Nov. 5, 1957 R. JACOB ET AL 2,811,986

LOOM

Filed Nov. 27, 1953 3 Sheets-Sheet 1

Fig. 1.

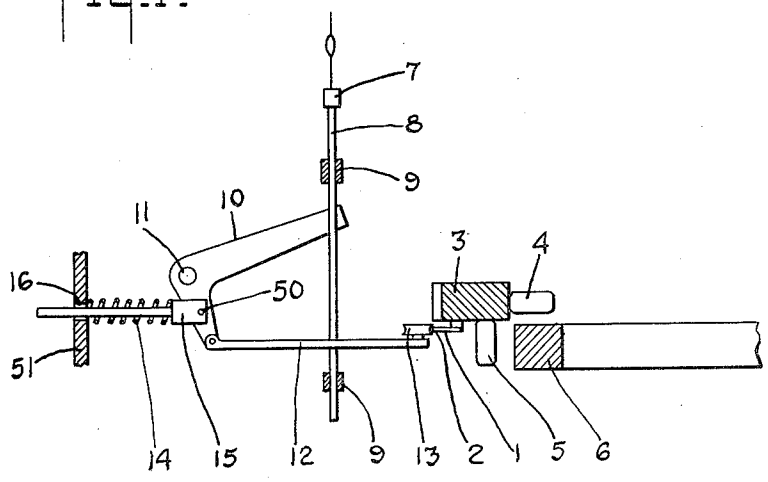


Fig. 3.

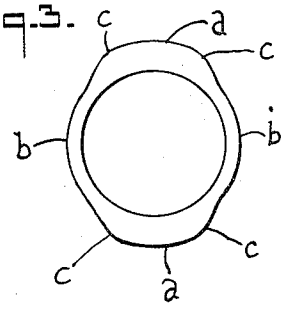


Fig. 2.

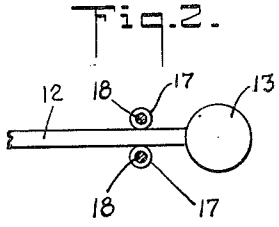
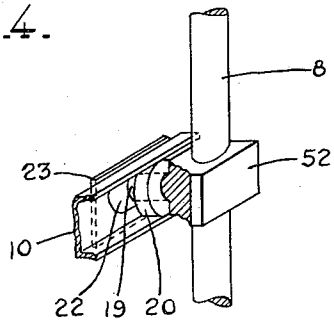


Fig. 4.



INVENTORS.
RAYMOND JACOB
BERNARD MASSON

BY

ATTORNEY.

Nov. 5, 1957 R. JACOB ET AL 2,811,986

LOOM

Filed Nov. 27, 1953 3 Sheets-Sheet 2

Fig. 5.

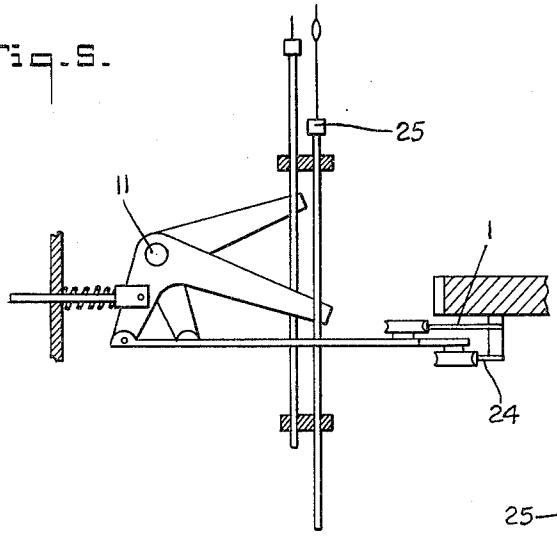
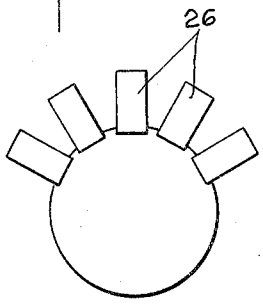


Fig. 7.



