No. 687,021. Patented Nov. 19, 1901.

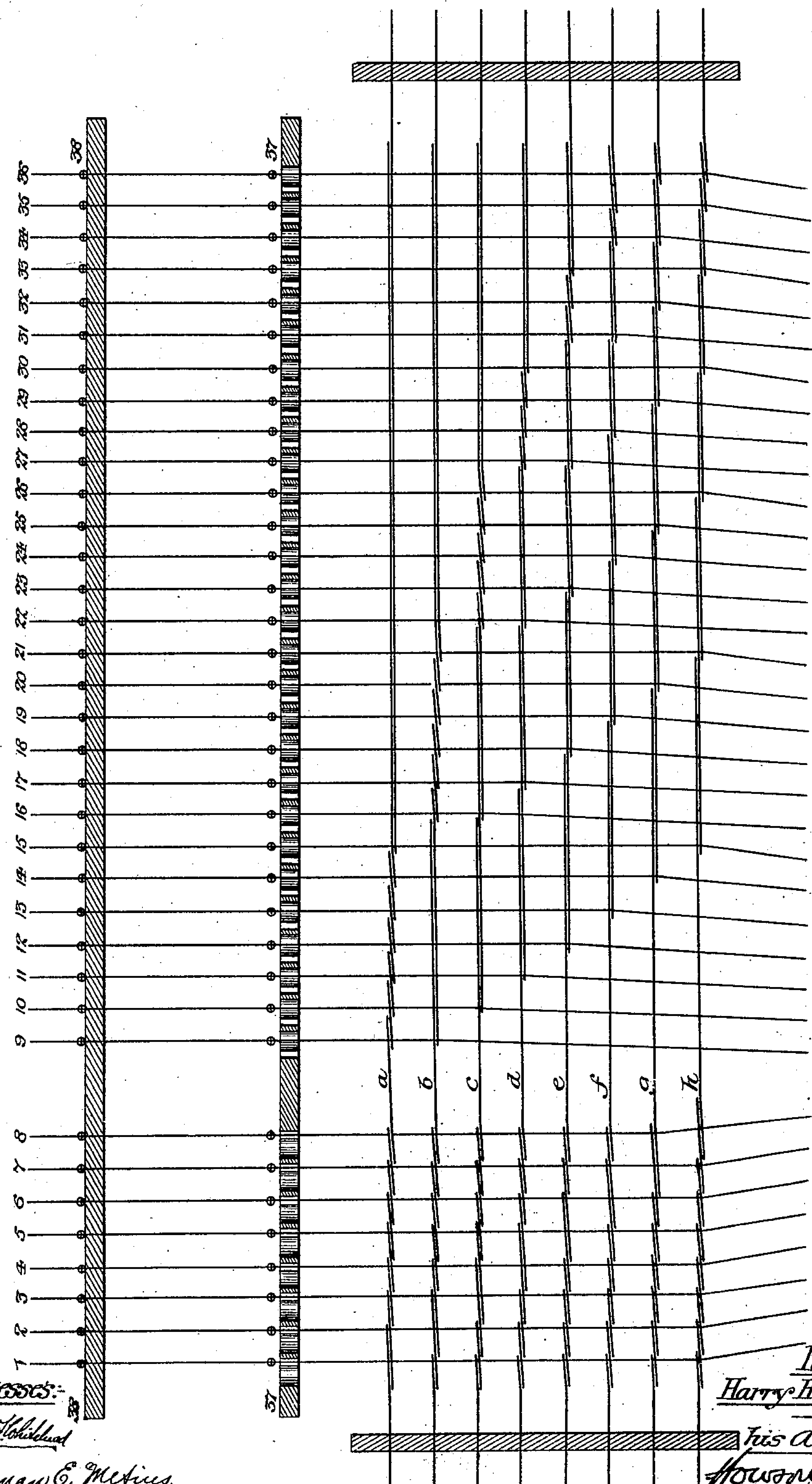
H. HARDWICK.

JACQUARD APPARATUS FOR LOOMS.

(Application filed Apr. 29, 1901.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



Witnesses:-
Louis W. Whitehead
Herman E. Metius

Inventor:-
Harry Hardwick
—by—
his Attorneys:-
Howson & Howson

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 687,021. Patented Nov. 19, 1901.

