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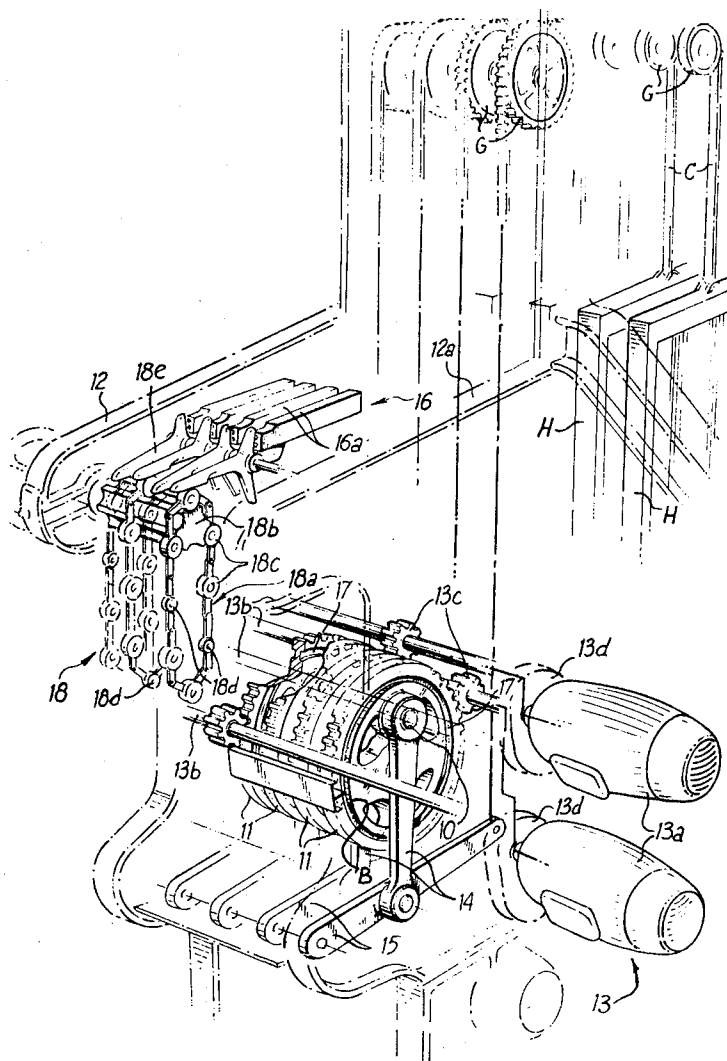
[54] **DOBBIES**  
**10 Claims, 4 Drawing Figs.**

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**139/337**

[51] Int. Cl..... **D03c 1/00,**  
**D03d 51/20**

[50] Field of Search..... **139/66-**  
**-78, 55, 336, 337, 327**

**ABSTRACT:** The present invention concerns a loom dobbie with a multiplicity of jack levers operating healds or shuttle drop boxes, each lever being moved back and forth by its own electric motor and a crank mechanism, and there is electrical control means to stop the jack levers automatically in positions for the insertion of weft picks in accordance with a preselected pattern to be produced on the finished fabric.





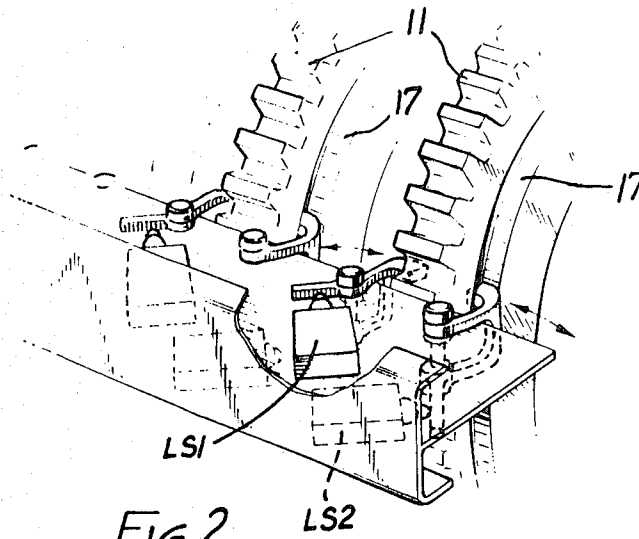


FIG. 2.

