4 Sheets—Sheet 1.

D. McC. SMYTH.

Book-Sewing Machine.

No. 220,312. **Patented Oct. 7, 1879.**

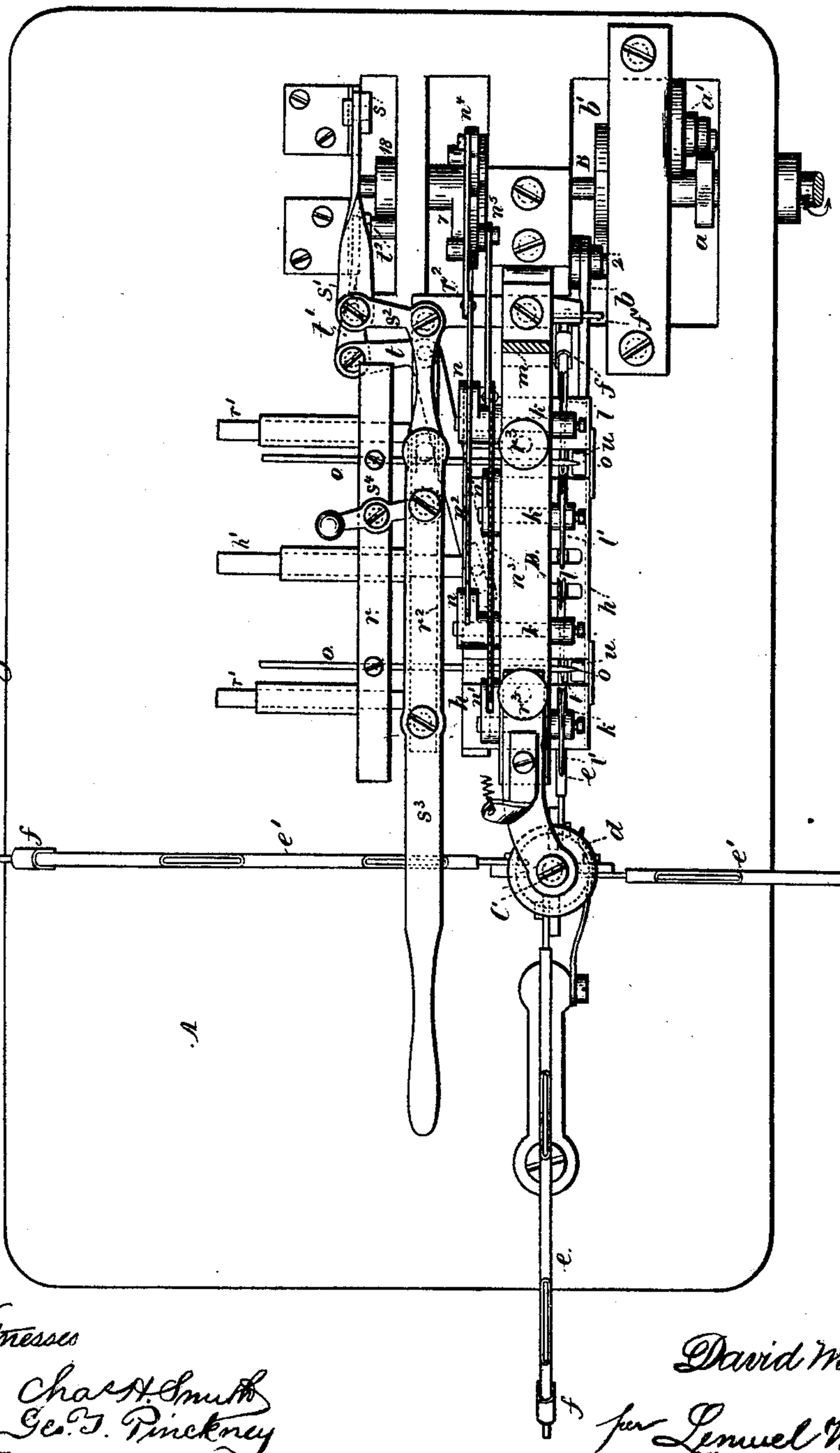

Fig. 1.