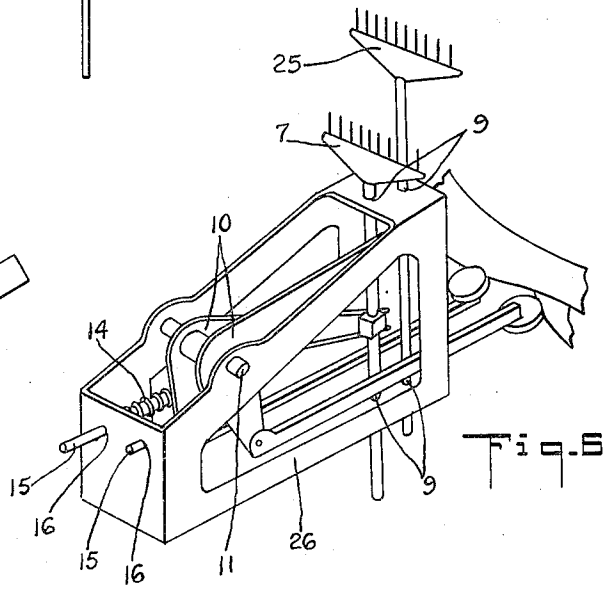
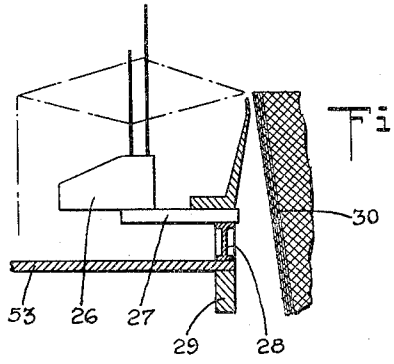


Fig. 6.

Fig. 8.



INVENTORS.
RAYMOND JACOB
BERNARD MASSON

BY

ATTORNEY.

Nov. 5, 1957 R. JACOB ET AL 2,811,986

LOOM

Filed Nov. 27, 1953 3 Sheets-Sheet 3

Fig. 9.

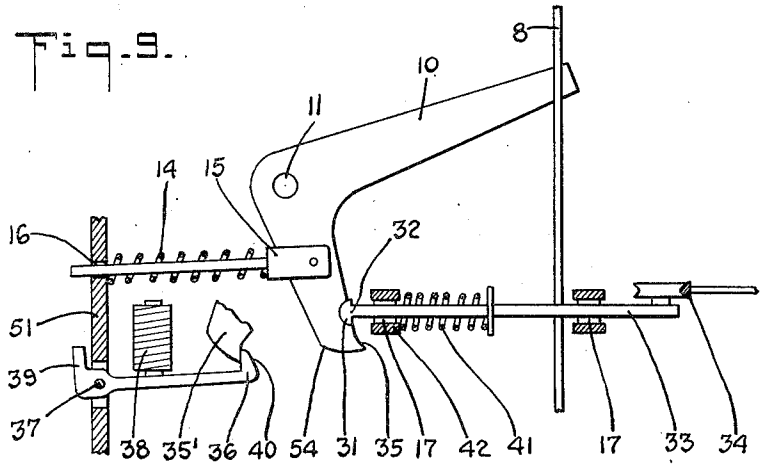


Fig. 11.

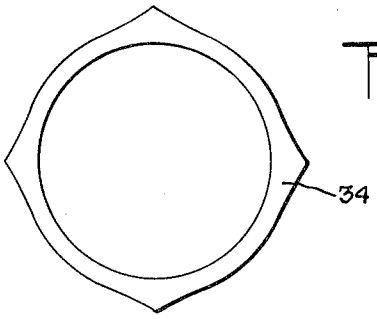
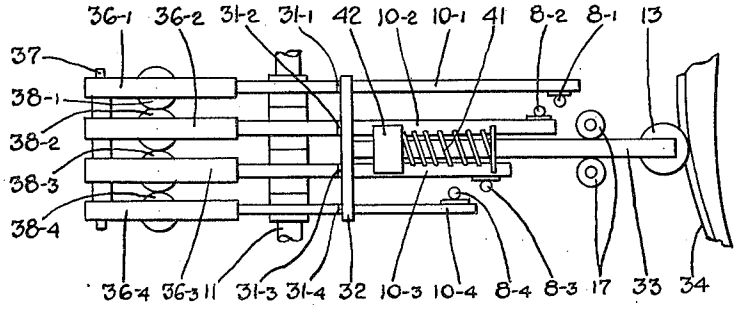


Fig. 10.



INVENTORS.
RAYMOND JACOB
BERNARD MASSON

BY

ATTORNEY.

United States Patent Office 2,811,986 Patented Nov. 5, 1957

2,811,986

LOOM

Raymond Jacob, Eaubonne, and Bernard Masson, Courbevoie, France, assignors to Societe d'Applications Generales d'Electricite & de Mecanique, Paris, France

Application November 27, 1953, Serial No. 394,612
Claims priority, application France November 28, 1952
26 Claims. (Cl. 139—13)

This invention relates to looms, and more particularly to a drive of the shafts of a loom, especially a drive of the shafts of a circular loom.