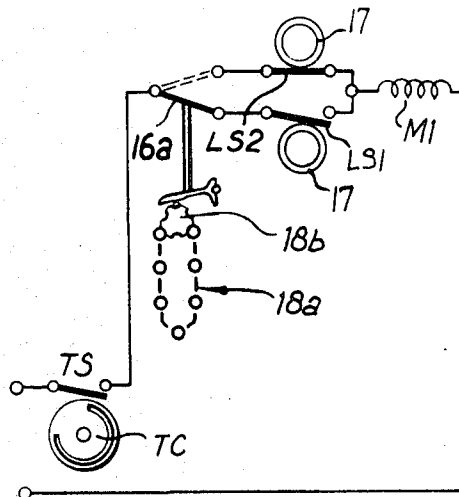


FIG. 3.

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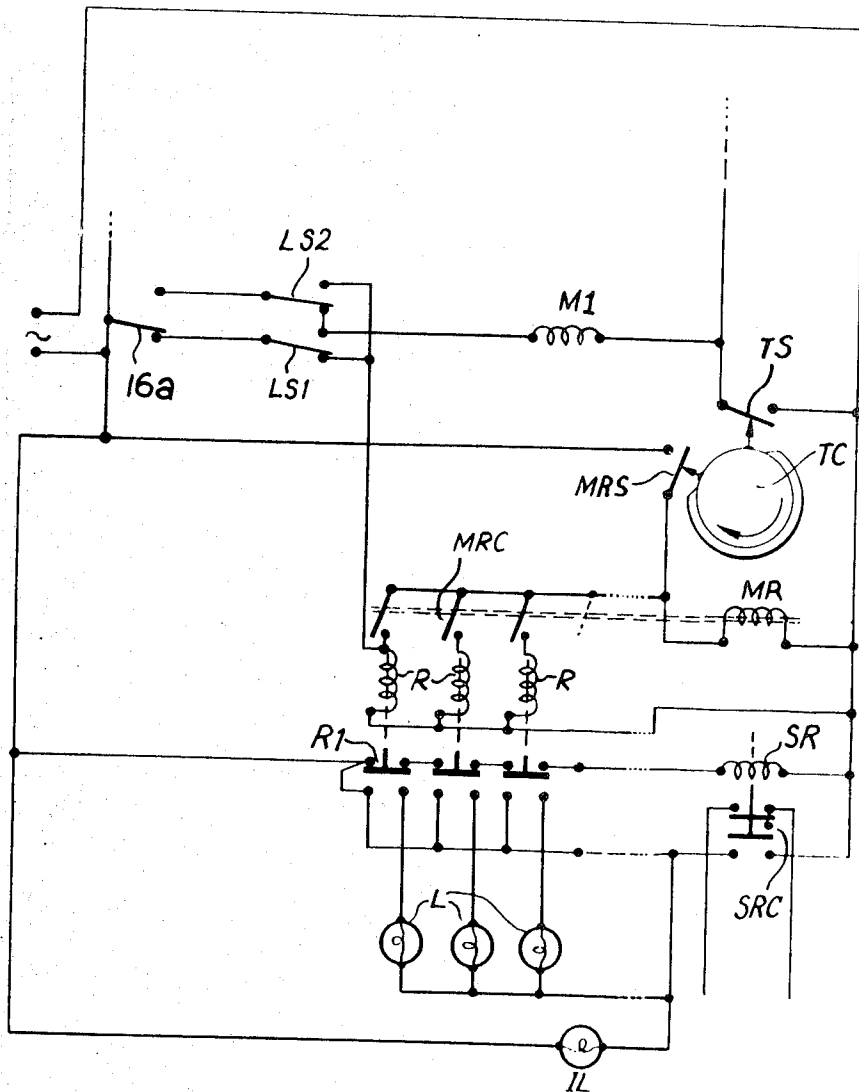


FIG. 4.