Witnesses

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David McC. Smyth
per Lemuel W. Serrell
atty

4 Sheets—Sheet 2.

D. McC. SMYTH.

Book-Sewing Machine.

No. 220,312. Patented Oct. 7, 1879.

Fig. 1.

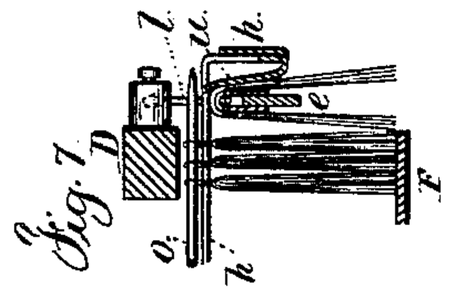
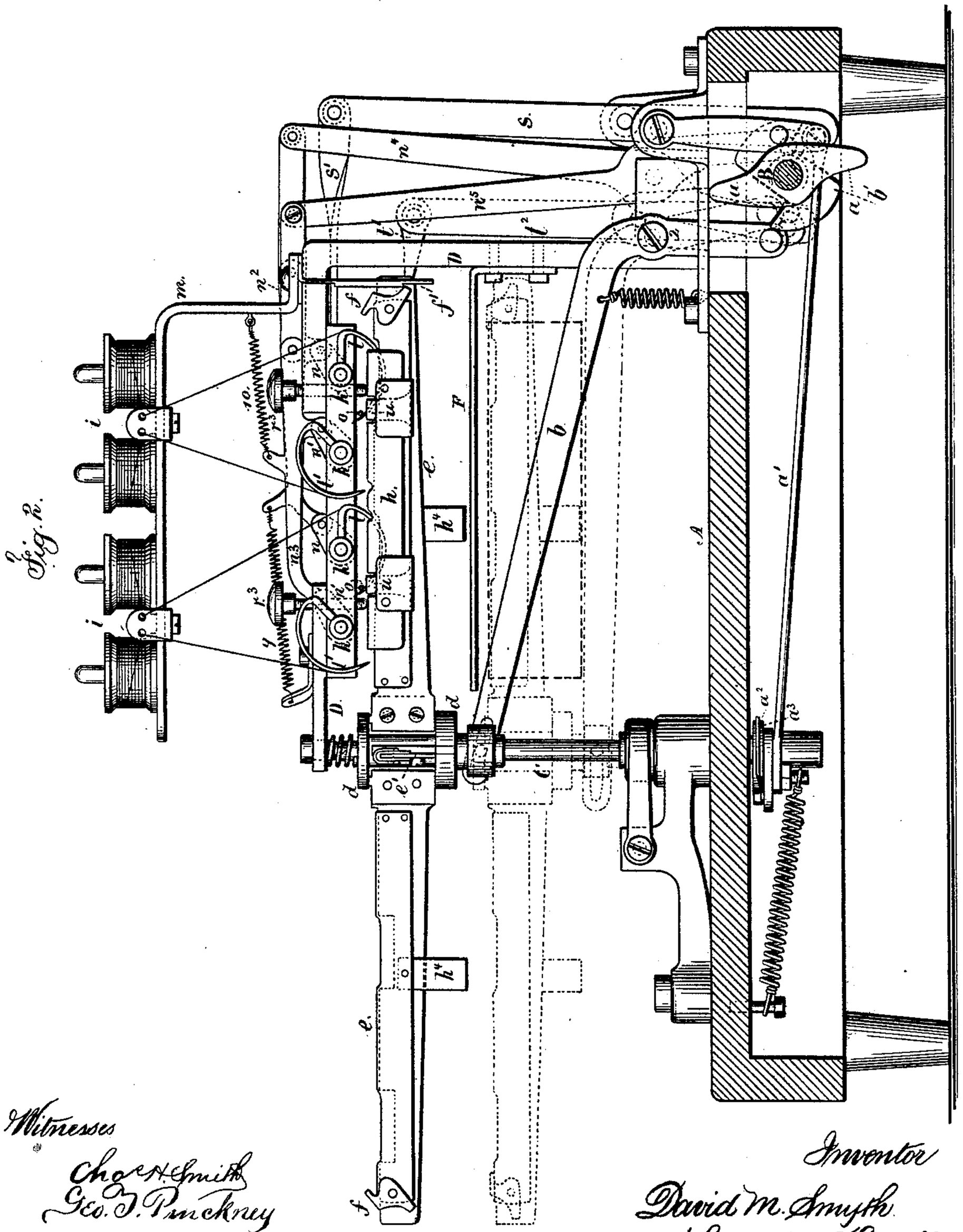


Fig. 2.



