

No. 890,612.

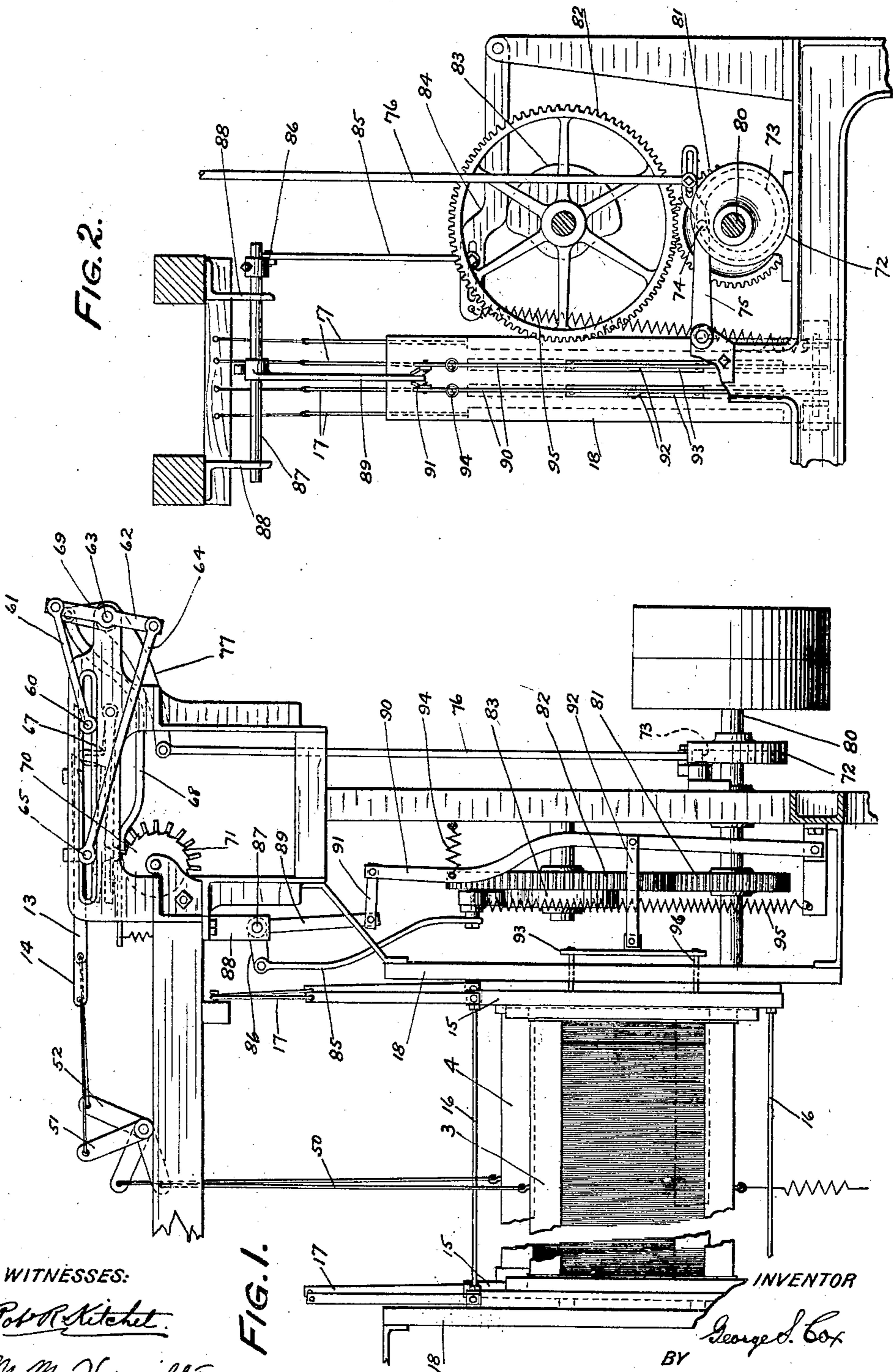
PATENTED JUNE 16, 1908.

G. S. COX.

## HAIRCLOTH LOOM.

APPLICATION FILED SEPT. 12, 1906.

2 SHEETS—SHEET 1.



**WITNESSES:**

Robt R. Kitchel.

M. M. Hamilton

**FIG. 1.**

**INVENTOR**

George S. Cox

BV

Harding Harding  
ATTORNEYS.

