Feb. 8, 1949. G. E. CLENTIMACK 2,461,493

LOOM FORK FILLING MOTION

Filed Oct. 4, 1947 2 Sheets-Sheet 1

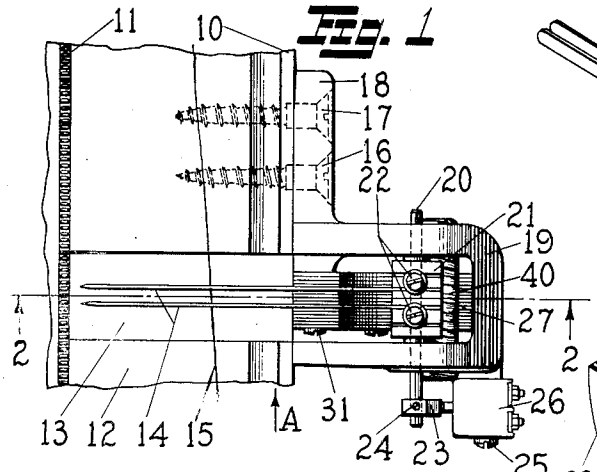


Fig. 1

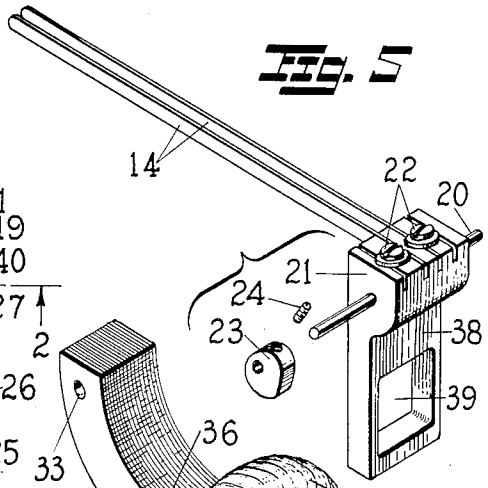


Fig. 5

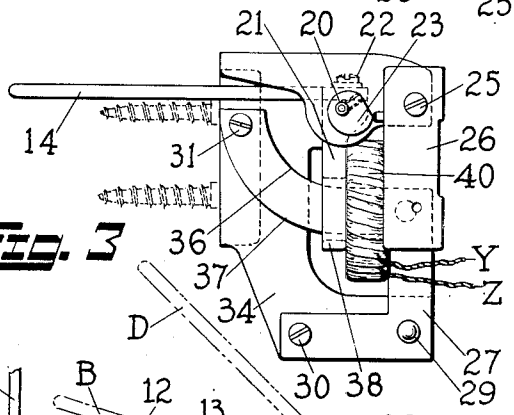


Fig. 3

Fig. 6

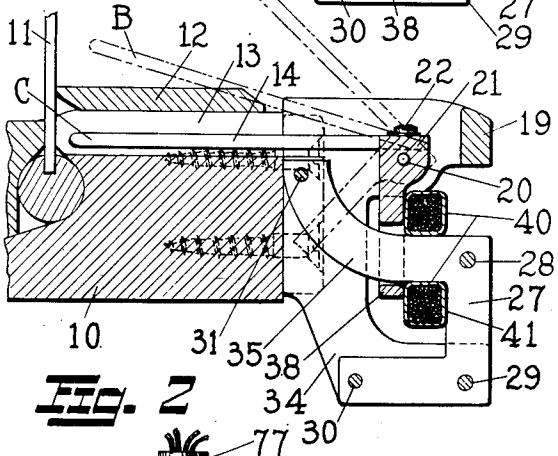


Fig. 2

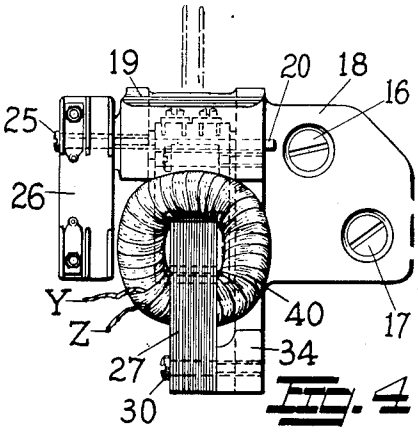


Fig. 4

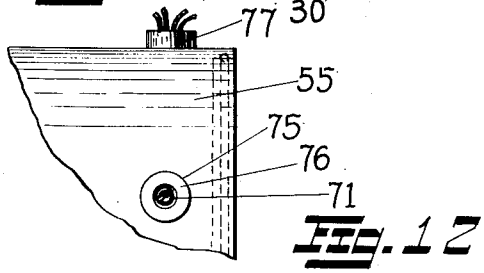


Fig. 12

INVENTOR.
GEORGE E. CLENTIMACK
BY
AGENT

Feb. 8, 1949. G. E. CLENTIMACK 2,461,493

LOOM FORK FILLING MOTION

Filed Oct. 4, 1947 2 Sheets-Sheet 2

Fig. 8

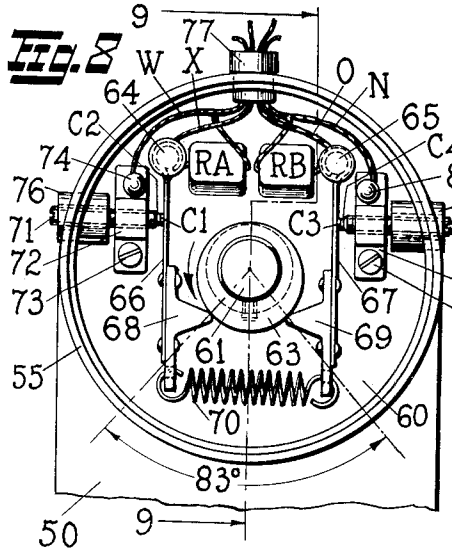


Fig. 11

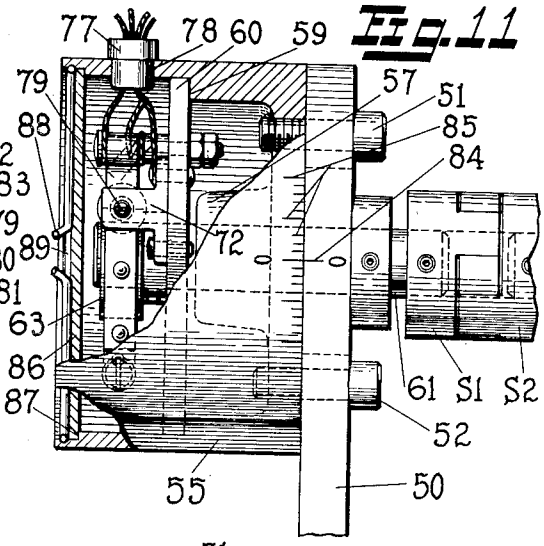
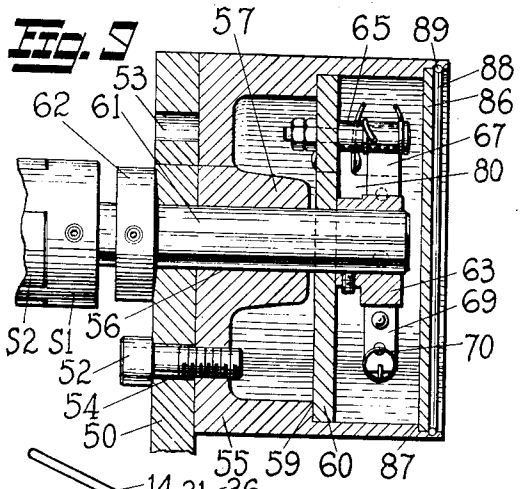


Fig. 9



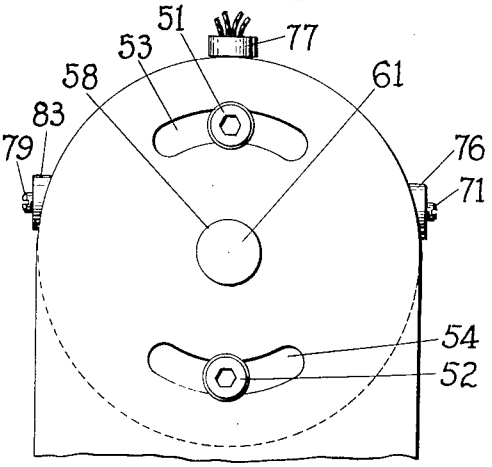


Fig. 10

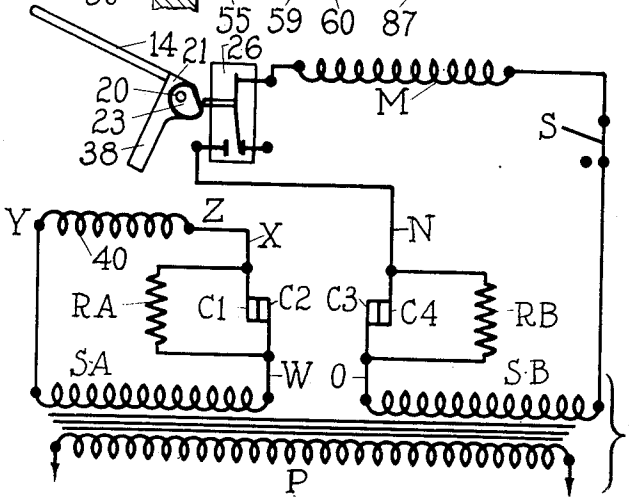


Fig. 7

INVENTOR.
GEORGE E. CLENTIMACK
BY
AGENT

Patented Feb. 8, 1949

2,461,493

UNITED STATES PATENT OFFICE

2,461,493

LOOM FORK FILLING MOTION

George E. Clentimack, Plainville, Mass., assignor to Draper Corporation, Hopedale, Mass., a corporation of Maine

Application October 4, 1947, Serial No. 777,981

14 Claims. (Cl. 139—375)

1

This invention relates to weaving looms, and more specifically to fork filling motions having filling fork devices for detecting absence or breakage of the filling at or in the warp shed in such looms.

Weaving looms customarily are equipped with one or more fork filling motions for initiating a change in the operation of the loom upon the occurrence of a filling fault, such as absence of a filling thread, or breakage thereof, in the warp shed. These motions are of two classes, namely, side fork filling motions and center fork filling motions. Side forks are employed, sometimes one at each side of the loom and in other instances at but one side of the loom, to initiate loom stoppage or filling replenishment in the event of occurrence of one of the mentioned filling faults. Center forks, located usually near the center of the lay of the loom, are employed to initiate stoppage of the loom if exhaustion or breakage of filling within the shed occurs. While, as will become evident hereinafter, certain features of my invention are applicable to either type of fork filling motion, the invention is principally directed toward and will be described in connection with a center fork filling motion for looms.