Witnesses

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4 Sheets—Sheet 3.

D. McC. SMYTH.

Book-Sewing Machine.

No. 220,312. Patented Oct. 7, 1879.

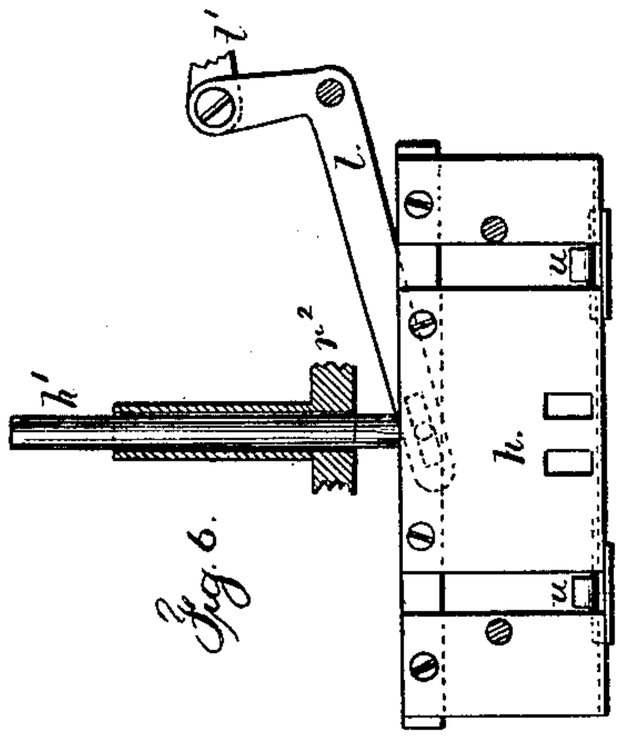

Fig. 6.

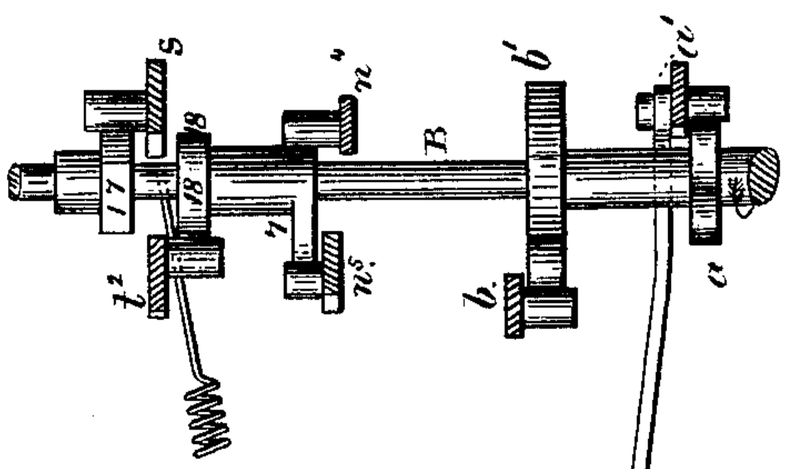

Fig. 3

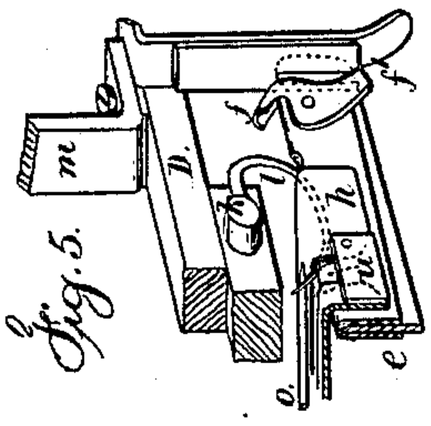

Fig. 5.