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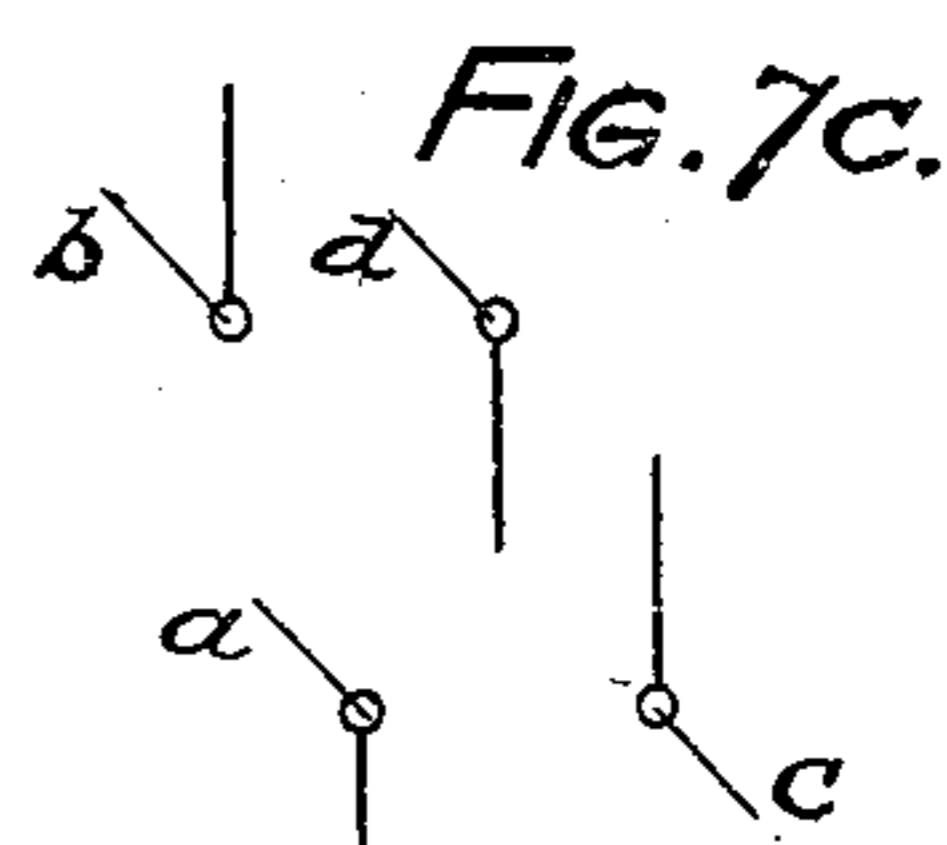
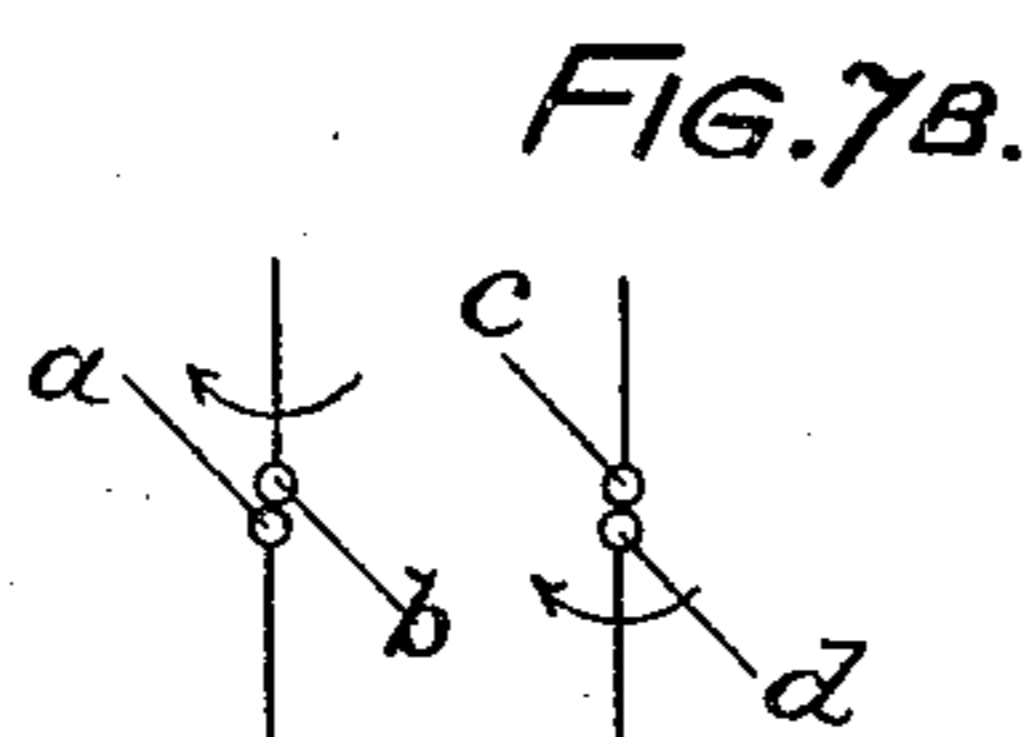