H. HARDWICK.

JACQUARD APPARATUS FOR LOOMS.

(Application filed Apr. 29, 1901.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 6.

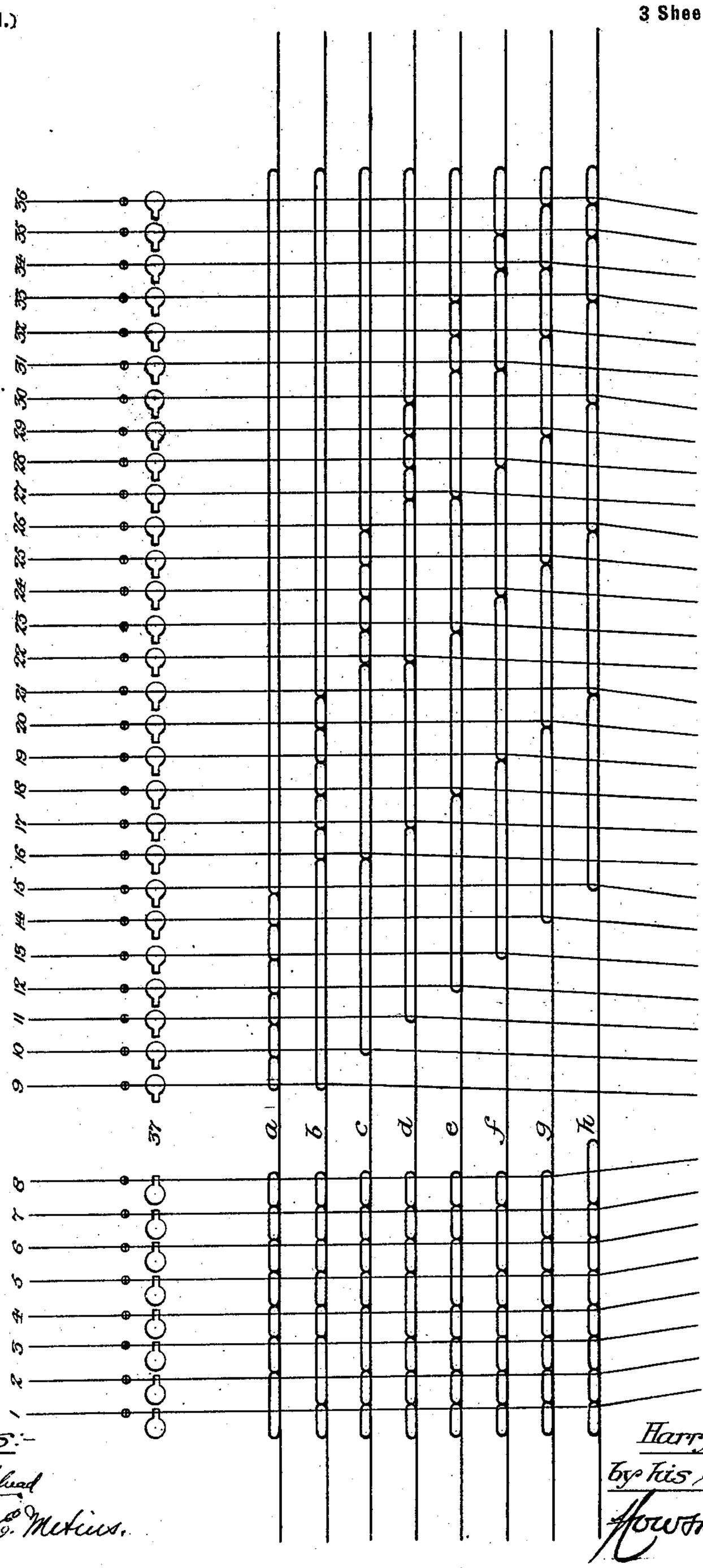


Fig. 7.

Witnesses:-
Louis H. T. Whitehead
Herman E. Metius.

Inventor:-
Harry Hardwick
by his Attorneys:-
Howson & Howson

No. 687,021. Patented Nov. 19, 1901.

