July 10, 1956 F. A. LOVSHIN ET AL 2,753,894

LOOM DRIVE WITH MEANS FOR SHOCKLESS STOPPING

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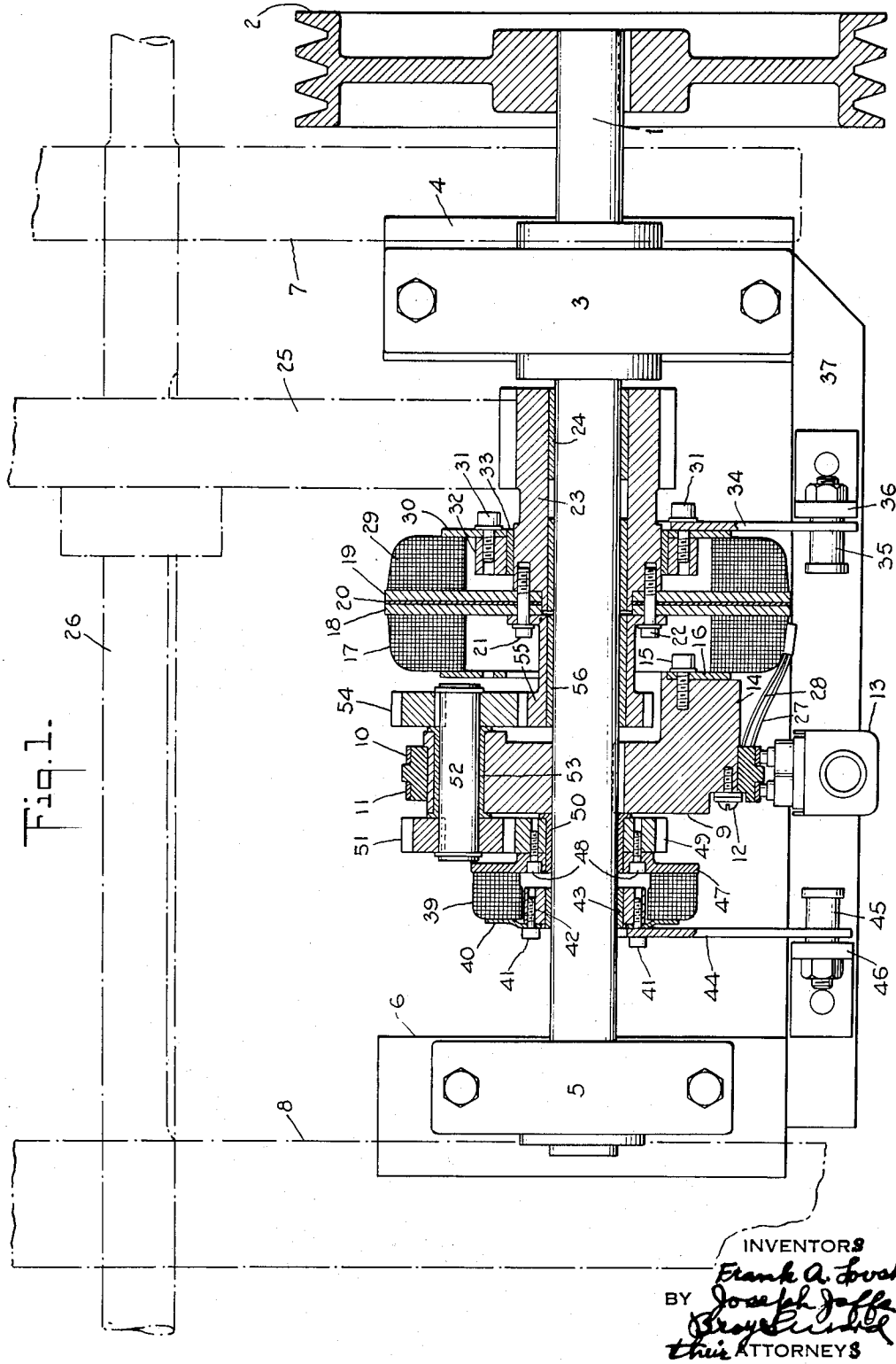


Fig. 1.