The driving elements of hitherto customary shaft drives are mostly elements being analogous to elements of ordinary looms, such as cam shafts and large, concentrically arranged cams. Circular looms equipped with shaft drives of this kind are of a rather complex construction and the cam shafts cause obstructions and increase considerably the weight of the circular loom. Furthermore, as the cams have a throw higher than or equal to or at the best only slightly less than the lift of the shafts; the cams being of rather large dimensions are difficult to manufacture and, owing to the given inclination of their profile or their grooves, these cams limit the speed of rotation of the looms or the lift of the shafts and, thus, the capacity of the shuttles being an essential factor with respect to the output of the loom.

Moreover, the number of shafts and the possibility of changing the weave are limited in all hitherto customary devices. A change of the weave indeed requires a replacement of the cams of the loom which, in turn, necessitates a partial disassembling of the loom consuming quite some time.

An object of the present invention is to provide a shaft drive overcoming the above mentioned disadvantages.

Hereinafter, the invention is described in connection with a circular loom having a horizontal shed, wherein the drive of the warp yarns of one and the same sheet is effected by a succession of shafts or frames of heddles connected to each other, or not, and arranged on a circumference. This description of the invention shall not be construed as a limitation, as the described principles may be applied to any other type of circular looms, or even to an ordinary loom without departing from the scope of the invention.

According to an embodiment of the invention the shafts or heddle frames displaceable in a vertical plane are driven by one or several cams arranged in a horizontal plane and being concentric to the axis of the loom. Thus, it is possible to arrange a transmission between the shaft and the actuating cam, whereby the value of the throw of the cam having rather small inclinations of reasonable dimensions is increased so as to obtain a lift of the shaft of the required degree.

According to another embodiment of the invention, for the manufacture of simple weaves (plain weave or twill weave using three warp threads to form the pattern), each cam drives by means of suitable connections the shafts being arranged in the same circumference and corresponding to one and the same sheet of warp yarns.

According to a further embodiment of the invention, the driving elements of the same group of shafts or heddle frames are united in a casing.

According to still another embodiment of the invention the above mentioned drive permits the realization of a single lift motion dobby which may be readily manufactured and wherein the movement of each shaft or

heddle frame may be disengaged at will from the associated cam by means of an electromagnetic device. The aggregate of said devices controlled by an electromechanic distributor permits an instant change of the weave by a simple change of the distributor. Furthermore, a levelling of all shafts in their low position may be readily obtained by a simultaneous switching-on of all of the electromagnetic devices.

Other objects and structural details of the invention will be apparent from the following description when read in conjunction with the accompanying drawings forming part of this specification, wherein:

Fig. 1 is a fragmentary vertical sectional view of a loom illustrating the elements of a shaft drive,

Fig. 2 is a top plan view of the guide of a connecting rod,

Fig. 3 is a top plan view of a driving cam of a loom having four shuttles for weaving a plain weave,

Fig. 4 is a perspective view of the connection between the bell-crank and the guide of a shaft,

Fig. 5 is a fragmentary vertical view of a drive of a group of two shafts,

Fig. 6 is a perspective view of a casing enclosing the elements of a drive of two shafts,

Fig. 7 is a somewhat diagrammatical top plan view of a loom illustrating the arrangement of the casings,

Fig. 8 is a vertical sectional view of half of a loom equipped with such casings,

Fig. 9 is a fragmentary vertical sectional view of the drive of a shaft in combination with a dobby,

Fig. 10 is a bottom plan view of the elements of a dobby for a drive of four shafts, and

Fig. 11 is a top plan view of a driving cam of a dobby of a loom with four shuttles.

Referring now to Fig. 1, the profile **2** of a cam **1** is traced according to the number of the shuttles of the loom and the weave to be obtained. Preferably the cam **1** is made of sheet metal so as to limit its inertia, and the profile **2** is made of a material of high resistance. The cam **1** is rigid with the crown **3**, which controls the rotation of the shuttles. This crown may be centered by means of rollers **4** and may rest on additional rollers **5**. Said rollers **4** and **5** are arranged on the frame **6** and are suitably distributed along its circumference. Of course, the crown **3** could also be rotatably mounted and centered by different means.

