roll in the desired position.

39. A structure according to claim 38, including a ratchet wheel fixed on said shaft, and a manually movable pawl pivoted on said loom and adapted to engage said ratchet wheel and prevent rotation thereof when said whip roll is located in raised position with respect to said ground warps.

40. In a loom for weaving terry cloth having a main drive, a cloth take-up, overriding clutch means normally operatively connecting said cloth take-up to said main drive, an oscillatable reed operatively connected to said main drive, shed forming heddles, and a pattern device controlling said heddles; the combination of a terry motion including a terry cam, means responsive to rotation of said cam for effecting relative movement between the fell of the cloth and the beat-up point of said reed for producing loose and fast picks in alternating sequence during terry weaving, means operatively connecting said main drive to said pattern device and to said cam, pattern controlled means for disconnecting said main drive from said cam at spaced intervals while maintaining operative the connection between the main drive and said pattern device, and pattern controlled means intermittently operable during the intervals at which said main drive is disconnected from said cam for rendering said overriding clutch inoperative during weaving to interrupt operation of said take-up and to thereby increase the number of picks per inch during plain weaving.

41. In a loom for weaving terry cloth from ground warps, terry warps and picks of weft, said loom having a drive shaft, an oscillatable reed and a cloth take-up connected in fixed driving relation with said drive shaft, heddles for said warps and a pattern device controlling said heddles; the combination therewith of a terry motion having means including a terry cam journaled on said shaft for relatively varying the displacement between the beat-up point of the reed and the fell of the cloth, said terry cam being so formed as to effect at least three different variations in the relativity between the beat-up point of the reed and the fell during each terry-loop-forming cycle of the loom, a power transmission for transmitting rotation from the drive shaft to the pattern device and the terry cam, and manually operable clutch means for disconnecting said drive shaft, reed and cloth take-up from driving relation with said transmission while maintaining the pattern device and terry cam in driving relation with said transmission whereby said pattern device is relieved from the load on the drive shaft to facilitate adjustment of the pattern device while adjusting and maintaining the terry cam in proper timed relationship to said pattern device.

42. In a loom for weaving terry cloth from ground warps, pile warps and wefts, said loom having a drive shaft, an oscillatable reed and a cloth take-up operatively connected to said shaft, heddles for said warps, and a pattern device controlling said heddles; the combination of a terry motion comprising a terry cam mounted for free rotation with respect to said shaft, first means transmitting rotation from said shaft to said pattern device, front and rear spaced pairs of cloth shifting levers pivoted on said loom, front and rear rolls carried by respective front and rear levers and over which the cloth and ground warps are respectively entrained, follower means operatively connected with said levers and engaging said cam for shifting the levers, the rolls and thus the fell of the cloth relative to the beat-up point of the reed for forming fast and loose picks in alternation, pattern controlled clutch means for transmitting rotation from the pattern device to said cam at predetermined spaced intervals and at a speed of one revolution wtih each series of three beat-up strokes of the reed, and said cam having at least three circularly spaced surfaces successively engageable with said follower means, said surfaces including a high surface, a low surface and an intermediate surface arranged in succession whereby the fell is shifted to three different positions relative to the beat-up point of the reed during each terry-loop-forming cycle of the loom.

43. In a terry loom having a weft beating means, means for oscillating said beating means forwardly toward and rearwardly away from the fell of the cloth being woven and means for taking up said cloth; the combination of means for cyclically varying the displacement between the beat-up point of said beating means relative to the fell with successive forward pick-forming strokes of said beating means so that at least two loose picks of weft are beat up in spaced relation from the fell and a fast pick of weft is then beat up to move the same and the loose picks to the fell, and said means for cyclically varying the displacement including means to cause said displacement to be greater during beating up of the first of said loose picks than it is during the beating up of the second of said loose picks.

44. In a terry loom operable in terry-loop forming cycles of at least three picks in each cycle, said loom having a weft beating means, means for oscillating said beating means forwardly and rearwardly with respect to the fell of the cloth being woven, and means for taking up the cloth; the combination of a terry motion cam, means to move said cam through one complete cycle during each terry-loop-forming cycle of the loom, follower means engaging said cam and movable thereby, means responsive to movement of said follower means for effecting proportional relative movement between the fell and

the beat-up point of the beating means with successive forward pick-forming strokes of said beating means, said cam including a low dwell point, at least one intermediate dwell point and a high point arranged in series, said high point causing the beating means to move to the fell, and said lower and intermediate points causing the beating means to beat up at points spaced rearwardly from the fell with the intermediate point causing the beating means to beat up closer to the fell than that caused by the low point.

45. A structure according to claim 44 wherin said cam is in the form of a cam wheel and the cam rotates a complete revolution in effecting said movement thereof through one complete cycle, and said dwell points being circularly spaced a substantially equal number of degrees apart.

46. A structure according to claim 45 in which the responsive means for effecting relative movement between the fell and the beat-up point of the beating means is embodied in means for shifting the fell of the cloth toward and away from the beat-up point of the beating means with successive forward pick-forming strokes of the beating means, and said fell shifting means being operatively connected to said follower means.

47. In a loom for weaving terry cloth from ground warps, terry warps and picks of weft and being operable in terry-loop-forming cycles of at least three picks in each cycle, said loom having an oscillatable reed, means to oscillate said reed forwardly and rearwardly with respect to the nominal fell of the cloth being woven, and means for taking up the cloth; the combination of means for successively shifting said cloth and ground warps to at least three different positions relative to the beat-up point of said reed during successive oscillations of said reed in each of said cycles, a first of said positions being such that the nominal fell is spaced a given distance from said beat-up point, a second succeeding one of said positions being such that the nominal fell is spaced a slightly lesser distance from said beat-up point than said given distance, and a third succeeding one of said positions being such that the nominal fell corresponds with said beat-up point.

48. A structure according to claim 47 in which the means for shifting said cloth comprises a driven cam rotatable a complete revolution during each of certain of said cycles, and said cam having at least three circularly spaced and successively arranged low, intermediate and high points, and follower means successively engageable by said low, intermediate and high points for shifting said cloth and ground warps as prescribed.

49. In a loom for weaving terry cloth from ground warps, pile warps, and wefts, said loom having a main drive, a pattern device, an oscillatable reed and a cloth take-up connected to said main drive; the combination of a terry motion comprising a terry cam mounted for free rotation in said loom, follower means engaging said cam, means operatively connected to said follower means for varying the displacement between the fell of the cloth and the beat-up point of the reed in response to rotation of said cam for forming fast and loose picks, means connecting said main drive to said terry cam for rotating the same, and means under control of said pattern device for interrupting said last-named connecting means and stopping rotation of said cam at predetermined intervals of predetermined duration and for then restoring the connection of said last-named connecting means.

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