

No. 656,592.

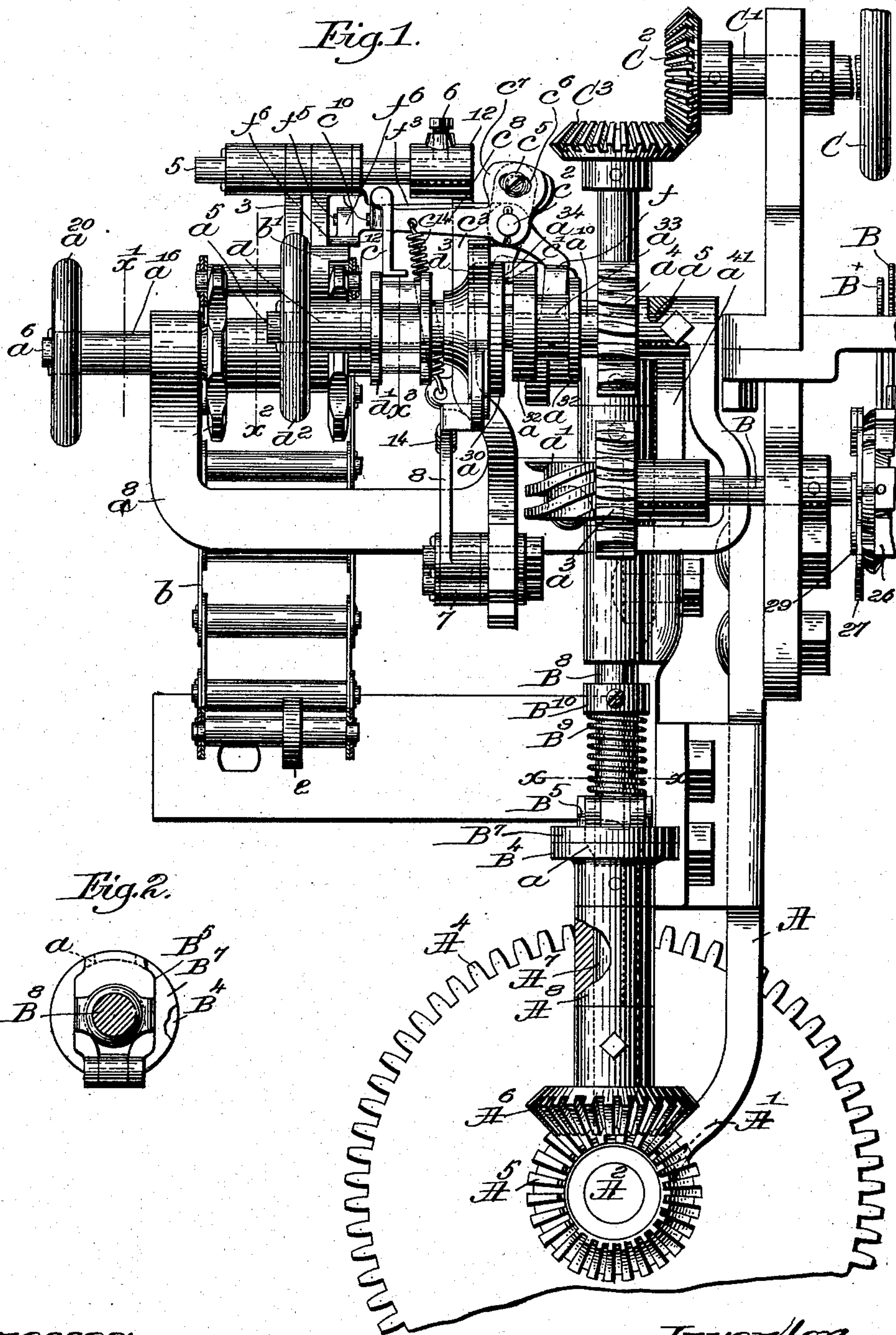
Patented Aug. 21, 1900.

H. WYMAN.  
LOOM.

(Application filed Nov. 29, 1897.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:  
Fred S. Grunhof.  
Walter O. Lombard

Inventor:  
Horace Wyman.  
by Leroy Meyers, attys.

No. 656,592.

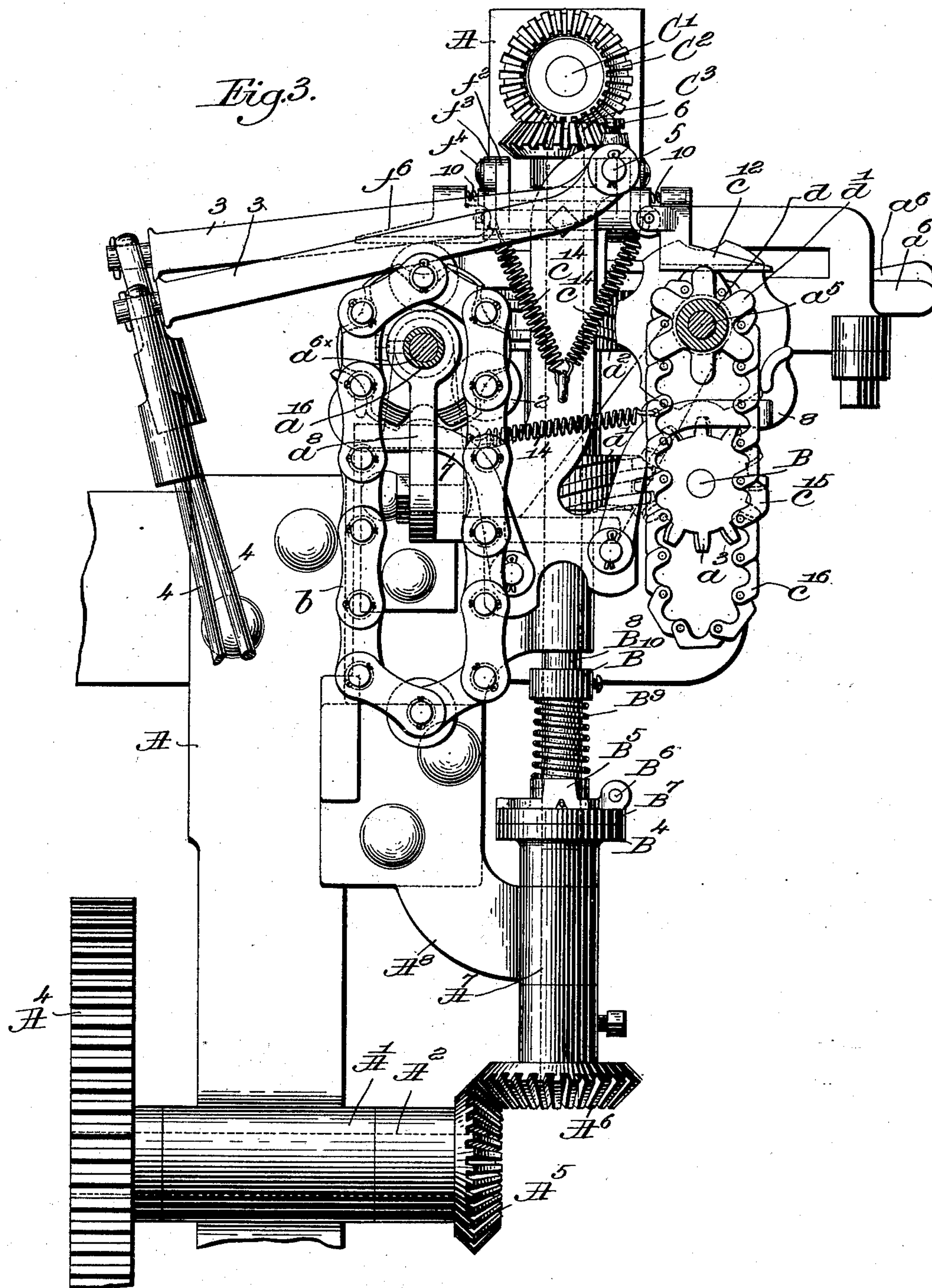
Patented Aug. 21, 1900.