Each shaft **7** is connected at its lower portion with a guide **8** which, for example, may have a cylindrical cross section. This guide **8** is guided by two sleeves **9**. A bell-crank lever **10** is rotatably mounted on an axis **11**. The upper arm of said bell-crank lever **10** is in pivotal and slidable engagement with the guide **8** and will be described later on in detail. The lower arm of said bell-crank lever **10** is pivoted to one end of a connecting rod **12**, which carries at its other end a roller **13**. Said roller **13** is held in engagement with the cam **1** by means of a spring **14** which acts on one of the arms of the bell-crank lever **10**. According to Fig. 1, for example, one end of a spiral spring **14** abuts against a shoulder of an element **15** pivoted to the bell-crank lever **10** at **50** and slidably engaged with a bore **16** of a wall **51** of the loom. The other end of the spiral spring **14** abuts against the surface of the wall **51**.

As best shown in Fig. 2, the connecting rod **12** is guided in the horizontal plane by means of a pair of rollers **17** slidably engaged with the connecting rod **12**. Said rollers **17** having their axis **18** in the vertical plane, are arranged as near as possible to the roller or cam follower.

As best shown in Fig. 4, the connection between the guide **8** and the upper arm of the bell-crank lever **10** is obtained by means of a block **52** rigid with the guide

8 and provided with a pivot 19 carrying a roller 20 slidably engaged with a U-shaped portion 21 arranged at the end of the upper arm of the bell-crank lever 10. The pivot 19 passing through a slot 22 of the bell-crank lever 10 carries a plate 23 at its projecting end. Said plate 23 holds the roller 20 through the medium of the upper arm of the bell-crank lever 10 in engagement with the block 52 assuring a positive connection between the bell-crank lever 10 and the guide 8. The described pin and slot connection permits also a derivation of a straight line movement of the shaft from a circular movement of the bell-crank lever 10 without wear and tear of the various members.

According to a peculiar feature of the device according to the invention, the profile of the cam 1 and of the roller 13 consists of arcs of identical circles so as to permit the oscillations of the connecting rod 12 while the latter is held in the vertical plane.

Fig. 3 illustrates a top plan view of a cam 1 for a loom weaving a plain weave with four shuttles.

The portions *a* of the cam 1 correspond to the low positions of the shafts.

The portions *b* of the cam 1 correspond to the high position of the shafts.

The portions *c* of the cam 1 correspond to the movement of the shafts from one position into the other.

The rotating cam 1 causes a displacement of the roller 13 and thus, through the linkage described above, a movement of the shafts. Said shafts are arranged in such a manner that they follow each other on a circumference. Each shaft is individually driven by a device analogous to the device described above. However, all of said devices are actuated by one and the same cam 1 so that the movements of each shaft are synchronized with the advancing movement of the shuttles.

As best shown in Fig. 5, the actuation of all shafts is obtained by means of two cams 1 and 24 in a loom for weaving a plain weave. For example, the cam 24 is arranged below the cam 1. The shafts are arranged in two rows and, for the sake of simplicity, the bell-crank levers could be swingably mounted in pairs side by side on the same axis 11.

In the device according to the invention the length of the arms of the bell-crank levers and the throw of the various cams may be readily determined in such a way, that the desired height of the shed and especially a progressive lift of the various shafts is obtained.

If it is desired to have the warp in groups of more than two, it is merely necessary to increase the number of cams and placing them above each other.

If desired, the drive of each shaft could also be modified, without departing from the scope of the invention, for example by replacing the cam plate 1 engaged with the roller 13 by a cam having a groove engaged with a roller; if such a cam groove is used, the spring 14 may be omitted.

As best shown in Fig. 6, the driving elements for each group of shafts may be united in a casing 26. Said casing 26 on one hand is provided with bores 9 receiving the guides of the shafts 7 and 25, and on the other hand carries a shaft 11 on which the bell-cranks 10 are swingably mounted. Said bell-cranks 10 are connected with the elements of the transmission. Furthermore, said casing 26 is provided with bores 16 receiving the elements 15 partly surrounded by the springs 14, as described above.

Thus, each group of shafts with its driving elements forms a mechanical aggregate which is simple and yet sturdy in construction. Said aggregate may be readily interchanged, if desired.

Thus, the drive of all shafts of a loom is formed by a series of casings 26 which are arranged on a circumference, as shown in Fig. 7. This construction reduces considerably obstructions in the loom and the weight of

the loom with respect to hitherto customary arrangements.