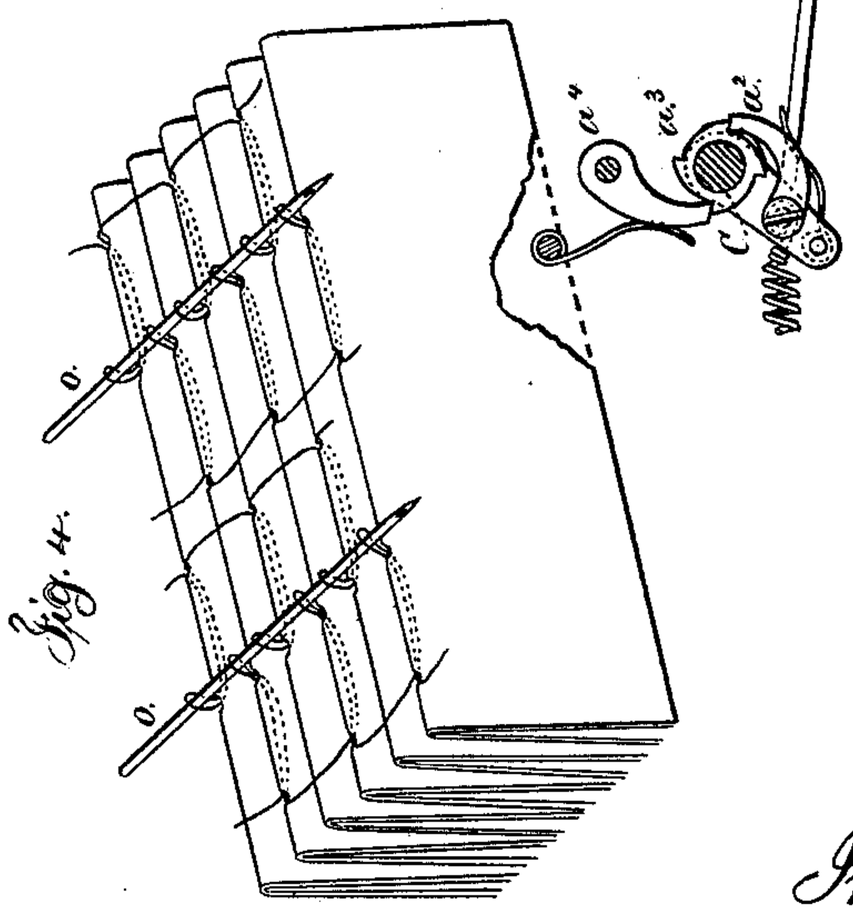

Fig. 4.

Witnesses

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4 Sheets—Sheet 4.

D. McC. SMYTH.

Book-Sewing Machine.

No. 220,312. Patented Oct. 7, 1879.

Fig. 9.

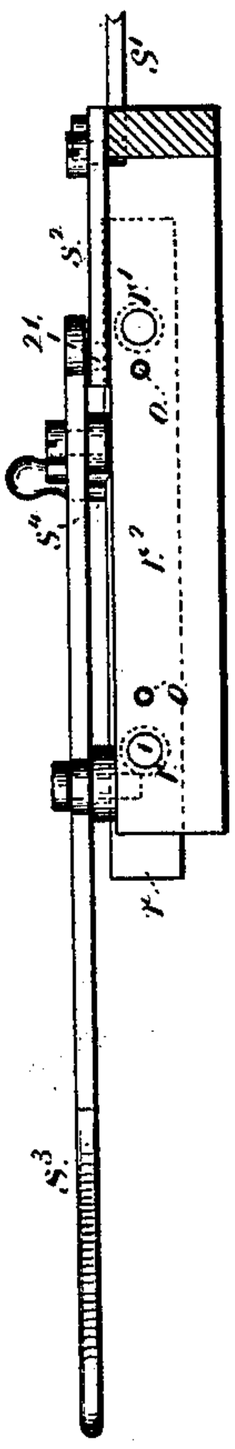


Fig. 8.