H. WYMAN.  
LOOM.

(Application filed Nov. 29, 1897.)

(No Model.)

4 Sheets—Sheet 2.



Witnesses:

Fred S. Gumbaf.  
Walter C. Lombard

Inventor:

Horace Wyman.  
by Wesley Gregory, attys.



No. 656,592.

Patented Aug. 21, 1900.

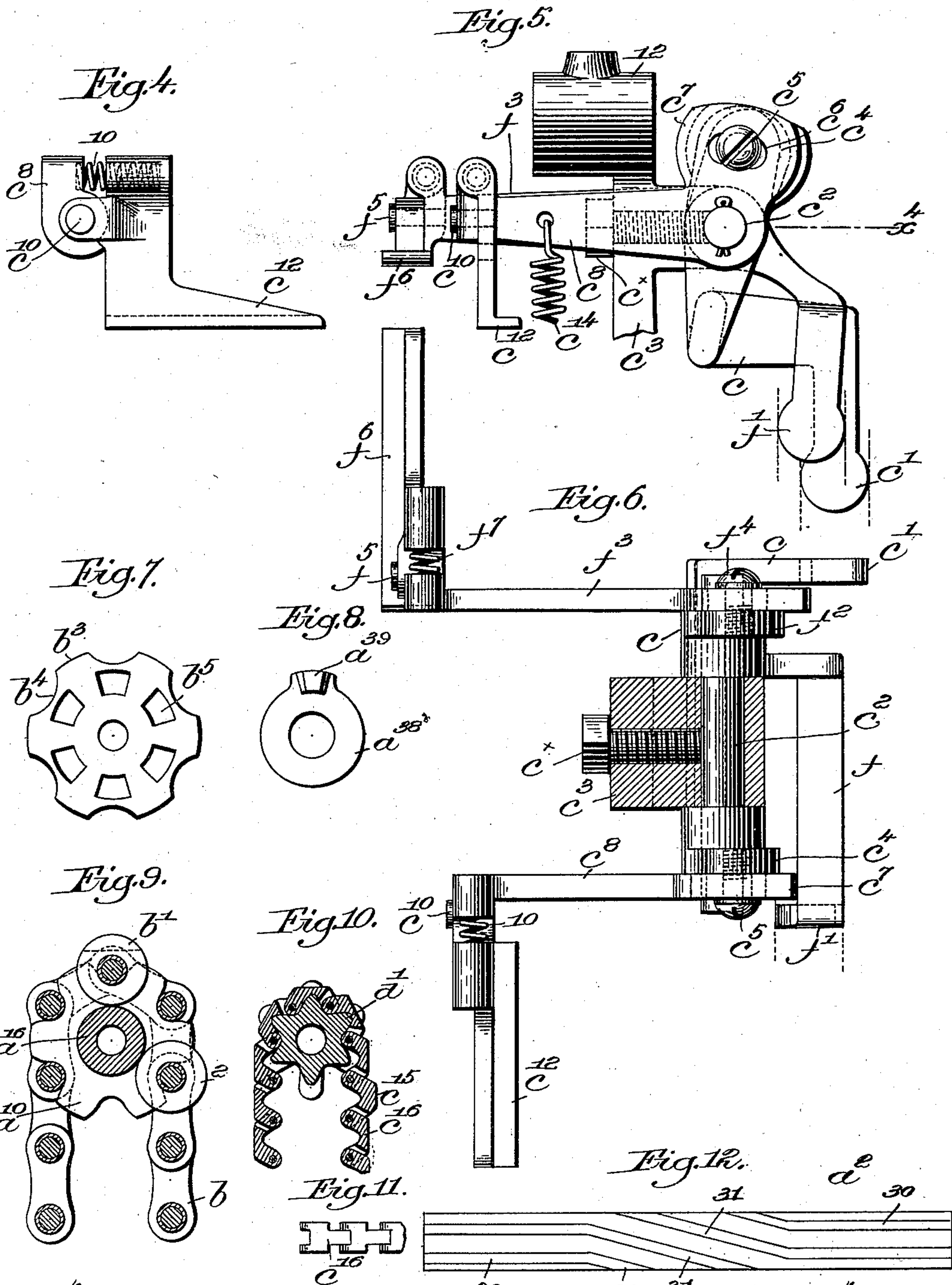
H. WYMAN.

LOOM.

(Application filed Nov. 29, 1897.)

(No Model.)

4 Sheets—Sheet 3.



witnesses:  
*Fred S. Grunhof.*  
*Walter O. Lombard*

*Inventor:*  
*Horace Wyman.*  
*by Crosby & Morgan,*  
*Attys.*

No. 656,592.