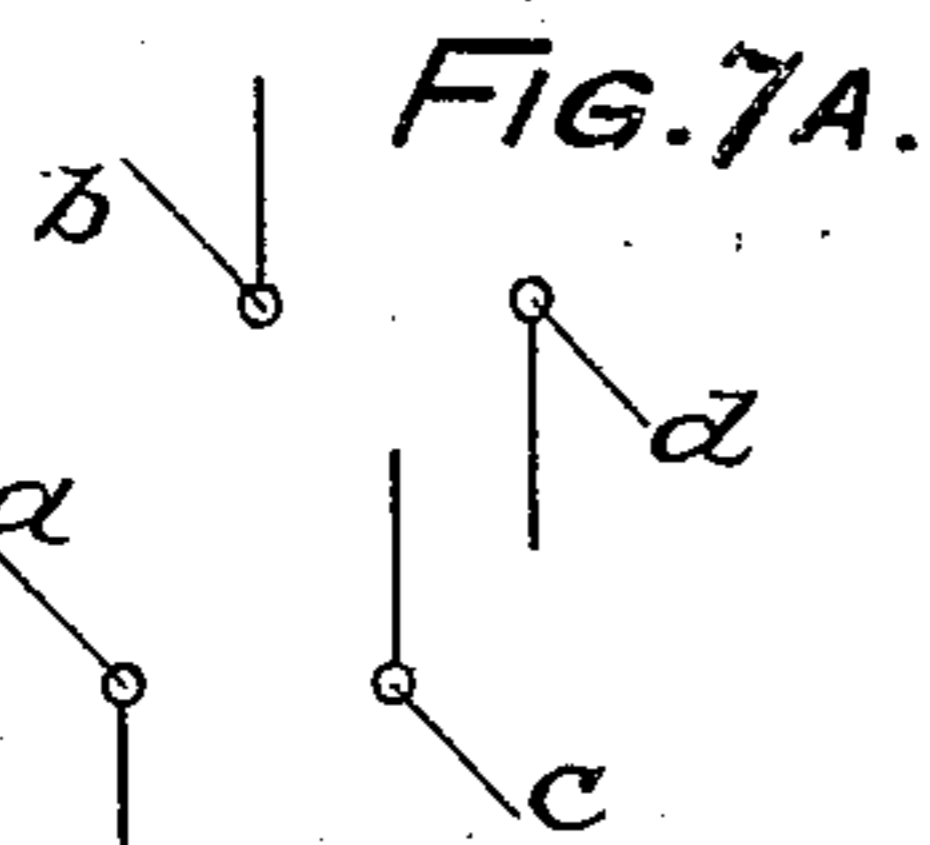
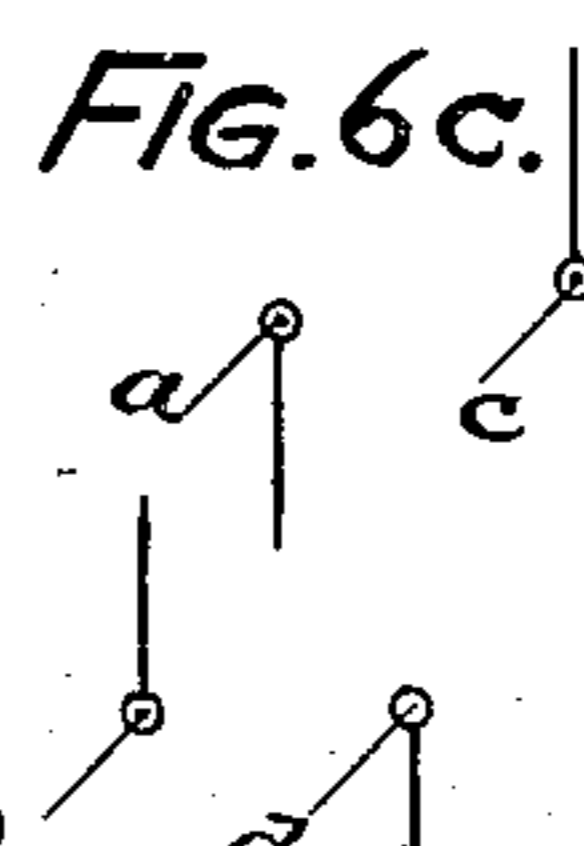
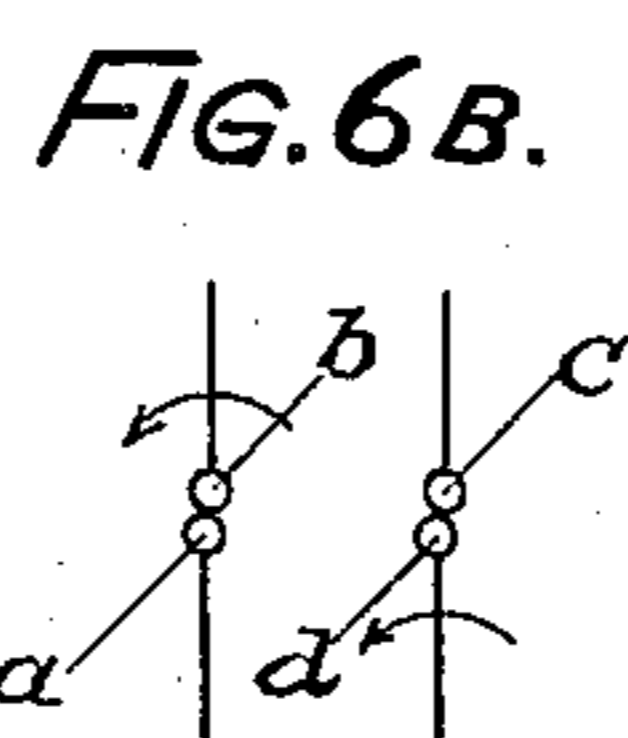
