No. 686,060. Patented Nov. 5, 1901.

H. I. HARRIMAN & L. BELL.

LOOM.

(Application filed Mar. 12, 1901.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

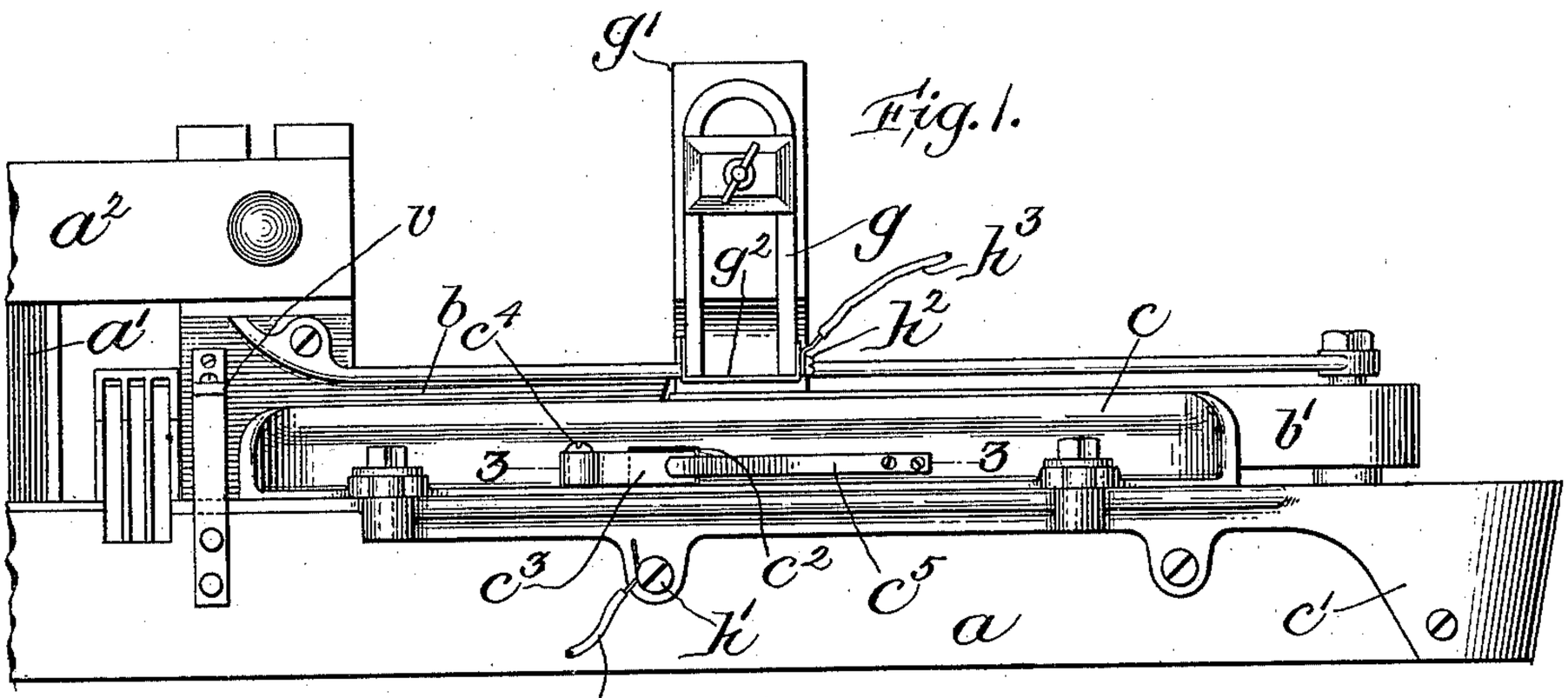

Fig. 3.

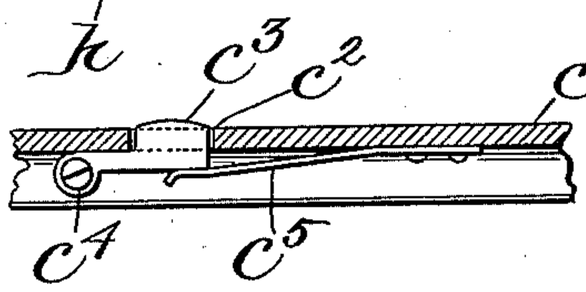

Fig. 2.

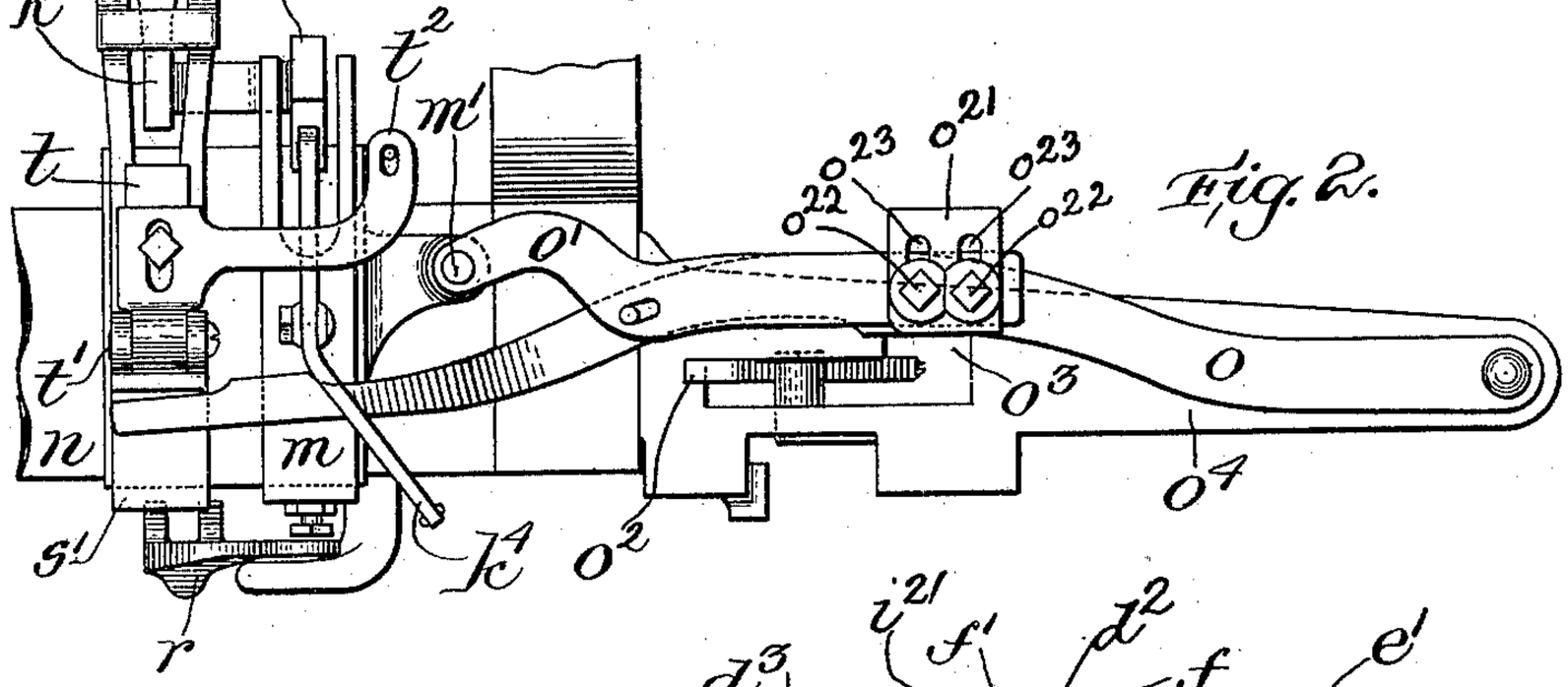

Fig. 5.