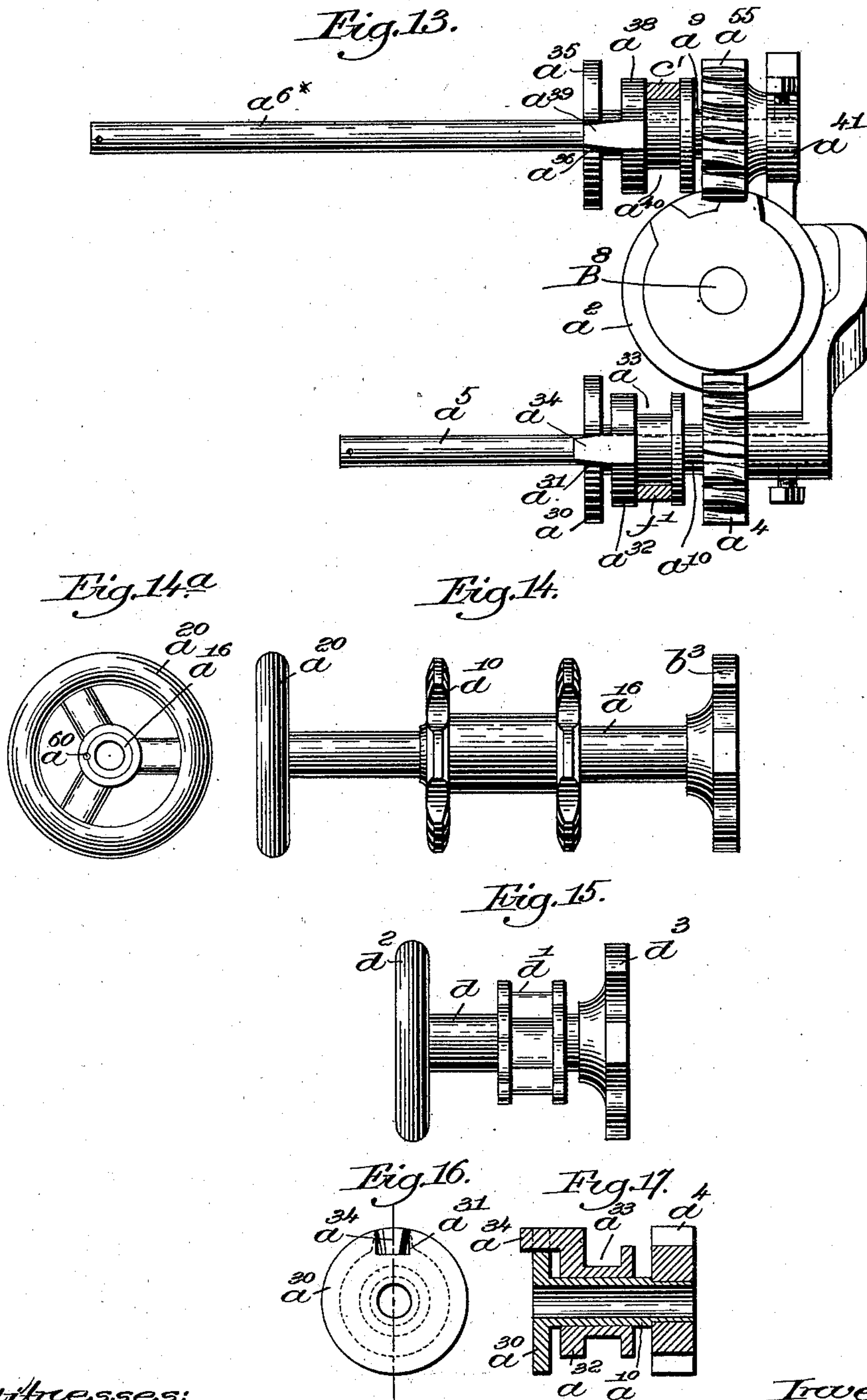
Patented Aug. 21, 1900.

H. WYMAN.  
LOOM.

(Application filed Nov. 29, 1897.)

(No Model.)

4 Sheets—Sheet 4.



witnesses:

Fred S. Grunhof.  
Walter E. Lombard.

Inventor:  
Horace Wyman.  
by Wesley M. May,  
attys.



# UNITED STATES PATENT OFFICE.

HORACE WYMAN, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE CROMPTON & KNOWLES LOOM WORKS, OF SAME PLACE.

## LOOM.

SPECIFICATION forming part of Letters Patent No. 656,592, dated August 21, 1900.

Application filed November 29, 1897. Serial No. 660,095. (No model.)

*To all whom it may concern:*

Be it known that I, HORACE WYMAN, of Worcester, county of Worcester, and State of Massachusetts, have invented an Improvement in Looms, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention has for its object to improve that class of loom designated under the term "dobby" and using movable shuttle-boxes. I having combined with the usual shed-forming pattern-surface and a shuttle-box pattern-surface, each employing as its indicating-surface a suitable pattern-chain, a multiplying mechanism, it having also a chain whereby any indicator carried by the shuttle-box pattern-surface may be made to repeat itself any desired number of times.

This invention, while specially applicable to a dobby-loom, as above indicated, is also applicable to any usual or suitable type of loom using shed forming and shifting shuttle-box mechanism.

On the occurrence of mispicks and other faults, which, if not corrected, would result in imperfections of the pattern, the loom is stopped and the pattern-surfaces must be turned by hand to again bring their indicators at the proper points before the loom is again started. To insure this at one operation, I have combined with the said pattern-surfaces and said multiplying mechanism devices whereby whenever it is required to adjust said pattern-surfaces or multiplying mechanism, the loom being at rest, the said pattern-surfaces and multiplying mechanism may be moved in unison, and this movement may be in either direction to thereby insure the maintenance of the said surfaces and multiplying mechanism in the established order requisite for the correct weaving of the pattern to be produced.