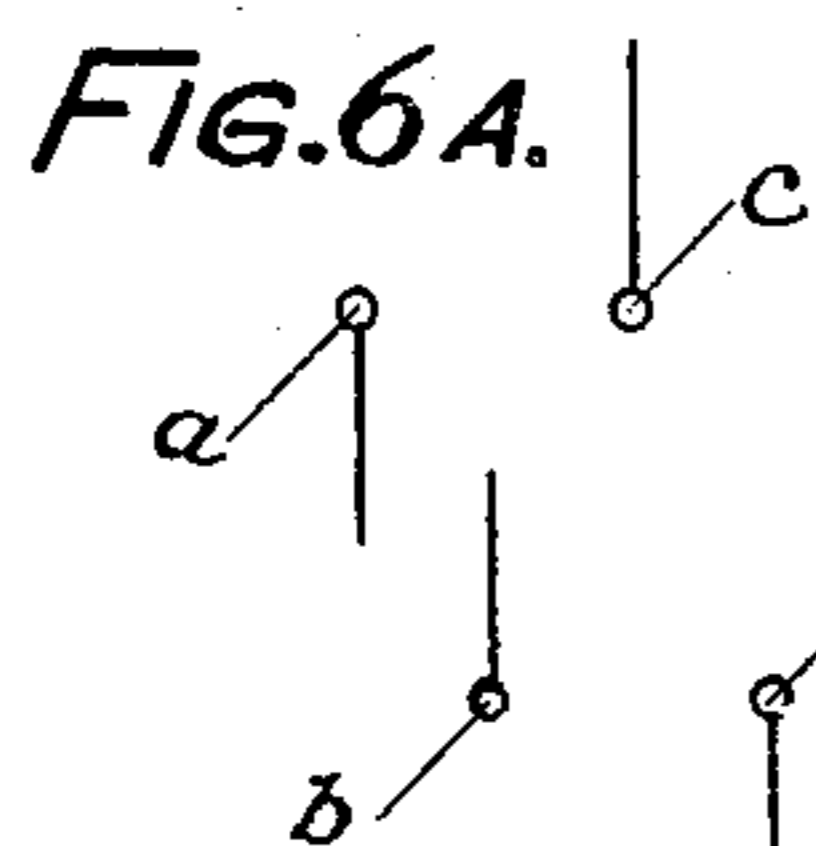
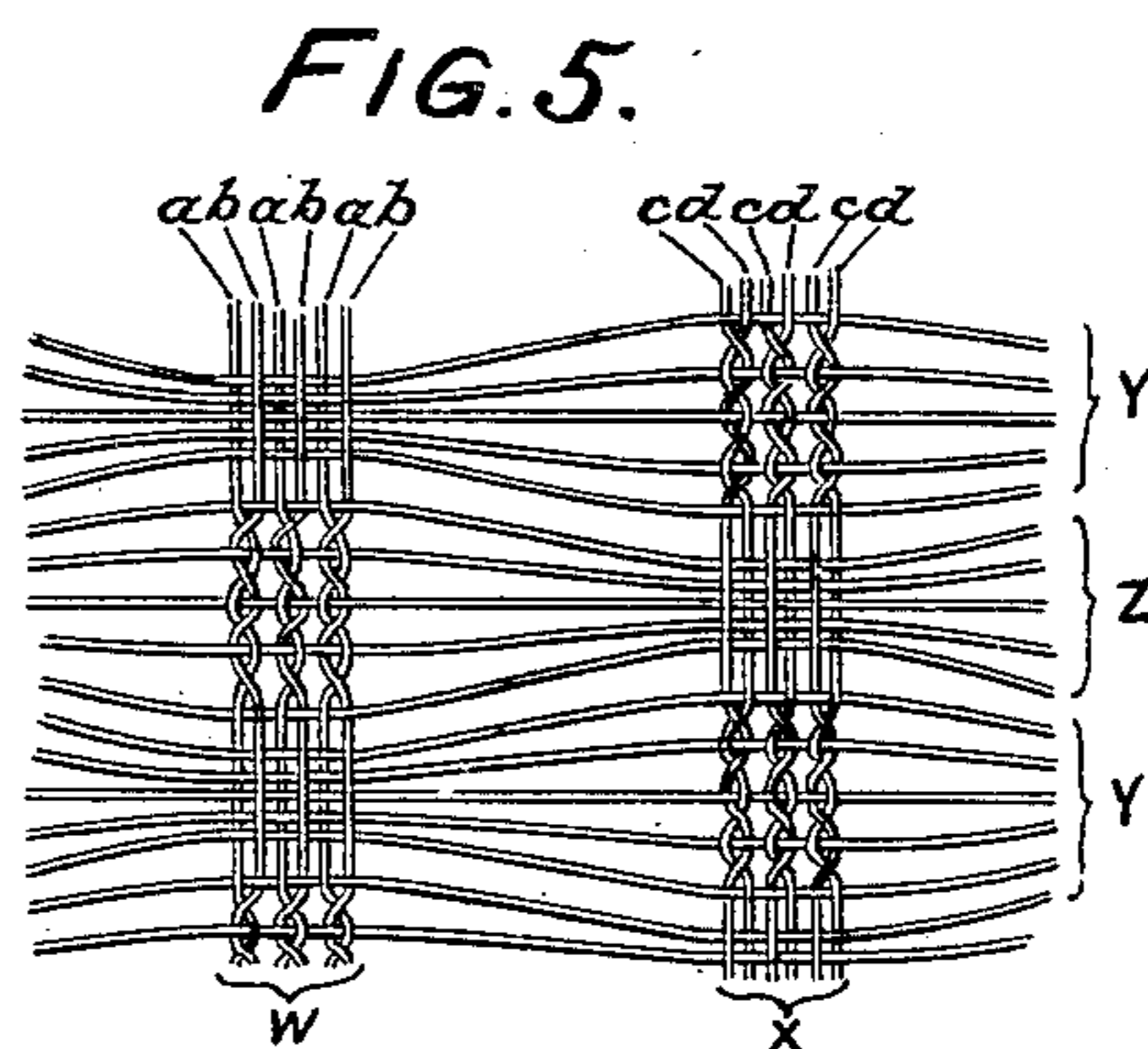
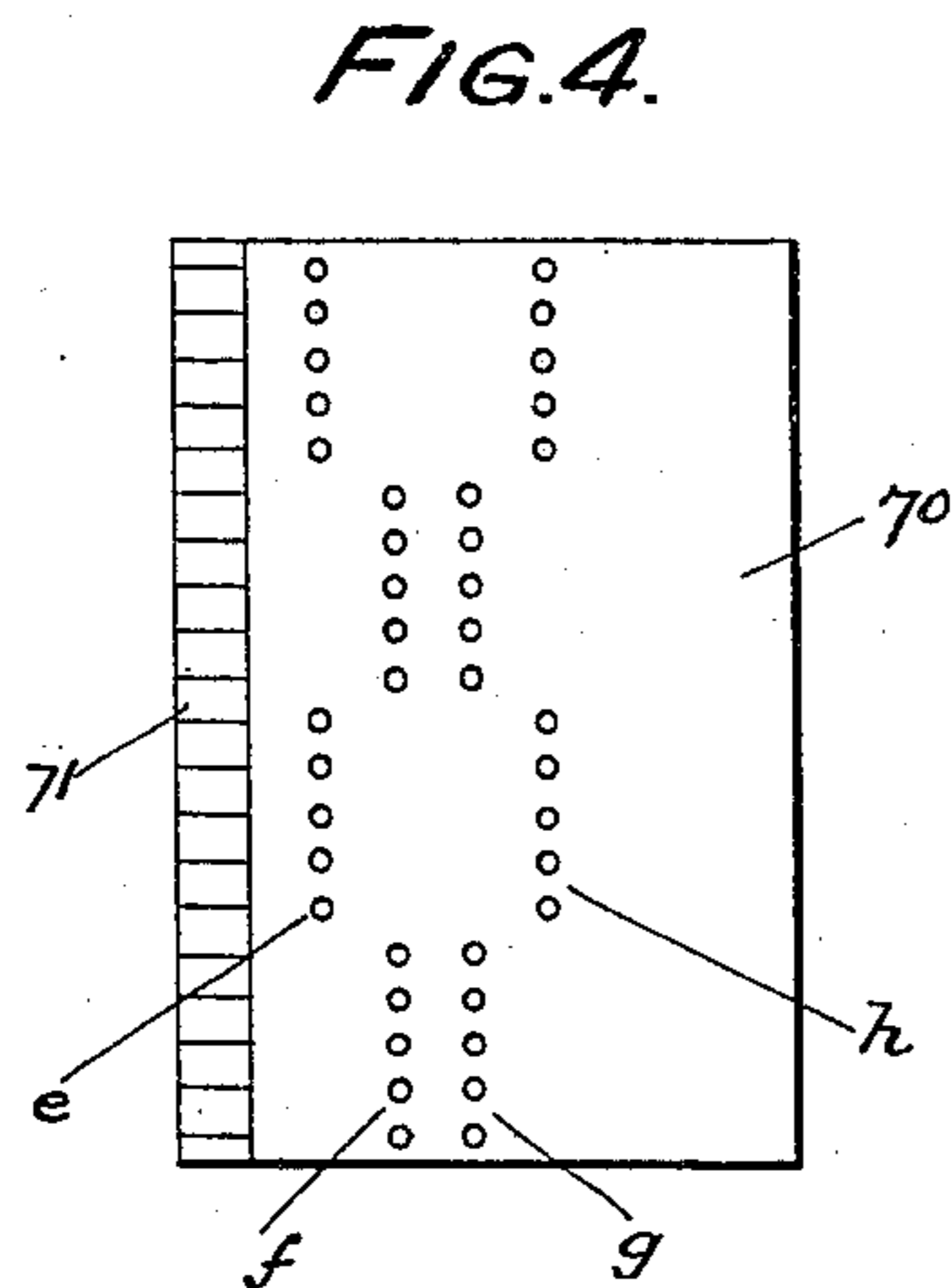