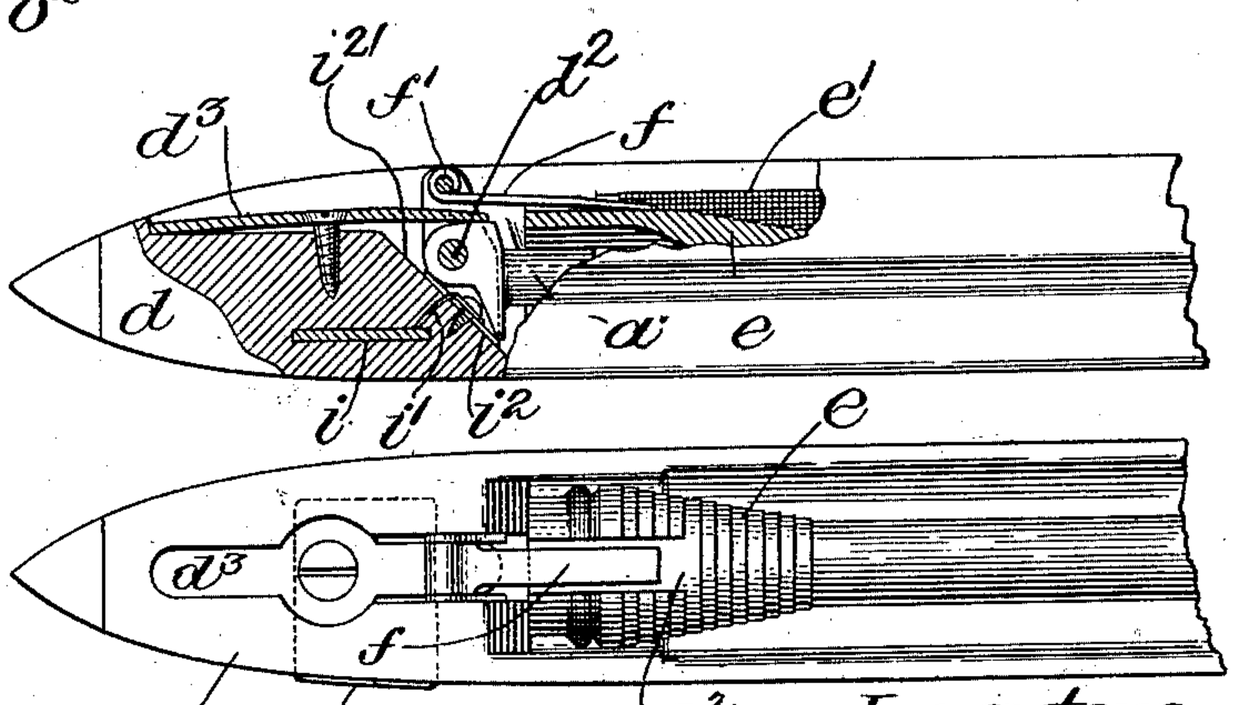

Fig. 4.

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(No Model.) 4 Sheets—Sheet 2.

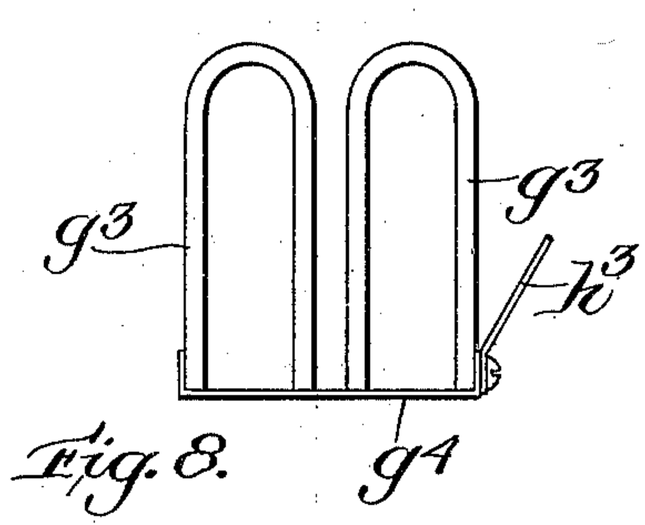

Fig. 8.

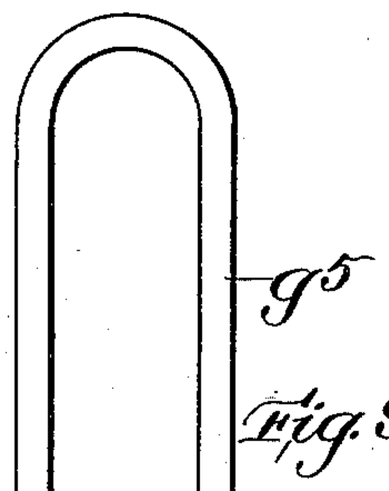

Fig. 9.

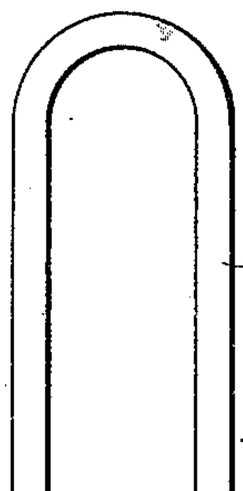

Fig. 11.

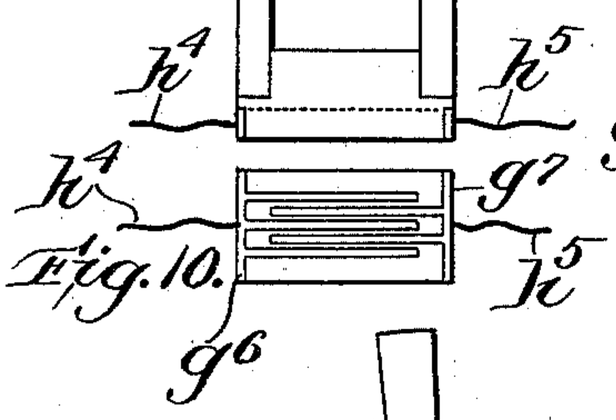

Fig. 10.