The reduction of the obstructions in the loom is especially important insofar as the height is concerned; as best shown in Fig. 8, a loom according to the invention may be directly placed on the floor of a building, or on the beams supporting the floor. The casings 26 are arranged on the frame 27 which, through the medium of legs 28, rests on the floor 53 (as shown in Fig. 8), or on the beams 29. The cloth 30 may be led downwardly through a single aperture made in the floor 53. Thus, the construction of an especially complicated platform is avoided. Furthermore, if the loom is to be set up in an existing building having several floors, the high costs may be avoided which are necessary for making in a floor very large openings receiving a portion of the loom, and for making a wooden framework on which the loom is supported at a level lower than that of the floor having the openings.

It will also be readily understood that the use of the casings according to the construction shown in Fig. 6, or a construction analogous thereto, permits the driving of the shafts of a loom of any width. It is sufficient to place said casings on a frame having a suitable diameter and to increase their number in proportion to said diameter.

With the foregoing description of the drive of the shafts in mind, it will be readily understood, that a single lift motion dobby may be made, which has original characteristics.

An embodiment of such a single lift motion dobby is shown in Fig. 9. In contrast to the above described embodiments, the bell-crank 10 is no longer pivoted to the connecting rod. According to Fig. 9 the connecting rod 33 is provided with a pushing head 32 disengageably engaged with a recess 31 of the lower arm of a bell-crank 10. The connecting rod 33 is guided in a horizontal plane by means of a pair of rollers 17. The connecting rod 33 is reciprocated by means of a cam 34 arranged in a position identical with that of the cam 1 of Fig. 1. The profile of the cam 34 of Fig. 9 being analogous to that of above described cam 1 of Fig. 1, is of such a shape that the connecting rod 33 (Fig. 9) is held in the vertical plane on one hand by said profile, and on the other hand by said recess 31. This arrangement has the advantage of limiting the friction caused by a rotating movement at the recess.

The lower arm of the bell-crank 10 has a projection 35 capable of locking engagement with a hook 36 swingably mounted on a pivot 37. The hook may be urged into its active position by means of an electromagnet 38. The hook 36 may return into its released position by the action of its own weight. The released position of the hook is limited by means of a projection 39 capable of engagement with a wall 51.

The operation of the device shown in Fig. 9 is as follows:

When the electromagnet 38 is not excited, the bell-crank 10 being moved in dependence on the action of the cam 34, transmits its movement to the shaft.

As soon as the electromagnet 38 is excited, the hook 36 is lifted. The profiles 40 and 54 of the hook 36 and of the projection 35 of the bell-crank 10 respectively are designed in such a way, that said projection 35 pushes the hook 36 away against the action of the electromagnet 38 during its movement from the right to the left (as viewed in Fig. 9). The cam 34 is of such a shape that it drives said projection 35 slightly beyond the hook 36, so that the latter may return into its elevated position under the action of the electromagnet 38 upon the passage of said projection 35. Thus, when the projection 35 starts to return, it comes into locking engagement with the hook 36 being now in its active position, whereby the projection 35 is held in the position 35' causing the shaft to be held in its low position.

During this time, the connecting rod 33 being held in engagement with the cam 34 by the spring 41 and being guided in a vertical plane by the sliding means 42, follows the movement of said cam 34. The shaft is held in its low position as long as the electromagnet 38 is excited.

When the electromagnet 38 is deenergized, the projection 35 of the bell-crank 10 remains in engagement with the hook 36 by the pressing action of the hook 36, so that the shaft is not immediately liberated. Only after the pushing head 32 of the connecting rod 33 comes into engagement with the recess 31 of the bell-crank 10, the bell-crank 10 with its projection 35 is displaced slightly beyond its locking position, whereupon the hook 36 may fall from its active position into its inactive position. Now, the connecting rod 33 being engaged with the bell-crank 10, controls again the movements of the latter and thus of the shaft.

Thus, the device according to the invention permits the control of the driving and stopping of a shaft by an opening or closing of an electric circuit.

It will be readily understood from above that the driving or the stopping of the shaft are caused effectively by the cam itself irrespective of the moment of energization of the electromagnet 38. Therefore, as the cam is suitably arranged with respect to the shuttles, the lifting or lowering of the shafts always takes place between the passage of two of said shuttles.

Thus, the device according to the invention has the advantage that it does not require a strict precision for the control of the circuit of the electromagnet, so that the device may be easily controlled and a proper operation thereof is assured.