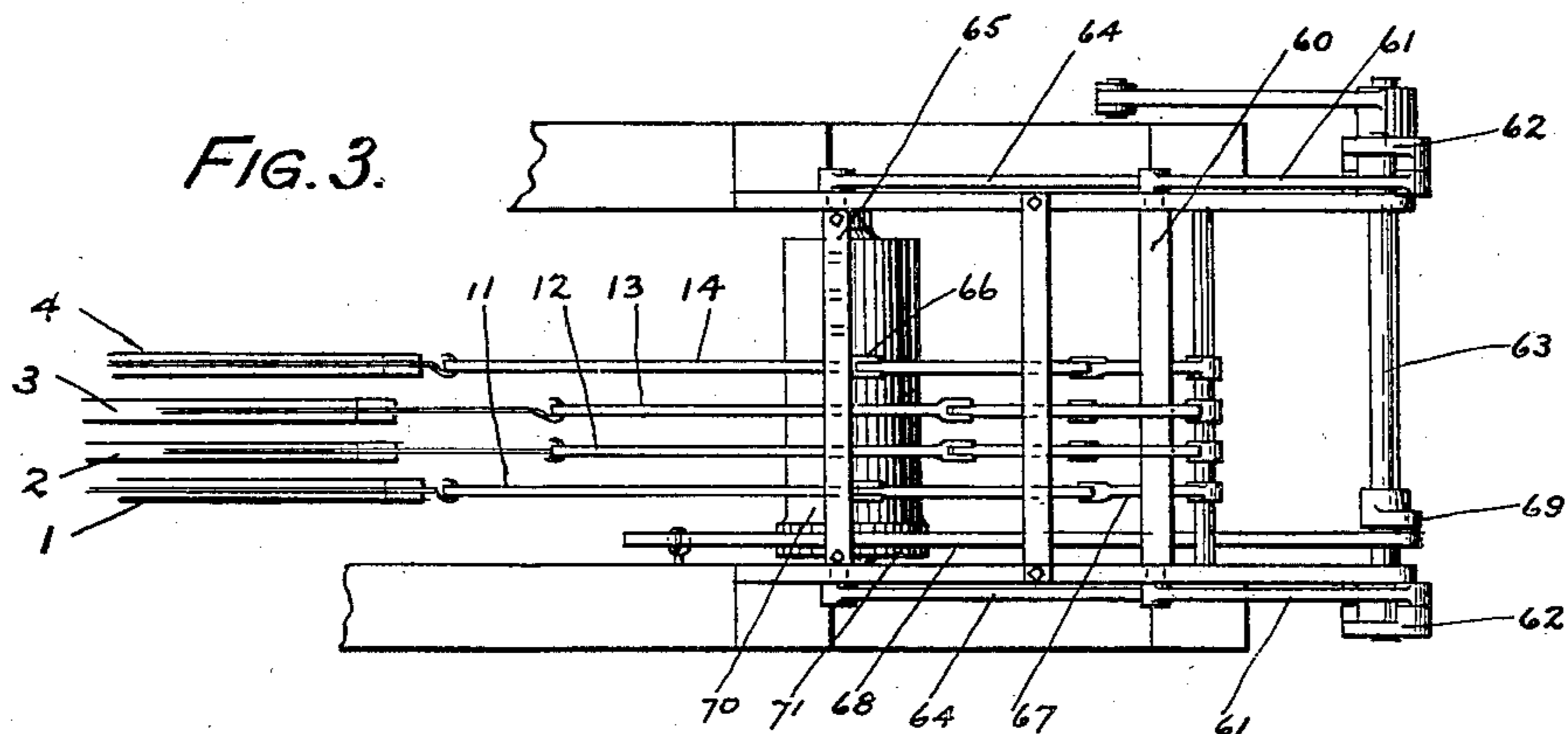
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HAIRCLOTH LOOM.

