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Keim

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[54] REVERSIBLE JACQUARD LOOM AND REVERSING MECHANISM THEREFOR

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[30] **Foreign Application Priority Data**

June 26, 1970 Germany.....P 20 31 807.4

[52] **U.S. Cl.**.....**139/1 E,** 139/324, 139/329, 74/812

[51] **Int. Cl.**.....**D03c 3/32**

[58] **Field of Search**.....78/126, 812; 139/1 E, 324, 328, 329

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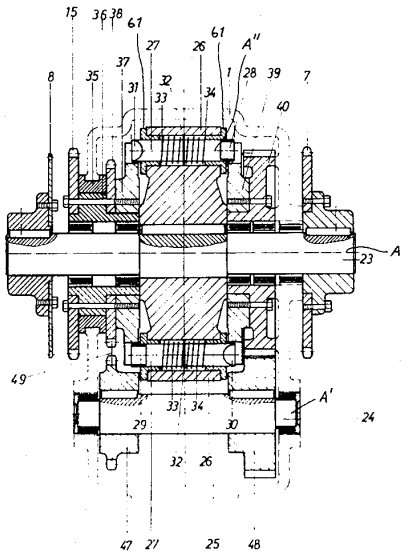
[57] **ABSTRACT**

A jacquard loom has a reversing mechanism which, on reversal of the loom drive in case of weft failure, causes the blades controlling the heddle-control rods to orbit backwardly (reverse sense) only until the loom is again in the open-shed or closed-shed position, whereupon the blades are caused to orbit forwardly (forward sense). This apparatus has a single input connected directly with the drive and a pair of outputs, one of which is rigidly (no slip) connected to the input and is operatively connected to the card-reading device and the other of which controls the control-rod blades. The input shaft carries, in addition to the input sprocket and first-output sprocket, a rotatable element flanked by a pair of disks and defining a unidirectional lost-motion indexing clutch therewith. A pair of pins passing through the rotatable element can engage with their ends in either of the flanking disks which are themselves positively coupled (no slip or phase shift) together to rotate in opposite senses. Each disk is formed with notches having one straight and one inclined flank (or only the pins may have such flanks) and these notches only line up in the open-shed and closed-shed positions of the loom, or in at least one of these positions, so that the pins can only slide to change second-output rotation sense when the loom is in either of these positions.

10 Claims, 8 Drawing Figures



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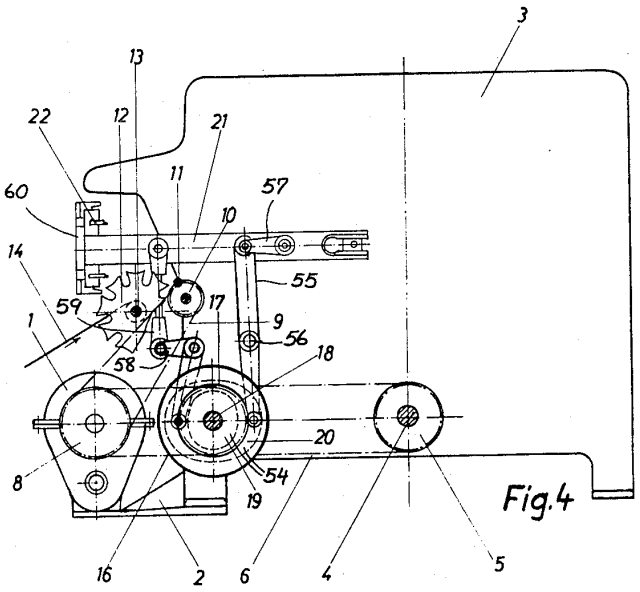