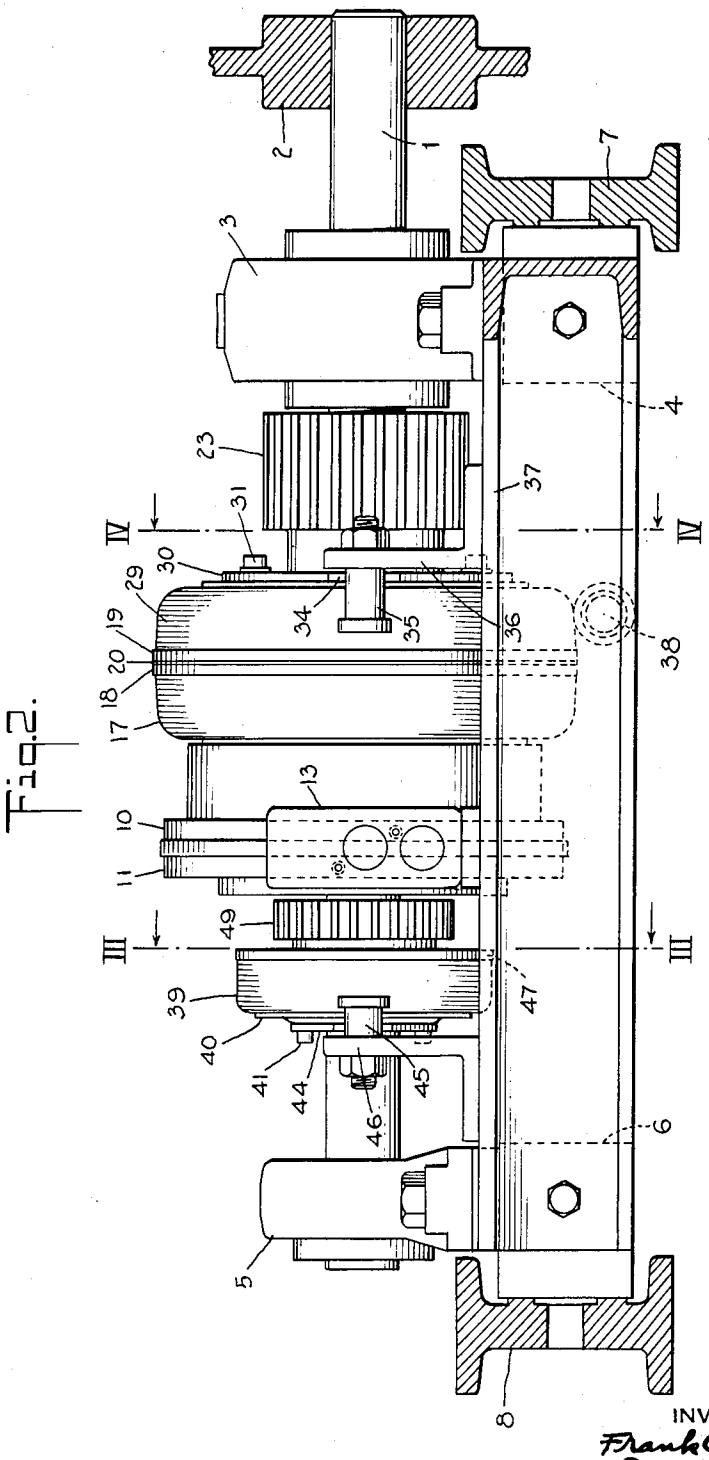
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LOOM DRIVE WITH MEANS FOR SHOCKLESS STOPPING

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Fig. 2.



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LOOM DRIVE WITH MEANS FOR SHOCKLESS STOPPING

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Fig. 3.

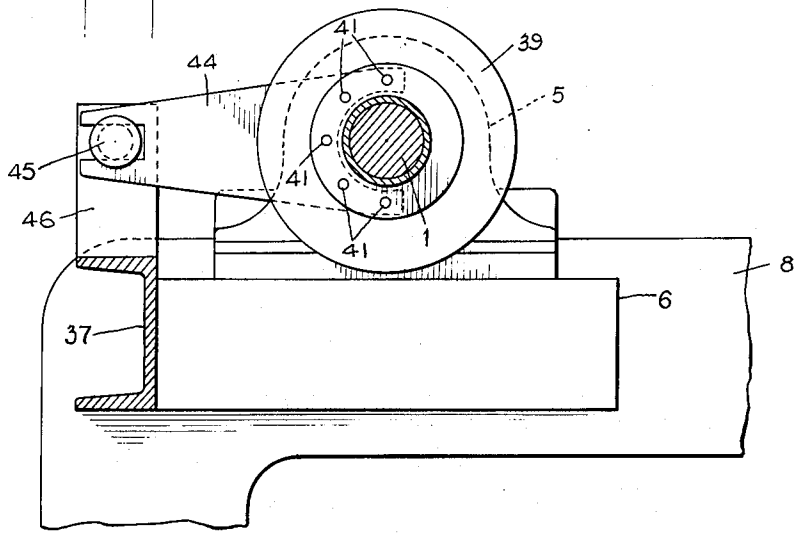
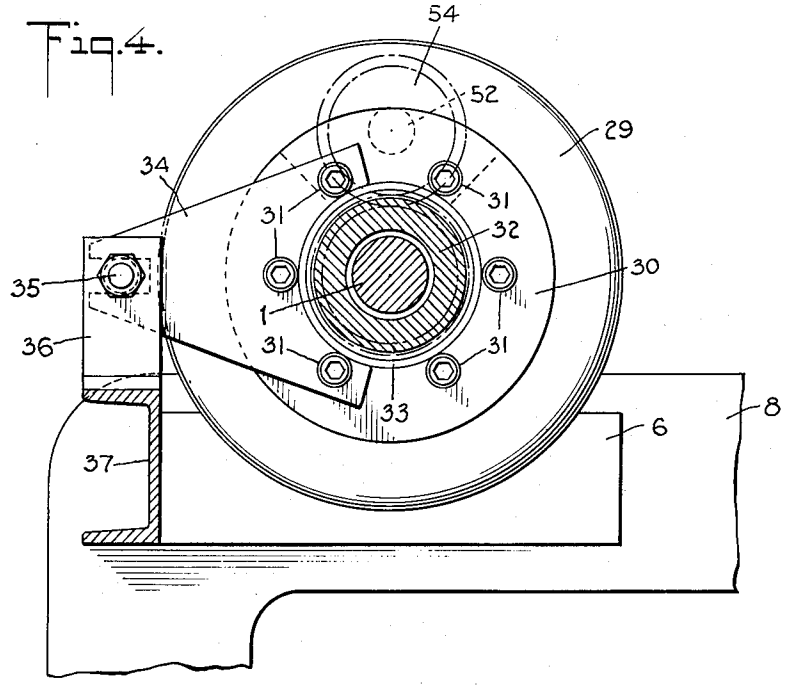


Fig. 4.