Heretofore center fork filling motions have included as actuators such mechanical means as cam and follower lever structures, push or pump rod structures, and driving links connected to a part of the breast beam of the loom. As is well known to those skilled in the weaving art, all of those known modes of operation of center fork filling motions present several common disadvantages and defects. A loom filling motion must operate in a certain time-relationship with other loom motions; and due to the inherent nature of ordinary loom construction and operation the filling fork must perform its operation of detecting the condition of the filling during a very short period of time. In high speed looms especially, the mentioned requirements of fork operation necessitate very fine adjustment of the cams, links, or pump rod mechanisms which raise and lower the fork in its rising and filling detecting movements. In many instances the adjustments must be made frequently, and since most fork actuating structures are inside the loom framework and between the cloth roll and the warp beam, it is readily perceived that adjustments are a source of considerable inconvenience and annoyance. Another disadvantage inherent in the prior art structures is that the adjustments must be made with the loom quiescent, which makes necessary a trial and error

2

type of repeated adjustment procedure which continues until a satisfactory adjustment is secured. Such procedures are obviously time-consuming and bothersome. A further disadvantage suffered by prior filling motions of the center fork type is that the period during which the fork was raised could not readily be varied at the terminal end of the period. Another undesirable feature of existing known types of filling motions is that the parts are numerous and many of them relatively heavy. Furthermore, all of the mentioned mechanical means for raising and lowering the fork tines necessarily operate so slowly that they allow an all too brief period of time for setting the mechanical, loom-stoppage initiating means into active position. It will be understood that the fork tines are lowered to determine the condition of the filling as the lay is at or near back center position and that it is desirable to stop the loom before the lay reaches front center position if a filling fault exists.

With the aforementioned and other undesirable characteristics of prior fork filling motions generally and more particularly of center fork filling motions in mind, it is an object of the invention to provide a novel fork filling motion which does not possess those undesirable characteristics. Another object of the invention is to provide a center fork filling motion of simple lightweight construction. An additional object is to provide a center fork filling motion which is capable of easy and accurate adjustment. Another object is to provide a center fork filling motion which may be easily and accurately adjusted while the loom is in operation. A further object is to provide a center fork filling motion whose timing may be regulated without substitution of cams or other parts. Another object is to provide a fork filling motion in which the portion of the loom cycle during which the fork is raised may readily be varied. Another object of the invention is to provide a filling fork tine and induction-repulsion means actuating the fork tine. Another object is to provide a magnetically actuated filling fork structure for a fork filling motion. An additional object is to provide an electromagnetically actuated, electrically controlled, center fork filling motion.

The objects of the invention, including both those specifically stated hereinabove and others that will hereinafter become apparent, are attained by the invention, a preferred embodiment of which is fully disclosed in the following description and accompanying drawings forming a part of this specification.

In the drawings:

Fig. 1 is a plan view of a portion of a loom lay equipped with center filling fork devices according to the principles of the invention;

Fig. 2 is a sectional view on line 2—2 of Fig. 1, viewed in the direction indicated by the arrows;

Fig. 3 is a view in elevation as viewed in the direction of arrow A of Fig. 1, of structure shown in that figure but removed from the lay beam;

Fig. 4 is a view of the structure shown in Fig. 3, as viewed from the right in the latter figure;

Fig. 5 is an exploded view in isometric projection of a filling fork armature and tines, and of a switch cam for actuation by the fork armature;

Fig. 6 is an isometric view of a magnetizable field piece and field coil forming a part of the fork filling motion according to the invention;

Fig. 7 is an electrical circuit diagram including a schematic illustration of electrical circuit elements and connections employed in the center fork filling motion according to the preferred embodiment of the invention;

Fig. 8 is a view in elevation of an electrical timer structure with a cover plate and cover plate lock removed;

Fig. 9 is a sectional view of the timer structure illustrated in Fig. 8, taken along line 9—9 in the latter figure, with the cover plate and cover lock ring added;

Fig. 10 is a rear view of the timer structure with a collar and shaft coupling removed;

Fig. 11 is a view in elevation, partly in section, of the timer structure, showing details of the interior construction; and

Fig. 12 is a fragmentary view of timer structure.

Referring to the drawings, and more particularly to Figs. 1 through 4, there is depicted a centrally located segment of a lay beam 10 upon which are mounted the customary reed 11 and shuttle race plate 12. The lay beam and race plate are cut away as usual to provide a fork well 13 into which the tines 14 of a filling fork may move if not prevented from so doing by an intact filling thread or yarn 15 extending along the race plate. As is well known, a single fork tine may be employed, or a plurality, as desired or needed. The structure thus far enumerated is well known to those skilled in the art and may be of conventional design. Only so much of the conventional loom structure is shown as is necessary to a clear understanding of the invention. Secured to the front side of the lay beam by any suitable means, as by screw means 16, 17, is a filling fork structure comprising the mentioned tines and including a frame 18 of iron or other magnetizable material, which may conveniently be formed by casting. The frame is formed with a U-shaped support 19 through the legs of which are bored or otherwise provided, aligned holes providing bearings for a fork spindle 20. The spindle supports for pivotal motion therewith an induction-repulsion fork armature 21 to which the tines 14 are secured in any suitable manner, as by means of slots and screws 22 (see Fig. 5). Armature 21 is secured to the spindle so as to rotate therewith, conveniently by being press-fitted upon the spindle. Carried by a portion of spindle 20 extending beyond support 19 is a switch cam 23 which is secured to and caused to rotate with the spindle by any suitable means, such as a set screw 24. Firmly secured to support 19 by any appropriate means, as by screw means 25 is an electrical switch 26, preferably of the snap-acting variety commercially available under such trade names as "Micro-Switch" and "Mu-Switch." Switches of this type are supplied with three or more terminals providing a normally "closed" pair of terminals and a normally "open" pair of terminals. Switch 26 and cam 23 are so positioned relatively to each other and the cam so positioned on spindle 20, that when the tines of the fork are in thread engaging position (indicated at B in Fig. 2), or above that position, the switch will be in open-circuit condition relative to the electrical circuit in which it is connected, and when the tines are allowed to fall by gravitational action or be lowered as by a conventional weft fork spring (not shown) into the well, as when they engage a broken filling thread or when no thread has been deposited on the race plate (as indicated at C in Fig. 2), the switch will be caused or allowed to assume a closed-circuit condition relative to the circuit.