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## DOBBIES

This is a continuation-in-part of my copending application Ser. No. 694,129, filed Dec. 28, 1967, and now abandoned.

The invention concerns loom dobbies and has particular, though by no means exclusive reference to dobbies for wide looms for use in the weaving of paper makers felts.

The primary object of the present invention is to provide a simple yet effective dobbie of the positive, open-shed type for a weaving loom, the said dobbie being unique in that it relies neither on the interaction of hooks and reciprocating knives nor on the intermittent meshing of mutilated gearwheels.

According to the present invention there is provided a loom dobbie for use in a weaving loom of the type which includes certain movable parts such, for example, as heald frames each movable up or down by a respective corresponding jack lever, the dobbie comprising a plurality of units, each unit including one of said jack levers aforesaid and being operative to actuate one of said movable parts, an electric motor for each jack lever for moving the respective jack lever up or down between selected limits in accordance with a predetermined pattern to be produced in cloth to be woven, and means for transmitting motion from each respective motor to the corresponding jack lever and, in combination, control means including a programmed pattern device operative so to start and stop selective motors automatically as to change the position of the jack levers in accordance with the predetermined pattern.

An embodiment of the invention will now be described by way of example, only, with reference to the accompanying drawings in which:

FIG. 1 is a diagrammatic perspective view, from behind, of a loom dobbie constructed in accordance with the invention;

FIG. 2 is a view, to a larger scale, of a part of the arrangement shown in FIG. 1; and

FIGS. 3 and 4 are circuit diagrams of electrical means for the control of the dobbie shown in FIG. 1.

The circuit of FIG. 3 shows only those parts necessary for the control of the drive means, while the circuit of FIG. 4, includes additional parts relevant to the practical operation of the loom.

Referring now to the drawings, and in particular to FIGS. 1 and 2 thereof, a loom dobbie for a four shaft loom comprises four crank wheels 11 rotatably mounted in dobbie frames on overhung axle pins carried in spiders (not shown) interleaved between adjacent crank wheels and supported by through bars extending between the dobbie frames, the front of such frame being shown at 12. The arrangement of the crank wheels 11 and the manner in which each is supported on an overhung axle pin projecting from a dislike spider is known in the art. There is a drive means such as the pinion 13c for each crank wheel. There is also a crank pin 10 secured in each crank wheel, and a connecting rod 14 linking each crank pin to a respective jack lever 15 operatively connected to a heald frame of the loom and a pattern means 16 for selectively operating each drive means 13 in accordance with the pattern to be produced on the finished fabric.

The means for driving each unit, indicated generally by the numeral 13 comprises an individual electric motor such as indicated at 13a, each such motor being of a conventional type which includes a friction brake for bringing it to a stop when the current is broken, these several motors being secured to a member of the dobbie frame (the rear member of which is indicated at 12a), the output shafts of the several motors extending between the front and rear members. Each shaft carries a spur gear or pinion such as indicated at 13c, these spur gears being mounted on their respective shafts in proper position to mesh with the gear teeth on the periphery of the corresponding associated crank wheel 11. Suitable reduction gearing 13d is arranged between each motor and each shaft. The ratio of the gearing 13d is dependent upon the speed of the loom crankshaft, and in what proportions the crankshaft revolution is to be divided between the changing and the dwell of the heald frames. By suitable choice of reduction ratio in the gear boxes, the heald dwell may be readily arranged to best advantage. The motors 13a for the respective crank

wheels 11 are angularly spaced about the rotational axis of the crank wheels 11, and each motor includes a friction brake (not shown), the brake for each of these motors being of conventional type including friction means applied by springs and released electromagnetically as is customary in motors of this type.