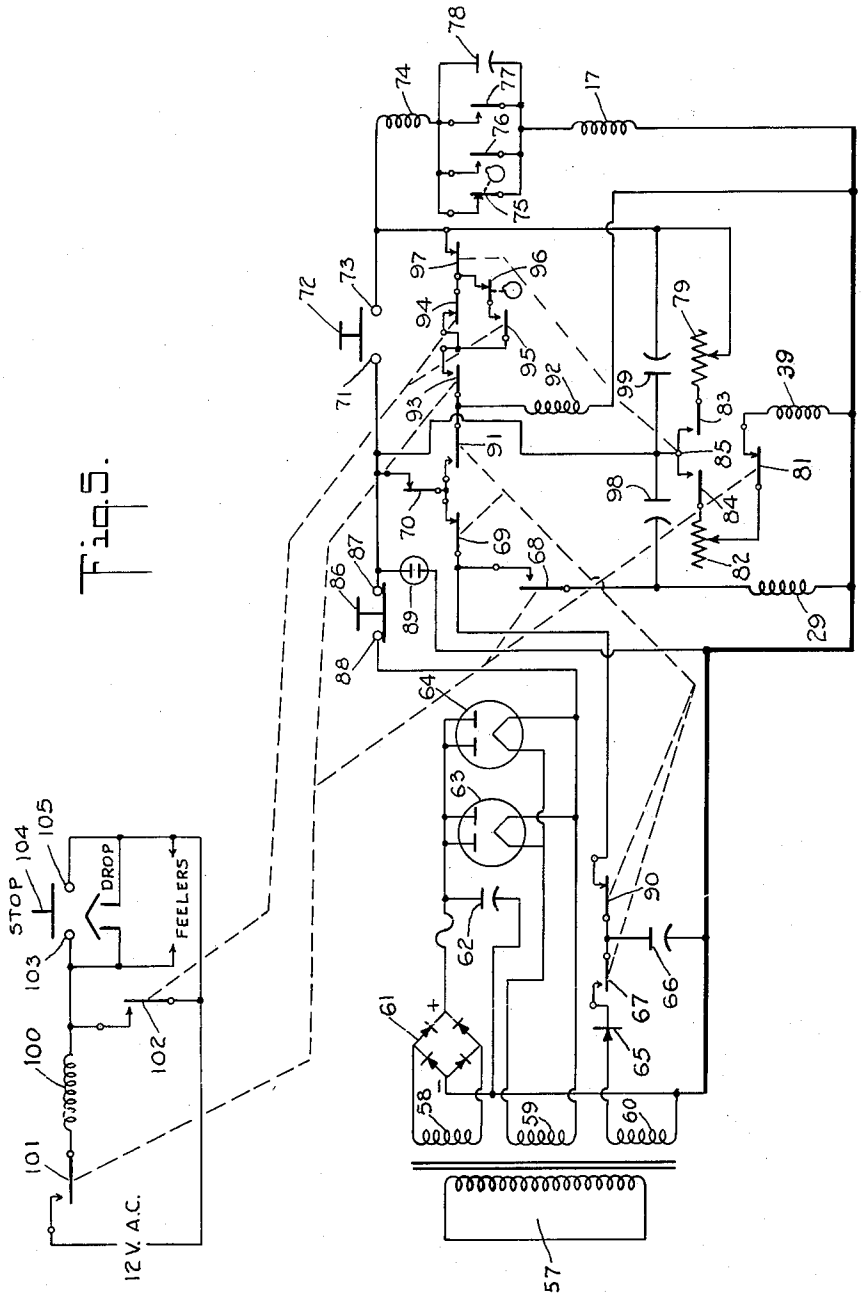
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LOOM DRIVE WITH MEANS FOR SHOCKLESS STOPPING

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Fig. 5.



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2,753,894

LOOM DRIVE WITH MEANS FOR SHOCKLESS STOPPING

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Application November 10, 1953, Serial No. 391,202

4 Claims. (Cl. 139—1)

This invention relates to a loom drive with means for shockless stopping, and has for an object to provide electro-magnetic-mechanical means whereby any failure in loom operation, including faulty shuttle, yarn break, weft runout, or knife rope break, will cause immediate loom stoppage by discontinuing the drive of and instantly braking the loom drive shaft, the stoppage being achieved without shock such as has previously been caused by the usual bang-off in which an arresting element is brought into the path of the lay.

Another object is to provide such a construction which embodies electro-magnetic means for operatively connecting the forward drive of the loom, electro-magnetic means for disconnecting the forward drive and braking the loom, and additional electro-magnetic means for connecting the reverse drive of the loom.