Secured to and supported by frame 18 is an electromagnet core or field piece 27 preferably formed of thin laminae of soft iron, and of shape indicated in Figs. 2 and 6. The laminae may be secured together to make a unitary element, as by rivets 28, 29, aided by screws 30, 31 which serve to secure the field piece to frame 18. Screws 30, 31 pass each through a respective one of holes 32, 33 formed in field piece 27 (see Fig. 6) and are received in respective tapped holes formed in the upper portion of frame 18 and in a downwardly extending flange portion 34 of the frame. The curved leg 35 of field piece 27 is formed with arcuate upper and lower surfaces 36, 37 concentrically arranged about the axis of spindle 20 as a center. Fork armature 21 is provided with a depending plate-like part 38 provided with an aperture 39 accommodating the curved leg 35 of the field piece. (See Fig. 5.) The plate-like part 38 is of non-magnetic material of good electrical conductivity and preferably of low specific gravity, such as aluminum, thus forming around the aperture 39 an electric coil having a single short-circuited turn in the electrical sense. Aperture 39 is of such dimensions as to allow armature 21 to oscillate freely about the axis of spindle 20 with clearance between the armature and leg 35 of the field piece, but preferably the opening is as small as the mentioned clearance will reasonably permit.

Surrounding and closely fitting the lower part of leg 35 of the field piece is a field coil 40 (see Fig. 6) formed of a plurality of turns of insulated electric conductor, such as aluminum or copper wire, the coil being suitably insulated and protected as by means of a tape wrapping 41. The field coil is arranged to be periodically energized by rapidly fluctuating current of suitable intensity in a manner and by means more fully described hereinafter, through coil leads Y, Z. When so energized, a rapidly varying magnetic field is set up by the coil, the magnetically permeable structure formed by frame 18 and field piece 27 forming a good flux path and allowing a relatively strong fluctuating field to be created. Since the current in coil 40 is rapidly fluctuating there is a continually changing magnetic flux cut by the short-circuited turn formed by armature part 38, which results in a flow of induced electrical current in the short-circuited turn. The last mentioned current creates a magnetic field which tends to oppose or "buck" the first mentioned magnetic field, causing the short-circuited turn formed by part 38 to tend to be repulsed by and hence to move away from coil 40. Being free to so move, part 38 moves to the left as viewed in

Figs. 2 and 3, rotating the fork armature of which it is a part about the axis of spindle 20 and consequently raising tines 14 above race plate 12 and into a position indicated at D in Fig. 2. As soon as the current supply to coil 40 is cut off, gravitational forces act to lower tines 14 to filling engaging position. Obviously, gravitational forces may, if desired, be aided by conventional filling fork spring means (not shown). It will be seen that by suitably opening and closing the current supply circuit for coil 40 in timed relation to the passage of the filling-layer or shuttle, the tines may be raised to permit passage of the weft layer and allowed to return to filling engaging position to detect presence or absence of an intact filling. Further it will be seen that if the tines are permitted to fall or be lowered into the fork well by absence of an intact filling, switch cam 23 will be rotated to a position causing switch 26 to assume a closed circuit condition. Through suitable instrumentalities more fully disclosed hereinafter, the loom may thus be stopped, or other loom changes initiated.

To supply fluctuating current (which may be pulsating direct current or alternating current) at the proper times and during the proper periods to coil 40, and to permit switch 26 to properly control initiation of an operational change in the loom, such as loom stopping, electrical circuit means and appurtenant structure are provided and connected as indicated diagrammatically in Fig. 7. Referring to the latter figure, rapidly fluctuating electric current is made available to coil 40 by means of a power transformer T whose primary P may conveniently be connected to the loom power supply circuit, not shown, preferably but not necessarily through the conventional master switch controlling the loom driving motor circuit, not shown. The transformer may have a tapped secondary but preferably has a plurality of secondary windings including a secondary S—A whose terminals are connected to suitable conductors or leads as indicated to supply current to coil 40 in series with timer contacts C1, C2 which are hereinafter more fully described and explained. It will be noted that engagement (closing) of the two contacts allows current to flow through, and energize, coil 40. Continuing reference to Fig. 7, fork armature 21 is diagrammatically illustrated as in a position wherein tines 14 are raised and switch cam 23 is positioned to cause or allow switch 26 to assume an open-circuit condition. Rotation of armature 21 by downward movement of the tines into the fork well results in cam 23 taking a position wherein switch 26 assumes a closed-circuit condition, allowing current to flow from an additional transformer secondary S—B through a normally closed switch S of any suitable conventional type to and through a stop motion magnet coil M of a suitable conventional electrical loom stop motion, through switch 26, through timer contacts C3, C4 which are hereinafter more fully described and explained, and back to and through secondary S—B, the enumerated parts being electrically connected by suitable insulated electrical conductors as indicated. While switch 26 is diagrammatically illustrated as with its "normally open" terminals connected in circuit with coil M and secondary S—B, it will be evident that cam 23 may be so set that the circuit may be operated with the "normally closed" terminals of switch 26 connected in series with coil M and secondary S—B. In this mode of operation cam 23 would cause switch 26 to assume a position wherein the "normally closed" terminals thereof would remain electrically disconnected until the fork tines descended into the fork well, whereupon the cam would permit or cause the switch to assume normal position with the "normally closed" terminals electrically connected. In the case of either of the described modes of operation of cam 23 and switch 26, closure of the circuit through the latter results in energization of stop motion magnet coil M and initiation of loom stopping action thereby, assuming for the moment that contacts C3, C4 are closed. The loom stopping action is of itself well understood in the art and need not here be further described.