Chains C trained over guide sprockets G transmit motion from the jack levers 15 to the heald frames H, in accordance with usual practice.

The character 16 (FIG. 1) indicates, in general, a control man means including a pattern mechanism 18 having a pattern chain 18a for each heald frame, such chains being arranged in side-by-side disposition on a pattern barrel 18b to be driven thereby, the latter being driven from the loom crankshaft (not shown). Usually, the barrel will be rotated in a stepwise manner by any suitable step-by-step mechanism, but such barrel may alternatively be rotated continuously through ordinary reduction gears. Each chain 18a has a plurality of bowls 18c and spacers 18d, the sequence of such bowls and spacers on any given chain, and the relative longitudinal positions of the chains on the barrel, being determined by the cloth being woven, and hence the required shedding of the loom. The mechanism 18 further includes four pivoted finger levers 18e each being for cooperation with a respective chain 18a and being so positioned relative to the chain as to be displaced about its pivotal axis or not according to the presence of a bowl 18c or spacer 18d on the barrel 18b and in contact with the lever. Each lever 18e is associated with an electric switch 16a which is moved between two positions as the lever 18e is pivoted up and down by the movement of the associated chain 18a.

Whilst a pattern chain consisting of bowls and spacers is preferred, means alternative thereto may be provided and thus the pattern switches may be selectively actuated by a punched paper band, or any other known programmed pattern means.

At each face of each wheel 11 and in an annular groove therein is an arcuate cam 17 which actuates a limit switch whose location on the right-hand face of the right-hand wheel is indicated in FIG. 1 by the character B, there being two such switches LS1 and LS2 (FIG. 2) on each wheel, one being provided for actuation by each of the cams 17 on each wheel, respectively, the arrangement being shown in greater detail in FIG. 2. The several switches serve to stop the motor upon the completion of the required rotation of the crank wheels 11, the cams 17 on the opposite surfaces of the crank wheel 11 being appropriately displaced one relatively to the other so as to operate in actuating the switches LS1, LS2 alternatively after each 180° movement. The cams 17 and limit switches LS1 and LS2 define parts of the control means 16 aforesaid.

The operation of the dobbie as illustrated in the drawings is as follows, reference now being had to the circuit diagram of FIG. 3.

In FIG. 3, in which references, are used like those of FIG. 1 to designate the same or similar parts, the circuit of only one drive means and its associated pattern chain is shown and it will be understood that there are similar components for each drive means and associated chain. Reference character M1 has herein at times been referred to as a "motor" but it is to be understood that M1, in fact, designates the starting coil for one of the motors 13a. Thus, the circuit indicated in FIG. 2 is required to carry only a relatively light relay current in comparison with the heavy current required to drive the motor.

In FIG. 4, the timing switch TS, operable by the timing cam TC, is common to all such circuits including a motor M1 and switches operable by the pattern chain and cams 17. The function of the timing switch TS is to determine the time in the loom cycle when the selected motors are energized to shift the heald frames. This switch must be closed before energization of any motor M1 can take place.

Upon the indexing of the pattern chains 18a by rotation of the pattern barrel 18b, one of the pivotally mounted finger levers 18e will actuate the related switch 16a, which switch corresponds to switch 16a in FIG. 1, between two positions

depending upon the part of the chain 18a (bowl or spacer) in contact therewith. In one position (FIG. 4) the switch 16a is in series with cam actuated switch LS1 and in the other position is in series with cam actuated switch LS2, the position of one of the switches LS1 and LS2 is indicated at B in FIG. 1, one switch being provided on each side of each respective crank wheel 11.