Another object is to provide such a construction in which the reverse drive of the loom embodies planetary gearing and is adapted to drive the loom at reduced speed as compared with the forward drive.

Another object is to provide such a construction in which the planetary gearing rotates as a unit with the drive shaft during forward drive of the loom.

Another object is to provide such a construction which embodies a stationary braking magnet, a rotatable forward drive magnet, and a double armature interposed between the said magnets.

Another object is to provide such a construction in which the double armature interposed between the braking magnet and forward drive magnet includes a magnetic gap to prevent magnetic force or field from passing through one part of the double magnet into the other and hindering fully effective functioning of either the forward drive or the braking.

Another object is to provide such a construction which embodies a hub for supporting the planetary gearing, and an adaptor portion or element associated with the hub which serves to afford an accurate mounting surface for the forward drive magnet, and also acts to balance the weight of the planetary gearing.

Another object is to provide such a construction in which the hub that supports the planetary gearing serves to carry collector rings adapted for cooperation with brushes of a holder that is fed from a suitable source of electric current.

Another object is to provide such a construction in which both the braking magnet and reverse drive magnet are mounted in rotatable relationship with respect to the drive shaft but fixed against rotation by connection with the loom frame.

Another object is to provide such a construction in which the connection of the braking magnet and reverse drive magnet with the loom frame is by means of torque arms connected with a member carried by the loom frame and permitted to have slight movement in the direction of the axes of the magnets to allow for wear of magnets

and armatures; the member carried by the loom frame also serving as a mounting for the brush holder.

Another object is to provide such a construction which facilitates assembly, avoids expensive parts, minimizes destructive or disorganizing wear, and accomplishes loom stoppage with such instantaneousness as to satisfy all conditions of loom operation especially with relation to proper shuttle protection.

A further object is to provide certain improvements in the form, construction and arrangement of the several parts whereby the above named objects and others inherent in the invention are effectively attained.

In brief summary, this invention envisages the provision in a loom structure of magnetic clutches so combined with the loom drive shaft that forward drive may be accomplished by mere completion of an electric circuit; discontinuance of forward drive and instantaneous braking to a stop automatically follows any one of the common instances of failure or faulty operation; and reverse drive is obtained by mere completion of an electric circuit and activated at a reduced speed as compared with forward drive through the effect of a planetary gear arrangement; the whole being embodied in a simple, reliable and rugged construction that lends itself readily to introduction into standard forms and types of looms without demanding redesign or substantial alteration of the main essential components.

A practical embodiment of the invention is shown in the accompanying drawings, in which

Fig. 1 represents a central horizontal section, partly in plan, of the operative parts, and showing their relationship to the loom;

Fig. 2 represents a side elevation, partly in section, of the parts shown in Fig. 1;

Fig. 3 represents a vertical section taken in the plane of the line III—III of Fig. 2, looking in the direction of the arrows;

Fig. 4 represents a similar view taken in the plane of the line IV—IV of Fig. 2; and

Fig. 5 represents a diagrammatic layout of the electric circuits governing the actuation of the parts.

For a long time it has been common practice in loom construction to incorporate means for stopping the loom in the event that a shuttle fails properly to enter its box, in order to prevent injury to the shuttle and/or yarn being woven as the result of striking of the same by the reciprocating lay. This means has usually included one or more movable daggers carried by the lay in position to contact one or more blocks or frogs fixed to the loom frame, which contact serves to stop the loom by what is commonly referred to as a "bang-off." To avoid such stoppage during satisfactory operation of the loom while the shuttles are properly entering their boxes, mechanism, generally including bell cranks and rods, has been associated wtih one or more of the shuttle boxes, which mechanism lifts each dagger out of contact relationship with its block or frog on each forward or beat-up stroke of the lay as long as the shuttles continue properly to enter their boxes. The arrangement just described necessarily involves complication in loom structure with need of corresponding power for operation, and also increases the likelihood of failure or faulty operation due to the increase in number of moving parts.

More advanced developments have involved the provision of electrical means for stopping the loom drive motor when a shuttle fails properly to enter its box, the said means being controlled by switches associated with the shuttle boxes, or by electric or magnetic impulses generated by the incoming properly running shuttle; but these developments have continued the employment of means for arresting by contact the forward stroke of the

lay, and have thus inevitably involved the "bang-off" stoppage, which latter has for a very long time constituted a serious impediment in the art of weaving because of the strain and shock which it imposes upon the loom as a whole as well as upon the parts thereof more particularly associated with the "bang-off."

Still more advanced developments are based upon the provision of electrically controlled magnetic means which in case of failure in loom operation, arising from various causes, such as faulty shuttle, warp or weft break, weft runout, or knife rope break, serves to de-clutch the loom driving mechanism and apply a brake for stopping the loom without the necessity of stopping the loom driving motor and without shock; or upon the provision of means for de-clutching the loom driving mechanism and very briefly clutching the loom reverse drive mechanism for the purpose of shockless loom stoppage. The present invention is along the line of the electromagnetic means for de-clutching the loom drive mechanism and applying a brake in case of faulty operation, but embodies substantial differences from and improvements upon previous developments.