Fig.4

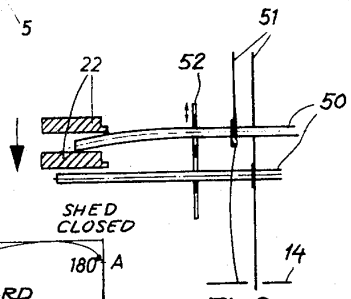

Fig.3

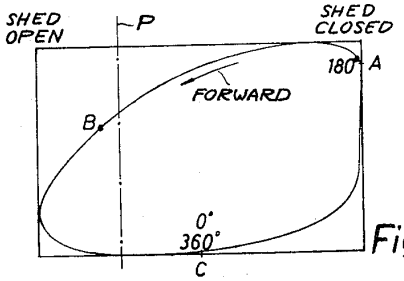

Fig.1

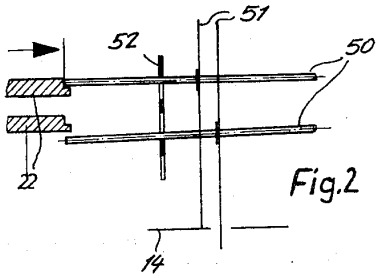

Fig.2

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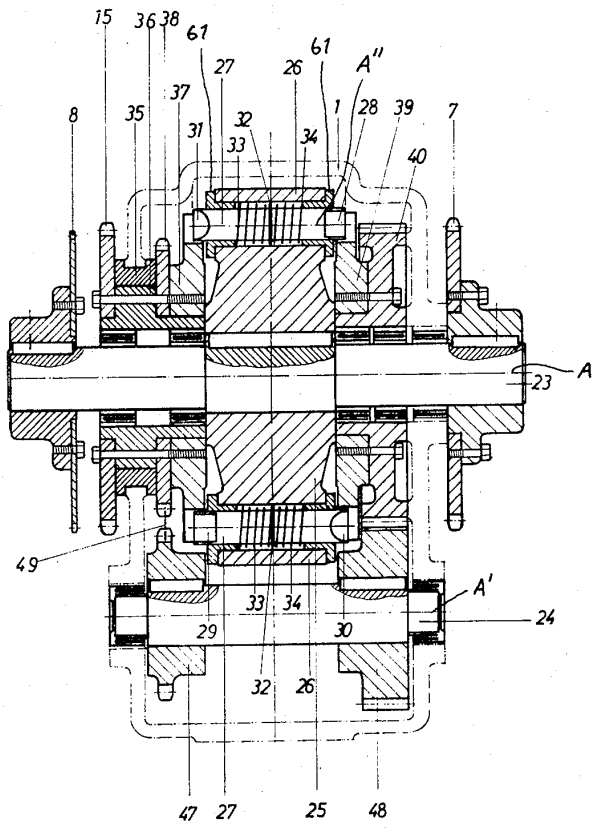

Fig.5

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Fig.7

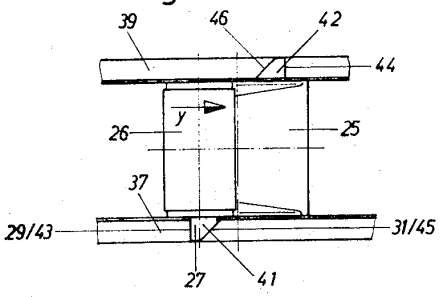
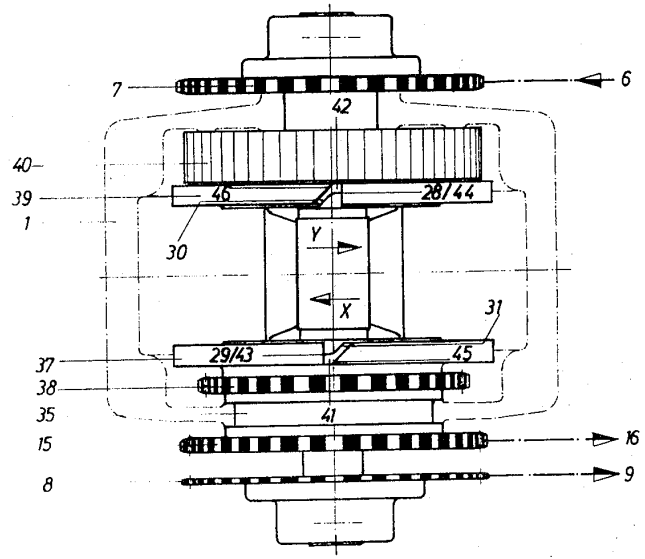