These results are obtained in dobby motions used in ordinary looms by the elasticity of the hooks or by pawls combined with springs, but the control of such elements is always delicate and the operation of said elements is unsatisfactory. On the other hand the mechanical control of said elements can be readily carried out in an ordinary loom wherein said elements are in alignment, while such a control would lead to an inacceptable complication in a circular loom wherein said elements are distributed on a circumference. The device according to the invention permits the construction of a dobby operating perfectly and being adaptable to circular looms without complications.

Fig. 10 illustrates the drive of a group of four shafts as a matter of example. Each shaft is moved by its guide 8—1, 8—2, 8—3, 8—4 respectively and an associated bell-crank 10—1, 10—2, 10—3, 10—4, respectively. The various independent bell-cranks 10—1, 10—2, 10—3 and 10—4 are swingably mounted next to each other on a shaft 11. A hook 36—1, 36—2, 36—3, 36—4 respectively is associated with each bell-crank 10—1, 10—2, 10—3, 10—4 respectively. For the sake of simplicity, the various hooks 36—1, 36—2, 36—3 and 36—4 are swingably mounted next to each other on a pin 27, and each hook is controlled by an independent electromagnet 38—1, 38—2, 38—3, 38—4 respectively.

There is a single pushing element 32 for engagement with the recesses 31—1, 31—2, 31—3, 31—4 of all bell-cranks 10—1, 10—2, 10—3, 10—4 arranged for driving the shafts of the group. Said pushing element 32 is rigid with the connecting rod 33 guided by the sliding means 42 and the pair of rollers 17 and driven by the cam 34.

As certain shafts must ascend and certain other shafts must descend between each passage of shuttles, the pushing element 32 must move forwardly and backwardly, so that the cam 34 obtains the shape shown in Fig. 11 for a loom with four shuttles.

The shafts which must be lowered after the passage of a shuttle for the formation of the weave are locked in their low position by energization of the corresponding electromagnet 38—1, 38—2, 38—3, or 38—4 respectively, This energization of the electromagnet takes place prior to the permutation which precedes the passage of said shuttle.

The various elements driving a group of shafts may be united in a casing similar to the casing 26 shown in Fig. 6. Thus, the aggregate of the shaft drive of the loom comprises a series of casings arranged on a circumference as described above.

Thus, the energization of the various electromagnets may be carried out by means of an electromechanic rotating distributor wherein the conducting area of the rotor are arranged in such a way that the desired weave is obtained.

Furthermore it will be readily understood that a modification of the order of branching of the electromagnets pertaining to a group of shafts and a repetition of said modification in a part of the casings 26 permits to obtain certain effects in the cloth wherein the color shading and the drawing-in may participate likewise.

The levelling of the shafts may also be obtained by means of above described dobby without the addition of any element. Indeed, the various shafts are locked in their low position when all of the electromagnets are energized simultaneously. The locking, however, occurs in synchronism with the movement of the shuttles and between the passage of two consecutive shuttles, as described above. Thus, the levelling of the shafts may take place during the operation of the loom without damage to the mechanical elements or to the warp yarns. The levelling of the shafts may be carried out at will in dependence on a mechanical element, on the electromechanic distributor, or on the operator. Among other possibilities, it could also be carried out in dependence on the weft stop motion, in the same way as the motor of the loom is controlled by the weft stop motion, so as to free the shuttles and stop the loom for repairing the weft.

The levelling of the shafts could also be obtained by the direct driving device shown in Figs. 1–6, when a hook of the type of a hook 36 and an electromagnet of the type of the electromagnet 38 is associated with each bell-crank.

In the same way as described above in connection with the direct drive of the shafts for a plain weave it is also possible to modify the dobby shown in Fig. 10, without departing from the scope of the invention, by replacing the cam 34 by a cam with a groove receiving the roller 13 whereby the spring 41 is rendered superfluous.

We have described preferred embodiments of our invention, but it is understood that this disclosure is for the purpose of illustration and that various omissions or changes in shape, proportion and arrangement of parts, as well as the substitution of equivalent elements for those, herein shown and described, may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

For example, the electromagnetic device for controlling the shafts could be arranged at any suitable place of the transmission, for example on the shafts themselves.

Moreover, the application of the shaft drive according to the invention is not limited to circular looms with a horizontal shed; the shaft drive may also be applied to circular looms of a different type, for example circular looms with a vertical shed, or even to ordinary looms. Merely the shapes and the arrangements of the various elements of the shaft drive may be different in such different embodiments. For example the bell-crank 10 could be replaced by a suitable lever, or perhaps could be omitted, in a circular loom with a vertical shed.