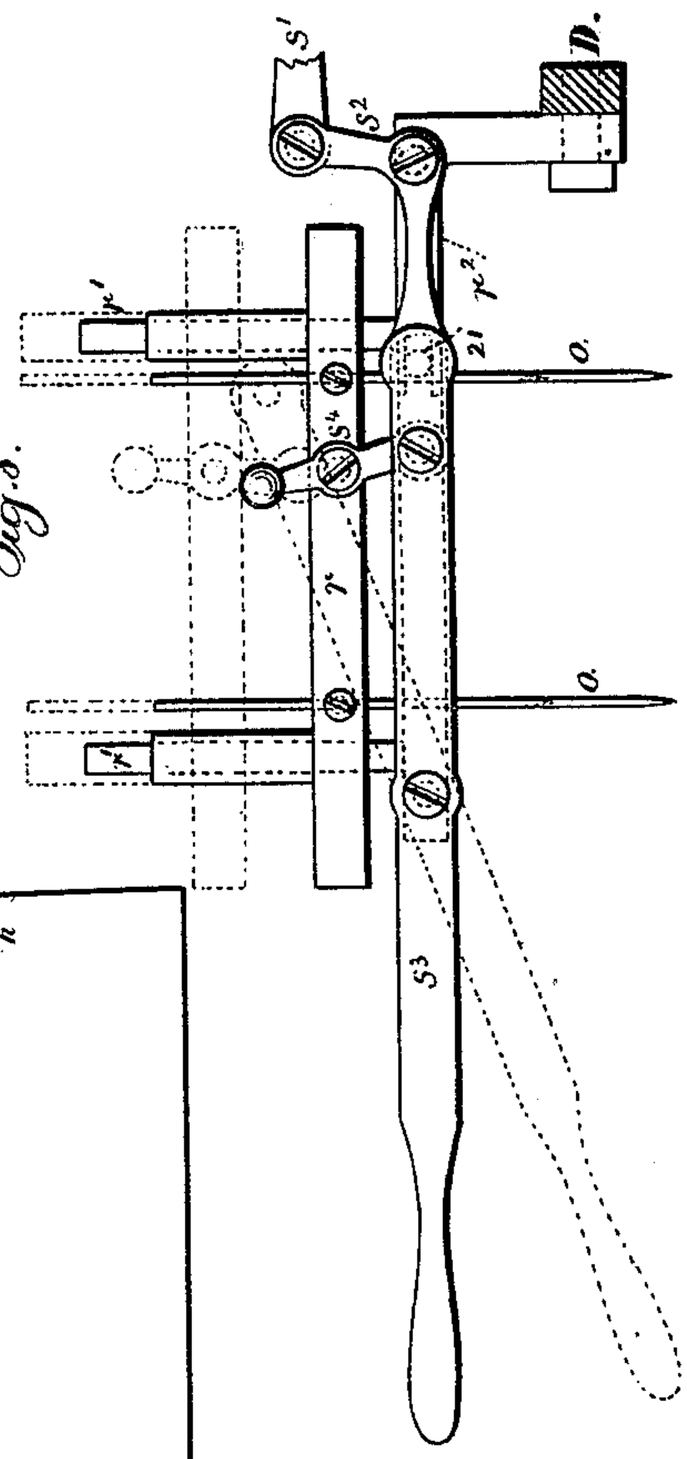
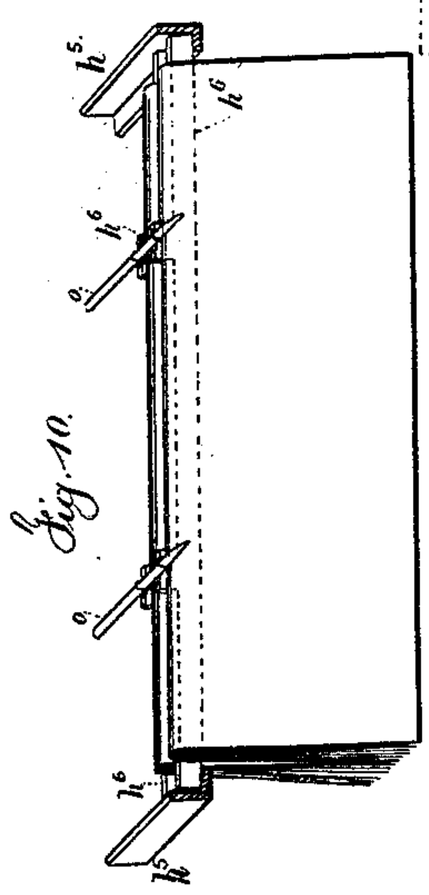


Fig. 10.