Fig.6



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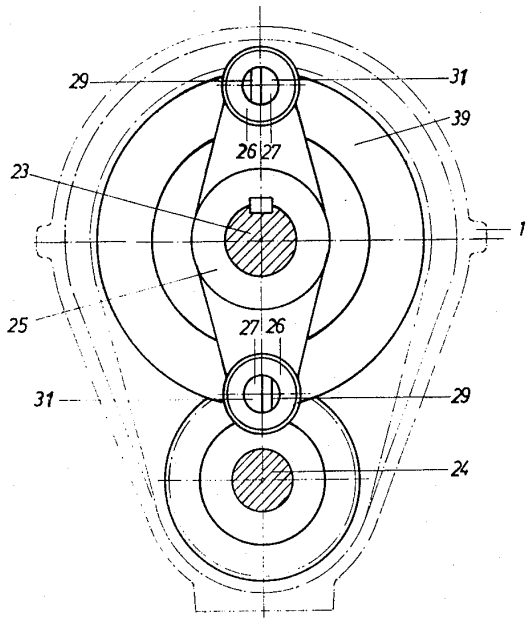

Fig. 8

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REVERSIBLE JACQUARD LOOM AND REVERSING MECHANISM THEREFOR

FIELD OF THE INVENTION

The present invention relates to a jacquard loom. More specifically this invention concerns a reversing mechanism permitting such a loom to be run backwards as is necessary when the weft or filler yarn is broken or otherwise lost.

BACKGROUND OF THE INVENTION

A jacquard loom has associated with each of its heddles a control rod which in turn is connectable through a linkage to a so-called drop needle that can pass through a hole in a program card. A succession of cards each having a particular pattern are fed by a reading device underneath the group of drop needles to set these control rods. Depending on which needles drop through holes in the card the shed is opened differently so that a pattern is produced by the weft thread. An endless belt of such cards is often used for recurrent patterns which can repeat every few centimeters or every few meters.

Such double-lift or double-stroke open-shed jacquard machines require that the pressure be maintained on the needles that control the hooks or sinkers until the two oppositely moving griff boxes have crossed in order that hooks engaged on the descending blade are not caught by the ascending blade. In prior-art looms this pressure is produced directly by the cylinder or prism which must remain stationary a correspondingly long period of time.

In other systems the position of the drop needles determines whether or not a pressure member can engage control rods passing through eyes formed in these needles. If the needle drops through a hole, for instance, the corresponding control rod drops so that it is moved out of the path of the pressure member or knife and will not be actuated thereby. In such systems it is possible to retract the drop needles once the pressure knife or blade is engaged against the control rods. The cards can be advanced during this time so that rapid operation of the loom is possible. In such a system the pressure member moves in a closed generally elliptical path to first engage the control rods whose needles have dropped through holes, then lift them to free the cards while simultaneously applying pressure to them and therethrough to the individual heddles, and finally to drop them back while retracting to allow the drop needles to take a new setting. Such a system has been adopted widely since it allows a maximum amount of time for card advance.

A common difficulty encountered with such jacquard machines is that the weft or filler thread occasionally breaks, necessitating reversal of the loom to take up at the point where the weft was lost. With customary looms this merely requires that the drive for the taking-up and letting-off beams be reversed. In a jacquard loom, however, the operation is not so simple since in addition to the above, the program-card belt must be reversed also so that the pattern recommences where it left off. What is more, the elliptical path of the pressure members is such that they cannot be reversed from certain portions of their path without catching on and damaging some control rods and/or drop needles. It is thus necessary to stop the device at just the right part

of the cycle and then decouple the pressure member from the drive.

OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide an improved jacquard machine of the above-described general type.

Another object is the provision of an improved reversing apparatus which allows such a jacquard loom to be reversed with ease and without damage to its parts.

SUMMARY OF THE INVENTION

The above objects are attained according to the present invention by a jacquard machine having reversing means which causes the various conventional elements (e.g. take-up beam, let-off beam, card reader) to be reserved while it it continues to displace the pressure members in their forward direction. Such an arrangement is only truly useful when the reversal is done just at the time when the loom is in the open-shed or close-shed position, otherwise the two portions of the device of the machine will get out of phase with each other. To this end the device according to the present invention also includes lost-motion means effective on reversal of the drive to first back up the pressure member, in the reverse direction in its orbit, until the machine is in the open- or closed-shed position, then to advance it forwardly. This slight amount of reverse travel of the pressure member is possible without damaging the device, with the subsequent forward travel is in phase with the rest of the device. The following switchover to forward direction, after finding and restarting the weft again, works the same way so that no overall phase shift is effected.

The reversing and lost-motion means comprise according to features of the present invention a pair of disks flanking a rotatable element in which is mounted a pair of axially slidable pins. The disks are each formed with a pair of notches having one straight flank and one inclined flank that mate with similarly formed ends of the pins in such a manner that each of the disks can be coupled to the central rotating member in one direction of rotation thereof only, in the other rotational sense the pin is cammed back through the rotating element into the corresponding notch. However, the notches and pins only line up in the open-shed and closed-shed positions of the loom so that the pressure member is reversed on reversal of the drive until it backs up to the previous open- or closed-shed loom position whereupon it is driven forwardly.

DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become apparent from the following description, reference being made to the accompanying drawing in which:

FIG. **1** is a diagram indicating the path of the pressure knife;

FIGS. **2** and **3** show various positions of the knife and control rods illustrating principles of the present invention;

FIG. **4** is a partly diagrammatic elevational view showing the jacquard machine according to the present invention;

FIG. **5** is an axial section through the reversing apparatus according to this invention;

FIG. 6 is a top view of the apparatus shown in FIG. 5;

FIG. 7 is a detail view of a portion of the reversing apparatus, shown in a position different from that of FIGS. 5 and 6; and

FIG. 8 is a cross-section through the apparatus of FIG. 5.

SPECIFIC DESCRIPTION

The chart of FIG. 1 shows the path a pressure member or knife 22 traces in a horizontal plane. The member 22 follows the path in a counter-clockwise direction with the right-hand end of the path corresponding to the closed-shed position of the loom and the left-hand end to the open-shed position. To the right of line P the knives 22 are engaged on control rods 50, and to the left of this line these knives do not engage the rods (see Swiss Patent No. 44,204).

In FIGS. 2 and 3 the control rods 50 are arranged in two levels, passing through eyes formed in drop needles 51 adapted to engage cards 14, with some of the needles passing through holes in these cards. A perforated plate 52 is vertically reciprocal in time with the motion of the knives 22 and of the loom 3, as the cards 14 are advanced the plate 52 is lifted to clear the old card. This lifting must only be done when the knives are in the portion of their path to the left of line P.

FIG. 2 shows how the knives are shifted to the right to engage the ends of the rods 50. Thus, in prior-art devices when the knives 22 are displaced from point A (closed web) to point B to the left of the line P, the reading is canceled, with the rods 50 out of contact with the knives 22. Should the weft thread break at this point B, or the machine have to be reversed for other reasons, a condition as shown in FIG. 3 will be produced, which clearly damages the control rods and needles. Just this condition is avoided by the present invention.

The loom 3 shown in FIG. 4 is provided with a reversing apparatus 1 connected to the loom frame at 2. A reversible drive 4 is provided which can be the loom drive or a separate drive motor for the card advance and heddle control. This drive 4 carries a sprocket wheel 5 connected via a chain 6 to a sprocket wheel 7 (see FIGS. 5 and 6) serving as the input of the reversing apparatus 1. A pair of output sprockets 8 and 15 are provided on the opposite side of the apparatus 2. Sprocket 8 is connected via a chain 9 to a sprocket wheel 10 also carrying an indexing rod 11 engageable with a Geneva wheel 12 pivoted at 13 and serving for a stepwise advance of the endless belt of cards 14. In time with this advance of the cards 14 the sprocket 15 drives a sprocket wheel 17 by means of a chain 16. The wheel 17 is mounted on a shaft 18 also carrying a pair of cams 19 and 20 each formed with an endless camming groove, both generally elliptical with their major axes mutually orthogonal. A two-arm lever 55 has one end provided with a follower riding in the larger cam disk 20 and is pivoted at 56. Its other end is connected via a short link 57 to a generally horizontal beam 21 carrying a traverse 60 on which the knives 22 are mounted. It should be clear that such a pair of cams is provided to each side of the machine 3, with the shaft 18 interconnecting them. Another lever 58 similarly pivoted on the machine 3 has one arm connected to the inner cam 19 and another arm end connected via a link 59 to a slider 21. Since the lever 55 is generally straight it serves to impart the horizontal component of movement to the element 21, while the arms of the lever 58 are at an angle of around 80° to each other so that this lever imparts the vertical component. Thus, as the cams 19 and 20 rotate the knives 22 will be displaced around the path shown in FIG. 1.