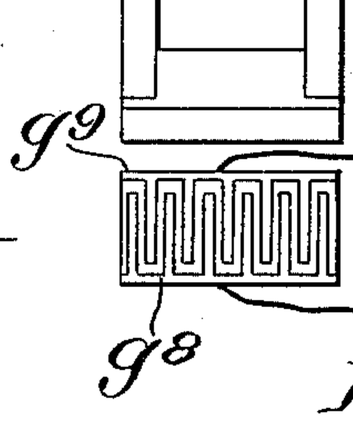

Fig. 12.

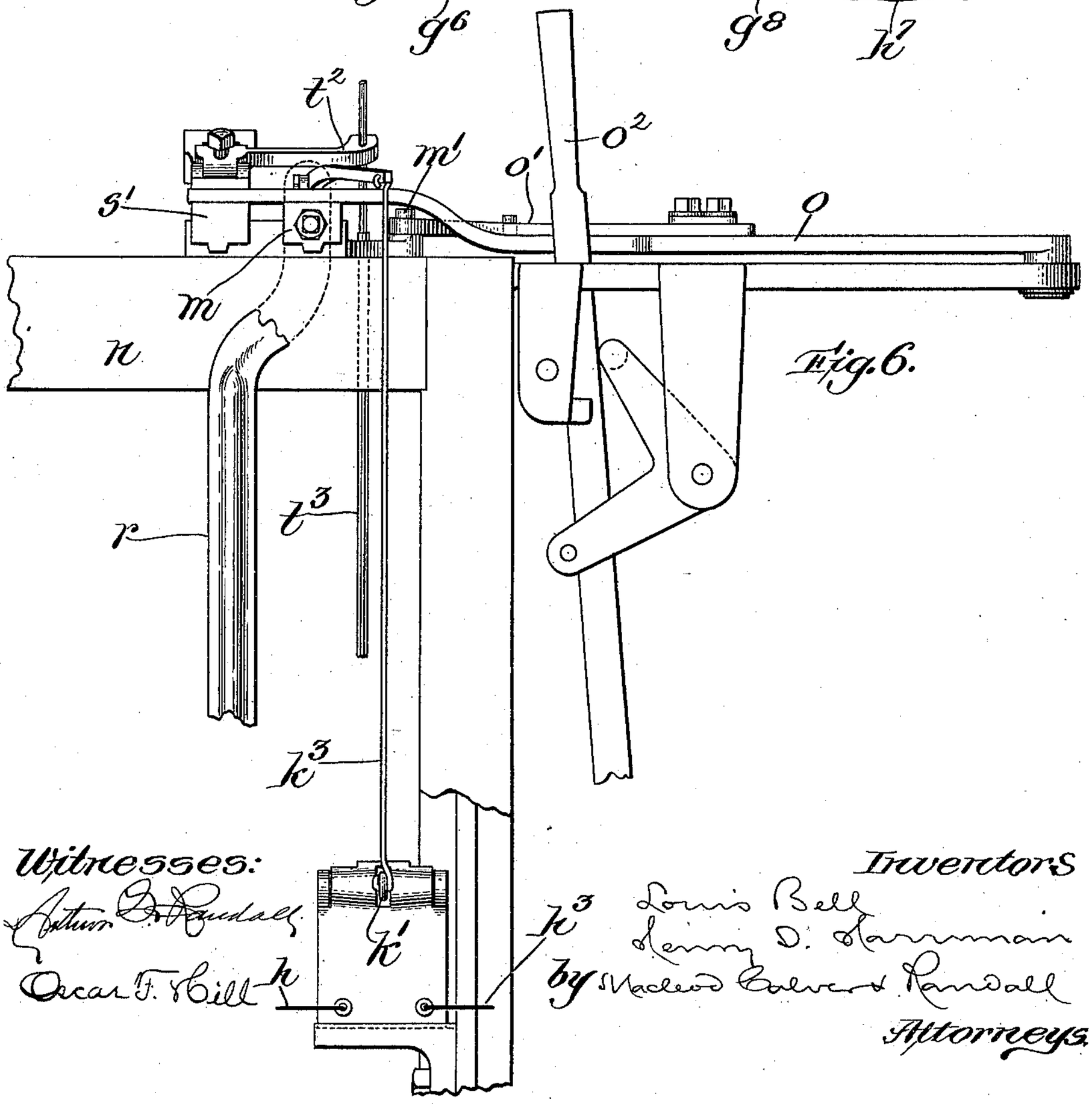

Fig. 6.

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LOOM.

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(No Model.) 4 Sheets—Sheet 3.

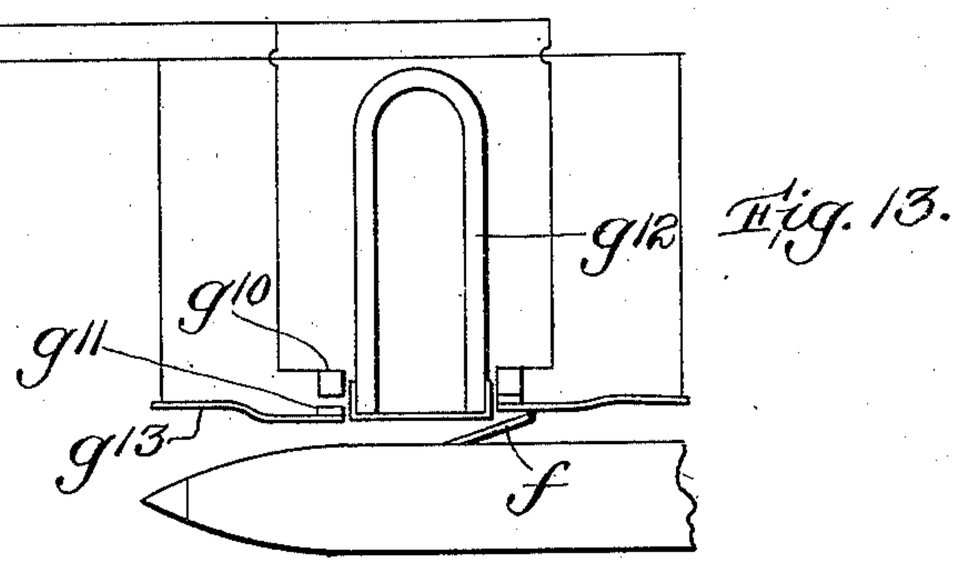

Fig. 13.