When the shaft drive is used in an ordinary loom, of course the shape and arrangement of the cams and the elements of the transmission are necessarily adapted to the peculiar arrangement of such an ordinary loom.

What we claim is:

1. A loom, comprising in combination: at least one shaft, said shaft being reciprocable in a predetermined

direction, a cam rotatable about an axis parallel to the direction of reciprocation of said shaft, said cam having a throw effective in a direction perpendicular to the direction of reciprocation of said shaft, a transmission having a ratio larger than one and having no more than two articulations, said transmission being interposed between said cam and said shaft for effecting movements of the latter in coordination with said cam and subjecting said shaft to a stroke larger than the throw of said cam and a pin and slot coupling means coupling said transmission to said shaft to enable a straight line movement of said shaft.

2. A loom, comprising in combination: at least one shaft, a reciprocable guide carrying said shaft, a rockable double-armed lever, one arm of said double-armed lever being slidably and pivotally engaged with said guide, a rotatable cam, and means interposed between and engaged with said cam and the other arm of said double-armed lever.

3. A loom, comprising in combination: at least one shaft, a reciprocable guide carrying said shaft, a rockable double-armed lever, one arm of said double-armed lever being slidably and pivotally engaged with said guide, a reciprocable connecting rod, one end portion of said connecting rod being engaged with the other arm of said double-armed lever, a roller journalled at the other end portion of said connecting rod, and a rotatable cam operatively engaged with said roller.

4. In a loom as claimed in claim 3, said first mentioned end portion of said connecting rod being pivoted to said other arm of said double-armed lever.

5. In a loom as claimed in claim 3, pushing means on said first mentioned end portion of said connecting rod, said other arm of said double-armed lever having an abutting surface, and said pushing means being detachably engaged with said abutting surface.

6. In a loom as claimed in claim 3, pushing means on said first mentioned end portion of said connecting rod, said other arm of said double-armed lever having a recess, and said pushing means being detachably engaged with said recess.

7. In a loom as claimed in claim 3, the circumferential profiles of said roller and of said cam engaged with each other comprising arcs of identical circles.

8. In a loom as claimed in claim 2, said slidable and pivotal connection between said first mentioned arm of said double-armed lever and said guide including a roller mounted at one of said elements and guiding means engaged with said roller and arranged at the other element.

9. A circular loom, comprising in combination: at least one shaft, a vertically reciprocable guide carrying said shaft, a bell-crank lever rockable about a horizontal axis, one arm of said bell-crank lever being operatively engaged with said guide, a horizontally extending reciprocable connecting rod, one end portion of said connecting rod being engaged with the other arm of said bell-crank lever, engaging means arranged at the other end portion of said connecting rod, and a cam rotatable about a vertical axis, said cam being in engagement with said engaging means.

10. In a circular loom as claimed in claim 9, said cam being rotatable about the vertical axis of said loom.

11. A circular loom, comprising in combination: a number of reciprocable shafts arranged on a circumference at a predetermined radial distance from the axis of the loom, said shafts being reciprocable in a direction parallel to the axis of the loom, a cam rotatable about the axis of the loom, said cam having a throw effective in a direction perpendicular to the axis of the loom, and a number of transmissions equal to the number of reciprocable shafts, each transmission being associated with one of said shafts and being interposed between the associated shaft and said cam for effecting movements of the associated shaft in coordination with said cam.

12. A circular loom, comprising in combination: a number of first reciprocable shafts arranged on a first circumference at a predetemined first radial distance from the axis of the loom, and first shafts being reciprocable in a direction parallel to the axis of the loom, a first cam rotatable about the axis of the loom, said first cam having a throw effective in a direction perpendicular to the axis of the loom, a number of first transmissions equal to said number of first reciprocable shafts, each first transmission being associated with one of said first shafts and being interposed between the associated first shaft and said first cam for effecting movements of the associated first shaft in coordination with said first cam, a number of second reciprocable shafts arranged on a second circumference at a predetermined second radial distance from the axis of the loom, said second shafts being reciprocable in a direction parallel to the axis of the loom, a second cam rotatable about the axis of the loom, said second cam having a throw effective in a direction perpendicular to the axis of the loom, and a number of second transmissions equal to said number of second reciprocable shafts, each second transmission being associated with one of said second shafts and being interposed between the associated second shaft and said second cam for effecting movements of the associated second shaft in coordination with said second cam.