It will be understood that transformer T may be replaced by other equivalent means, such as a rectifier circuit or a vibrator circuit, to supply pulsating direct current or alternating current to coil 40 and to supply either pulsating or continuous current power to coil M. Further, it will be obvious that any suitable power voltages and currents may be employed, the circuit elements being designed and insulated in accordance with the values chosen. Common voltages used for loom motor operation are 110 volts, 220 volts and 440 volts, for any of which the primary of transformer T may be wound. Commonly employed loom auxiliary and stop motion voltages range from 4 to 16 volts, for any of which the transformer secondaries S—A and S—B may be wound. Coils 40 and M may be constructed for 50 watts power consumption, and may differ from that value as conditions warrant or require. While equivalent means for supplying pulsating current to coil 40 and current to coil M may be employed, an alternating current transformer is preferred for its simplicity, cheapness and other obvious characteristics.

Referring to Figs. 8 through 12, there is illustrated means including a preferred form of timer structure including the aforementioned pairs of contacts C1, C2 and C3, C4, which structure allows of easy and precise adjustment whereby the time of energization and period of energization of field coil 40, and the portion of the loom operating cycle during which switch 26 is permitted to be potentially capable of completing a circuit through magnet coil M, may be easily and precisely regulated to secure optimum results in detecting filling faults and effecting early loom stopping. A plate-like bracket 50 of which only one end is shown, and of any desired shape and size is secured to any convenient fixed part of the loom frame (not shown), preferably adjacent the loomside and extending outwardly to a position near the end of the crankshaft of the loom. Mounted on bracket 50 by means of headed screws 51, 52 passing through and movable in respective arcuate apertures 53, 54 in the bracket is a timer cup 55 having tapped holes as indicated to receive the screws 51, 52. The timer cup is preferably of cylindrical exterior configuration and is provided with an axially extending bore 56 passing through the base of the cup and through an integral bearing boss 57 extending from the base of the cup, see Fig. 9. Bracket 50 is provided with a circular central aperture 58 aligned with and of the same diameter as bore 56, and about which are formed the arcuate openings 53 and 54, Fig. 10. Tightly engaging the inner wall of the cup and resting on a shelf 59 formed on the inner wall is a disk 60 of electrical insulation, e. g. synthetic resin, some of which are sold under the names, "Micarta" or "Bakelite." The disk is provided with a centrally located aperture align-

ed with bore 56. The latter bore and the aperture aligned therewith rotatably accommodate a timer cam shaft 61. The shaft extends outwardly of the base of the timer cup and through the aperture 58 in bracket 50 and has secured to it at its outer end one member, S1, of a coupling by means of which the shaft is given rotative movement by a second and similar coupling member S2 secured to, or otherwise driven in timed relationship with, the conventional loom crankshaft, not shown. Holding shaft 61 in position in the bore, and retaining disk 60 against shelf 59, is a collar 62 outside of and bearing against a face of bracket 50, and a timer cam 63 secured on the inner end of the shaft. The collar and the cam may be secured in proper positions on the shaft by any suitable means, as by set screws as indicated. The cam preferably has a circular hub to bear against disk 60 as indicated, and may be of eccentric shape.

Mounted on disk 60 is a pair of screw pivots 64, 65, which are secured to the disk by each passing through respective holes formed therein and having locking nuts thereon turned tight against the disk as indicated in Fig. 9. These screw pivots serve as electrical terminals and pivot mounts for respective breaker arms 66, 67 having looped ends closely surrounding the respective pivots between shoulders thereon, said arms being formed of suitable electrically conductive spring material such as copper-beryllium alloy or steel; each of the arms having secured thereto as by means of rivets a respective cam follower block 68, 69 formed of a suitable wear-resistant electrical insulation material such as have been mentioned above. Holding the two follower blocks into contact with the aforementioned timer cam 63 is a coil spring 70 hooked at each end in a suitable hole formed in a respective one of the blocks. See Fig. 8. Breaker arm 66 has secured to it as by brazing the aforementioned contact C1, which is arranged for electrical co-action with its mating contact C2 which in turn is secured to or forms an end of an adjusting screw 71 carried by and threaded through a tapped opening in an electrically conductive terminal mount 72 suitably secured to disk 60 as by a screw 73 and a rivet 74 which conveniently may form a terminal for contact C2. Screw 71 preferably is made of sufficient length to extend outwardly from its mount through an aperture 75 formed in cup 55 (see Fig. 12). The aperture may be fitted with a suitable bushing 76 of electrical insulation, the interior diameter of the bushing being such as to easily pass screw 71. Thus it is evident that screw 71 may be adjusted from the exterior of the timer cup to move contact C2 toward or away from its mate, C1, for a purpose more fully explained hereinafter. Across the terminals formed by rivet 74 and screw pivot 64 there is preferably connected a spark-suppressing resistor RA, of about 750 ohms resistance; and suitable insulated leads W, X from the terminals extend out of the timer cup through an insulating bushing 77 mounted in an aperture 78 formed in the wall of the cup. Similarly to the case of arm 66 and appurtenant structure, breaker arm 67 has secured to it contact C3 which coacts with its mate C4 on an adjusting screw 79 threaded through an opening in a conductive terminal mount 80 secured to disk 60 by screw 81 and rivet 82. Similarly, terminals formed by screw pivot 65 and rivet 82 have connected thereacross a 750 ohm resistor RB, and have connected thereto insulated leads N, O, extending out of the timer cup through bushing 77. Screw 79 is extended outwardly of the timer cup through an insulating bushing 83. Contacts C3, C4 are employed to open the circuit through stop motion magnet coil M during that period of each loom cycle when the filling is moved from under the fork tines as it is beaten into the fell of the cloth being woven. During that period, commencing a short time prior to front center position of the lay and terminating a short time after front center, the fork tines are forced into the fork well and thus cause switch 26 to assume a closed circuit condition. Separation of contacts C3, C4 during the entirety of that period prevents switch 26 from initiating an undesired loom stoppage. The above mentioned resistors are of such resistance as to pass insufficient current to cause operative energization of coils 40 and M.