H. HARDWICK.

JACQUARD APPARATUS FOR LOOMS.

(Application filed Apr. 29, 1901.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

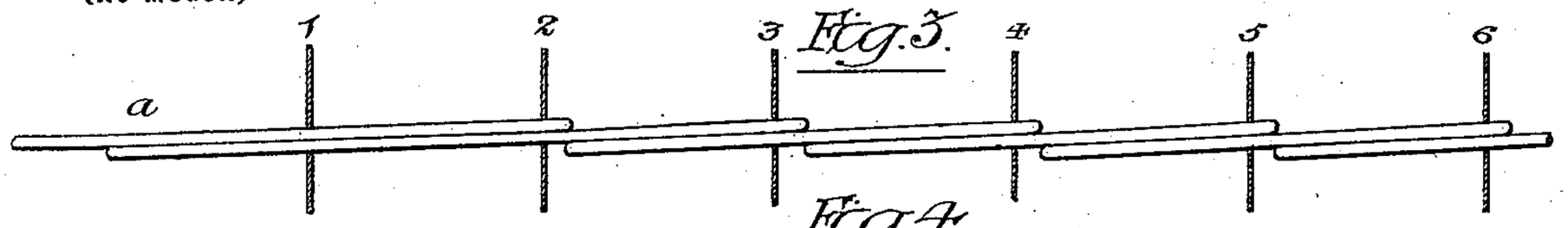
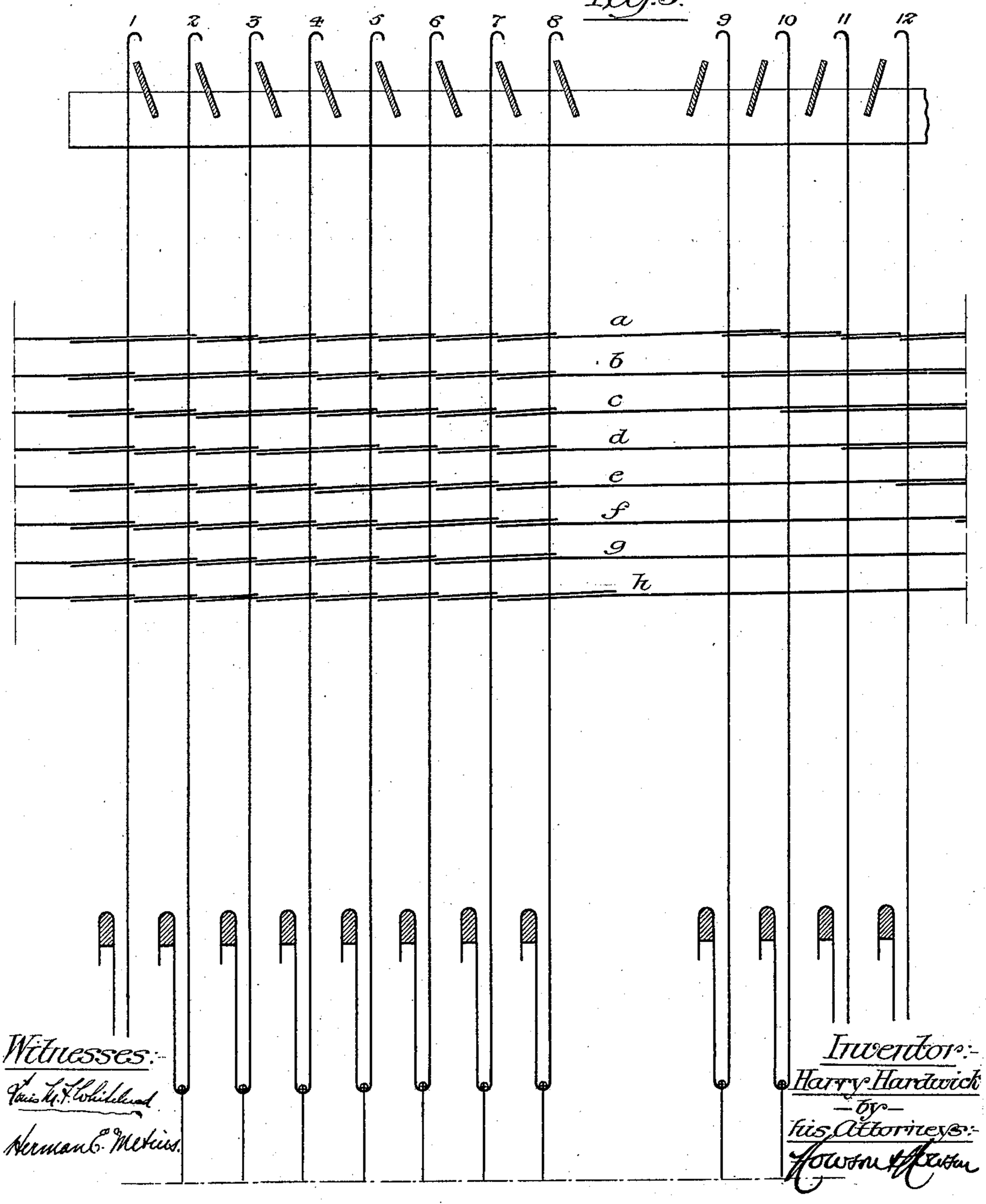