Referring to the drawings, the loom drive shaft is denoted by 1 and has keyed to its protruding end a sheave 2 that is grooved to receive V-belts driven by a suitable motor, not shown. The shaft 1 is journaled in pillow block bearings 3–4 and 5–6, the blocks 4 and 6 of the said bearings being rigidly mounted on the loom frame parts 7 and 8 respectively.

A hub 9 is keyed to the shaft 1 and its periphery is shouldered to receive suitably insulated collector rings that are indicated generally by 10, 11, and are clamped in position by a series of screws, one of which is shown and marked 12; the collector rings serving to draw power from the brushes of holder 13 which is properly connected to any suitable source of electric current, not shown.

The face of hub 9 toward drive sheave 2 is projected in the form of a heavy flange denoted by 14 which extends over about three-fourths the circumference of the hub, as shown in dotted lines in Fig. 4, which flange provides an adapter surface for the mounting of the loom forward drive clutch magnet and also is a counter balance for loom reverse drive planetary gears to be hereinafter described.

To the flange 14 is secured by cap screws, one of which is marked 15, a mounting bracket 16 for the forward drive clutch magnet 17, that is in cooperative relationship with a double armature composed of the parts 18, 19, with an intervening non-magnetic shim 20, which is composed of brass or other suitable material for the purpose of preventing the magnetic force or field in one part of the armature from passing through to the other part with the possibility of causing drag in operation. The double armature is securely fastened by cap screws, two of which are marked 21, 22, to a drive pinion 23 that is mounted for free rotation on shaft 1 by sleeve bearing 24 and meshes with the loom gear 25 which is keyed on the usual crank shaft 26.

From the foregoing it will be clear that, when the drive shaft 1 is rotated by sheave 2 which is connected with the loom motor, the supplying of electric current to magnet 17 from the collector rings 10, 11, through wires 27, 28, will magnetically clutch armature 18, 19, 20, to the said magnet and thus rotate pinion 23 which, in turn, will activate the loom gear 25 and establish forward drive for the loom.

A brake magnet is denoted by 29 and its mounting bracket 30 is fixed by screws 31 to a collar 32 that floats on pinion 23 by a bearing 33; the said magnet being prevented from rotating by a torque arm 34 which has its inner end fastened to the magnet by some of the screws 31 and its outer bifurcated end embracing a round stud 35 mounted in a bracket 36 on a channel iron loom frame member 37; the said engagement of the torque arm with the stud permitting a slight amount of motion in the direction of the axis of the magnet to allow for wear and to facilitate assembly. An electric terminal box 38 serves for the supply of current to the magnet 29 when its energization is called for. Thus, assuming that current is supplied to forward drive clutch magnet 17, and the loom is in forward drive, the cutting off of the supply of current to the said magnet and the approximately simultaneous supplying of current to brake magnet 29 will cause cessation of the forward drive followed immediately by a braking action due to release of the armature 18, 19, 20, by magnet 17 and the attraction of the said armature to stationary magnet 29. As will be hereinafter explained, this cutting off of current to forward drive clutch 17 and supplying of current to brake magnet 29 will automatically take place upon the occurrence of any operational defect such as faulty shuttle, yarn break, weft runout or knife rope break.

The reverse drive mechanism for the loom, which is very useful for the purpose of jogging or adjustment or arrangement of operational setup, embodies a reverse clutch magnet 39 which, though smaller than, is similar to brake magnet 29 in its construction and mounting. Its bracket 40 is fastened by cap screws 41 to a collar 42 which rides freely on drive shaft 1 through the intermediation of a bearing 43; and the said magnet is itself fixed against rotation by a torque arm 44 that has its inner end secured to the magnet by some of the screws 41 and its outer bifurcated end embracing a round stud 45 carried in a bracket 46 mounted on the member 37, the connection of the torque arm and the stud being such as to permit a slight movement in the direction of the axis of magnet 39. A complementary armature 47 is associated with magnet 39 and is fastened by screws 48 to a spur gear 49; the armature and the said gear being freely mounted on the drive shaft 1 by a bearing 50. The said gear 49 meshes with another spur gear 51 that is keyed on a short shaft 52 which is journaled in a bore in the hub 9 by means of a bearing 53. A third spur gear 54 is keyed on the other end of shaft 52 and meshes with a gear 55 which floats on a bearing 56 on shaft 1 and has a flanged sleeve that is pierced by the screws 21 and 22, which secure the armature 18, 19, 20, to drive pinion 23, whereby the said gear 55 is likewise fast to the said drive pinion. The pitch diameter of gear 49 is one and one-half times that of gear 51, while the pitch diameters of gears 54 and 55 are equal.