If the switch 16a is positioned such that motor M1 is energized, a 180° rotation of the associated crank wheel 11 and thus a lifting or lowering of the associated heald frames H takes place, the drive continuing for the required degree of rotation until the appropriate limit switch LS1 or LS2 is operated by the cam 17 (FIG. 3) to open the motor circuit, the motor then being braked. Once this shedding operation has been completed, the timing cam TC opens the common timing switch TS in readiness for the next selection. Of the switches LS1 and LS2, when one of these, LS1, has been opened by the cam 17 and the wheel 11 has stopped, if at the next shed setting the wheel 11 again has to be rotated by a further 180°, during this further rotation, switch LS1 is closed by the cam 17.

A further indexing of the pattern barrel 18b occurs at an appropriate stage in the loom cycle and the pattern switches 16a are reset. Again, according to the condition of the pattern switches 16a, the motors M1 are selectively energized when the timing switch TS closes and the respective crank wheels 11 turned, the drive being discontinued upon the opening of the limit switches LS1 or LS2 opposite to those last operated, under the control of a corresponding cam 17 on the crank wheel.

If, on a shed change, any given heald frame is to remain in an upper or lower position during the insertion of a further pick or picks, there will be no energization of the motor associated therewith since the limit switch LS1 or LS2, as appropriate, corresponding to that position will be open and will remain so, thus the motor circuit will not be completed. It will be understood therefore that all the heald frames are automatically positioned by the control means just described so that the programmed pattern is produced on the finished cloth.

The arrangement as the before described can readily be provided with various indicator and automatic stop means whereby, upon the failure of any mechanical or electrical part of the loom satisfactorily to fulfill its function, the loom will be stopped and the nature of the fault visually indicated. Thus, for example, means may be provided to prevent the continued operation of the loom in the event of a shedding inconsistent with the requirement of the pattern barrel. Such a means is included within the circuit diagram, shown in FIG. 4, for each shaft together with a master relay MR, an additional switch MRS operated by the timing cam TC and a single indicator lamp IL, to show that a fault has occurred.

Referring to FIG. 4 in detail, it will be seen that much of the contents of FIG. 3 are included therein inasmuch as the switches 16a, LS1, LS2, the motor 13a, the timing switch TS and the cam TC are shown. In order to provide an automatic stopping arrangement and warning indication there is provided for each circuit including a motor M1 and switches 16a, LS1 and LS2, a relay R, having contacts R1, and a lamp L. Also included (but these components are common to all parallel circuits including a motor M1 and switches 16a, LS1 and LS2) and a master relay MR, master relay contacts MRC, a master relay switch MRS which is operable by the timing cam TC, a stop relay SR, stop relay contacts SRC and a small stop warning light IL.

Each switch LS1 and LS2 is movable between two positions by the cams 17 and in one position of the switch 16a one of the switches LS1 or LS2 completes the supply to motor M1 and in the other completes the supply to relay R. When the motor is stopped at the end of a heald change the relay R is energized. The contacts MRC of the master relay MR also serve to energize the relay R but these contacts serve to energize all relays R simultaneously. The master relay is energized by closing of switch MRS by the timing cam TC.

All of the contacts such as R1 of the relays R are connected in a series circuit with the stop relay SR such that before the stop relay can be energized so all relays R must be energized as the series circuit is connected in parallel across the main supply. Should the stop relay be deenergized contacts SRC move to complete a circuit including the warning lamp IL and this is illuminated indicating a fault.

If any one of the relays R is deenergized for any reason, its contact will move to illuminate the associated light L and the stop relay SR will be deenergized with the result described above.

Assuming that a selected shaft 13b has just completed the lowering of the corresponding heald frame and has opened its down limit switch LS1 prior to the timing switch TS opening at the end of the heald change cycle of operation, then, for the loom to continue normal running, as stated above, all the relays R must remain permanently energized together with the stop relay SR.

At the end of each heald change each individual relay R continues to remain energized, providing its limit switch contact LS1 or LS2, has been properly operated and changed from its motor contactor circuit to the relay circuit.

If a crank wheel 11 has not moved to the position to which it was selected, or due to some fault it has not arrive at its correct stopping position, or has overrun the latter position, then the particular relay R cannot continue to remain energized when the master relay MR opens.