Fig. 4.

Fig. 5.



Witnesses:-
Louis M. F. Whitehead
Herman E. Metius.

Inventor:-
Harry Hardwick
—by—
his Attorneys:-
Howson & Howson

UNITED STATES PATENT OFFICE.

HARRY HARDWICK, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO IVINS, DIETZ AND METZGER COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

JACQUARD APPARATUS FOR LOOMS.

SPECIFICATION forming part of Letters Patent No. 687,021, dated November 19, 1901.

Application filed April 29, 1901. Serial No. 58,025. (No model.)

To all whom it may concern:

Be it known that I, HARRY HARDWICK, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Jacquard Apparatus for Looms, of which the following is a specification.

My invention relates to that class of jacquard-machines for looms in which the number of needles employed is less than the number of harness-cords or other harness elements, one object of my invention being to so construct jacquard apparatus of this character as to provide for the control of a maximum number of harness elements with an ordinary jacquard-cylinder adapted for use with needles arranged in vertical rows of eight, a further object being to provide for the operation of the harness-cords without undue wear upon the same or undue strain upon the needles. These objects I attain in the manner hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional view of sufficient of a jacquard-machine for looms to illustrate the application of my invention thereto. Fig. 2 is a diagrammatic representation of one set of harness-cords with the needles and the eyes of the lifter-board in normal relation thereto. Fig. 3 is an enlarged side view of part of one of the needles. Fig. 4 is a top or plan view of the same, and Figs. 5 and 6 are views illustrating modifications of my invention.

In the drawings is shown a jacquard-machine having a longitudinal row of thirty-six harness-cords and a vertical row of eight needles, the harness-cords being numbered from 1 to 36, respectively, and the needles being lettered, respectively, *a*, *b*, *c*, *d*, *e*, *f*, *g*, and *h*. The ordinary supporter-board for the harness-cords is represented at 37 and the lifter-board at 38.

It has not been deemed necessary to illustrate the means for imparting vertical reciprocating movement to the lifter-board nor the card-cylinder and its operating mechanism, as these may be similar to the devices usually employed in jacquard-machines and form no essential part of my invention.