If, now, it be desired to reverse the loom drive, both the forward drive clutch 17 and brake magnet 29 are de-energized by cutting off the supply of electric current thereto, and the reverse magnet 39 is energized by providing current thereto, as will be hereinafter explained. This energization of the reverse magnet will clutch armature 47 to it and, as the latter is fixed to gear 49, the said gear will remain motionless. As the loom drive shaft 1 is rotating under the influence of its motor driven sheave 2, hub 9 which is keyed to the said shaft will likewise be rotated and will cause shaft 52 and gears 51 and 54 to revolve around shaft 1. This revolving movement of the said shaft 52 and gears 51 and 54 will cause the last named gears also to rotate on their own axes due to the intermeshing of gear 51 with motionless gear 49, and the rotation of gear 54 will simultaneously rotate gear 55 with which it meshes and thereby rotate the drive pinion 23 and the loom gear 25 that is intermeshed therewith. However, the planetary action resulting from the combined revolving and rotating motions of gears 51 and 54 will drive the pinion 23 in reverse direction rather than in forward direction, and its speed of rotation will be one-half of normal forward speed due to the above mentioned fact that the pitch diameter of gear 49 is one and one-half times the pitch diameter of gear 51. It should be remarked that, when the loom drive is idling, i. e. shaft 1 is being driven by the motor, but neither the forward magnet clutch nor reverse magnet clutch are energized, reverse magnet armature 47 will be caused to rotate at

one-third normal speed in forward direction, because it is fixed to gear 49 that is enmeshed with gear 51, which is always being revolved about shaft 1 because of its mounting in hub 9 that is keyed to the said shaft. When the forward drive clutch magnet 17 is energized and the loom is running in forward direction, the said reverse armature and the planetary gears connected therewith rotate as a unit at normal forward speed with a sort of flywheel effect and, under such conditions, the bulk of flange 14 on hub 9 serves substantially as a counter balance to the weight of shaft 52 and gears 51 and 54 fixed thereon.

A satisfactory form of shuttle box and electric switch construction for cooperation with the subject matter of the present invention is shown and described in United States Patent to Andrew J. Dufourd and Frank A. Lovshin, No. 2,625,183, granted January 13, 1953; and, as the said construction per se forms no part of the present invention, it is not shown or described herein—reference to the said patent being deemed sufficient.

Turning now to the diagrammatic showing in Fig. 5 of the electric control, the primary 57 of the power transformer is energized by one phase of the power source for the loom drive motor such, for instance, as a supply of 220 volts alternating current, so that the electric control is in operative condition whenever the loom motor is running. The transformer includes three secondaries 58, 59, 60, that are designed to furnish suitable current for operating the parts connected therewith, such as 140 volts alternating current at 500 milliamperes; 5 volts alternating current at 2.5 amperes; and 800 volts alternating current at 5 mililamperes, respectively. Secondary 58 is fitted with a rectifier 61, which may be of the selenium dry disc type, and a filtering capacitor 62, and it supplies operating current for the forward drive magnet 17 and brake magnet 29, as well as the reverse magnet 39. Secondary 59 supplies filament power to vacuum tubes 63, 64, the plates of which are connected to the capacitor 62; while secondary 60 is provided with a rectifier 65, preferably of the selenium type, and charges capacitor 66 through normally open switch 67. The brake magnet 29 is connected through normally open switch 68 and normally closed switches 69, 70, with a contact 71 that is fitted for cooperation with normally open loom starting push button 72; the other contact 73 being connected through relay 74 with normally closed timing cam switch 75, normally open left and right hand shuttle box switches 76, 77, and arc preventing capacitor 78; which said switches and capacitor are connected with forward drive magnet 17. Contact 73 and relay 74 are also connected to a rheostat 79.

The reverse magnet is marked 39 and is connected through normally closed switch 81 with another rheostat 82. The rheostats 79 and 82 are adjustable and are added to the forward drive and reverse circuits to enable the operator to vary the torque to the forward and reverse magnets. The reverse is a jogging operation, normally controlled by a shipper handle, and a lowered torque permits smooth clutch engagement. The same is true of short motion or jogging forward drive. Thus the rheostats 79 and 82 are connected to normally open switches 83 and 84, respectively, while the latter are mechanically connected to a shipper handle of any suitable form, not shown but indicated at 85, which is connected to starting contact 71.

The normally closed loom stopping push button is denoted by 86 and has one of its contacts 87 connected with contact 71 and its other contact 88 connected to tubes 63, 64, and transformer secondary 59. A neon lamp 89 is connected to contact 87 to give a visual indication when current is available for the control circuit.

Capacitor 66 is connected through normally closed switch 90 and switches 69 and 70 with starting contact 71; through switch 68 with brake magnet 29; through normally open switch 91 with a second relay 92; and through normally open switch 93 with the stop motion and holding circuit consisting of normally closed switch 94, normally open switch 95, and normally closed stop motion cam switch 96; the said circuit being also connected through normally closed switch 97 with starting contact 73 and rheostat 79. Switch 97 is mechanically connected to jogging shipper handle 85. Capacitors 98 and 99 are interposed as shown in the diagram and, like capacitor 78, are for the purpose of preventing arcing if there be interruption of an inductive circuit.

The normally closed switch 81 serves as a safety device in case the operator should move the jog control shipper handle to reverse position while the loom is in normal forward drive, as it will cause the brake magnet 29 to stop the loom and current will not be supplied to the reverse magnet 39 until relay 92, which is a time delay relay, is deenergized, switch 68 opens to release the brake, and switch 81 closes to energize the reverse magnet. This period during which the brake magnet is energized is approximately one tenth of a second and is controlled by the delay built into relay 92, i. e., when current is removed from the coil of the relay its contacts do not close until approximately one tenth of a second later.

