Lift mechanism for a heddle frame, particularly applicable to a heddle frame in a machine for making pile fabric. For controlling the heddle or harness frames of the loom adapted particularly for weaving pile fabric there is provided a dobbys having two pairs of conventional draw knives each pair mounted on a crosshead. Said crossheads are operated by a pair of bellcrank levers pivoted on a common axis with a first arm of each of said bellcranks pivoted to the middle of each crosshead. A first further bellcrank is pivoted to a fixed axis and a first arm thereof connected by a linkage to the second arm of one of the first pair of bellcranks. A second further bellcrank is pivoted to the second arm of said first further bellcrank and has its first arm connected by a linkage to the second arm of the other of said first pair of bellcranks. The output for said dobbys is applied to suitable means by the second arm of said second further bellcrank and is preferably adjustable toward and away from the pivot point thereof to provide adjustment for both its own operation and that of the first further bellcrank and the parts connected thereto.

8 Claims, 12 Drawing Figures
The invention relates to a heddle frame lift mechanism preferably for heddle frames for making pile fabric, said mechanism having two heddle frame lift units.

Pile fabric, like velvet, plush and fur imitations, are preferably woven with two foundation fabrics in two layers one above the other, whereby at the operating point of the batten of the weaving machine both basic fabrics form at first one single piece through the pile threads leading from one fabric to the other. The pile threads are thereafter separated by cutting approximately at half of their length, and two fabric webs with pile trimmings on one side of each thereof are created.

In weaving such fabrics a weaving machine is used which has two superposed devices for insertion of a pick each of which simultaneously insert one pick into an upper and a lower loom shed. The heddle frames used for the formation of these two loom sheds have heddles with two threads eyes into which the back warp threads are drawn. The heddle frame is operated in such a manner that each eye of a heddle moves only in the zone of its loom shed and is driven by a known simple dobby.

The thread warp of the heddle frames for making pile fabric runs also parallel to the back warp threads. Same are drawn into heddle frames which have heddles with only one thread eye. Such a heddle frame is driven so that the thread eye moves interchangably within each loom shed. Therefore the heddle frame must be able to assume at least three positions. To drive it, two lift units each comprising for example two hooks, a crosshead and a scutch blade which each engage the ends of a further crosshead are arranged in a dobby, through whose cooperation they operate in the manner of adding devices. If now both scutch blades produce equal amounts of lift and the third crosshead has equally long legs, the heddle frame is moved into three different positions which positions correspond to the planes which are identified with I,II,III and IV in the FIG. 2 to be described later. In order to manufacture certain fabrics, it is, however, necessary to direct the heddle frame into four different positions corresponding to the FIGS. 3 and 5 and the associated diagrams. In this known machine the two scutch blades which at onto one heddle frame receive thereby different lifts or the third crosshead is constructed with legs which are not equal. The distance of the warp thread layers with respect to the middle plane must be adjusted variably so that either the different lifts of the scutch blades or the leg lengths of the third crosshead must be made adjustably. Moreover, the entire lift of the heddle frame for pile fabric, namely, from the lowermost to the highest position must be constructed adjustably.

The arrangement of the third crosshead and the provision of such adjustable lift elements within the space available in the weaving machine has great disadvantages. Also it is difficult to construct the apparatus with sufficient rigidity due to the limiting small division of the heddle frames.

The purpose is to produce addition apparatus for the drive of a heddle frame for pile fabric with which, depending on the adjustment of one single easily accessible part, three or four heddle frame positions can be obtained and can be adjusted steplessly, whereby the operation does not require any special instructions or thought and in addition can be easily arranged in the usual limited space.

The heddle frame lift mechanism of the mentioned type is characterized according to the invention by a lever drive with a movable arm hinged to the first lift unit, which arm is constructed as a support point of a segment of a second lever drive, which second drive is operatively connected to the second lift unit, through which the two end positions of the first lever drive form two initial positions of the second lever drive and the control arm assumes four positions.

Preferably the two lever drives can be arranged in such a manner that the control arm which is engaged at the rear by the actuating mechanism of the heddle frame assumes in two of the four possible positions such a position that a point of intersection is obtained.