Cam 63 is, as above indicated, preferably of eccentric configuration; and being secured to shaft 61 will rotate synchronously with the loom crankshaft and thereby cause oscillation of breaker arms 66, 67 about their respective pivots to cause opening and to allow closing of the respective pairs of contacts C1, C2 and C3, C4, under the influence of spring 70. It is evident that, since a single cam is employed to operate both breaker arms, and since both the times of closing and opening and the duration of engagement of contacts C1, C2 are quite different from those of contacts C3, C4, a particular arrangement of the parts is necessary. It is desirable that contacts C1, C2 close at a point in the loom cycle corresponding to about 45° of crankshaft revolution past front center as the lay moves toward top center position, to cause raising of the fork tines as soon as practicable after they clear the fell of cloth and before filling laying or shuttle picking occurs, at or near the top center position of the lay; and it is desirable that those contacts open at a point in the cycle corresponding to about 90° past top center position of the lay so the tines may move down into detecting position as soon as possible after the filling has been laid past the fork well. These times of closing and opening of contacts C1, C2 vary somewhat for different loom speeds, and are different for different widths of looms. It thus is important, especially in high speed looms, to be able to widely vary and to precisely adjust the time of closure of contacts C1, C2 and the duration of the period of their closure. It is desirable that contacts C3, C4 open the stop motion magnet circuit some time following termination of the active filling detection period and prior to the time the filling is moved from under the fork (the former time corresponds roughly to a point in the loom cycle 60° before front center position), and to maintain the circuit open until after the fork tines have been lifted from the fork well (which occurs somewhat prior to a point in the loom cycle corresponding to 90° past front center position of the lay). Thus is it seen that contacts C1, C2 should be closed from approximately 45° past front center to approximately 90° past top center, or roughly through 135° of rotation of the eccentric or cam 63, this period having its middle at about 22° past top center; whereas contacts C3, C4 should be closed from approximately 90° past front center to approximately 30° past bottom center, or roughly through 210° of rotation of the cam, this period having its middle at about 15° past rear center. Since the middles of the respective periods of closure of contacts C1, C2 and C3, C4, are thus roughly 83° apart, the highest point

of cam 63 should contact follower block 68 about 83° ahead of the point at which it will later contact follower block 69. Accordingly, the follower blocks are so shaped and placed that their lines of contact with the cam are 83° apart, as illustrated in Fig. 8. In this arrangement it is assumed that cam shaft 61 will rotate in the direction indicated in the arrow in Fig. 8. The durations of time or portions of the 360° of rotation of the cam during which the respective pairs of contacts are in contact may readily be adjusted by moving respective screws 71, 72, in or out, toward or from, their mating contacts, as is deemed to be obvious, each spring breaker arm bending slightly and returning to normal condition during the period of interengagement of its associated contacts. Thus by adjustment of screw 71, contacts C1, C2 may be set to engage during exactly 135° of rotation of the cam, or more, or less, as conditions warrant or require. After screw 71 has thus been adjusted to provide the proper period of closure of C1, C2, the precise time at which closure commences may be adjusted by loosening screws 51, 52 and rotating the timer cup about shaft 61, thus rotating breaker arm 66 and follower block 68 about the cam, until the proper timing has been secured. Thereafter screws 51, 52 are tightened to secure the cup in adjusted position. To facilitate initial adjustment of the timer cup and to allow of ready duplication of a previous adjustment thereof, an index mark 84 is scribed on bracket 59 and cooperating marks 85 are formed on the outside face of the cup at the base thereof, as indicated in Fig. 11. Since the times of closure and opening of contacts C3, C4 are not critical but may be shifted as much as 15° of each cam revolution without detrimental results, it is seen that the precise adjustment of the timing of contacts C1, C2 need not deleteriously affect the timing of contacts C3, C4. The duration of the period of closure of the latter contacts may, of course, be widely varied by adjustment of screw 72.

It will be understood that screws 71, 72 may be secured in their terminal mounts by any suitable means as by lock nuts (not shown), but preferably the screws and mounts are made with tightly interfitting surfaces, which allows of ready external adjustment of the screws.

The contained structure within cup 55 may conveniently be protected from dust or accidental damage by a cover plate 86 (Fig. 11) resting on a shelf 87 formed on the inner wall of the cup, the plate being held in place by an expansible internal spring locking ring 88 bearing in a groove 89 formed in the inner face of the cup.