Should one or more relays R drop out through failure to be maintained by the respective limit switches LS1, LS2, during the period of the master relay MR is off, then the stop relay SR is deenergized and its contacts break the loom stop circuit as above-described and the loom stops. At the same time, other contacts on their relay SR close the indicator lamp circuit. In addition, any particular relay R which failed to remain energized closes individual contacts to illuminate lamp L and so indicates which shaft is at fault. No further running of the loom is possible until the particular crank wheel has been moved to its correct position.

The electric dobby arrangement before described does present substantial advantages as compared with conventional mechanical dobbies. Thus, for example, in the event of the loom carrying a large number of frames, and the dobbies requiring to be split between the two ends of the loom, the duplication of the actuating linkages and the control mechanism met with in conventional looms having mechanical dobbies is avoided, since the only requirement is that the electrical circuitry be continued from one end to the other of the loom. It is envisaged that, in order to facilitate the construction of a compact dobby for the actuation of a still larger number of shafts, motors and their associated gear boxes may be mounted on the front frame of the dobby, in addition to those mounted on the rear frame, which latter arrangement is shown in FIG. 1. In such case, the front and rear gear shafts corresponding to 13b, may be in axial alignment, but of approximately half the length of the loom. These short shafts may be provided with bearings midway between the front and rear frames of the dobby.

A more important advantage arises, however, if it is required to unweave to correct a weaving fault. With the electric dobby, by isolating the timing cam switch TS it is possible to operate the dobby at will and without requiring the loom to follow its full cycle. Thus, if the pattern barrel is indexed in the reverse direction, the pick last inserted is in an open shed and can easily be removed. By repeating the procedure any number of picks can be unwoven. The indexing of the pattern barrel can be effected manually or, if the cloth takeup and warp let-off motions can be reversed, by running the loom in the normal direction.

A still further advantage lies in the facility with which the heald frame can be adjusted after gaiting up a warp, the control mechanism being actuable without running the loom, by isolating the timing switch TS and turning the pattern barrel 18b.

If it is required to bring all heald frame to a common level, in order to facilitate drawing in a new warp, or when repairs to the warp have to be carried out, this can readily be effected by lifting all of the pivoted finger levers 18e to a common level prior to turning the loom crankshaft one revolution. Any convenient mechanical or electromechanical means can be provided for lifting all the finger levers simultaneously.

The loom as before described, in addition to offering various advantages both from the point of view of constructional convenience and of adjustment and control facility, does present advantages during the normal operation of the loom. Thus, for example, when the weft is beaten up into the cloth by the reed, the warp yarn in the changing heald frames is relatively slack because of their midtravel position, and the beat-up force is therefore mainly imposed on the warp yarns in the nonchanging heald frames, then dwelling in their open-shed positions. This force is transmitted by the harness to the then stationary jack levers, but is not transmitted to the teeth of the crank wheels 11 because the crank pins 10, at the moment of beat-up, are on one or the other of their dead centers, when the turning moment exerted by the connecting rod 14 on the crank wheel 11 is zero.

Again, the crank pin 10, linked to the jack lever 15 by the connecting rod 14, in moving from one dead center to the other, provides a close approximation to simple harmonic motion for the jack levers and thence to the heald frames. As a consequence, the starting torque to be exerted by the electric motor when moving off from either dead center of the crank pin 10 is at a minimum, which facilitates the starting and acceleration of the motor to its full rated speed within two or three cycles of the electricity supply.

The timing of the movement of the heald frames in relation to that of the loom crankshaft is closely maintained because both these elements, although not mechanically connected, are each driven by alternating current motors, which rotate at a speed very nearly equal to their theoretical synchronous speeds and the motors for driving the heald frames are controlled by the timing cam TC which is itself driven from the crankshaft.

The invention is not restricted to the exact features of the embodiment hereinbefore described since alternatives will readily present themselves to one skilled in the art. Thus, for example, the face cam or cams 17 for actuating the limit switches LS1 and LS2 may be on one surface only of the crank wheel 11.