Switch 93 supplies additional safety features in that relay 92 cannot operate until relay 74 operates and therefore the forward drive magnet and brake magnet cannot be simultaneously energized. And, if relay 92 should fail, the holding circuit for relay 74, which includes switch 93, would not be completed and the loom would not continue in operation after release of the starting push button 72.

Rectifier 61, capacitors 62 and 66, lamp 89, brake magnet 29, reverse magnet 39, relay 92, and forward drive magnet 17, are all properly grounded as indicated at the heavy base line in Fig. 5. Also, switches 67 and 90 are mechanically connected with switches 69 and 91, and switch 97 is similarly connected to shipper handle 85, as shown by broken lines on Fig. 5.

The stop motion circuits for the purpose of arresting the loom motion in case of failures, such for instance, as warp or weft break, weft runout, or knife rope break, are illustrated in the detached portion of Fig. 5, wherein a relay 100 has one end connected to a normally open switch 101, which latter is also connected to a source of 12 volts alternating current; the other end of the relay being connected to a normally open switch 102 that is also in connection with the said current source. The relay 100 is further connected to one terminal 103 of a normally open loom stopping push button 104, as well as with one terminal of the drops and feelers that are indicated by legends. The other terminal 105 of the push button 104 is in connection with the other terminals of the stops and feelers and also with switch 102 and the source of 12 volt current. The drops, of which there are many, and the feelers, of which there are two sets for double shuttle looms to indicate weft runout, are conventional loom equipment and call for no further showing or description. They are connected in parallel with each other and with the stop button. Switch 101 is mechanically connected with switches 68, 81 and 93; while switch 102 is similarly connected with switches 94 and 95; all as shown by broken lines on Fig. 5.

The switch 70 and its connections provide a filling fork stop motion circuit as an added measure of safety in the event of failure of the bobbin feelers or other parts of the normal stop motion circuit. This switch is directly in series with the current supply and, when it is opened by absence of filling yarn, the loom will coast to a stop without braking, thus indicating the kind of failure that has occurred.

Referring generally to the operation of the electric control, the loom may be started by momentary depression of button 72, which closes contacts 71 and 73 to complete

the circuit to forward drive magnet 17, if either the left hand or right hand shuttle box switch 76 or 77 is closed by the proper housing of the shuttles, or the timing cam switch 75 is closed. This completion of the circuit energizes magnet 17 and drives the loom in forward direction as previously explained. The closing of the starting button 72 also energizes relay 74, which closes the first holding switch 91 and energizes relay 92, thereupon closing the second holding switch 93 to permit the manual release of button 72; while switches 69 and 90 are opened and 67 is closed, with the result of charging capacitor 66 with 1,000 volts. Also, with the energization of relay 92, switch 81 opens and switches 68 and 101 close. This position of the various elements remains in effect while the loom is running in forward direction and until either the stop button 86 is manually depressed, or the shipper handle 85 is moved, or there is failure in shuttle operation or some other failure that initiates a stop motion.

In case either shuttle fails, or both shuttles fail, properly to enter and be housed in its or their box or boxes, the hereinabove mentioned shockless "bang-off" stoppage of the loom occurs at the moment when the lay reaches a predetermined position in a forward stroke. To accomplish this, the cam of switch 75 is mounted on the loom main or crank shaft for cooperation with the switch. During a fixed degree of rotation the cam holds the switch open, preferably beginning when the lay is approximately four inches away from the limit of a forward stroke, and the circuit to the magnet 17 will remain complete as long as either the left hand or right hand shuttle box switch 76, 77, is closed by the proper housing of the shuttles in their boxes. Under these conditions the lay continues to the limit of its forward stroke and, on its return or rearward stroke, the cam of switch 75 permits the latter to close just prior to the following picking of the shuttles from their boxes; the loom thus continuing in operation while all its parts are performing satisfactorily.

If, however, either shuttle is not properly housed, or both are not properly housed, in the box or boxes toward which it or they are moving the switch 76 or 77 connected with the boxes will not be closed and the circuit to magnet 17 will be broken because, at that moment, switch 75 is held open by its cam. Thus magnet 17 becomes deenergized and releases its armature 18 so that the loom is no longer driven forwardly, and simultaneously relay 74 is deenergized with the result of opening switch 91 and closing switch 69 to energize magnet 29, while the capacitor 66 is changed from charging to discharging condition by the opening of switch 67 and the closing of switch 90. This discharging of capacitor 66 develops a brief current pulse in magnet 29, say of one ampere lasting for 5 milliseconds, which is sufficient to overcome the normally inductive lag of current following the closing of switch 69. As the magnet 29 has an inductance of approximately 8 henrys and a resistance of approximately 230 ohms, its time constant, i. e. time in seconds required for current to reach sixty-three per cent (63%) of its steady state value, is approximately 35 milliseconds. Thus, with the addition of the above mentioned current pulse from the discharge of capacitor 66, the current in magnet 29 attains its steady state value in less than approximately 5 milliseconds. The effect of the foregoing is very quickly to transfer current power from the forward driving magnet 7 to the brake magnet 29 which immediately applies stopping force to the loom by attracting its armature 19. From the instant shuttle failure initiates the loom stopping sequence just described to the instant of complete stoppage the time involved is only approximately 50 milliseconds during which the lay moves forwardly approximately one and one-half inches from its above mentioned position four inches away from the limit of its forward stroke, so that its motion is stopped approximately two and one-half inches before completion of the forward stroke, thereby avoiding injury even though one or both shuttles may be caught in the yarn shed. Furthermore, the stresses and strains occasioned by "bank-off" stoppage according to previous practice are so greatly reduced that the present invention may be said with reasonable accuracy to achieve a shockless loom stopping.