FIGS. 5 and 6 show how the two sprockets 7 and 8 are keyed to a shaft 23 mounted via bearings in the housing of the apparatus 1. Thus, the sprocket 10 carrying the indexing element 11 will always rotate in the same sense as the drive 4 since the two are positively linked. As also shown in FIGS. 7 and 8 the shaft 23 is keyed to an elongated element 25 having a pair of ends 26. Flanking this body 25 are a pair of disks 37 and 39 rotatable by means of roller bearings on the shaft 23. The disk 37 is connected via an intermediate annulus 36 to the sprocket wheel 15, and is rotatably fixed thereto. The housing 1 is journaled on the annulus 36 by means of a ring 35. Clamped between the disk 37 and the body 36 is a sprocket wheel 38 connected via a chain 49 to a sprocket wheel 47 keyed to a shaft 24 rotatable in the housing 1 about an axis A′ to the axis A of the shaft 23. The shaft 24 carries on its other end a pinion 48 meshing with a gear wheel 40 rotatable on the shaft 23 and rotationally fixed to the disk 39. It should be clear that the two disks 37 and 39 will either stand still together or rotate in opposite directions. The various wheels and gears are so dimensioned that they turn in opposite directions at the same rotational speed.

Received in each head 26 is a pin 27 having an axis A″ parallel to the axes A and A′. A pair of washers 61 with cylindrically extending portions receive the pin 27 and compress a pair of springs 33 and 34 against a central shoulder 32 formed on this pin to urge it into the central position shown in FIG. 5 with each end projecting slightly from the face of the element 25. The pin 27 is formed at its ends with coupling faces 28 and 29 and with camming faces 30 and 31, with the shape of the pins 27 preventing them from turning in the heads 26 and the coupling face on one end facing in the opposite direction as the one of the other end.

The disks 37 and 39 are formed with respective peripheral inwardly directed notches 41 and 42 each with one straight coupling face 43, 44 and one inclined camming face 43, 44, respectively. The notches 41 and 42 correspond to the ends of the pins 27, with these latter snugly receivable in the former. The two notches 41 and 42 on each disk line up with the respective pin 27 only in the open-shed and closed-shed positions of the machine. It should be clear that on rotation of the number 25 in one sense the coupling flanks which face forward relative to that sense will come into engagement with similar flanks of the corresponding grooves, while the forwardly directed camming faces on the opposite ends, once again relative to the rotational sense, will only serve to cam the pins 27 axially and force them further home in the opposite grooves, thereby making for positive axial coupling between the arm 25 and only one of the disks 37 and 39.

The apparatus operates as follows:

Under normal weaving conditions the shaft is rotated counterclockwise as shown by the arrows in FIG. 4. This rotates the wheels 7, 8, and 10 also in the counterclockwise direction as shown by the arrow X of FIG. 6. In this rotational sense the coupling flanks 29 of the pins 27 are the forward facing coupling flanks so that the element 25, which is also rotated in the direction X,

will be rotationally engaged with the disk **37.** Since the only force tending to move the pins **27** to the right is that of the springs **33** and **34** and this force is insufficient to overcome the friction between the coupling flanks of the interlocked notches and pins, the pins **27** stay engaged in the wheel **37.** Even should the pins start to slip to the right (as seen in FIG. **5**) all that will happen is that at the moment when the notches register across the pin in the open-shed and closed-shed loom positions, the camming faces of the notches in the other disk will strike the opposite camming flanks and drive the pins back to the left. Thus, counterclockwise rotation of the drive will result in counterclockwise rotation of the cam **18** and counterclockwise orbiting of the knives **22** for forward, conventional weaving,

Should the weft yarn break or a new thread have to be inserted, the drive **4** is reversed (direction Y) and the card-advancing wheel **12** is also automatically and immediately reversed. Two conditions can be present in the reversing device **1** on reversal of the drive. If the loom is in the open-shed or closed-shed position the notches and pins **27** will be in line so that a change of rotational sense from Y to X will cause the camming flanks **31** to bear against the corresponding camming flanks **45** of the corresponding notches in the wheel **37** and will immediately drive the pins across into the opposite notches **42.** With the pins **27** engaged in the notches **42** the sprocket **15** will continue to rotate in the counterclockwise direction to drive the knives **22** forwardly. Thus, although the card advancing means **12, 13** is driven backwards to be able to start up weaving where the weft was lost, the knives continue to orbit in the forward direction so that they cannot jam against the rods **50** and damage them.