Initial setting, adjustment, and operation of the filling motion may briefly be summarized as follows. With screw 71 adjusted so the cam will cause closure of contacts C1, C2 during only approximately 135° of each 360° it rotates, and screw 72 adjusted so contacts C3, C4 will be closed by the cam during 210° of each complete rotation, and with screws 51, 52 positioned approximately in the centers of their respective slots 53, 54 and tightened, and with the lay of the loom advanced about 45° of crankshaft rotation toward top center from front center, cam 63 is loosely rotated on shaft 61 until contacts C1, C2 just close. The timer cam set screw is then tightened, cover plate 86 locked in place by ring 88 and the loom may then be operated. With the crankshaft, and hence the lay, operating and moving successively through front center (0°), top center (90°), rear center (180°), and bottom center (270°) positions in repetitive cycles, timer cam 63 is rotated synchronously therewith, periodically causing closure of the respective pairs of contacts C1, C2 and C3, C4 and thereafter allowing opening thereof under the influence of spring 70. Commencing with the lay at 0° position, with the fork tines in the fork well and transformer T energized, switch 26 is closed but contacts C3, C4 are open and consequently magnet coil M is not energized. Contacts C1, C2 are likewise open and coil 40 is not energized. As the lay moves rearwardly, contacts C1, C2 close at or about the time the 45° position is reached, closing the circuit through coil 40, and tines 14 commence to rise. The tines rise quickly, causing switch 26 to assume open circuit condition, and are well above the level of the race plate by the time the lay reaches the 90° position, at approximately which time contacts C3, C4 close. Closure of the latter contacts fails to complete the circuit through coil M, however, since that circuit is at this time open at switch 26. Filling laying commences at about 90° position and continues usually until after 180° position, the filling being laid past the fork well sufficiently early in the movement of the lay from the 90° to the 270° position to allow deenergization of field coil 40 at about 180° position, and at approximately that time contacts C1, C2 are opened. The fork tines then move down and are either stopped at the level of the race plate by an intact filling or move into the well if not so stopped, this action being completed by the time the lay reaches the 200° position or shortly thereafter. In the event the tines move into the well, the circuit through coil M is completed by switch 26 and the loom is stopped through action of the conventional stop motion. In the event the tines encounter an intact filling, the lay continues to and through the 270° position. At about the 300° position, contacts C3, C4 are opened, and the lay continues on toward 360° (0°) position. At approximately the 320° position, the filling moves out from under the fork tines and the latter move down, causing switch 26 to assume the closed circuit condition. This action is ineffective, however, to cause energization of coil M, due to the previous opening of contacts C3, C4 at about the 300° position. Upon the lay again reaching the 0° position, the cycle of operations is repeated. It will be obvious that screw 71 and timer cup 55 may be adjusted while the loom is in operation to lengthen or shorten the period during which the field coil 40 is energized and also to vary the point in the loom cycle at which such energization commences, to most advantageously utilize the time following laying of the filling past the fork well in initiating operation of the loom stop motion and effecting loom stopping.

It will be obvious to those skilled in the art that contacts C3, C4 and the means for actuating and adjusting them may be eliminated from the stop motion magnet circuit if the stop motion mechanism is so arranged as to be ineffective during the time the filling fork is normally in the well. I prefer, however, to employ a timing device in the stop motion magnet circuit to obviate the continual intermittent energization of the stop motion magnet coil and resultant vibration of stop motion parts.

From the above description of the construction and operation of a preferred embodiment of the invention it will be seen that there has been provided for looms a filling motion of simple construction whose parts are few and small and

light in weight, which may be precisely adjusted and timed with great accuracy while the loom is in operation, whose parts are readily accessible to the loom fixer, and in which the duration of the period during which the fork tines are raised may be readily varied without change of filling motion cams or other parts. Further it will be seen that there has been provided a filling motion which allows ready adjustment to secure the maximum possible time between detection of a weft fault and loom stoppage in which to initiate and effect stopping of the loom. Further it will be seen that there is provided a filling motion that lends itself to easy incorporation into existing as well as new looms, and which in these and other ways achieves the objects of the invention.

Having fully disclosed a preferred embodiment of my invention it will be evident that changes and modifications will occur to those skilled in the art to which it pertains; and I do not desire to be limited to the particular physical structure chosen to illustrate the invention, but what I claim is:

1. A filling fork structure for a loom including, in combination: a fork tine, and means including periodically active interacting magnetic field producing means for actuating said tine.

2. A filling fork structure for a loom including, in combination: a fork tine, means responsive to a changing magnetic field to move said tine to active position, and means producing a changing magnetic field to which the first-named means is responsive.

3. A fork filling motion for a loom, comprising, in combination: magnetic-field producing means; filling fork means including magnetic-field responsive means and a tine moved thereby in response to changes in the magnetic-field produced by said field producing means; and means causing said changes in the magnetic field produced by said field producing means.

4. A fork filling motion for a loom, comprising, in combination: electric coil means arranged to produce upon energization a first magnetic field; means capable of producing a second magnetic field within said first field; a filling fork tine on one of said means to receive operative movement in response to interaction of said first and second magnetic fields; and electrical means periodically energizing said electric coil means.

5. A fork filling motion for a loom comprising, in combination therewith: eletromagnet means including a magnetizable field piece and a conducting coil on said piece; filling fork means including a tine and an armature carrying said tine and including a short-circuited conducting coil encircling said field piece; means capable of supplying fluctuating electric current to said first named conducting coil; and means capable of intermittently interrupting the supply of current to said first named conducting coil in timed relation to loom operaion.

6. A fork filling motion for a loom, comprising, in combination: a first means producing a first magnetic field; a second means producing a second magnetic field having a component interacting with a component of said first magnetic field; structure supporting said first and second means for relative movements therebetween in response to changes in the interacting components of their fields; apparatus causing periodic changes in said interacting components of said magnetic fields and thereby causing said relative movements; a filling fork tine; and structure connecting said tine to one of said means and causing said tine to move to active position in response to one of said movements.