One part of this invention therefore consists in combining with the shuttle-box pattern-surface a multiplying mechanism to insure the repeating of any desired indication of the shuttle-box pattern-surface for any desired number of times, the chains of the shuttle-box pattern-surface and said multiplying mechanism being mounted, as herein repre-

sented, on different cylinders adapted to be rotated about suitable shafts, the centers of motion of said pattern-surfaces and said multiplying mechanism being out of line. Preferably each of said cylinders and the shaft of the shed-forming pattern-surfaces will have a suitable hand-wheel, whereby each of said cylinders or said shaft may be moved independently of the other, if necessity requires, by its own hand-wheel. The cylinders carrying the shuttle-box pattern-chain and the chain of the multiplying mechanism are sustained upon shafts held in bearings so constructed, as will be hereinafter represented and described, that either of said chains may be readily removed from the end of said cylinder and over its hand-wheel without dismembering the chain.

Another feature of the invention herein contained consists in combining with said pattern-surfaces and multiplying mechanism devices under control of the operator whereby said pattern-surfaces and multiplying mechanism may be turned backward or forward in unison at one operation and without disturbance of the predetermined set or arrangement of said parts necessary to produce the particular pattern which it is desired to weave in the cloth to be produced.

In this invention I have one and the same rotating shaft to operate the shuttle-box pattern-surface, the chain of the multiplying mechanism, and the shed-forming pattern-surface, said shaft having, however, a plurality of worms, one of which engages a worm-toothed gear fast on a shaft carrying the shed-forming pattern-surface, said gear at each rotation effecting two step-by-step movements of the said shed-forming pattern-surface to indicate the formation of two sheds, the other of said worms having teeth of peculiar shape which engage the teeth of and rotate two worm-toothed gears, one cooperating with each of said cylinders, the teeth of this latter worm being so shaped or inclined that when one portion of said teeth engage the teeth of one of said toothed gears that toothed gear will dwell or remain at rest, while the other toothed gear will be rotated, and vice versa, so that the shuttle-box pattern-surface or the chain of the multiplying mechanism, which-



ever is moved at one rotation of the shaft carrying said worm, will be moved for but one division or for a distance to bring first one and then the next indicator thereon into operative position. The two worm-toothed gears which cooperate with said shuttle-box pattern-surface and the support for the chain of the multiplying mechanism have connected to and adapted to rotate with them each one half of a suitable clutch device, the other cooperating half of such clutch device being connected to or moving with the cylinders carrying the shuttle-box pattern-chain and the chain of the multiplying mechanism, each of said clutch parts being under the control of a suitable lever, preferably of the first order, said lever being moved, however, by an indicator of the other chain, so that each chain controls through said levers the clutch employed to move the other chain, and thereby each chain may be moved whenever desired from or through the indicators of said chains, there preferably being an independent row of indicators on each chain for the purpose of controlling these clutches, so as to stop and start either of the chains at will. The worm which actuates the two worm-toothed gears is located between said gears and engages each of them, and these teeth of the worm are so shaped, as will be described, that when one worm-toothed gear is at rest the other will be moving, and vice versa; but at this same time the other worm, it engaging a worm-toothed gear on the shaft carrying the shed-forming pattern-surface, rotates that shaft continuously step by step, said shaft having a movement of two steps for one step of either the shuttle-box pattern-surface or the chain of the multiplying mechanism. It will be understood that the shuttle-box pattern-surface will be moved only in the interval in which the chain of the multiplying mechanism is at rest, and vice versa.

Figure 1 in end elevation shows a sufficient portion of a loom with my improvements added to enable my invention to be understood, said figure showing but a small part of the shed-forming pattern-surface and part of the chain of the shuttle-box pattern-surface, the chain of the multiplying mechanism being omitted, as it is shown fully in Fig. 3. Fig. 2 is a sectional detail in the line  $x$  of Fig. 1. Fig. 3 is a partial rear side elevation and section of the parts shown in Fig. 1, the line of section being across the shaft on which is mounted the cylinder carrying the shuttle-box pattern surface or chain in line  $x'$  and across the cylinder and shaft carrying the chain of the multiplying mechanism in the line  $x^2$  of Fig. 1, Fig. 3, however, showing said chain in position, together with the shed-forming pattern surface or chain and two of the usual fingers of the dobby. Fig. 4 is a detail showing the shoe at one end of the lever, located between the chain of the multiplying mechanism and the clutch cooperating with the shuttle-box pattern-surface. Fig. 5 is a

detail showing the two levers actuated by the shuttle-box pattern surface or chain and by the chain of the multiplying mechanism to effect the stopping and starting of the cylinder carrying the pattern surface or chain of the shuttle-box pattern-surface and the chain of the multiplying mechanism, so that any indicator on the pattern surface or chain for the shuttle-box may be repeated any desired number of times. Fig. 6 is a partial top or plan view and longitudinal section in the line  $x^4$  of the parts shown in Fig. 5. Fig. 7 is a detail showing one of the two like disks connected to one or the other chain-carrying cylinder and forming one of the clutch parts of the two like clutches to be designated. Fig. 8 shows an end view of the fingered end of the sliding collar forming part of the other half of one of said clutches. Fig. 9 shows part of the cylinder for supporting the shuttle-box pattern surface or chain, said figure showing the usual indicator-rolls and by dotted lines one of the special indicators movable with said chain to indicate the stopping and starting of the cylinder moving the chain of the multiplying mechanism. Fig. 10 is a sectional detail view of the cylinder carrying the chain of the multiplying mechanism, together with part of said chain, the figure showing one of the high links which when in position to operate indicates and compels the clutching and starting of the cylinder carrying the chain of the shuttle-box pattern-surface. Fig. 11 is a top view of the chain shown in Fig. 10. Fig. 12 shows laid out one form of worm for actuating the worm-toothed gears having the clutch parts and being instrumental in rotating the cylinders carrying the shuttle-box pattern surface or chain and the chain of the multiplying mechanism; Fig. 13, a detail in plan showing the worm  $a^2$ , the worm-toothed gears actuated thereby, and the collars sliding on the sleeves of said gears and forming parts of the clutches to be described; Fig. 14, a detail of the cylinder for carrying the chain of the shuttle-box pattern-surface; Fig. 14<sup>a</sup>, a detail looking at the left-hand end of Fig. 14; Fig. 15, the cylinder carrying the chain of the multiplying mechanism; and Fig. 16, an end view of a sleeve on which is fixed a worm-toothed gear, said figure showing the end of the finger  $a^{34}$ . Fig. 17 is a longitudinal section of the parts shown in Fig. 16.