Various exemplary embodiments are schematically illustrated in the drawings, in which:

FIG. 1 is a side view in which the different positions of the warp threads which serve the known weaving of pile fabric can be seen, particularly in the case where the lower shed position of the heddle frames for the weaving of the pile thread into the upper foundation fabric lies in the same plane with the upper shed position of the heddle frames for the weaving of the pile thread into the lower foundation fabric, namely the heddle frames assume three different positions,

FIG. 2 illustrates the associated time-path diagram of the principle of the heddle frame movements for the shed formation,

FIG. 3 is the view of a weaving machine corresponding to FIG. 1, in which the lower shed position of the heddle frames for the upper foundation fabric is positioned higher than the upper shed position of the heddle frames for the lower foundation fabric, namely the heddle frames assume four different positions,

FIG. 4 is the associated time-path diagram,

FIG. 5 is the view of a weaving machine corresponding to FIG. 1, in which the lower shed position of the heddle frames for the upper foundation fabric is positioned lower than the upper shed position of the heddle frames for the lower foundation fabric, namely the heddle frames assume four positions,

FIG. 6 illustrates the associated time-path diagram,

FIG. 7 is an axonometric view of an inventive arrangement,

FIG. 8 illustrates a detail of the example according to FIG. 7,

FIG. 9 illustrates a second variation of construction of the subject matter of the invention,

FIG. 10 is a front view of a weaving machine corresponding to FIG. 1, in which the two sheds have different heights,

FIG. 11 is the associated time-path diagram and

FIG. 12 is a third variation of construction of the subject matter of the invention with which the weaving process according to FIGS. 10 and 11 is controlled.

The following description relates unless otherwise indicated to FIGS. 1,3,5 and 10 with the associated diagrams in FIGS. 2,4,6 and 11. FIG. 1 illustrates the known and FIGS. 3,5 and 10 the new method of operation for the manufacture of pile fabrics. Each of the figures illustrate a cross section with respect to the position of the weft threads, namely through the part of the weaving machine where the heddle frames and the batten are positioned. Only one thread each is illustrated for one position. Seen over the entire weaving machine,
each thread position has a plurality of threads. The plane M is provided between the two foundation fabrics 2 and 3 which are connected by the pile threads 1 and the two loom sheds 4 and 5 are threads symmetrically arranged with respect to said plane M.

FIG. 1 illustrates the case where the heddle frame positioned in the plane 6 can assume three different positions, namely the positions in which the pile thread controlled by said heddle frame is at 7, 8 or 9. The possible positions of the pile thread are identified by reference numerals 10, 11, 12, 13, 14 and 15 with thick lines. The picks inserted into the two loom shreds 4 and 5 are beaten by the batten (not illustrated) at point a which causes the two pile threads 17 and 20 to become the connection 1 between the two foundation fabrics 2 and 3. The pile threads which form the connection are separated continuously at the point b by a knife (not illustrated) so that from this point on one obtains two independent pile fabrics from the weaving machine.

The two back warp threads 22 and 23 (thin lines) move in the upper shed 4 between the two end positions 26 and 27 and the other two back warp threads 24 and 25 move in the lower shed 5 between the linking positions 28 and 29. The two back threads 26 and 28 are in the case of a calico weave pulled into the heddles of a heddle frame and the threads 27 and 29 into the heddles of another base heddle shaft. One of these base heddle shafts can move in the plane 30.

In FIG. 1 the pile threads 18 and 19 are positioned in the zone of the heddle frame plane 6 in the middle plane M. This can clearly be understood from FIG. 2 where the movement of the heddle frame for the shed 4 of the upper foundation fabric is illustrated in a conventional manner in the upper part with thick lines and the movement of the heddle frame for the shed 5 of the lower foundation fabric is illustrated in a conventional manner in the lower part. The heddle frame with the pile threads can now follow these thick diagram lines or their movement may also occur according to the thin lines. Points shown at 7, 8 and 9 or 1, II, III and IV are the possible positions of the eye of the heddle frame. A change from the lowermost position 1 into the uppermost position IV corresponds to the position 17 of the pile thread and serves to create the connection I. The reversal thereof results in the position 20 of the pile thread transferred from one foundation fabric 3 to another foundation fabric 2. Thus the pile thread moves either within the one loom shed 4 or 5 or from one loom shed to the other loom shed. As will be explained more in detail later on, in the first case only one of the two coupled lift units of a dobby will effect a driving of the heddle frame while the other lift unit remains stationary. In the second case two lift units operate simultaneously and in the same direction for each heddle frame, whereby both movements are combined and transferred in one single large movement to the heddle frame by the new addition apparatus.