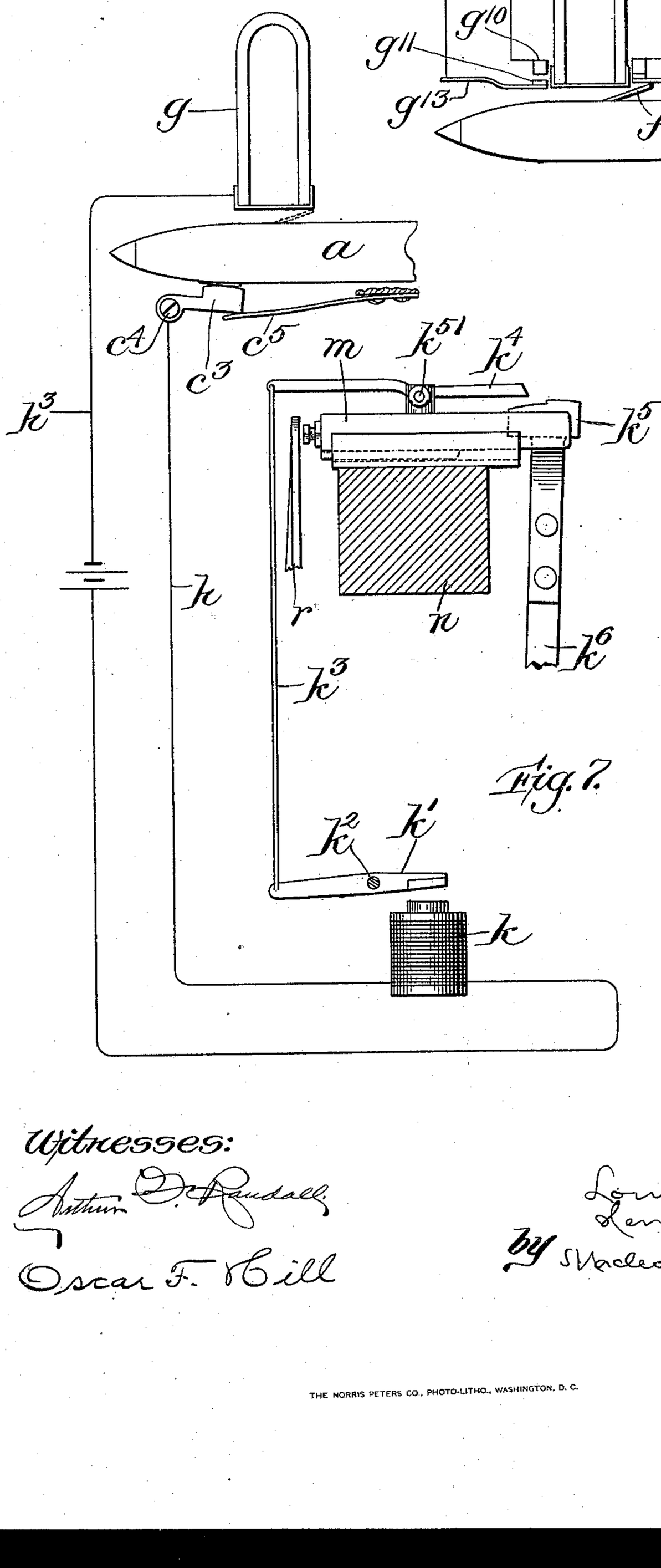

Fig. 7.

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(No Model.) 4 Sheets—Sheet 4.

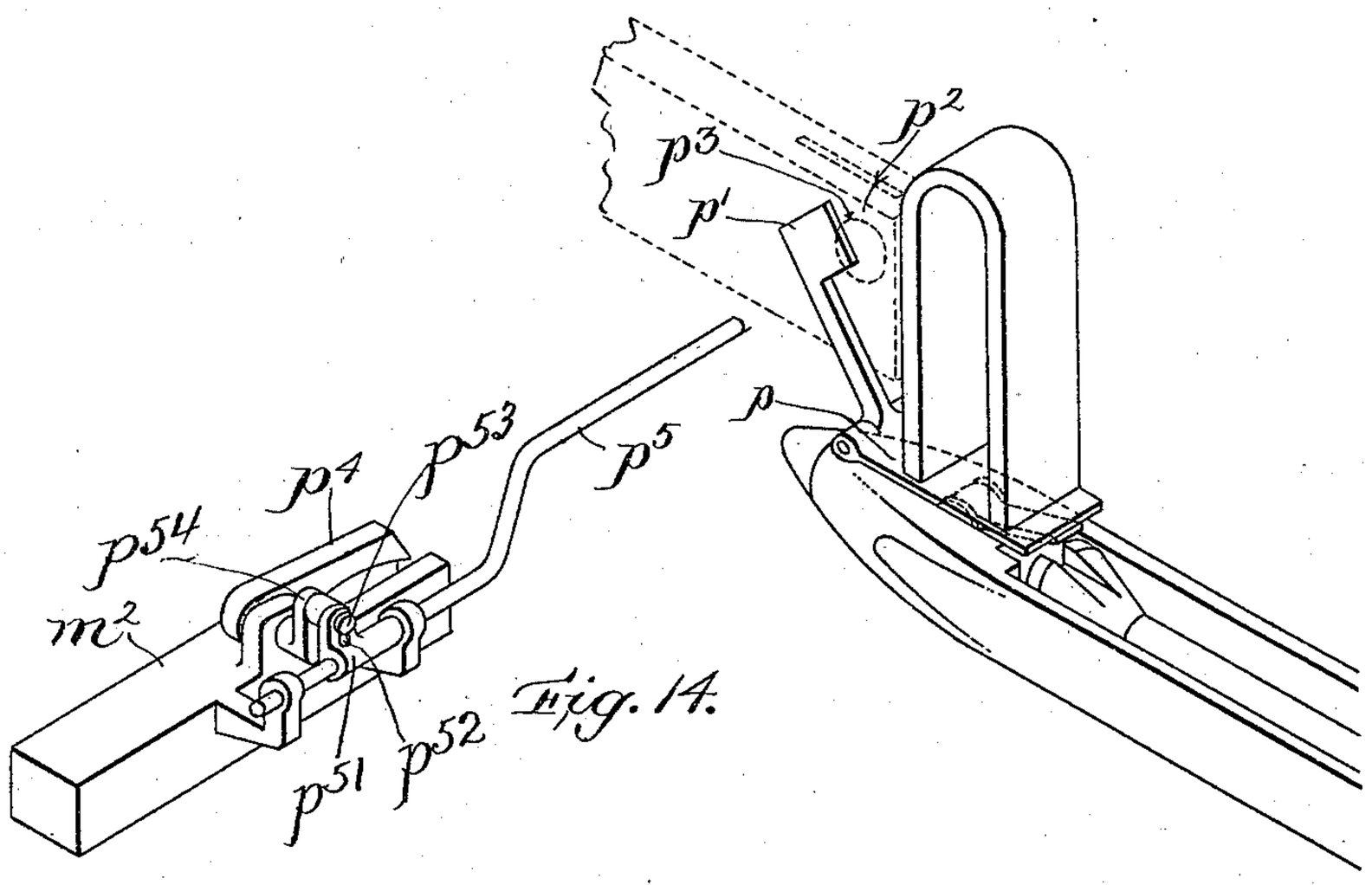

Fig. 14.