Witnesses

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Inventor

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atty.

UNITED STATES PATENT OFFICE.

DAVID McCONNELL SMYTH, OF EAST NORTHWOOD, NEW HAMPSHIRE,
ASSIGNOR TO GEORGE WELLS ROOT, OF HARTFORD, CONNECTICUT.

IMPROVEMENT IN BOOK-SEWING MACHINES.

Specification forming part of Letters Patent No. **220,312,** dated October 7, 1879; application filed February 3, 1879.

To all whom it may concern:

Be it known that I, DAVID MCCONNELL SMYTH, of East Northwood, in the State of New Hampshire, United States of America, have invented an Improvement in Machinery for Sewing together Sheets of Paper or other Material into Books or Pamphlets, of which the following is a specification.

The printed or blank sheets are folded in any usual manner, and they may be sawed at the places where the threads pass into and out of the folded back edges of the sheet, but usually the sawing is dispensed with.

A vertical shaft is provided with horizontal arms. Preferably there are four of these arms. The shaft is turned around progressively. The attendant lays a folded sheet over one of these arms, the shaft is revolved to bring the arm and folded sheet to the place where the sewing is to be done, the arms are lifted up, and the one with the sheet passes into a locking device that holds the arm and sheet into place under a stripper-plate. Two or more needles, each of a semicircular form, now receive a partial revolution and penetrate down through the folded back edge of the sheet into hollows or recesses in the upper edge of the arm, and the points pass upwardly and out again through the fold of the sheet, and these needles are eye-pointed and carry thread with them. At this moment two straight horizontal needles are moved across the path of the curved needles and catch the loops of thread. The curved needles retire, leaving the double thread through the back edge of the sheet. The sheet-carrying arms drop down out of the way, leaving the sheet suspended. The stripper-plate moves and carries the sheet along out of the way of the next sheet and upon a table that is beneath the lower edge of the leaves. During this time the attendant has placed another sheet upon the next arm, and it is moved around to position and raised up, and the sheet sewed as before; but it is preferably sewed by another set of semicircular needles standing in the opposite direction, so that the back of the book will not be unduly increased in thickness by the threads occupying the same position in each sheet; but the back will be uniform in thickness by the distribution of the threads with uniformity.

After one book is sewed or any desired number of sheets have been stitched together, the horizontal needles are to be threaded with twine through the eyes near the points, and the needles pulled bodily from across the back of the book, and the cords or twine drawn thereby into their places in the backs.

Means are provided for giving the proper motions to the parts, such as an actuating-shaft, cams, levers, racks, and springs, and when the books are heavy I arrange to support the horizontal needles at suitable intervals by metal plates introduced between one sheet and the next, and resting at their ends on supports or ways.

A thread may be laid into the loops of thread by a looper, and catch-threads may also be laid across the back at the places where the needle passes into the fold.

In the drawings, Figure 1 is a plan of the machine. Fig. 2 is an elevation with the bed in section. Fig. 3 is a plan of the actuating-cams below the bed. Fig. 4 is a perspective view illustrating the sheets and the horizontal needles. Fig. 5 is a perspective view of part of one sheet-supporting arm and the semicircular needle. Fig. 6 is a detached view of the stripper-plate. Fig. 7 is a section of one arm with the sheets and horizontal needles. Fig. 8 is a plan of the horizontal needles and their supporting and actuating devices, and Fig. 9 is an elevation of the same. Fig. 10 shows a device that may be used to aid in supporting the sheets after they have been sewed.

The bed A sustains the main driving-shaft B, and also the other parts of the machine. The shaft C passes through and is supported at the bottom by the bed A, and at the top it is held by the end of the frame D, that is L-shaped and fastened at the lower end to the bed A.

The cam *a* upon the shaft B gives motion to the rod a^1 and pawl a^2, to turn the ratchet-wheel a^3 and the vertical shaft C a quarter-revolution periodically. The spring-pawl a^4 retains the parts and prevents the shaft turning backward.

The shaft C has around it a hub, *d*, that can be moved up and down upon the shaft, there being a key or square to cause the hub to turn

with the shaft, and the lever *b* on the fulcrum 2 and the cam *b'* on the shaft B are employed to raise the hub *d* at the proper time.