APPLICATION FILED SEPT. 12, 1906.

2 SHEETS—SHEET 2.



WITNESSES:

*Robert R. Kitchin.*  
*M. M. Hamilton*

INVENTOR

*George S. Cox*

BY

*Harding & Harding*  
ATTORNEYS.

# UNITED STATES PATENT OFFICE.

GEORGE S. COX, OF FITZWATERTOWN, PENNSYLVANIA, ASSIGNOR TO HIMSELF, AND  
WALTER S. COX, OF PHILADELPHIA, PENNSYLVANIA, TRADING AS GEORGE S. COX  
AND BROTHER.

## HAIRCLOTH-LOOM.

No. 890,612.

Specification of Letters Patent.

Patented June 16, 1908.

Application filed September 12, 1906. Serial No. 334,266.

*To all whom it may concern:*

Be it known that I, GEORGE S. COX, a citizen of the United States, residing at Fitzwattertown, county of Montgomery, and State of Pennsylvania, have invented a new and useful Improvement in Haircloth-Looms, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

The object of my invention is to provide mechanism capable of attachment to the ordinary haircloth loom whereby hair cloth of a peculiar character may be woven.

In the drawings: Figure 1 is a front elevation partly broken away, of a part of a loom embodying my invention. Fig. 2 is a side view of a part of the mechanism shown in Fig. 1. Fig. 3 is a plan view of the shedding motion. Fig. 4 is a developed view of the dobby cylinder. Fig. 5 is an enlarged plan view of a portion of the fabric adapted to be woven. Figs. 6<sup>A</sup>, 6<sup>B</sup>, 6<sup>C</sup>, and 7<sup>A</sup>, 7<sup>B</sup>, 7<sup>C</sup> are diagrammatic views illustrating the operation of the heddles.

An example of hair cloth that may be woven on a loom embodying my invention is illustrated in Fig. 5 and will first be described. The warp may be regarded as being composed of two series of sets of threads, the sets of one series alternating with the sets of the other series, adjacent sets being separated from each other by a space of any desired width. Each set of warp threads is composed of one or more pairs of threads (in the drawing three pairs are shown) and the sheds of warp are formed by these pairs.

*a* and *b* represent the two threads of each pair of threads comprised in a set *W* of warp and *c* and *d* represent the two threads of each pair of threads comprised in a set *X* of warp. The sets *W* are arranged alternately with the sets *X* and are repeated across the width of the fabric and constitute respectively the two series of warp.

One warp thread of each pair is caused to pass over its companion thread after one or more picks of hair have been inserted, as hereinafter described, thus binding the pick or picks of hair between them. The horse hair weft may also be considered as composed of two series of sets of hair strands, the sets of one series alternating with the sets of the other series. Each set of hair weft is

composed of any desired number of picks of hair (five picks being shown in the drawing.)

One set of weft is indicated by the letter *Y* and another set by the letter *Z*, and these sets are arranged alternately and are repeated along the length of the fabric and constitute respectively the two series of weft.

The five picks of each of the weft sets *Y* lie together in single warp sheds formed by the warp threads of the warp sets *W*, while these same picks are bound in separate warp sheds formed by the warp threads of the warp sets *X*. The five picks of each of the weft sets *Z* lie together in single warp sheds formed by the warp threads of the warp sets *X*, while these same picks are formed in separate warp sheds formed by the warp threads of the warp sets *W*.