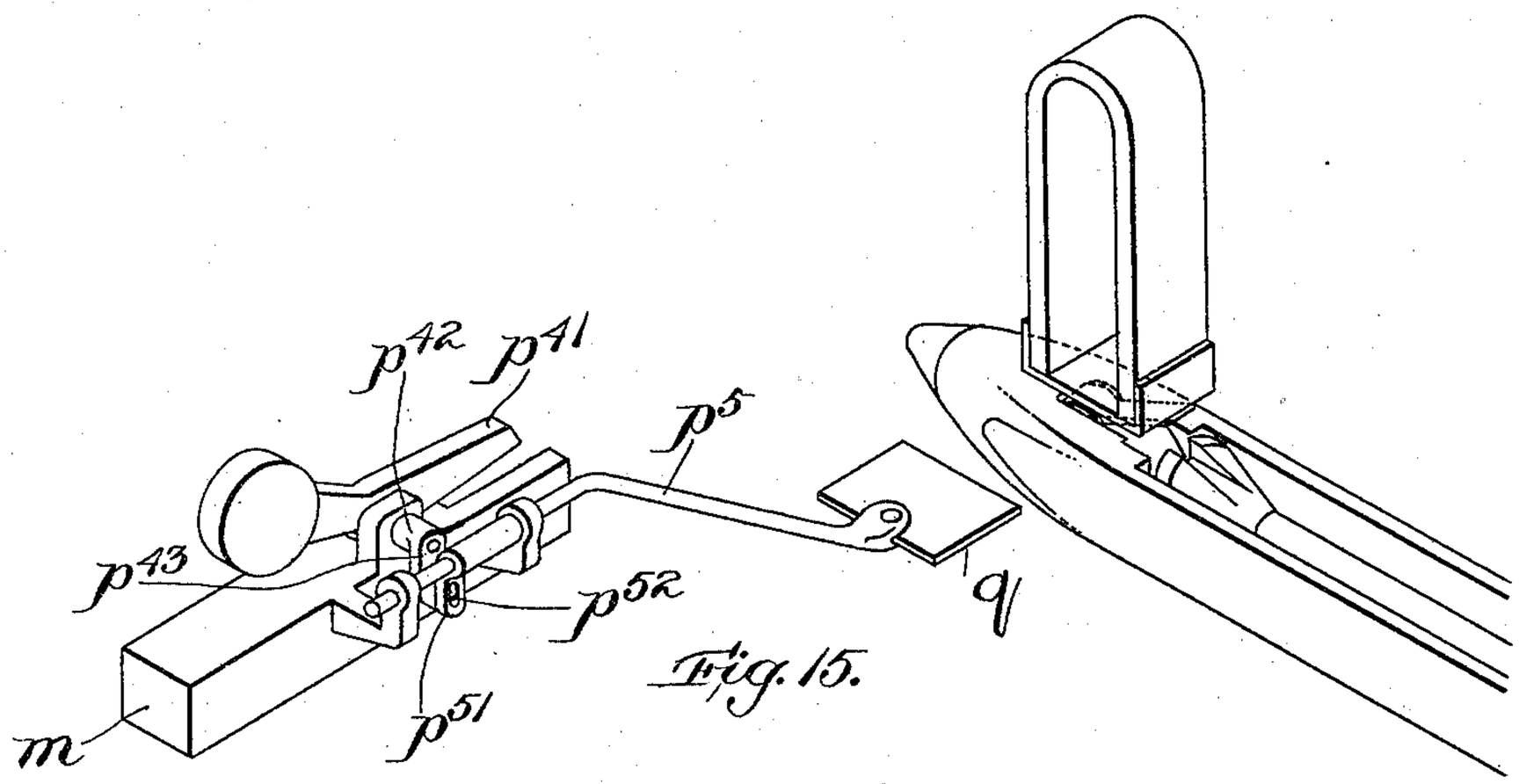

Fig. 15.

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UNITED STATES PATENT OFFICE.

HENRY I. HARRIMAN, OF NEW YORK, N. Y., AND LOUIS BELL, OF BROOKLINE, MASSACHUSETTS.

LOOM.

SPECIFICATION forming part of Letters Patent No. 686,060, dated November 5, 1901.

Application filed March 12, 1901. Serial No. 50,818. (No model.)

To all whom it may concern:

Be it known that we, HENRY I. HARRIMAN, residing at New York, county of New York, State of New York, and LOUIS BELL, residing at Brookline, county of Norfolk, State of Massachusetts, citizens of the United States, have invented a certain new and useful Improvement in Looms, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention comprises improved instrumentalities for ascertaining the condition of the weft-supply carried by the working shuttle in a loom and also combinations of the said instrumentalities with instrumentalities for controlling or modifying the working of the loom.

The invention has been designed to constitute more especially an improvement in looms of the class in which replenishment of the working weft-supply is effected automatically when the necessity for replenishment arises. Looms of this class are presented, for instance, in prior United States Letters Patent to Henry I. Harriman, No. 626,834, granted June 13, 1899; No. 636,228, granted October 31, 1899; No. 637,113, granted November 14, 1899, and No. 652,105, granted June 19, 1900. The precise manner and means of effecting the weft-replenishment in looms having the present invention applied thereto is immaterial, and the invention is equally well adapted for employment whether the said replenishment is effected by making automatic change of shuttles or of shuttle-boxes or of weft-carriers.

Some of the features of the invention are not restricted necessarily to use in an automatic weft-replenishing loom, but may be utilized in other looms as well, as will be apparent from the description which is contained hereinafter.

The weft-detecting instrumentalities of the present embodiment of our invention are designed to ascertain the occurrence of the predetermined degree of depletion or exhaustion of the weft-supply that is carried by the working shuttle on the lay of a loom and in practice will be caused to indicate or act when some yarn still remains unwound within the said shuttle, the object being, as will be understood, to provide for occasioning the weft-replenishment or the stoppage of the loom before complete unwinding of the said weft-supply takes place, so that neither a short or incomplete length or pick of weft nor the portion of yarn first wound in preparation for introduction into the shuttle shall occupy a given shed in the cloth with injury to the latter.