In some instances it is preferable to attach the hub to the shaft by clamping-nuts above and below it, and to move the shaft endwise with the arms at the proper time. In that case the shaft and its feather will slide through the ratchet-wheel. Upon this hub *d* are four horizontal arms, *e e' e' e'*, projecting radially. Each arm is made of a folded piece of sheet metal over a body, and the folded edges are upward and notched at the proper places for the semicircular needles to pass in, as hereinafter more fully described.

Near the end of each arm there is a pivoted swinging gage and clip, *f*, that is made U-shaped to set over the arm and hooked at the inner end. When the folded sheet is laid upon the arm the top angle of the back or fold is brought under the hooked end of this gage, and then the gage is pushed down upon the paper and forms a spring-clip to catch and hold the paper.

As the shaft C and arms *e e e' e'* are revolved intermittently, the arms are sufficiently above the bed A for the sheets to be placed upon each arm in succession, as indicated by dotted lines in Fig. 2; but as the parts are turned the cam *b'* also acts and lifts the sheet-holding arms upwardly, and the sheet is brought up adjacent to the edge of the book-holding table F. The end of the arm passes into the vertical slot of the locking-plate *f'*, and in so doing it is guided to place, and the clip *f* is relieved by the back end of the clip striking against such plate. The sheet is carried up under the stripper-plate *h*, that is formed with openings for the passage of the needles next described, the sewing is performed, the arms drop, leaving the sheet behind, and the next progressive movement of the shaft C brings another arm and its sheet into position, and the operations are repeated.

Upon the frame D there are four or more horizontal shafts, *k*, with their ends projecting and carrying the needles. Each needle *l* or *l'* is made with a straight part extending radially from the shaft, and then the needle is bent into the form of a semicircle. The groove for the thread is in the exterior surface, and the eye of the needle is near the point. The threads pass to these needles from spools *i* upon a suitable arm or frame, *m*. These needles are arranged in pairs, the needles *l* working from right to left, and the needles *l'* moving from left to right.

Any suitable means are employed for giving to these needles and their shafts a partial rotation at the proper time.

I have shown crank-arms n n^1 upon the back ends of the shafts and links n^2 n^3 for the needles *l l'*, respectively, and these links are moved at the proper time to give the half-revolution to the needles by the levers n^4 n^5 and cam 7 on the main shaft B, and the springs 9 and 10 serve to draw the parts back into their normal position after each stitch has been taken.

When the arm *e* comes around and presents its sheet the needles *l l* are moved and take their threads down through the fold and up again, and the loops of thread are left on the points of the horizontal needles *o*, that are moved forward at that time to take said loops like the looper in a sewing-machine, and when the next arm, *e'*, comes around with its sheet, the other needles, *l' l'*, operate in the opposite direction and stitch that sheet, and the loops of thread are also taken by the needles *o;* but they draw off in the opposite direction, as illustrated in Fig. 4.

By this arrangement the sewing is made to resemble the ordinary book-sewing by hand, the threads that hold one sheet being at a different place in the back to the threads that hold the next sheet as in off-and-on sewing.

The horizontal needles *o* are in the cross-bar *r*, that slides upon rods r^1, projecting backwardly from the stationary bar r^2, and the cam 17 on the shaft B acts upon the lever *s*, link s^1, bent lever s^2, lever s^3, and link s^4, to move the bar *r* and needles *o* back and forth at the proper time to cause the needle-points to take off the loops of needle-threads from the semicircular needles and hold them and suspend the sheets.

The stripper-plate *h* is supported by the guide-rod h^1, that passes through the bar r^2. It is adjusted by the screw r^3, and it is moved back and forth at the proper time by the bent lever *t*, link t^1, lever t^2, and cam 18 on the shaft B.

The parts are so timed that as soon as the sheet-carrying arm descends the stripper *h* is moved back to carry the sheet upon the needles *o* and back out of the way of the next sheet; then the needles *o* are moved back ready to go forward again and take the next loop of thread, the stripper-plate *h* is moved forward, another sheet is brought to position, the other set of curved needles operated, and the sewing is performed as before.

