of the governing cycle oscillating mechanism and of the lifting cycle mechanism should be phased to one another about the angle $\alpha$, as will be explained later.

It will be appreciated that FIGURES 3 and 4 are purely diagrammatic or symbolic, and consequently the members bear little resemblance to the actual parts of a Jacquard mechanism, but these two figures are intended to illustrate the relationship of the governing cycle to the lifting cycle.

In FIGURES 3 and 4, 10 is a Jacquard hook, 11 is a griffe, 12 represents the presser frame, and the circle 13 represents one cycle, the arrow indicating the direction of operation. In FIGURE 3, the elements of the two mechanisms are shown at the moment of maximum deflection of the hooks 10, that is, when the hooks are "on press." If the hook 10 is not to be raised by the griffe 11 it must remain deflected by the presser frame, through the needle 14 when the griffe 11 passes the hub 15 of the hook 10 on its upward movement.

If the mechanism of FIGURE 3 was to run backwards, i.e., in the opposite direction to the arrow, as is necessary, for example, in left-seeking arrangements or reverse weaving, then it will be seen that after the griffe 11 passes through the lower dead point, the hook 10 would not be on press and pattern formation would not be possible. Therefore, when running in reverse, the governing cycle must be phased at double the angle $\alpha$ relatively to the lifting cycle, as shown in FIGURE 4.

Taking FIGURE 3, the vertical axis must be regarded as a datum line, and by reference to FIGURE 2, it is evident that the griffe is at its lowest point at the bottom of this datum. So long as the Jacquard is weaving forwards, the needles must be "on press" during angle $\alpha$ as shown in FIGURE 3 so that a proper selection occurs. When the Jacquard is weaving backwards griffe is moving down (towards the datum) through $\alpha$ as seen in FIGURE 3 and if the needles were "on press" during this period there would be no useful result. When going backwards, the needles must be on press through the angle $\alpha$ as seen in FIGURE 4 (i.e., on the opposite side of the datum) if a selection is to occur as the griffe is beginning to rise.

Assuming that a weft breakage has occurred, then, as previously mentioned, the loom will be stopped shortly before shed closure, and the pattern card for the said shed has already been replaced by the pattern card for the next succeeding shed. The loom must now be turned backwards one pick at a time and the correct pattern card brought into operative position for each shed to be formed. This must be done according to the following procedure, in which the letters denote the pattern cards to be positioned, and the numbers denote the sheds.

Weaving backwards: $a, b, c, d, e, f, g, h$
Thence forwards again: $g, f, e, d, c, b, a$

The cards are the usual Jacquard pattern cards and the identification letters are conventional in the industry. The above sequence is correct and during reverse weaving the first three cards $a, b$ and $c$ are positioned to be presented by the action of the pegs 27, 28 and 29 during one cycle of the operating mechanism, and then each of the cards $d, e, f$ and $g$ are presented in ascending order, one during each cycle. When forward weaving re-commences, cards $g, f$ and $e$ are all positioned during one cycle and cards $d, c, b, a$ and each have one cycle. The whole process of reverse weaving followed by forward weaving is necessary to "find the pick" after a stoppage.

The necessity for the above sequence can be explained as follows:

It is assumed that the pattern is so arranged that in ordinary forward weaving the cards are positioned to be presented to the needles or dropper wires in the sequence $g, f, e, d, c, b, a$. Supposing that the loom is stopped
to remove web b, but the weaver finds it necessary to remove also webs c, d, e, and f, before weaving can commence. The loom stops on pick b and will come to rest just before front center, with the griffes on their downward movement, but the griffes will still be in engagement with the hooks according to the pattern of card b. However, before the loom stops, the pattern card mechanism will have switched card a into the reading position.

The weaver then turns the loom backwards to the rear of the shed, and the front of the shed is fully open. This must be so regardless of the position of the front of the shed. However, the rear of the shed is fully open. This position is where the shed is fully open. The weaver then removes the faulty web b, and continues to wind the loom backwards. Before the griffes again ascend (or the continued backward rotation of the loom crankshaft!) the pattern card c must be brought into the reading position and pattern impressed on the hooks, because it is web c which has to be removed next. But as has been mentioned, at the commencement of winding back, card a was in the reading position, so it is necessary to operate the card mechanism twice in the one shed, to bring first card b and then card c into the reading position. Hence cards a, b, and c are all positioned to be presented in the first shed. Thereafter, one card is presented for each shed in the usual manner (but in the reverse sequence).

When the weaver has removed sufficient web threads, and is about to start weaving forwards, the reverse action takes place. That is to say, it will be necessary to operate the card mechanism to switch the cards twice in a forwards direction during the first shed forwards after the loom has stopped.

Connection g is necessary in synchronised running of the governing and lifting cycles because of the position of the striking nose of the loom.

The reverse running of the loom can be carried out manually or by power drive with the weaver counting off the correct pattern cards.

In mechanical or automatic backward weaving, the correct adjustment of the phasing of the governing cycle and the lifting cycle according to FIGURE 4 must be made as well as the correct placing of the pattern card sequence.

The present invention makes provision for automatic and simultaneous correction of phasing of the governing cycle to the lifting cycle when the pattern card is in web seeking or reverse weaving, and has a so-called card storing arrangement whereby the correct placing of the pattern card sequence is provided at the beginning of reverse weaving as well as at the beginning of subsequent forward weaving.

The mechanism for this purpose is shown in FIGURES 5 and 6, in which 21 is the main shaft of the Jacquard machine, and a hollow shaft 22 on the main shaft rotates with the main shaft but is moved axially in the directions indicated by the arrows 23 and 24 of FIGURE 6 according to whether the shaft is rotating forwardly during normal forward weaving, or reversely for reverse weaving. Incorporation of the mechanism of FIGURE 5 into a conventional Jacquard machine is disclosed in my co-pending application Serial No. 36,590, the reference to which is hereby made for further details.

The mechanism for displacing the hollow shaft 22 axially is not illustrated but it is connected to the reverse running mechanism and may be of any convenient construction.

When using the arrangement described above, there is no necessity for watching the correct operation of the governing cycle when web seeking or reverse weaving.

When using the arrangement described above, there is no necessity for watching the correct operation of the governing cycle when web seeking or reverse weaving. The counting of the pattern card sequence by the weaver is eliminated, and the loom is consequently easier to operate. Furthermore, this solution of an automatic reverse engagement mechanism is compact, thus saving space and materials.

As stated above, any convenient mechanism, either mechanical or electrical may be employed for moving the hollow shaft 22 axially. For example, an electro-magnet may be provided for this purpose, contacts in a circuit for energising the electro-magnet being incorporated in a circuit with the reverse weaving mechanism whereby the said contacts will be operative only during reverse weaving.

I claim:

1. In a Jacquard weaving machine, a rotateable drive shaft, a movably mounted Jacquard hook, a Jacquard pattern feeding mechanism having a rotateable star wheel input, means axially shiftably mounted relatively to and connected for rotation with said main shaft mounting three pins for selective engagement with said star wheel, said means also mounting a pair of cams in angularly displaced relation for rotation said with said main shaft and for axial movement with said pins, and means operatively corresponding to said cams for engagement with said pins in said star wheel.

2. In a Jacquard weaving machine defined in claim 1,
a hollow shaft surrounding said main shaft and on which said pins and cams all being mounted in fixed relative position.

3. In the Jacquard weaving machine defined in claim 1, one of said cams being wider axially than the other so as to have operative association with said hook control means when either or both of two of said pins has operative engagement with said star wheel.

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