We have illustrated our invention in the best form thereof which has yet been devised by us in the accompanying drawings, in which latter—

Figure 1 shows in front elevation one end portion of the lay of a loom, the same having applied thereto certain parts which will be referred to hereinafter. Fig. 2 shows in plan the corresponding end of the breast-beam and the parts which are applied thereto. Fig. 3 is a detail view, partly in horizontal section, on line 3 3, Fig. 1. Fig. 4 is a plan of portion of a loom-shuttle provided with a certain feature of the invention. Fig. 5 is a partly-sectional or broken-away side elevation of the said shuttle. Fig. 6 shows in front elevation the various parts which are represented in Fig. 2. Fig. 7 is a view on the order of a diagram, illustrating the action of the parts which are involved in the invention. Fig. 8 shows an arrangement including two magnets. Figs. 9 and 11 show in elevation, and Figs. 10 and 12 show in bottom view, two other modified arrangements of magnets. Figs. 13 and 14 are detail views showing certain modifications of the invention. Fig. 15 shows another modification.

Having reference to the drawings, *a*, Fig. 1, designates the lay-beam of a loom, *a'* the reed, and a^2 the reed-cap, only portions of the said parts being shown.

b, Fig. 1, is the back of the shuttle-box at one end of the lay-beam, *b'* the binder or swell pertaining to the said shuttle-box, and *c* the front of the said shuttle-box.

d, Figs. 4 and 5, is the body of a loom-shuttle, *d'* a spindle pivoted therein upon a transverse pin d^2, as usual, and d^3 the usual spring acting upon the head of the spindle to hold the spindle either depressed within the main cavity of the shuttle, as in Figs. 4 and 5, when the shuttle is in readiness for

use in weaving, or elevated, as for the removal or application of a bobbin or the like.

e, Figs. 4 and 5, is a bobbin mounted upon the spindle *d'* within the shuttle, a portion of a load of yarn upon the said bobbin being represented at *e'* in Fig. 5, but being omitted from Fig. 4 for the sake of securing greater clearness.

For the purpose of ascertaining automatically the occurrence of the predetermined condition of the weft that is carried by the shuttle we apply to the shuttle a movable armature which is controlled by the said weft. We also employ a magnet, preferably a permanent magnet, which is located in a position in the loom to enable the said armature to enter within the field thereof in the working of the shuttle. Each time the armature comes within the said field the influence of the magnet tends to move it into an abnormal position. Means is provided for causing the armature when thus operated by the magnet to signalize the occurrence or to bring about the required results in the working of the loom. The means employed for this purpose may be either electromechanical or purely mechanical, as preferred.

We contemplate in some instances utilizing the movement of the armature by the magnet for the purpose of bridging or closing a normally open or broken electric circuit. This is the case in certain of the illustrated embodiments of the invention. In these latter so long as the armature is restrained from moving fully in response to the influence of the magnet the said circuit remains open. In other instances the armature may be utilized in occasioning the opening or breaking of a normally-closed circuit.

The form of armature which is employed in the illustrated embodiments of the invention is shown at *f*, Figs. 4 and 5. It is in the shape of a metal strip and is mounted upon a pivotal support constituted by a pin *f'*. A magnet such as aforesaid is shown at *g*, Fig. 1. It is held fixed upon a support *g'*, with its poles above the shuttle-box in close proximity to the plane of the upper side of the shuttle.

The particular form and arrangement of the armature, as well as the manner of mounting the same in the shuttle, may in some cases be varied in practice, while the manner of causing the yarn to directly or indirectly effect the restraint of the movement of the armature may be varied to correspond with the construction and with the conditions of use.

Ordinarily the armature will be caused to coöperate directly with the base of the yarn-load and in most cases (though not necessarily all) will have a portion thereof inclosed or surrounded by some of the coils of yarn at the said base. So long as the coils of yarn which interfere with the movement of the armature remain in place the armature will be held thereby from making under the influence of the magnet as it passes into the field of the latter after entering the shuttle-box the full extent of movement that is required in order to close the normally open electric circuit aforesaid.

It is contemplated that the magnet ordinarily shall be arranged, as shown, in such position that when the shuttle comes to rest within the shuttle-box at the end of its flight from the opposite side of the loom the armature shall remain in sufficiently close proximity to the poles of the magnet to enable the latter to act to move the armature when the previously-interfering coils of weft-yarn have been unwound.

The circuit above referred to may be located wholly outside of the shuttle, or a partial circuit pertaining thereto may be carried by or contained within the shuttle. In Figs. 1, 3, 4, and 5 the latter is the case. Fig. 1 shows an electric conducting-wire, as *h*, of one polarity communicating with a source of electric energy and clamped by a screw *h'* to the metal end casing *c'* of the lay-beam, to which end casing the shuttle-box front *c* is bolted. In the front *c* is formed a slot c^2, within which fits a movable contact c^3, (see also Fig. 3,) the said contact being pivoted upon a screw c^4, engaging with the bottom flange of the said front, and being pressed rearwardly toward the interior of the shuttle-box by means of a leaf-spring c^5. The poles of the magnet *g* are bridged by a strip of non-magnetic metal, as at g^2, against which is clamped by a screw h^2 a wire h^3 of the other polarity. When now, the shuttle being in the shuttle-box, the armature *f* is in electrical communication with contact c^3, if the said armature is permitted to be moved by the magnet so as to contact with a strip g^2 the break in the electric circuit normally existing at the shuttle-box will be closed. For the purpose of placing armature *f* in electrical communication with contact c^3 at the required time a contact *i* is inserted into the shuttle-body, with one surface thereof exposed in position to receive the pressure of the contact c^3 while the shuttle is at rest within the shuttle-box. The manner of placing the contact *i* in electrical communication with the armature will vary according as the construction varies, and this last will depend more or less upon the manner in which the yarn-supply is carried with the shuttle-body. We have illustrated in Figs. 4 and 5 of the drawings the construction and arrangement which we prefer when the weft is wound upon a bobbin, as *e*, or the like and when the latter is held in place within the shuttle by means of a shuttle-spindle *d'*. In the said figures the pivotal pin of the armature is shown applied to lugs on the upper part of the head of the spindle, the armature and also the spring d^3, which coacts in usual manner with the spindle-head to hold the spindle in the required position, fitting between the said lugs. The attach-

ment of the armature to the spindle-head enables the armature to move in unison with the spindle, as the latter is swung up and down on its pivot without movement of the armature relative to the spindle and facilitates the operation of placing and maintaining the armature and the coöperating coils of yarn on the bobbin in proper relationship with respect to each other. For convenience, merely, the head of the spindle is included in the partial circuit within the shuttle, the lower part of said head being caused to bear against a plate i^2, which is held by a screw to the inclined surface i^{21} within the shuttle, the said screw and plate being connected electrically by a wire i' with the contact i. The yarn-carrier (bobbin) is recessed at e^2, Figs. 4 and 5, to facilitate the introduction of the armature beneath the coils of yarn at the base of the yarn-carrier.