Referring now to the mechanism embodying my invention: 1, 2, 3, 4 are the four heddle frames controlling respectively the warp threads *a*, *b*, *d* and *c*. The several heddle frames are connected, by means of cords 50, bell-cranks 51 and rods 52, respectively with the draw bars 11, 12, 13 and 14. The free end of each draw-bar is notched and adapted to be engaged by the constantly reciprocating knife 60 of the shedding motion. The knife 60 is attached to the ends of the connecting rods 61, which are pivoted to double ended levers 62 secured to the oscillating shaft 63. The lower ends of levers 63 are connected by links 64 with the cross-bar 65. The draw-bars extend through orifices in the cross-bar 65 and are provided with shoulders 66, which, in the reciprocation of the cross-bar, are engaged by the cross-bar; whereby at each oscillation of the shaft 63 (as in the ordinary closed shed machine) each draw-bar not engaged by the knife 60 is pushed into position to be engaged by the knife 60 when the notched end of the draw-bar is dropped. The notched end of each draw-bar is either raised or allowed to drop by means of a draw-bar control-lever 67, which in turn is either raised or allowed to drop by means of the dobby cylinder 70. The dobby cylinder 70 is provided with four series of pins *e*, *f*, *g* and *h*, controlling, through the medium of the respective levers 67, the four draw-bars 11, 12, 13 and 14 respectively. The dobby cylinder 70 is turned step-by-step by means of a pawl-lever 68 pivoted to

an arm 69 secured to the oscillating shaft 63 and engaging a ratchet 71 on the dobby cylinder.

72 is an eccentric in the crank shaft 80. This eccentric has a grooved cam 73, also eccentric to the crank shaft. The cam 73 is engaged by a pin 74 on the lever 75, which lever is pivoted at one end on the loom frame and connected at the other end, by means of a link 76, with an arm 77 secured to the shaft 63. Thus the shaft 63 is oscillated once to and fro, and the dobby cylinder 70 advanced one step, at each revolution of the crank shaft 80.

Secured to the crank shaft is a gear 81 engaging a gear 82 of twice the diameter of gear 81. Secured to the shaft of gear 82 is a cam 83. The cam 83 engages a lever 84 pivoted at one end on the loom-frame and at the other end connected, by means of a link 85, with an arm 86 secured to a shaft 87 turning in brackets 88 depending from the loom frame.

89 is an arm secured to the shaft 87 and connected, by means of two links 91, with the upper ends of two upright levers 90 whose lower ends are pivoted on the loom frame.

The several heddle frames are each shown as inclosed by a guide frame composed of upright guide bars 15 and cross-bars 16. The heddle frames move up and down in the guide-bars 15 and two of them (2 and 3 as shown) are moved laterally by a bodily lateral movement of the guide frame, as herein-after described. The guide-frames are suspended from the loom frame by means of cords 17. Secured to the loom frame are posts 18, which limit the lateral movement of the guide-frames.

Secured respectively to the two upright levers 90, between their ends, are the two arms 92, to which are respectively secured the upright arms 93 carrying pins 96 extending through orifices in one of the posts 18. The ends of the pins of one of the arms 93 are secured to the guide frame engaging the heddle frame 2, while the pins of the other arm 93 are secured to the guide frame engaging the heddle frame 3. The heddle frames 2 and 3 are thus moved to the left, Fig. 1, and returned to the right, at each revolution of the cam 83. That is, the heddle frames 2 and 3 are moved to the left at one revolution of the crank shaft and returned to the right at the next revolution, and so on alternately. The return movement is effected by means of springs 94 and 95, springs 94 being attached to the loom frame and the upright levers 90, and spring 95 being attached to the loom frame and lever 84.

It will be understood that, as in the ordinary closed shed machine, the warp threads 65 controlled by the heddles whose draw-bars

are actuated by the cross-bar 65 are lowered from a median position, while the warp threads controlled by the heddles whose draw-bars are actuated by the knife 60 are simultaneously raised from a median position. Thus a shed is formed to receive the pick of weft. The arrangement of the pins on the dobby cylinder 70 is such as to dictate the raising of draw-bars 12 and 13 and the lowering of draw-bars 11 and 14 for five successive turns of the dobby cylinder. Consequently the draw-bars 11 and 14 will be actuated by the knife 60, and the draw-bars 12 and 13 actuated by the cross-bar 65, and hence the heddles of the heddle frames 1 and 4 are raised and the heddles of the heddle frames 2 and 3 lowered from their median position. Thus each pick of weft passes below threads *a* and *c* and above threads *b* and *d*.

During the shedding of the heddle frames, as just described, the heddle frames 2 and 3 are moved to the left before alternate picks of weft as before described. As will be seen by reference to Figs. 6<sup>A</sup>, 6<sup>B</sup> and 6<sup>C</sup>, the heddles of frame 2, in their movement to the left, cause the thread *b* to cross over thread *a*. In their return movement the heddles of frame 2 again cause the thread *b* to again cross over thread *a*. A pick of weft is inserted after the said lateral movement of heddle frame 2 in each direction. Thus is formed the leno weave hereinbefore described. The heddles of frame 3 have a similar movement back and forth, but the thread *d* does not cross over the thread *c*, thus forming a plain weave consisting of a shed of five picks. After the draw-bars 12 and 13 have thus been raised, and the draw-bars 11 and 14 lowered prior to five successive picks as above described, the arrangement of the pins on the dobby cylinder 70 is such as to dictate the raising of draw-bars 11 and 14 and the lowering of draw-bars 12 and 13 for five successive turns of the dobby cylinder. Consequently the draw-bars 12 and 13 will be actuated by the knife 60, and the draw-bars 11 and 14 will be actuated by the cross-bar 65, and hence the heddles of the heddle frames 2 and 3 are raised, and the heddles of the heddle frames 1 and 4 lowered, from their median position. Thus each pick of weft passes below threads *b* and *d* and above threads *a* and *c*.