FIGS. 3 and 5 illustrate how the heddle frame with its eye 8’ does not reach or extend beyond the middle plane M in order to satisfy the technical requirements of weaving. Differing from the diagram of FIG. 1, the diagram of FIGS. 4 and 6 illustrate each four different planes I, II, III, IV into which the eye of the heddle frame must be moved by the dobby controlling this heddle frame. Depending on the technical require-
from the base position through the drawing-out movement of a draw hook 32, while the crosshead 46 remains in the basic position. If, however, a draw hook 33 of the crosshead 46 would be drawn out and the crosshead 44 would remain in the basic position, the effect according to FIGS. 3 and 4 would be obtained through the rest position of the crosshead 44 the hinge point 41 is not moved. Thus one can obtain with two positions of the hinge point 41, which positions are opposite with respect to e, on the arm 48 the same heddle frame positions or, with the reversal of the sequence of the pattern card for the control of the draw hooks 32 and 33, it is possible at a fixed adjustment of the hinge point 41 outside of the point e to achieve a reversal of the effect of FIGS. 3, 4 into FIGS. 5, 6.

The arrangement illustrated in FIG. 7 serves for working according to FIGS. 3 and 4. However, all intermediate positions are also possible. All movements of both crossheads effect the heddle frame actuating device, partially also as a superposition. The lift unit 32, 34, 35, 36, 37 moves the fulcrum point 39 into two positions 39 and 39′. The lift unit 33, 46, 47, 35, 37 pivots the arm 48 for the angle α. This results in combination and addition in the four positions I, II, III and IV. From the foregoing discussion it can be seen that the two two-armed levers 36 and 37 and the hinge point 41 have an important purpose. FIG. 8 illustrates in detail one form of said parts. All of the same members are provided with the same reference numerals and the four positions, I, II, III and IV of the two-armed lever 37 are also illustrated. The slide 49 is slidely secured on the arm 48 so that it can be moved into the desired position by only a few manipulations. Slide 49 and 48 are arranged neatly and easily accessible so that even inexperienced personnel can also make the desired adjustment.

In the arrangement according to FIG. 9, the two rods 34 and 35 which are each driven by a known heddle frame unit are illustrated. The rod 34 is hinged to the two-armed lever 36a which is in this case elongated and pivotably mounted on the axis 38. The two-armed bent lever 37a is hinged pivotably to the second arm. The heddle frame actuating device 43 is secured in 41 to the one arm of said bent lever 37a and the second arm of said bent lever 37a is connected to the rod 35 through a connecting rod 50 and a further two-arm bent lever 51. The bent lever 51 is mounted pivotably to the axis 38.

The arm 48a is in turn moved into four different positions I, II, III and IV through the movements of the heddle frame units of the dobbi, which movements have already been discussed in connection with the embodiment of FIG. 7. These positions correspond depending on the position of the hinge point 41 to the desired three or four positions of the heddle frames according to FIGS. 1 to 6.

Insofar as it is desirable for meeting the particular circumstances of a given weaving operation, that the two loom sheds 4 and 5 are of different height, as this is shown in FIGS. 10 and 11 with the two sheds 4′ and 5′, a small change of the structure of the inventive control mechanism is sufficient to accomplish this as illustrated in FIG. 12. Compared with the exemplary embodiments illustrated so far, unchanged elements have the same reference numerals.

A variation of the drawing-out path of the draw hooks 32 and 33 is possible only through complicated changes in the drive path of a dobbi. Thus each movement is built on the movement of the rocking lever 45 and 47. The rod 34 is hinged in the described manner to the rocking lever 45 which is connected to the crosshead 44 and the two-arm lever 36 which is pivotable on the fixed axis 38 is hinged to said rod 34. The lever 36 carries on one arm the joint 39 for the two-arm lever 57 — which corresponding to the already described lever 37 is moved by the crosshead 46 — and on the arm 48 of which the heddle frame actuating device 43 engages at 41. The connection between the rocking lever 47 or the rod 55 hinged thereto and the two-arm lever 57 is accomplished by one arm of the lever 57 extending slidingsly through the eye 58 of the rod 55. The rod 55 itself is slidingly guided in the fixed bearing 56.