For the purpose of preventing injury to warp-threads in the flight of the shuttle across the loom the pivot of the armature is located below the upper surface of the shuttle and the armature itself normally lies wholly below such surface. The armature is free to turn on its pivot, so that in case it accidentally should become freed and should incline upwardly in the direction of the flight of the shuttle the contact of the free extremity of the armature with warp-threads or any other object in its path would tilt the armature over into a reversed position.

For the purpose of preventing the armature from catching against the selvage-warps in case through accident the shuttle should begin its flight with the free extremity of the armature inclining upwardly in the direction of such flight, which would tend to wear the said selvage warp-threads, we provide a device adjacent the edge of the warps for turning over the armature and depressing it within the shuttle-body. Such a device is represented at v, Fig. 1. It comprises a strip extending across the shuttle-race just clear of the top of the shuttle and preferably composed of leather to obviate injury to the armature.

The magnet will act to move the armature whichever position the latter may occupy with reference to its pivot, since the middle of the width of the magnet is intended to correspond approximately with the position of the pivot at the armature after the shuttle has come to rest in the shuttle-box. (See Fig. 7.)

If desired, for the purpose of providing for failure of the shuttle to assume an exact position in the shuttle-box two magnets may be employed, arranged as at g^3 g^3, Fig. 8, with a single bridging-strip g^4 extending across their poles. The bridging-strips g^2 g^4 are operative to prevent the end of the armature from being caught in the spaces between the magnet-poles.

Figs. 9, 10, 11, and 12 illustrate two arrangements of magnet and contact-pieces which we employ when the shuttle does not contain a partial circuit making part of the general circuit when the shuttle occupies the shuttle-box. In these the magnet g^5 or g^6 has applied to the poles thereof contacts g^6 g^7 or g^8 g^9, insulated from each other and preferably formed with interlapping portions, the contacts of each pair respectively having connected therewith the wires h^4 h^5 or h^6 h^7 of opposite polarity. When the armature touches the two contacts g^6 g^7 or g^8 g^9, it connects them electrically, closing the circuit.

Fig. 13 shows an arrangement in which two contacts of opposite polarity are represented at g^{10} g^{11}, the magnet at g^{12}, and a circuit-closer at g^{13}, the latter being mounted in position to be operated by the armature f when the latter is moved by the magnet g^{12}. The arrangement of contacts is duplicated at the opposite sides of the magnet in order that the armature may operate to close the circuit in whichever direction it may incline upward.

The fact of the closing of the circuit may be signalized in any desired manner. Preferably we combine with the said circuit means of controlling or modifying the working of the loom. We have herein shown (see Figs. 2 and 6) connections for unshipping the loom and also connections forming part of weft-replenishing instrumentalities. Thus, having reference to Fig. 7, k is an electromagnet, to which wires h h^3 lead. The said electromagnet has arranged to coöperate therewith the armature-lever k', the latter being pivoted at k^2 and being connected by a wire or other link k^3 with a dog k^4, which is pivoted at k^{51} upon a slide m or other movable carrier mounted on the breast-beam n. The slide m is loosely connected at m' with an arm o', projecting from the usual knocking-off lever o at the end of the breast-beam. The usual shipper-handle is shown at o^2, and at o^3 is shown the holding-notch therefor in the plate or bracket o^4 at the end of the breast-beam. At o^{21} is shown a plate which is held to the lever o and its arm o' by the securing-bolts o^{22} o^{22} passing through all three. Slots o^{23} o^{23} in said plate permit the same to be adjusted toward and from the shipper-handle to enable adjustment of the extent of the lateral displacement of the shipper-handle by the plate to be varied as required. When electromagnet k is excited, the dog k^4 is moved into the path of a suitable going part in the loom, herein constituted by an arm k^5 of the usual gooseneck k^6, which last is, as usual, in practice moved to and fro by a cam on one of the rotating shafts of the loom. The engagement of the said arm k^5 with the dog k^4 causes the slide m and knocking-off lever to be carried forward, with resulting dislodgment of the shipper-handle and unshipping of the loom. For the purpose of enabling the weft-replenishing instrumentalities to be brought into action we place the arm r in position to locate its upper extremity within the path of the slide m. Consequently when the said slide is advanced it acts against the said

arm to move the latter. The arm r is the starting or tripping-in arm of the weft-replenishing instrumentalities, as the same are presented in the Letters Patent aforesaid of October 31, 1899, November 14, 1899, and June 19, 1900, to which reference may be had. If arm r and the weft-replenishing instrumentalities are omitted from a loom having applied thereto our improved weft-detector devices, the advance of the slide m will act simply to unship the loom and the latter will remain at rest until restarted by the weaver. However, if the said arm and instrumentalities are employed the weft-replenishing instrumentalities will operate to automatically ship on the loom after the replenishing operations have been performed and the loom will continue at work, more especially as in the Letters Patent of October 31, 1899.

The usual weft-fork of a loom is shown at s, Fig. 5, the slide on which the same is mounted being represented at s'. The free extremity of knocking-off lever o extends into position to be acted upon by the said slide when advanced by the engagement of the gooseneck k^6 with the hooked tail of the weft-fork. Thereby the loom is arrested in case of discontinuity of the weft.

At t, Fig. 2, is shown a dog, pivoted at t' upon the weft-fork slide s' and having the arm t^2, to which is applied the rod t^3 pertaining to the warp-stop mechanism, as in prior United States Letters Patent No. 649,242, granted May 8, 1900. This enables the loom to be arrested in case of breakage among the warp-threads.

It will be obvious that in winding the yarn mass for introduction into the shuttle a certain number of coils sufficient for one or more picks of weft will be wound upon the bobbin above the base thereof before coils are wound on the base itself in order to give the required length of weft to prevent complete unwinding from the bobbin between the release of the armature to the action of the magnet and the stoppage or replenishment of the loom.

Fig. 14 shows an arrangement in which the armature when operated by the magnet acts to move a lever p, having connected therewith a striker p', working in connection with a guide p^2, having an opening p^3 therethrough. The slide m^2, corresponding with slide m of Figs. 2, 6, and 7, has pivoted thereto a pawl p^4 to coöperate with the projection k^5 of the gooseneck. A rod or feeler p^5, mounted to slide in bearings on said slide, is loosely connected with the said pawl p^4 by means of an arm p^{51}, having a slot p^{52}, in which works a pin p^{53} on a crank-arm p^{54}, connected with the pivot of pawl p^4. The rear end of rod or feeler p^5 is in line with the opening p^3 of guide p^2 and each time the lay beats up passes into the said opening. Until the predetermined condition of the weft is reached the said striker occupies a position in line with the opening and at each beat of the lay encounters the rod or feeler p^5, pushing the latter forward and raising pawl p^4 out of the path of movement of projection k^5 of the gooseneck. When, however, the armature is released and is moved by the magnet so as to shift lever p and move striker p' out of line with opening p^3, the rod or feeler p^5 and pawl are left in their normal position, so that the pawl remains within the path of motion of projection k^5 of the gooseneck, which thereupon acts to push forward the slide m and in the manner already explained brings about the predetermined change in the working of the loom.