The lifter-board has notched eyes of the usual character for engagement with the knots upon the harness-cords; but said eyes are divided into two sets, one set—namely, those intended to control the harness-cords 1 to 8, inclusive—having their notches facing in one direction, while the eyes of the other set—namely, those controlling the harness-cords 9 to 36, inclusive—have their notches facing in the opposite direction. The harness-cords 1 to 8 normally occupy the notches of their eyes in the lifter-board, and the harness-cords 9 to 36 normally occupy the eyes, so that each of the cords 1 to 8 must pass from the notch into the eye to render it inoperative, and each of the harness-cords 9 to 36 must pass from the eye into the notch to render it operative, it being understood that the draft upon the harness-cords 1 to 8 is in a direction opposite to the draft upon the harness-cords 9 to 36, so that said draft tends to pull each set of harness-cords into the notches of its respective set of eyes in the lifter-board. Each of the needles controls all but one of the set of harness-cords 1 to 8, and each of the harness-cords 9 to 36 is controlled by a pair of needles. Thus each of the needles has six short loops and a long loop so disposed that the rear end of a loop will be in contact with or close to seven of the set of eight harness-cords 1 to 8, but will receive the eighth cord of the set in the middle of its long loop, the long loop of the needle *a* receiving the cord 1, the long loop of the needle *b* receiving the cord 2, the long loop of the needle *c* receiving the cord 3, and so on to the end of the series, the long loop of the needle *h* receiving the cord 8. Hence when the needle *a* is projected all of the harness-cords except the cord 1 will be pushed into the eyes of the lifter-board and rendered inoperative, the cord 1 only being operative, and in like manner the projection of the needle *b* will render inoperative all but the harness-cord 2, the projection of the needle *c* will render inoperative all but the harness-cord 3, and so on to the end of the series, the simultaneous projection of any two of the needles rendering the entire set of harness-cords 1 to 8 inoperative. Each of the needles also has

seven loops for controlling the harness-cords 9 to 36; but the long and short loops of the needles are so disposed that each of said harness-cords 9 to 36 is under control of but two of the needles of the set—that is to say, these two needles normally tend to retain the harness-cord in the eye of the lifter-board; but when both of them are simultaneously projected they permit said harness-cord to move into the notch of the eye, and thus render it operative.

On reference to the diagram Fig. 2 it will be noted that the control of the harness-cords 9 to 36 is as follows: Cord 9 is controlled by the needles *a b*, cord 10 is controlled by the needles *a c*, cord 11 is controlled by the needles *a d*, cord 12 is controlled by the needles *a e*, cord 13 is controlled by the needles *a f*, cord 14 is controlled by the needles *a g*, cord 15 is controlled by the needles *a h*, cord 16 is controlled by the needles *b c*, cord 17 is controlled by the needles *b d*, cord 18 is controlled by the needles *b e*, cord 19 is controlled by the needles *b f*, cord 20 is controlled by the needles *b g*, cord 21 is controlled by the needles *b h*, cord 22 is controlled by the needles *c d*, cord 23 is controlled by the needles *c e*, cord 24 is controlled by the needles *c f*, cord 25 is controlled by the needles *c g*, cord 26 is controlled by the needles *c h*, cord 27 is controlled by the needles *d e*, cord 28 is controlled by the needles *d f*, cord 29 is controlled by the needles *d g*, cord 30 is controlled by the needles *d h*, cord 31 is controlled by the needles *e f*, cord 32 is controlled by the needles *e g*, cord 33 is controlled by the needles *e h*, cord 34 is controlled by the needles *f g*, cord 35 is controlled by the needles *f h*, and cord 36 is controlled by the needles *g h*. By projecting any individual needle, therefore, the corresponding uncontrolled single thread of the set 1 to 8 will be permitted to remain operative, and by projecting any pair of needles the corresponding controlled thread of the set 9 to 36 will be rendered operative.

It will be noted that each of the needles is provided with loops throughout the entire extent of each set of harness-cords, the loops being long or short, as the character of the control intended to be exercised by the needle may render necessary, but each thread of each set passing through a loop of one or more of the needles, so that it is not possible for any thread to pass laterally beyond the control of the needles. It will also be noticed on reference to Figs. 3 and 4 that the wire composing each needle is so bent in forming the loops that the centers of said loops are all in the same longitudinal plane, the needles being so disposed that this longitudinal plane is directly in line with the centers of the longitudinal row of eyes in the lifter-board. Hence the needles will have no tendency to impart lateral draft to the harness-cords, and thereby cause them to bear against the sides of the eyes or notches in the lifter-board, so as to be subjected to excessive wear. This overcomes a serious objection to that class of needles in which some of the eyes are on one side and some on the opposite side of the needle. The pull upon the needles due to the draft of the harness-cords is perfectly equalized—that is to say, there are the same number of cords pulling upon each needle in one direction as in the other. Hence the movement of a number of needles can be effected with a minimum of effort, and the movement of any harness-cord of either set by either needle or pair of needles is not in any manner restricted by any other needle or needles. Hence the harness-cords can be lifted as readily as in an ordinary jacquard-machine. By disposing the loops of the needles closely end to end said loops afford each other mutual support, and thus strengthen the needle and stiffen it longitudinally.