There are spring-fingers *u* at the notches in the stripper-plate, to hold the sheet adjacent to where the needles perforate the fold of the paper, and these spring-fingers also aid in pushing the sheet upon the horizontal needles *o* as the stripper is moved back.

The presser-plate h^4 on the arms *e e'*, coming between the leaves of the folded sheet and above the book-holding bed F, aids in placing each sheet in position above such bed, so that the weight of the book may rest upon such bed and relieve the needles *o* from undue strain; but, if desired, there may be supporting-plates h^6 introduced at intervals between the sheets, the ends resting upon supports or slides h^5, and their upper edges being below the needles, as illustrated in the detached view, Fig. 10.

When the proper number of sheets have been sewed to form one or more books, the eyes of the horizontal needles are to be threaded

with cord or twine and the needles drawn back, so as to draw the twine into the loops of thread that project from the backs of the folded sheets, and connect and hold the same in a manner similar to the cords in ordinary book-binding.

The needles *o* occupy the mortises in the stripper-plate *h*, and the back edge of this stripper-plate is adjacent to the stationary frame r^2, and the needles pass freely through this frame and are attached in the sliding bar *r*; hence, when the pin 21 of the lever s^3 is lifted out of the hole in the bent lever s^2, the lever s^3 can be used to force back the bar *r* and draw the needles *o* out of the loops of thread and draw into said loops the back cords of the book, as aforesaid.

During this operation the mass of sewed sheets are supported either by the back part of the stripper-plate or by the frame r^2 as the needles are drawn out.

In some instances a looper may be made use of to draw a thread through the loops of needle-thread, as in a two-thread chain-stitch sewing-machine; but I prefer the devices shown.

If desired, a catch-thread may be supplied through an eye in line with the places where the semicircular needles enter. This eye is moved first one way and then the other, so that the semicircular needle descends first at one side of this thread and then at the other side in its next descent, so that the catch-thread may pass across the back and be confined by the sewing and strengthen the back of the book.

I claim as my invention—

1. In a machine for sewing books, a horizontal range of arms upon a vertical shaft revolved intermittently, in combination with mechanism, substantially as specified, for introducing the thread into the folded back of the sheet and sewing the sheets together in succession as presented by said arms, substantially as set forth.

2. The combination of the vertical shaft C, revolving horizontal sheet sustaining and presenting arms with semicircular needles for carrying the threads into and out of the folded back of the sheet, and means, substantially as specified, for interlocking such threads together, substantially as set forth.

3. The combination of the sheet presenting and holding arms, the stripper, the semicircular eye-pointed needles, and the horizontal loop-holding needles, substantially as set forth.

4. The combination, in a book-sewing machine, of means for supporting the folded sheet, curved eye-pointed needles, means, substantially as specified, for giving a partial rotary movement to the needles, and the stripper-plate for holding the sheet, substantially as specified.

5. A pair of curved eye-pointed needles, arranged to act in opposite directions, in combination with the loop-taking needle that receives the loops from the two needles, substantially as set forth.

6. In a book-sewing machine, a sheet-supporter that is made of a folded sheet of metal notched at the portions of the fold where the needle enters, in combination with an eye-pointed curved needle that passes in between the folded metal in stitching the sheet, substantially as specified.

7. The combination, in a book-sewing machine, of a shaft and radial sheet-sustaining arms with mechanism, substantially as specified, for imparting a progressive rotation, and a guide or locking plate for holding the outer end of such arm in position while the sheet is being sewed, substantially as set forth.

8. The combination, in a book-sewing machine, of the sheet-sustaining arm or plate with the swinging clip *f*, substantially as set forth.

9. The combination, in a book-sewing machine, of the sheet-sustainer, the stripper, the eye-pointed needles, the loop-holding needles, means for reciprocating such needles, and the bed F, upon which the edges of the sewed sheets rest, substantially as set forth.

10. The combination, with the loop-holding needles, of the sliding bar *r* and lever s^3, for withdrawing the needles from the sewed book, substantially as set forth.

Signed by me this 27th day of January, A. D. 1879.

DAVID McCONNELL SMYTH.

Witnesses:

GEO. T. PINCKNEY,

CHAS. H. SMITH.