The part A of the framework herein shown is and may be common, say, to the loom represented in United States Patent No. 217,589, dated July 15, 1879. In practice the shaft B may be considered to be substantially the same as the shaft indicated in said United States Patent No. 217,589 for carrying the shed-forming pattern surface or chain composed of parts 26 27 29, adapted to actuate fingers  $a^6$ , common to the dobby mechanism, fully described in said patent, where the said chains and fingers are designated by like letters; but instead of said pattern surface or chain a pattern-surface of any usual or suit-



able construction may be made and used to actuate any other usual jacks or hooks commonly employed in connection with shed-forming mechanism to form sheds in the warp.

The framework A has a suitable bearing, as at A', through which is extended a shaft A<sup>2</sup>, (represented by dotted lines, Fig. 3,) said shaft having at its inner end a large gear A<sup>4</sup>, which may be connected and actuated by any usual or suitable pinion connected with or deriving its motion from the usual crank-shaft of the loom, as provided for in United States Patent No. 217,589. The outer end of the shaft A<sup>2</sup> has fast upon it a bevel-toothed pinion A<sup>5</sup>, which engages a bevel-toothed pinion A<sup>6</sup>, fast on the lower end of a short shaft A<sup>7</sup>, (shown by dotted lines in Fig. 3,) said shaft having its bearings in a suitable stand or bracket A<sup>8</sup>, bolted in suitable manner to the frame A. The upper end of the shaft A<sup>7</sup> has fast upon it a hub of a disk B<sup>4</sup>, provided at one edge with a suitable notch to receive a tongue a, (see dotted lines, Fig. 1,) extended downwardly from a latch B<sup>5</sup>, pivoted at B<sup>6</sup> on a disk B<sup>7</sup>, attached to a shaft B<sup>8</sup> in line with the shaft A<sup>7</sup>, said shaft B<sup>8</sup> being surrounded by a suitable spring B<sup>9</sup>, acted upon at its upper end by a collar B<sup>10</sup>, fast on said shaft B<sup>8</sup>, so that said spring normally acts upon said latch to keep its tongue in engagement with the notch in the disk B<sup>4</sup>, said two parts of the shaft being moved together in unison by or through the gears A<sup>5</sup> and A<sup>6</sup> whenever the loom is working regularly; but should the loom be stopped for any reason and it be desired to rotate the part B<sup>8</sup> of the two-part shaft B<sup>8</sup> A<sup>7</sup> then power applied in this instance of my invention to a suitable hand-wheel C, (shown in Fig. 1,) connected to the end of a cross-shaft C', supported in the framework A and having at one end a bevel-pinion C<sup>2</sup>, may be turned, causing said bevel-pinion to engage a bevel-pinion C<sup>3</sup> on the upper end of the part B<sup>8</sup> of said two-part shaft, and by applying sufficient force to said shaft C' the friction of the spring B<sup>9</sup> may be overcome and the shaft B<sup>8</sup> turned, leaving the part A<sup>7</sup> of the shaft at rest. This turning of the part B<sup>8</sup> of the shaft is necessary at times, as will be hereinafter stated, to enable the different pattern-surfaces and parts deriving movement from said shaft to be rotated in unison in one or the other direction to correct mistakes, such as mispicks or other faults occurring in weaving.

The part B<sup>8</sup> of the shaft is provided in this instance of my invention with two worms—viz., a worm a' and a worm a<sup>2</sup>. The worm a' engages a worm-toothed gear a<sup>3</sup> on the shaft B, before referred to, carrying the shed-forming pattern-chain, and rotates said shaft continuously. The worm-gear a<sup>2</sup> engages a worm-toothed gear a<sup>4</sup>, (see Fig. 13,) where said gear is shown in plan, said gear being secured to a sleeve a<sup>10</sup>, (see Fig. 17,) mounted loosely on a stud a<sup>5</sup>. (See Figs. 1, 3, and 13.) The worm

a<sup>2</sup> rotates said worm-toothed gear a<sup>4</sup> and its sleeve a<sup>10</sup> intermittingly about said stud. The sleeve has fixed to its end opposite the worm-toothed gear a plate a<sup>30</sup>, (see Fig. 16,) having a notch a<sup>31</sup>. The sleeve a<sup>10</sup> has mounted upon it a collar a<sup>32</sup>, having an annular groove a<sup>33</sup> and a finger a<sup>34</sup>, said collar being free to be slid on said sleeve and cause said finger to move back and forth in the notch of said plate. The worm a<sup>2</sup> also engages a second like worm-toothed gear a<sup>55</sup>, (shown in Fig. 13,) it being hid from view in Figs. 1 and 3 by the parts immediately in front of it. The gear a<sup>55</sup> is fast on a sleeve a<sup>9</sup>, said sleeve being just the same as sleeve a<sup>10</sup>, before described, and the said sleeve a<sup>9</sup> has at its front end a connected disk a<sup>35</sup>, having a notch a<sup>36</sup>, and the said sleeve a<sup>9</sup> has mounted upon it loosely, between said worm-toothed gear a<sup>55</sup> and said disk, a collar a<sup>38</sup>, having a finger a<sup>39</sup>, which enters the notch a<sup>36</sup> in said disk, said collar having an annular groove a<sup>40</sup>. Both the said collars a<sup>32</sup> and a<sup>38</sup> are free to be slid at suitable times, as will be described, on the said sleeves a<sup>10</sup> a<sup>9</sup>, and said collars and sleeves form part of a clutch to be described. The sleeve a<sup>9</sup> is mounted loosely on a stud a<sup>6x</sup>, corresponding with the stud a<sup>5</sup>, it being held at its right-hand end, Figs. 1 and 13, in a suitable bearing in a part a<sup>41</sup>, erected upon the framework. The stud a<sup>6x</sup> is extended through a second bearing in an extension a<sup>8</sup> of the loom-frame. The stud a<sup>6x</sup> receives upon it a sleeve a<sup>16</sup>, having connected with it a chain-carrying cylinder a<sup>10</sup>, on which is hung the shuttle-box pattern surface or chain b, it having any usual or suitable indicators, as 2, and a series of special indicators b', one of said indicators being shown by full lines in Fig. 1 and by dotted lines in Fig. 9. The sleeve a<sup>16</sup> also has connected with its inner end a plate b<sup>3</sup>, having at its periphery suitable notches b<sup>4</sup>, which are adapted to be engaged by a projection extended from a locking-lever 7, said locking-lever operating to enter any one of said projections and prevent the overrunning of the motion of the sleeve a<sup>16</sup> and pattern surface or chain b and keep it at rest when not actuated positively. The disk b<sup>3</sup> also has a series of spaces b<sup>5</sup>, which may be entered one or the other by the finger a<sup>39</sup> at the end of the collar a<sup>38</sup>. The sleeve a<sup>16</sup> has connected to it at one end by a spline or key a<sup>60</sup> (see Fig. 14<sup>a</sup>) a hand-wheel a<sup>20</sup>, and said sleeve, it surrounding the stud a<sup>6x</sup>, is extended through a hole in and takes its bearing in the projecting arm a<sup>8</sup>, before referred to. Viewing Fig. 3 it will be seen that the shuttle-box pattern surface or chain b hangs on the cylinder a<sup>10</sup> about the projecting end of the arm a<sup>8</sup>, supporting the said sleeve and its cylinder, and when the pattern-chain is to be removed it may readily be drawn off bodily (see Fig. 3) from the cylinder without unfastening the chain.