It is to be understood that a like mechanism to that described above is of application to the control of the sequential operation of shuttle drop boxes in a weaving loom, and the expression "loom dobbie" as used herein and in the appended claims is intended to mean any loom mechanism operating on the basis of the preselected programmed pattern to produce a pattern on the finished fabric.

We claim:

1. A loom dobbie for use in a weaving loom of the type which includes certain movable parts such, for example, as heald frames each movable up or down by a respective corresponding jack lever, the dobbie comprising a plurality of units, each unit including one of said jack levers aforesaid and being operative to actuate one of said movable parts, an electric motor for each jack lever for moving the respective jack lever up or down between selected limits in accordance with a predetermined pattern to be produced in cloth to be woven, and means for transmitting motion from each respective motor to the corresponding jack lever and, in combination, control means including a programmed pattern device operative so to start and stop selective motors automatically as to change the position of the jack levers in accordance with the predetermined pattern.

2. A loom dobbie according to claim 1, further characterized in that the movable parts are heald frames and the means for transmitting motion from each motor to its respective jack lever includes a crank wheel with a crankpin mounted thereon, a connecting rod for transmitting motion from the crankpin to the jack lever, and speed-reducing means for transmitting force from the motor to the crank wheel.

3. A loom dobbie according to claim 2, in which the limiting positions, up or down of each jack lever, correspond to the two diametrically opposed dead centers of the corresponding crankpins.

4. A loom dobbie according to claim 1, further characterized in that the programmed pattern means for each jack lever comprises a chain, each chain being made up of bowls and spacers in preselected order in accordance with the desired woven pattern, further characterized in that the control means includes a switch so arranged to respond differently to the passage of a bowl or a spacer on the chain to control the operation of one of said motors and thereby to determine which one of its limiting positions shall be occupied by the corresponding jerk lever.

5. A loom dobbie according to claim 2, further characterized in that the control means includes a cam carried by each respective crank wheel, and a stop switch corresponding to each respective limiting position of each respective lever and which is responsive to said cam means for stopping the motor when the jack lever reaches either of said limiting positions.

6. A loom dobbie according to claim 1, further characterized in that each of said motors is of a conventional type which includes a friction brake which is operative to stop the motor and the parts driven thereby when the motor circuit is broken as the jack lever reaches a limiting position.

7. A loom dobbie according to claim 1 in which the control means includes a timing cam adapted to close a timing switch in the control means and thereby to initiate the simultaneous starting of all the selected motors and subsequently, after the selected crankgears have completed their half-turns, to open said timing switch in readiness for the next selection and shedding operation, the jack levers meanwhile being retained in one or other of their limiting positions for a time sufficient to enable a weft pick to be passed through the shed defined by those heald frames which have been actuated by the selected jack levers.

8. A loom dobbie according to claim 1, in which the control means includes automatic stop means operable to stop the loom in the case of faulty movement of any jack lever.

9. A loom dobbie according to claim 7, further characterized in that the control means includes automatic stop means operable to stop the loom in the case of faulty movement of any jack lever, and in which the automatic stop means includes a master relay energizable through a master switch which is operated by the timing cam, such master relay when energized serving to enable an auxiliary relay for the selected jack levers to be energized and each jack lever having contacts in series with a stop relay such that the stop relay can be energized only when the contacts of the auxiliary relay are closed, the stop relay having contacts adapted to be situated such that when the stop relay is deenergized the loom is stopped, and also including bypass means whereby when the master relay is deenergized when the jack levers are stopped in one or other of their limiting positions, the auxiliary relays remain energized to prevent undesired stopping of the machine.

10. A loom dobbie according to claim 9 including a warning light associated with each auxiliary relay which is connected to that relays contact to be illuminated if the relay is deenergized and a stop stop light arranged to be illuminated if the stop relay is deenergized.