Fig. 15 shows an arrangement somewhat similar to that shown in Fig. 13, with the difference that the rear end of rod or feeler p^5 is formed or furnished with a flat piece q to enter between the top of the shuttle and the poles of the magnet g. So long as the armature remains within the shuttle-body said flat piece q enters freely between the shuttle and magnet at each advance of the lay. When, however, the magnet causes the armature to rise, the latter encounters the flat piece q in the advance of the lay and pushes forward the rod or feeler. Rod or feeler p^5 in Fig. 15 is furnished with a downwardly-extending slotted arm p^{51}, receiving a pin p^{52}, projecting from a downwardly-extending arm p^{43} on the pivot p^{42} of a pawl p^{41}, which is mounted on slide m and arranged to coöperate with the projection of the gooseneck. Pawl p^{41} is weighted to hold the acting end thereof normally elevated above the path of movement of the said projection. When, however, the armature pushes forward the rod or feeler, as just mentioned, the pawl p^{41} is turned down into position to be engaged by the said projection, with the result that slide m will be advanced in the loom.

What we claim is—

1. In a loom, a magnet having its pole or poles adjacent to the path of the shuttle, and a movable armature therefor mounted upon the shuttle, substantially as described.

2. In a loom, in combination, the lay, the magnet, and the shuttle provided with the movable armature controlled by the yarn carried by the shuttle and carried by the movement of the shuttle into the field of the magnet, substantially as described.

3. In a loom, in combination, the lay, the magnet, and the shuttle provided with the movable armature carried by the movement of the shuttle into the field of the magnet and released to the action of the latter by depletion of the yarn-supply within the shuttle to the predetermined extent, substantially as described.

4. A loom containing an electric circuit and comprising, essentially, in combination, the lay, a magnet, and a shuttle provided with a movable armature carried by the movement of the shuttle within the field of the said magnet, controlled by the yarn carried by the

shuttle, and operated by the magnet to control the said circuit, substantially as described.

5. A loom containing an electric circuit and comprising, essentially, in combination, the lay, a magnet, and a shuttle provided with a movable armature carried by the movement of the shuttle within the field of the said magnet and operated by the latter to control the circuit on depletion of the yarn-supply within the shuttle to the predetermined extent, substantially as described.

6. A loom containing a normally open or broken electric circuit, and comprising, in combination, the lay, a magnet, and a shuttle provided with a movable armature carried by the movement of the shuttle within the field of the said magnet and operated by the latter to close the circuit on occurrence of the predetermined condition of the yarn carried by the shuttle, substantially as described.

7. A loom containing a normally open or broken electric circuit, and comprising, essentially, in combination, the lay, a magnet, and a shuttle provided with a movable armature carried by the movement of the shuttle within the field of said magnet and operated by the latter to close the circuit on depletion of the yarn-supply within the shuttle to the predetermined extent, substantially as described.

8. In a loom, in combination, a train of parts correlated for definite action in the loom, the lay, the magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the magnet, and controlling means for the said train made operative through the said armature to determine the working of the train, substantially as described.

9. A loom containing an electric circuit and comprising, essentially, in combination, a train of parts correlated for definite action in the loom, the lay, the magnet, the shuttle provided with a movable armature carried by the movement of the shuttle within the field of the said magnet and operated by the latter to control the said circuit on occurrence of the predetermined condition of the yarn carried by the shuttle, and an electromagnet embraced in the said circuit and in operative control of the said train, substantially as described.

10. A loom containing an electric circuit and comprising, essentially, in combination, the lay, the magnet, the shuttle provided with the movable armature carried by the movement of the shuttle within the field of the said magnet and operated by the latter to control the said circuit on depletion of the yarn-supply within the shuttle to the predetermined extent, and an electromagnet embraced in the said circuit and in operative control of the said train, substantially as described.

11. In a loom, in combination, unshipping mechanism for the loom, the lay, the magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the magnet, and means through which the said armature occasions the action of the said unshipping mechanism, substantially as described.

12. In a loom, in combination, unshipping mechanism for the loom, the lay, the magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the magnet and released to the latter on depletion of the yarn-supply to the predetermined extent, and means through which the said armature occasions the action of the said unshipping mechanism, substantially as described.

13. A loom containing an electric circuit and comprising, essentially, in combination, unshipping mechanism, the lay, a magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the magnet and operated by the latter to control the said circuit, and an electromagnet embraced in the said circuit and in operative control of the said unshipping mechanism, substantially as described.

14. In an automatic weft-replenishing loom, in combination, the starting device for the weft-replenishing instrumentalities, the lay, the magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the magnet, and means under the control of the said armature to occasion the operation of said device to thereby bring about weft-replenishment, substantially as described.

15. In an automatic weft-replenishing loom, in combination, the starting device for the weft-replenishing instrumentalities, the lay, the magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the magnet and released to the latter on depletion of the yarn-supply to the predetermined extent, and means under the control of the said armature to occasion the operation of said device to thereby bring about weft-replenishment, substantially as described.

16. An automatic weft-replenishing loom containing an electric circuit and comprising, essentially, in combination, starting devices for the weft-replenishing instrumentalities, the lay, the magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the magnet and operated by the latter to control the circuit, and an electromagnet embraced in the said circuit and in operative control of the said starting devices, substantially as described.

17. An automatic weft-replenishing loom containing an electric circuit and comprising, essentially, in combination, starting devices for the weft-replenishing instrumentalities, the lay, the magnet, the shuttle provided with the movable armature passing in the movement of the shuttle into the field of the mag-

net, released to the latter on depletion of the working supply of weft to the predetermined extent, and operated thereby to control the circuit, and an electromagnet embraced in the said circuit and in operative control of the said starting devices, substantially as described.

18. In a loom, in combination, a lay, an electric circuit having an opening or break therein with a contact at each side of the latter and a magnet in connection with or constituting one of said contacts, and the shuttle provided with the movable armature operated by the said magnet and also with a contact in electrical communication with said armature, for coöperation with the other contact of said circuit, substantially as described.

In testimony whereof we affix our signatures in presence of witnesses.

HENRY I. HARRIMAN.
LOUIS BELL.

Witnesses to signature of H. I. Harriman:
CHAS. F. RANDALL,
WILLIAM A. COPELAND.

Witnesses to signature of Louis Bell:
EDITH J. ANDERSON,
ARTHUR B. RANDALL.