The stud a<sup>5</sup> receives upon it a sleeve d, having detachably secured to one end thereof a



hand-wheel  $d^2$ , said sleeve having at its opposite end a plate or disk  $d^3$ , which in all particulars is the same as the disk  $b^3$  before described and carried at one end of the sleeve  $a^{16}$ , said disk or plate  $d^3$  having a like series of spaces in which may be entered the finger  $a^{34}$  of the collar  $a^{32}$  at desired times. The sleeve  $d$  also has as part of it a cylinder  $d'$ , (see Fig. 15,) upon which is hung the multiplying pattern-chain  $c^{16}$ , having at suitable intervals high links or indicators  $c^{15}$ .

The disks or plates  $b^3$  and  $d^3$  constitute each one half of a clutch, the other halves being the collars  $a^{32}$  and  $a^{38}$ , said collars having the fingers  $a^{34}$  and  $a^{39}$ , and either one of the said sleeves  $d$  or  $a^{16}$  may be rotated at any desired time by simply putting the clutches into operation, and they may be left at rest for any desired time by putting the clutches out of operation.

The indicators  $b'$  on the shuttle-box pattern surface or chain  $b$  control the movement of the clutch part to start or stop the sleeve  $d$ , carrying the multiplying pattern surface or chain  $c^{16}$ , and the indicators  $c^{15}$ , carried by the chain  $c^{16}$  of the multiplying mechanism, control the collar  $a^{38}$  of the clutch part instrumental to start and stop the sleeve  $a^{16}$ , carrying the shuttle-box pattern surface or chain.

In the operation of the loom the indicators 2 act in the proper order to lift one or the other of a series of levers 3, having attached rods 4, connected with and to operate any usual or suitable shuttle-box-moving mechanism—such, for instance, as represented in United States Patent No. 227,667, dated May 18, 1880.

For putting into and out of operation the clutch parts referred to I have provided devices which I will now describe.

In a bracket  $c^3$  of the framework I have mounted a stud  $c^2$ , confining it in position with a suitable set-screw  $c^x$ . One end of the stud receives upon it loosely a lever  $c$  of the first order, said lever being bent, as shown, to present a depending extremity  $c'$ , which enters the annular groove  $a^{40}$  in the collar  $a^{38}$ . The lever  $c$  has an upwardly-extended ear  $c^4$ , (see Figs. 5 and 6,) and at the side of said ear the said stud  $c^2$  receives on it loosely an adjustable continuation  $c^8$  of said lever, said continuation having an upwardly-extended short arm  $c^7$ , provided with a slot  $c^6$ , through which is extended a screw  $c^5$ , which is screwed into a threaded hole in said ear  $c^4$ , so that by the loosening of said screw  $c^5$  the particular angles occupied by the end  $c'$  of the lever  $c$  and the end of the continuation  $c^8$  may be varied to insure just the proper movement for the collar  $a^{38}$ . The continuation  $c^8$  of the lever  $c$  has a stud  $c^{10}$ , on which is pivoted a shoe  $c^{12}$ , said shoe resting immediately above the chain  $c^{16}$  of the multiplying mechanism in position to be struck by an indicator  $c^{15}$  when it is desired to effect the clutching of the finger  $a^{39}$  of the collar  $a^{38}$  with the plate or disk  $b^3$  to start the sleeve  $a^{16}$  and chain  $b$  in motion,

the absence of a high link or indicator  $c^{15}$  from under said shoe  $c^{12}$  enabling a spring  $c^{14}$ , connected with the lever  $c^8$ , to move said collar and effect the disengagement of the clutch referred to from the plate or disk  $b^3$  and leave the shuttle-box pattern surface or chain  $b$  at rest, so that the indicator then operative will insure that the shuttle, the position of which is controlled by said indicator, may be thrown any desired number of times. The shoe  $c^{12}$  is provided above its pivotal point  $c^{10}$  with a suitable spring 10, said spring yielding whenever the stress upon the said shoe from any accidental cause would be more than it and the parts carrying the shoe would bear without breaking. The stud  $c^2$  also has mounted loosely upon it, but at its opposite end, a second peculiarly-shaped lever  $f$  of the first order, it having a depending end  $f'$ , which enters the groove  $a^{33}$  of the collar  $a^{32}$ , and the end of the stud  $c^2$ , alongside of the ear  $f^2$  of the lever  $f$ , has mounted loosely upon it an adjustable continuation  $f^3$  of the lever  $f$ , said continuation having a slot like the slot  $c^6$  in the part  $c^7$  of the continuation  $c^8$ , the slot of said continuation  $f^3$  receiving a suitable set-screw  $f^4$ , which is inserted through said slot and screwed into the ear  $f^2$  of the lever  $f$ , said ear extending above the stud  $c^2$ . The continuation  $f^3$  of the lever  $f$  has a pivot or stud  $f^5$ , upon which is mounted a shoe  $f^6$ , a suitable spring  $f^7$  acting on said shoe, as described of the spring 10 in connection with the shoe  $c^{12}$ . The shoe  $f^6$  stands above and in position to be acted upon by the indicator  $b'$  of the shuttle-box pattern surface or chain  $b$ , and when a special indicator  $b'$  acts on the shoe  $f^6$  the lever  $f$  is turned to cause the finger  $a^{34}$  of the clutch  $a^{32}$  to enter one of the like spaces  $b^5$  of the plate or disk  $d^3$ , fast on the sleeve  $d$ , carrying the chain of the multiplying mechanism, and said chain is moved so long as said clutch is in engagement therewith, it being stopped whenever an indicator  $b'$  passes from under said shoe. The levers  $c$  and  $f$  are each acted upon to keep their shoes in contact with the indicators for moving them by like springs  $c^{14}$ . The levers or fingers 3 turn on a stud 5, held by a screw 6 in a bearing 12. The plates or disks  $b^3$  and  $d^3$  are held locked in place, so that they will not be moved accidentally, by projections on usual levers 7 8, held normally in operative position by one common spring 14 connecting them.