Other forms of loom failure, such as yarn break or runout, are handled by the above described stop motion circuit in a manner that will now be explained. When the loom starting button 72 is pressed, relay 92 is energized and closes switch 101, thereby applying a 12 volt potential to one end of relay 100. The loom continues running until yarn break causes a drop to fall or the feelers find a yarn runout and are short circuited. Either such condition completes the circuit to relay 100 and it becomes energized; whereupon switch 102 closes to hold the circuit, switch 95 also closes and switch 94 opens. Cam operated switch 96 then opens to break the circuit to forward drive magnet 17 and the loom is braked to a stop, as hereinabove explained, with the lay always in the same predetermined position. Relay 92 is then deenergized and opens switch 101 which deenergizes relay 100 and opens switch 102 to reset the stop motion circuit in condition for re-starting the loom. Knife rope break is handled in the same way as yarn break and, of course, the push button 104 can be manually depressed to cause loom stoppage. It should be added that the effect of switch 101 in cutting the current to relay 100 when the loom is not running eliminates the hazard of sparks at the drops when tying broken yarn ends.

Reverse running of the loom is a manually controlled operation for jogging or adjustment or arrangement of operational setup, and the like. It is effected by shifting the shipper handle 85 that is mechanically connected to switches 83, 84, 97, and electrically connected to starting contact 71. The shipper handle is normally in neutral position, and its movement to close switch 84 will serve to energize reverse magnet 39 and drive the loom in reverse as hereinabove described. If it should be desired to jog in forward direction, the shipper handle may be shifted to close switch 83 and thus apply power to magnet 17 through relay 74. It is advisable to have the handle spring biased to neutral position so that, when manually released, it will disconnect either reverse or forward drive, as the case may be. Switch 81 provides a safety interlock in that, if the operator should move the shipper handle to reverse the loom drive while it is running forwardly, the brake magnet 29 will first act to stop the loom and current will not be applied to the reverse magnet 39 until time delay relay 92 is deenergized, switch 68 opens to release the brake, and switch 81 closes to energize the reverse magnet 39. The time during which the brake magnet is thus energized is approximately one-tenth of a second and is controlled by the time delay built in relay 92; i. e. when current is removed from the coil of the said relay its contacts do not close until one-tenth second later.

It is believed that the construction and operation of the mechanical, magnetic and electric features of the invention have been so fully set forth that an additional summary would amount to surplusage; but it may be pertinent to note that the physical embodiment of the apparatus is neither large nor very complicated, while all the electrical components or elements, other than those in mechanical connection with working parts of the loom, may be enclosed in a single cabinet provided with plug-in connecting devices, for ease of replacement, repair or servicing.

While the description sets forth the invention as applied to a double shuttle loom, it is not thus limited, but is suitable for all types of looms, and, further, in place of the shuttle box and switch construction of U. S. Patent 2,625,183, hereinabove mentioned, other forms of electric and/or magnetic control actuated by shuttles could be employed in connection with this invention,

such, for instance, as the arrangements disclosed in U. S. Patent to Francis J. Sullivan and Arthur R. Abbott No. 2,499,887, issued March 7, 1950; and U. S. patent to Arthur R. Abbott No. 2,556,785, issued June 12, 1951; which patents are cited without intention of limitation.

It will be understood that various changes may be resorted to in the form, construction, material and arrangement of the several parts without departing from the spirit or scope of the invention; and hence we do not intend to be limited to details herein shown or described except as they may be included in the claims or be required by disclosures of the prior art.

What we claim is:

1. In a loom, driving means and means for shockless loom stopping automaticaly activated by operative fault in loom functioning, said stopping means comprising, a drive shaft, forward drive means, braking means, reverse drive means, and electro-magnetic means for operatively connecting and disconnecting said forward drive means, braking means and reverse drive means with and from the drive shaft, said reverse drive means including a hub fixed to the drive shaft, planetary gearing mounted on one portion of the hub, and a counter balance for said gearing at another portion of the hub.

2. In a loom, driving means and means for shockless loom stopping automatically activated by operative fault in loom functioning, said stopping means comprising, a drive shaft, forward drive means, braking means, reverse drive means, and electro-magnetic means for operatively

connecting and disconnecting said forward drive means, braking means and reverse drive means with and from the drive shaft, said reverse drive means including a hub fixed to the drive shaft, a non-rotatable magnet freely mounted on the shaft, an armature carrying gear also freely mounted on the shaft for cooperation with the magnet, a second gear freely mounted on the shaft, and a pair of planetary gears carried by the said hub and meshing with said two first named gears.

3. Loom construction as defined in claim 2, which also includes a drive pinion freely mounted on the shaft and operatively connected to the said second gear.

4. Loom construction as defined in claim 3, which also includes collector rings carried by the said hub for receiving electric current.

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