7. A fork filling motion for a loom comprising, in combination: a fork armature and a tine carried thereby; means capable, upon change of a condition, of repelling said armature and moving said tine; and means periodically causing said change of condition.

8. A fork filling motion for a loom including, in combination therewith: electromagnet means; induction-repulsion means responsive to a change in magnetic-field produced by the electromagnet means to produce relative movement therebetween; means supplying fluctuating electric current to said electromagnet; means interrupting the supply of said current in timed relation to loom operation; and a filling fork tine carried by one of said first and second named means and moved thereby upon occurrence of said relative movement.

9. A center filling fork motion for a loom having a moving lay beam, comprising, in combination therewith: a frame carried by the lay beam; an electromagnet field piece carried by said frame; a first electric coil on said field piece; a fork armature pivotally carried on said frame and including a short-circuited coil encircling said field piece; a fork tine carried by said armature; electrical means connected in circuit and capable of supplying rapidly fluctuating electrical current to said first coil; means operating in timed relation to movement of the lay beam to interrupt and to re-establish said circuit whereby said first electric coil is periodically energized to cause repulsion of said short-circuited coil and raising of said tine to active position; and means operable by said armature and tine to initiate loom stoppage upon abnormal movement of said tine.

10. In a loom having a filling inserting mechanism and means for initiating the stopping of the loom upon failure of said filling inserting mechanism properly to insert a pick of filling, means affecting said means to initiate stopping which includes a filling fork motion comprising at least one filling fork tine, a support for said tine upon which it moves to and from a position to contact the filling, and means for acting through said support for moving the tine to and from a position to engage the filling which comprises a magnetic core, a circuit and means for periodically varying current flowing in said circuit to induce a magnetic field in said core, and a current conductor movable with said support and so positioned with respect to said core as to have a current induced therein, thereby to set up a second magnetic field in opposition to the magnetic field first mentioned, said opposed magnetic fields being effective for moving the current conductor and tine support relatively to the said core.

11. In a loom having a filling inserting mechanism and means for initiating the stopping of the loom upon failure of said filling inserting mechanism properly to insert a pick of filling, means affecting said means to initiate stopping which includes a filling fork motion comprising at least one filling fork tine, a support for said tine upon which it moves to and from a position to contact the filling, and means acting through said support for moving the tine to and from a position to engage the filling which comprises a magnetic core, a circuit including a coil surrounding said core and means for periodically varying current flowing in said cir-

cuit to induce a magnetic field in said core, and a current conducting armature forming a part of said support and movable therewith, said armature being so positioned with respect to said core as to have a current induced therein, thereby to set up a second magnetic field about the said armature and in opposition to the magnetic field first mentioned in said core, said opposed magnetic fields being effective for moving the armature, support and tine relatively to the core and for the purpose above indicated.

12. In a loom having a filling inserting mechanism and means for initiating the stopping of the loom upon failure of said filling inserting mechanism properly to insert a pick of filling, means affecting said means to initiate stopping which includes a filling fork motion comprising at least one filling fork tine, a support for said tine upon which it moves to and from a position to contact the filling, and means acting through said support for moving the tine to and from a position to engage the filling which comprises a curved core of magnetically permeable material, a circuit including a coil surrounding said core adjacent one end thereof and means for periodically varying current flowing in said circuit to induce a magnetic field in and adjacent said core, and a current conducting armature surrounding said core and movable with said support, said armature being adapted to have a current induced therein when the said core is magnetized, thereby to set up a secondary magnetic field about the conductor and in opposition to the magnetic field primarily induced in said core, said opposed magnetic fields being effective for moving the current conductor, support and tine relatively to the said core.

13. In a loom having a filling inserting mechanism and means for initiating the stopping of the loom upon failure of said filling inserting mechanism properly to insert a pick of filling, means affecting said means to initiate stopping which includes a filling fork motion comprising at least one filling fork tine, a support for said tine and a pivot upon which said support and tine may be oscillated to and from a position to contact the filling, and means acting through said support and including an armature, a magnetic core, a circuit and means for periodically varying current flowing in said circuit to induce a primary magnetic field in said core, said armature surrounding said core and constituting a short-circuited, non-magnetic conductor within which a current is induced as said core is magnetized, said armature, when a current is induced therein, having produced therein a secondary magnetic field relatively disposed with respect to the primary magnetic field so that the two act in opposition for moving the armature along the core thereby to swing the support and tine about their pivot.

14. In a loom having a filling inserting mechanism and means for initiating the stopping of the loom upon failure of said filling inserting mechanism properly to insert a pick of filling, means affecting said means to initiate stopping which includes a filling fork motion comprising at least one filling fork tine, a support for said tine upon which it moves to and from a position to contact the filling, and means for acting through said support for moving the tine to and from a position to engage the filling which comprises a magnetic core, a circuit and means for periodically varying current flowing in said circuit to induce a magnetic field in said core, which means comprises a circuit interrupter and cam means functioning on a moving part of said loom which operate in timed relation to the filling inserting movement thereof, and a current conductor movable with said support and so positioned with respect to said core as to have a current induced therein when said core is magnetized, thereby to set up a second magnetic field in opposition to the magnetic field first mentioned, said opposed magnetic fields being effective for moving the current conductor, support and tine relatively to the said magnetized core.

GEORGE E. CLENTIMACK.

REFERENCES CITED

The following references are of record in the file of this patent:

FOREIGN PATENTS

Number	Country	Date
675,283	Germany	May 5, 1939