13. A loom comprising in combination: a frame, at least one group of a number of shafts, a number of guides corresponding to the number of shafts, each guide being connected with one of said shafts, at least one unitary body mounted on said frame, said guides being reciprocably arranged in said unitary body, rotatable cam means, and a number of transmissions equal to the number of shafts, each transmission being associated with one of said shafts and being interposed between the associated shaft and said cam means for effecting movements of the associated shaft in coordination with said cam means, and said transmissions being arranged in said unitary body.

14. In a loom as claimed in claim 13, said group of shafts comprising a first shaft and a second shaft arranged at different distances relative to the axis of the loom, and said cam means including a first cam and a second cam each being associated through one of said transmissions with said first shaft and said second shaft respectively.

15. A loom comprising in combination: at least one shaft, a reciprocable guide carrying said shaft, a rockable double-armed lever, one arm of said double-armed lever being operatively engaged with said guide, a reciprocable connecting element, pushing means arranged at one end of said connecting element, said pushing means being detachably engaged with the other arm of said double-armed lever, engaging means arranged at the other end of said connecting element, a rotatable cam, said cam being in engagement with said engaging means, resilient means arranged for urging said other arm of the double-armed lever into engagement with said pushing means, locking means movable into a releasing and a locking position, said locking means being arranged for holding the double-armed lever in an extreme position when said locking means is in its locking position, and actuating means associated with said locking means for urging same into at least one of its two positions.

16. In a loom as claimed in claim 15, said other arm of the double-armed lever having a recess, and said pushing means being detachably engaged with said recess.

17. In a loom as claimed in claim 15, said actuating means including an electrical actuating device.

18. In a loom as claimed in claim 15, said locking means including a hook capable of engagement with said double-armed lever when it is in its locking position.

19. In a loom as claimed in claim 15, said locking means including a rockable hook, said hook being ar-

ranged for dropping into its releasing position by the action of gravity, said actuating means including an electromagnet capable of urging said hook into its locking position upon energization, and said hook being capable of engagement with said double-armed lever when it is in its locking position.

20. In a loom as claimed in claim 15, said locking means including a rockable hook, said hook being arranged for dropping into its releasing position by the action of gravity, said actuating means including an electromagnet capable of urging said hook into its locking position upon energization, said double-armed lever passing beyond said hook during its movement into said extreme position and pushing said hook during such a passage temporarily out of its locking position against the action of the energized electromagnet, and said hook engaging and locking said double-armed lever upon its return from said extreme position during the energization of said electromagnet.

21. A loom comprising in combination: at least one group of a number of shafts, a number of reciprocable guides corresponding to the number of shafts, each guide carrying one of said shafts, a number of rockable double-armed levers equal to the number of guides, one arm of each double-armed lever being operatively engaged with one of said guides, a reciprocable connecting element, pushing means arranged at one end of said connecting element, said pushing means being detachably engaged with the other arms of all of said double-armed levers, engaging means arranged at the other end of said connecting element, a rotatable cam, said cam being in engagement with said engaging means, resilient means arranged for urging said other arms of said double-armed levers into engagement with said pushing means, a number of locking means equal to the number of double-armed levers, said locking means being movable into a releasing and a locking position, each of said locking means being arranged for holding the associated double-armed lever in an extreme position when said locking means is in its locking position, and a number of actuating means corresponding to the number of locking means, each actuating means being associated with one of said locking means for urging same into at least one of its two positions.

22. In a loom as claimed in claim 21, the shafts of said group of shafts being at different distances from the axis of said loom.

23. In a loom as claimed in claim 21, automatic controlling means associated with said number of actuating means for controlling same in a predetermined sequence.

24. In a loom as claimed in claim 21, each of said actuating means including an electrical actuating device.

25. In a loom as claimed in claim 21, each of said actuating means including an electrical actuating device, and an electrical distributor in circuit with said electrical actuating devices for controlling same in a predetermined sequence.

26. In a loom as claimed in claim 21, a frame, and at least one unit attached to said frame, each unit comprising said shafts of a group of shafts, the associated guides, the associated double-armed levers, the associated connecting element, the associated pushing means, the associated locking means and the associated actuating means.

References Cited in the file of this patent

UNITED STATES PATENTS

522,742	Schuler	July 10, 1894
1,139,073	Rhomoser	May 11, 1915
2,592,820	Moessinger	Apr. 15, 1952
2,725,080	Catry et al.	Nov. 29, 1955

FOREIGN PATENTS

615,739	Great Britain	Jan. 11, 1949