When it is desired to change the chain  $b$  of the shuttle-box or the chain  $c^{16}$  of the multiplying mechanism for other chains having indicators arranged in a different order, then said chains may be easily slipped off from the sleeves carrying them over their attached hand-wheels without dismembering said chains.

The springs  $f^7$  and 10 referred to serve to permit the breaking of the levers  $c$  or  $f$  whenever, by any disarranging of the parts, the said levers might not be free to move, or should either clutch stick.



From the foregoing it will be understood that the worm  $a^2$  actuates intermittingly both the worm-toothed gears  $a^4$  and  $a^{55}$  and their sleeves and clutch parts; but said clutch parts do not engage and rotate the sleeves  $d$  and  $a^{16}$  except at times, controlled by the position of the indicators on, respectively, the chains  $c^{16}$  and  $b$ .

The teeth of the worm  $a^2$  are of peculiar shape. (See Fig. 12, where it will be seen that the portions marked 30 extend circumferentially about the hub of said worm and the portions 31 are placed at a steep inclination.) The portions 30 are designated as "dwell" portions and the portions 31 as "moving" portions. When the dwell portions 30, covering substantially one-half the worm, act on a worm-toothed gear, that gear does not rotate, but the moving portions 31 at the other half of the worm, it engaging the other worm-toothed gear rotates it, so it will be understood that the worm  $a^2$  in its rotation moves first one and then the other of the two gears engaged by it. I have chosen this form of worm for the reason that the loom hereinsofar described is supposed to contain movable shuttle-boxes at but one end of the lay, and the said shuttle-boxes may be moved only at every other pick; but should this invention be applied to a loom having shuttle-boxes at each end of the lay, said shuttle-boxes being adapted to be moved at each pick, then in each instance the worm  $a^2$  would have its teeth so constructed that at each rotation of the said worm its teeth, in connection with the teeth of the worm-toothed gears referred to, would turn both of said gears for one step at each half-rotation of the worm.

I will also herein note that the shaft B is rotated, in this present instance of my invention, twice by or through the worm  $a'$ , while the worm  $a^2$ , as shown, operates once either of the two worm-toothed gears  $a^4$  and  $a^{55}$ , such order of timing being necessary in the class of looms herein described and having, as stated, a shuttle-box at but one end of the lay.

The facility hereinbefore described for readily and easily removing the chains  $b$  and  $c^{16}$  without dismembering them is of very considerable importance to a loom-fixer, as it not only saves his time, but also prevents any loss of the parts of the chain, provided they are not immediately put together again.

This invention is not limited to the exact shape of the clutch parts herein represented, and instead of the particular clutch parts I may employ any other usual or suitable clutch devices adapted for the purpose.

The worm-surfaces  $a'$  and  $a^2$  on the gear-shaft are shown as made in separate sleeves properly applied thereto; but this invention would not be departed from if the said worm-surfaces were all on one sleeve, one located above the other.

Having fully described my invention, what

I claim as new, and desire to secure by Letters Patent, is—

1. In an organized loom, the following instrumentalities, viz: a shuttle-box pattern-surface; a multiplying mechanism cooperating therein; a pattern-surface to determine the order of forming sheds; a rotating shaft provided with endless screw or worm surfaces; and worm-toothed gears arranged on opposite sides of said worm-surfaces and driven thereby to actuate the pattern-surface of the shed-forming mechanism, the shuttle-box pattern-surface, and said multiplying mechanism, means for rotating said shaft and a yielding clutch between said means and shaft, substantially as described.

2. In a loom, a shuttle-box pattern-surface; a multiplying mechanism cooperating therewith; a pattern-surface to determine the order of forming sheds; a rotating shaft provided with endless screw or worm surfaces; worm-toothed gears arranged on opposite sides of and driven by one of said screw or worm surfaces, and clutches intermediate the said shuttle-box pattern-surface and multiplying mechanism and two of said worm-toothed gears, to move said shuttle-box pattern-surface and said multiplying mechanism alternately, and to also move the pattern-surface of the shed-forming mechanism, substantially as described.

3. In a loom, the following instrumentalities, viz: a shuttle-box pattern-surface; a multiplying mechanism cooperating therewith; two worm-toothed gears, means to enable the said worm-toothed gears to engage and turn said shuttle-box pattern-surface or the said multiplying mechanism at desired intervals; a shaft provided with an endless screw or worm arranged between said gears constructed with a dwell and an actuating portion, to produce a dwell alternately in the movement of each of said worm-toothed gears actuated thereby for the purposes set forth.

4. In a loom, a shuttle-box pattern-surface, a multiplying mechanism cooperating therewith, a pattern-surface to determine the order of forming sheds, a rotating shaft provided with a plurality of worms, one of said worms engaging a worm-toothed gear to actuate the pattern-surface of the shed-forming mechanism; two clutches, one cooperating with the shuttle-box pattern-surface and the other with the multiplying mechanism, each having as a part thereof a worm-toothed gear, the second worm on said shaft having a dwell portion and arranged between and engaging and rotating both the worm-toothed gears cooperating with the said clutches to move the said gears alternately, substantially as described.

5. In a loom, a shuttle-box pattern-surface, a multiplying mechanism cooperating therewith, a pattern-surface to determine the order of forming sheds, a rotating shaft provided with a plurality of worms, one of said



worms engaging a worm-toothed gear to actuate the pattern-surface of the shed-forming mechanism; and two clutches, each having as a part thereof a worm-toothed gear, the second worm on said shaft arranged between and engaging and rotating both said worm-toothed gears and the said clutches, and means to automatically move said rotating clutches to effect the starting or stopping of either the said shuttle-box pattern-surface or said multiplying mechanism at predetermined times, substantially as described.