While I prefer in all cases to form the loops of the needles by bending a wire, as shown, it will be evident that the needles can be formed from sheet metal by a punching operation, as shown, for instance, in Fig. 6.

The application of my invention is not limited to that form of jacquard-machine in which knotted harness-cords are employed in connection with a lifter-board having notched eyes, the invention being applicable to other forms of jacquard-machine—for instance, to that form in which vertically-reciprocated griff-bars are employed in connection with hooked lifter-wires, the respective griff-bars facing in opposite directions to correspond with the oppositely-facing notches of the lifter-board eyes and the lifter-wires of one set being normally in engagement with the griff-bars and movably out of engagement therewith and those of the other set being normally out of engagement with the griff-bars and movable into engagement therewith. A portion of a jacquard-machine embodying this modification is illustrated in Fig. 5. In the claims, therefore, I have adopted the general term "lifter" to apply either to a lifter-board or griff-bars and the term "duplex lifter" to indicate either eyes with oppositely-facing notches or a griff-frame with oppositely-facing bars, the term "harness elements" being employed to designate either the knotted harness-cords which operate in conjunction with the lifter-boards or the hooked wires which operate in conjunction with the griff-bars.

Having thus described my invention, I claim and desire to secure by Letters Patent—

1. The combination in jacquard apparatus for looms, of a duplex lifter, harness elements comprising two series, one series normally in engagement with its lifter and the other series normally out of engagement therewith, and a series of eight needles, each controlling all but one of the normally operative harness elements and acting when projected to move them out of operative position, and each of the normally inoperative harness elements being controlled by a pair of needles which

when simultaneously projected permit said harness element to move into operative position, substantially as specified.

2. The combination in jacquard apparatus for looms, of a duplex lifter, harness elements comprising two series, one controlled by one portion of the duplex lifter and the other by the reverse portion of the same, and needles each controlling certain harness elements of each series, the draft upon the harness elements of one series being opposed to the draft upon the harness elements of the other series, whereby each needle is subjected to draft in each direction so that the pull upon the same is neutralized, substantially as specified.

3. The combination in jacquard apparatus for looms, of a duplex lifter, two sets of harness elements, one set comprising eight of such elements each normally in engagement with the lifter and the other set comprising twenty-eight of such elements normally out of engagement with the lifter and eight needles each controlling all but one of the set of eight harness elements and each pair of said needles controlling one of the set of twenty-eight harness elements, substantially as specified.

4. The combination in jacquard apparatus for looms, of a duplex lifter, two sets of harness elements one set normally in engagement with its lifter and the other set normally out of engagement therewith, and needles having sets of loops covering the entire extent of each set of harness elements, some of said loops being short and others long, whereby each harness element is contained laterally within a looped portion of one or more of the needles, substantially as specified.

5. The combination in jacquard apparatus for looms, of a lifter, a series of harness elements movable into and out of engagement with said lifter, and a series of needles each having two or more loops in the same longitudinal plane, each of the harness elements passing through loops of two or more needles, and each of said loops being of such length as to permit said harness element movement therein sufficient to carry it into and out of operative position with respect to the lifter, substantially as specified.

6. The within-described needle for jacquard apparatus, said needle having a succession of loops, all in the same longitudinal plane and disposed closely end to end, substantially as specified.

7. The within-described needle for jacquard apparatus, said needle consisting of a wire bent so as to form a succession of loops all in the same longitudinal plane and disposed closely end to end, substantially as specified.

8. A needle for jacquard apparatus, said needle having loops some of which are longer than others, all of the loops being long enough to permit movement of the jacquard element into and out of operative position therein, substantially as specified.

9. The within-described needle for jacquard apparatus, said needle consisting of a wire bent so as to form loops some of which are longer than others, all of the loops being long enough to permit movement of the jacquard element into and out of operative position therein, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HARRY HARDWICK.

Witnesses:
F. E. BECHTOLD,
JOS. H. KLEIN.