As shown in Figs. 7<sup>A</sup>, 7<sup>B</sup> and 7<sup>C</sup>, the heddles of frame 2, in their movement back and forth, do not cause the thread *b* to pass under the thread *a*, and a plain weave is formed consisting of a shed of five picks. The heddles of the frame 3, in their movement back and forth, cause the thread *d* to cross under thread *c*, thus forming a leno weave.

It will be understood that the mechanism described may be rearranged to produce a fabric specifically different from that shown

in Fig. 5 without departing from the invention and that the invention is not limited to the specific construction shown even when it is desired to make the specific fabric shown in Fig. 5.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. In a loom, the combination with two vertically-extending heddle frames whose heddles are secured at one end only, the heddles of one frame being secured at their lower ends and the heddles of the other frame at their upper ends, of means to reciprocate either heddle frame vertically above a median position while the other heddle frame is reciprocated vertically below a median position, and means to move at least one of the heddle frames laterally, whereby a leno or plain weave will be formed dependent upon which heddle frame is reciprocated above, and which below, said median position.

2. In a loom, the combination with two vertically-extending heddle frames whose heddles are secured at one end only, the heddles of one frame being secured at their lower ends and the heddles of the other frame at their upper ends, of means operating to move either heddle frame to bring the warp-engaging eyes of its heddles at a higher level than the warp-engaging eyes of the heddles of the other frame, and to thereafter reciprocate said heddle frames in opposite directions to cause the warp engaging eyes of their respective heddles to move toward and from each other, and means to move at least one of the heddle frames laterally, whereby a leno or plain weave is formed dependent upon which heddle frame is raised to the higher level, substantially as described.

3. In a loom, the combination with two vertically-extending heddle frames whose heddles are secured at one end only, the heddles of one frame being secured at their lower ends and the heddles of the other frame at their upper ends, of means operating to bring the warp engaging eyes of the heddles of either frame at a higher level than the warp engaging eyes of the heddles of the other frame and to thereafter reciprocate at least one heddle frame to cause the warp engaging eyes of the heddles of the upper frame to move successively downwardly and upwardly with relation to the warp-engaging eyes of the heddles of the lower frame, and means to move at least one of the heddle frames laterally, whereby a leno or plain weave is formed dependent upon which heddle frame is raised to the higher level, substantially as described.

4. In a loom, the combination with two pairs of heddle frames whose heddles are secured at one end only, the heddles of one frame of each pair being secured at their lower ends and the heddles of the other

frame of the corresponding pair being secured at their upper ends, of means to reciprocate either heddle frame of a pair vertically above a median position while the other heddle frame of the pair is reciprocated vertically below a median position, and means to simultaneously move laterally one heddle frame of each pair, substantially as described.

5. In a loom, the combination with two pairs of heddle frames whose heddles are secured at one end only, the heddles of one frame of each pair being secured at their lower ends and the heddles of the other frame of the corresponding pair being secured at their upper ends, of means operating to bring two heddle frames, one of each pair, either to a higher level or to a lower level than the other two heddle frames, means to thereafter move the upper heddle frames successively downwardly and upwardly and the lower heddle frames successively upwardly and downwardly, and means to move two heddle frames, one of each pair, laterally with respect to the other two heddle frames, substantially as described.

6. In a loom, the combination with two pairs of heddle frames whose heddles are secured at one end only, the heddles of one frame of each pair being secured at their lower ends and the heddles of the other frame of the corresponding pair being secured at their upper ends, of means operating to bring two heddle frames, namely, one of one pair whose heddles are secured at their upper ends and one of the other pair whose heddles are secured at their lower ends, either to a higher level or to a lower level than the other two heddle frames, means to thereafter reciprocate the upper and lower heddle-frames respectively in opposite directions to cause the warp engaging eyes of their respective heddles to move toward and from each other, and means to move two heddle frames, one of each pair, laterally with respect to the other two heddle frames, substantially as described.

7. In a loom, the combination with two vertically-extending heddle frames whose heddles are secured at one end only, the heddles of one frame being secured at their lower ends and the heddles of the other frame at their upper ends, of continuously operating means to reciprocate at least one frame laterally, continuously operating means to reciprocate said frames vertically with respect to each other, and means to move said frames vertically with respect to each other to change their relative vertical positions during reciprocation, whereby the warp threads may be caused by their heddle eyes to cross or not to cross to form respectively a leno or plain weave.

8. In a loom, the combination with two vertically-extending heddle frames whose heddles are secured at one end only, the hed-

dles of one frame being secured at their lower  
ends and the heddles of the other frame at  
their upper ends, of the cam shaft, mechan-  
ism operated from the cam shaft to continu-  
ously reciprocate laterally at least one frame,  
5 the head motion comprising means to con-  
tinuously reciprocate said frames vertically  
with respect to each other and to intermit-  
tently move said frames vertically with re-  
10 spect to each other to change their relative

vertical positions during reciprocation, and  
pattern mechanism dictating said intermit-  
tent operation of the head motion.

In testimony of which invention, I have  
hereunto set my hand, at Philadelphia, on 15  
this eleventh day of September, 1906.

GEORGE S. COX.

Witnesses:

M. M. HAMILTON,  
A. M. URIAN.