Due to the swivel motion of the support point 39 by a change of the position of the rocking lever 45 and thus the lever 36, the effective length between support point 39 and eye 58 of the horizontal part of the lever 57 is changed. Through this the movement of the rocking lever 47 effects, in the case that the support point is at 39, an adjustment of the size of angle β on the lever arm 48, and in the case that the support point is at 39′, an adjustment of the size of angle 6.

Since the horizontal arm of the lever 57 has an inclination already in its basic position and/or is bent in the zone of the eye 58, the sizes of the angles β and 6 can be influence, either by themselves or in relation to one another, through which the desired asymmetry of the loom sheds 4 and 5 can be selected.

I claim: 1. A heddle frame lift mechanism, comprising: heddle frame actuating means;

first and second input drive means;

first and second independently operated lever means for effecting a controlled movement of said heddle frame actuating means in response to an input from the respective one of said first and second input drive means, said first lever means including support means for pivotally supporting said first lever means for movement between first and second angularly spaced positions; first connecting means for pivotally connecting said second lever means to said first lever means for pivotal movement between third and fourth angularly spaced positions when said first lever means is in said first position and fifth and sixth angularly spaced positions when said first lever means is in said second position, said third, fourth, fifth and sixth positions causing said heddle frame actuating means to assume four different positions; and second connecting means for connecting said second lever means to said heddle frame actuating means, said second connecting means being a sliding connection joint whereby the point of connection between said second lever means and said heddle frame actuating means is adjustable.

2. A heddle frame lift mechanism according to claim 1, wherein said control arm means, when in too of said four positions at two spaced intervals of time, intersect at one location (f).

3. A heddle frame lift mechanism according to claim 1, wherein said second lever means comprises a two arm lever pivotally secured at the junction between said two arms by said first connecting means to said first lever means, one of said arms defining a control connected by said second connecting means to said
heddle frame actuating means, the other of said arms being connected to one of said first and second input drive means.

4. A heddle frame lift mechanism according to claim 3, wherein said first lever means comprises a two arm lever secured to said support means at the juncture between said two arms, one of said arms thereof on one side of said support means being connected by said first connecting means to said second lever means, the other of said arms on said first lever means on the other side of said support means being connected to the other of said first and second input drive means.

5. A heddle frame lift mechanism according to claim 4, wherein said other of said input drive means comprises a two arm operating lever pivotally secured at the juncture between said two arms to a second support means, one of said arms of said operating lever being connected through a linkage member to said other arm of said first lever means.

6. A heddle frame lift mechanism according to claim 5, wherein said linkage member includes means defining an eye therein, said other arm of said second lever means being slidably received in said eye.

7. A heddle frame lift mechanism according to claim 3, wherein said two arms of said second lever means define an angle; and wherein said one of said first and second input drive means comprises a two arm operating lever pivotally secured at the juncture between said two arms to a second support means, one of said arms of said operating lever being connected through a link- age member to said other arm of said second lever means.

8. A heddle frame lift mechanism according to claim 7, wherein the pivot axis of said second support means is coaxial with the pivot axis of said first-mentioned support means.

* * * * *
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3 759 298

Dated September 18, 1973

Inventor(s) Werner Kaufmann

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 38; delete "the" and insert ---a---.

lines 49 to 51; delete ", said third, fourth,
fifth and sixth positions causing said heddle
frame actuating means to assume four different positions"

line 57; after "adjustable" insert ---, said third,
fourth, fifth and sixth positions of said second
lever means causing said heddle frame actuating
means to assume four different positions ---.

line 59; delete "control arm" and insert ---

second lever ---.

line 67; after "control" insert ---arm---.

Column 8, line 12; change "link-age" to ---linkage---.

Signed and sealed this 9th day of April 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

G. MARSHALL DANN
Commissioner of Patents