If, on the contrary, the drive **4** is reversed when the loom is not in the open- or closed-shed position so that the notches **41** and **42** are not in alignment the pins **27** cannot simply be shot across to immediately uncouple the element **25** from the one disk **37** and to the other disk **39.** In this case the element **25** will continue to entrain the disk **37** even though the two camming surfaces **31** and **45** are in engagement and are urging the ends of the pins **27** out of the notches **41.** The pins **27** will simply rub against the opposite disk **39** until the notches line up and the element can be coupled to the disk **39,** thereby rotating the sprocket **15** in the opposite (forward) direction. Clearly this means that on reversal of the loom when it is not in either the open-shed or closed-shed position the knives **22** will be driven backwardly until one of these positions is attained, and then forwardly. This backtracking in conjunction with the subsequent catching up insures that the correct phase relationship is maintained between the displacement of the griff-box knives and the open- and closed-shed positions of the loom.

This clockwise travel of the knives **22** about their path can only lead to damage of the loom when nearly a complete cycle is passed, or as seen in FIGS. **1–3** when they are reversed through the closed-shed position of the loom. Thus, it is important that prior to reversal through this closed-shed position the knives be orbited in the forward direction again.

Of course, it should be obvious that after restarting the weft and reversing the drive motor back to the forward direction the reversing apparatus will function in the same manner to once again start the whole loom running in the forward direction.

I claim:

1. A reversing apparatus for the heddle-control members of a double-stroke open-shed jacquard machine, said apparatus comprising:

an element rotatable about an axis by the drive of said machine;

a pair of disks flanking said element and rotatable about said axis, each of said disks being formed with at least one notch directed toward said element, said disks being coupled to said heddle-control members;

at least one pin received in said element offset from said axis, said pin having a pair of ends each formed with a coupling flank and a camming flank, said camming flanks facing in opposite directions, said pin being axially slidable in said element between a position with one of said ends engaged in one of said notches and a position with the other of said ends engaged in the other of said notches, said pin being of an axial length greater than the spacing between said disks; and

means pivotally coupling said disks to each other for rotation of said disks in opposite senses with said notches and said pin in alignment only in one of the open-shed and closed-shed positions of said machine.

2. The apparatus defined in claim **1** wherein said machine has a card-reading device operable in a forward and a reverse direction, said element being positively coupled to said card-reading device.

3. The apparatus defined in claim **2** wherein said members are coupled to said disks and are rotatable in forward and reverse directions around a closed path.

4. The apparatus defined in claim **3** wherein said means includes a rotatable body, a chain drive connecting said body at one side of said disks, and a gear drive connecting said body at its other side to the other of said disks.

5. The apparatus defined in claim **3,** further comprising spring means for urging said pin into a position with both ends projecting from said element.

6. The apparatus defined in claim **5** wherein said element is elongated and extends transverse to said axis.

7. The apparatus defined in claim **6** wherein said element has one such pin at each of its ends, each of said disks being formed with two such notches.

8. A jacquard machine periodically displaceable between an open-shed position and a closed-shed position and comprising:

a reversible drive;

a plurality of heddle control members;

a plurality of elements engageable with said members and displaceable in a forward sense and in a reverse sense around a continuous closed path;

means associated with said rods for advancing a succession of program cards through a reading station in a forward and a reverse direction;

reversing means having an input connected to said drive and a first output connected to the card-advancing means for operating same in said forward direction on forward operation of said drive and in said reverse direction on reverse operation of said drive, and a second output connected to said elements for forward displacement of same on forward operation of said drive; and

lost-motion means for displacing said elements in said forward sense on reverse operation of said

drive only after displacement of said machine into one of said positions, and for displacing said elements in said reverse sense on reverse operation of said drive and only prior to displacement of said machine into one of said positions.

9. The machine defined in claim **8** wherein said reversing means includes a body connected to said drive and rotatable thereby about an axis, said body being operatively connected to said drive and to said card-advancing means, said reversing means including:

a pair of disks flanking said body and each formed with at least one notch directed toward said body, said disks being coupled to said elements;

at least one pin received in said body offset from said axis, said pin having a pair of ends each formed with a coupling flank and a camming flank, said camming flanks facing in opposite directions, said pin being axially slidable in said body between a position with one of said ends engaged in one of said notches and a position with the other of said ends engaged in the other of said notches; and

means positively coupling said disks to each other for rotation of said disks in opposite senses with said notches and said pin in alignment only in said open-shed and closed-shed positions of said machine.

10. The machine defined in claim **9** wherein said means coupling said disks includes a rotatable connecting member, a chain drive connected between one side of said connecting member and one of said disks, and a gear drive between the other side of said connecting member and the other of said disks.

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