6. In a loom, a shuttle-box pattern-chain, means to support it, a cooperating worm-toothed gear; the chain of a multiplying mechanism, means to support it, and a cooperating worm-toothed gear; and a pattern-chain to determine the order of forming sheds, a support for it, and a cooperating worm-toothed gear, the centers about which said chains turn being out of line; combined with a rotating shaft provided with a plurality of worm-surfaces, one of said worm-surfaces engaging the worm-toothed gear cooperating with the shed-forming pattern-chain; and the other of said worm-surfaces engaging and rotating both the two worm-toothed gears cooperating respectively with the shuttle-box pattern-chain and the chain of the multiplying mechanism, substantially as described.

7. In a loom, a shuttle-box pattern-chain, a sleeve supporting it provided with a hand-wheel, and a cooperating worm-toothed gear; the chain of a multiplying mechanism, and a sleeve to support it having a hand-wheel cooperating with it; combined with a rotating shaft provided with a worm-surface between and to engage and rotate both of said worm-toothed gears alternately, and clutches carried by said worm-toothed gears and engaging at intervals the supports of said chains, substantially as described.

8. A shuttle-box pattern-chain, means to support it, a cooperating worm-toothed wheel; the chain of a multiplying mechanism, means to support it, and a cooperating worm-toothed wheel; a rotatable shaft, having a worm provided for portions of its periphery with dwell teeth and with inclined teeth, the inclined teeth being a continuation of the dwell teeth, said worm occupying a position intermediate said worm-toothed gears and engaging the teeth of the latter; clutches intermediate said worm-toothed gears and said chain-supporting means; and two levers, each of which is acted upon by the indicators of one of said pattern-chains to control the period of operation and of rest of the clutch cooperating with the other of said pattern-chains, substantially as described.

9. In a loom, the following instrumentalities, viz: a shuttle-box pattern-surface having a row of indicators to determine the movement of a multiplying mechanism; a multiplying mechanism having indicators to determine the movement of the shuttle-box pattern-surface; a worm having a dwell portion,

worm-toothed gears actuated thereby and moved alternately, and controlling the movement of the pattern-surface and multiplying mechanism, clutches driven by said worm-toothed gears; mechanism intermediate said two clutches and said shuttle-box pattern-surface and multiplying mechanism whereby the shuttle-box pattern-surface is enabled to control the clutch for stopping and starting the multiplying mechanism, and the multiplying mechanism is enabled to control the clutch for starting and stopping of the shuttle-box pattern-surface, substantially as described.

10. The sliding collar forming part of a clutch mechanism; means for rotating said collar, a pattern-surface, and a lever intermediate said pattern-surface and collar, and engaging the latter, combined with a shoe pivoted on said lever and adapted to rest on said pattern-surface, and a spring interposed between said lever and said shoe, substantially as described.

11. In a loom, a two-part power-operated shaft, a clutch intermediate said parts, two worm-surfaces and a bevel-gear  $C^3$ , carried by the upper part of said power-operated shaft; a shaft carrying the shed-forming pattern-chain and a worm-gear thereon operated by one of said worm-surfaces; a sleeve having a cylinder carrying a shuttle-box pattern surface or chain, means to support said sleeve; a second sleeve having a cylinder carrying the chain of a multiplying mechanism, means to support said sleeve out of line with relation to the shaft carrying the shed-forming pattern-chain and the sleeve carrying said shuttle-box pattern-surface; the two sleeves each having an attached worm-gear; both of such gears being actuated by one of said worms; clutches to effect the engagement of said sleeves with or their disengagement from said shuttle-box pattern-surface and said multiplying mechanism; and a shaft having a gear  $C^2$  engaging the gear  $C^3$  and adapted to be rotated by hand in either direction when the lower part of said power-operated shaft is held at rest and the loom stopped, whereby the upper part of said power-operated shaft and the parts actuated by its attached worm-surfaces may be turned in unison in either direction at will, substantially as described.

12. In a loom, the following instrumentalities, viz: a shuttle-box pattern-surface, a worm-toothed gear, means connecting said gear and said pattern-surface; a shed-forming pattern-surface to determine the order of forming sheds, a worm-toothed gear in operative connection therewith; a rotatable shaft provided with two worm-surfaces, one of said worm-surfaces engaging the worm-toothed gear cooperating with the shuttle-box pattern-surface being provided with dwell and inclined teeth, substantially as described, to enable said shuttle-box pattern-surface to be moved from one to the next series of indicators and remain at rest, the operation of the other worm-surface and worm-toothed gear



coöperating with the shed-forming pattern-surface to move the latter for a distance equal to two series of its indicators before the shuttle-box pattern-surface is again moved, substantially as described.

13. In a loom, the following instrumentalities, viz: a shuttle-box pattern-surface, a coöperating worm-toothed gear; a multiplying mechanism including a worm-toothed gear; a pattern-surface to determine the order of forming sheds, a worm-toothed gear in operative connection therewith; a rotatable shaft disposed between the two first-mentioned toothed gears and provided with two worm-surfaces, the worm-surfaces coöperating with the two toothed gears of the shuttle-box pattern-surface, and the multiplying mechanism being constructed to present dwell and inclined teeth to enable the said worm-surfaces to move alternately the said two worm-toothed gears for one step to actuate the shuttle-box pattern-surface or the multiplying mechanism alternately from one to the next indicator of its chain, while the worm-toothed gear of the pattern-surface de-

termining the order of forming sheds is moved for a distance to effect the opening of two sheds, substantially as described.

14. Two pattern surfaces or chains, supports for the same; studs about which said surfaces or chains may rotate; two worm-toothed gears; a shaft having a worm-surface between and in engagement with both said gears, the teeth of the said worm being constructed with a dwell and active portion to provide for a dwell alternately and successively in the rotation of each of said worm-toothed gears; clutch-surfaces rotating with said worm-toothed gears and each controlled by one of said pattern-surfaces, whereby one of said surfaces controls the movement of the clutch to start and stop the other pattern-surface, substantially as described.

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

HORACE WYMAN.

Witnesses:

GEO. W. GREGORY,  
J. B. SYME.