(No Model.)

3 Sheets—Sheet 1.

A. STARK.

FOLDING BED.

No. 370,426. Patented Sept. 27, 1887.

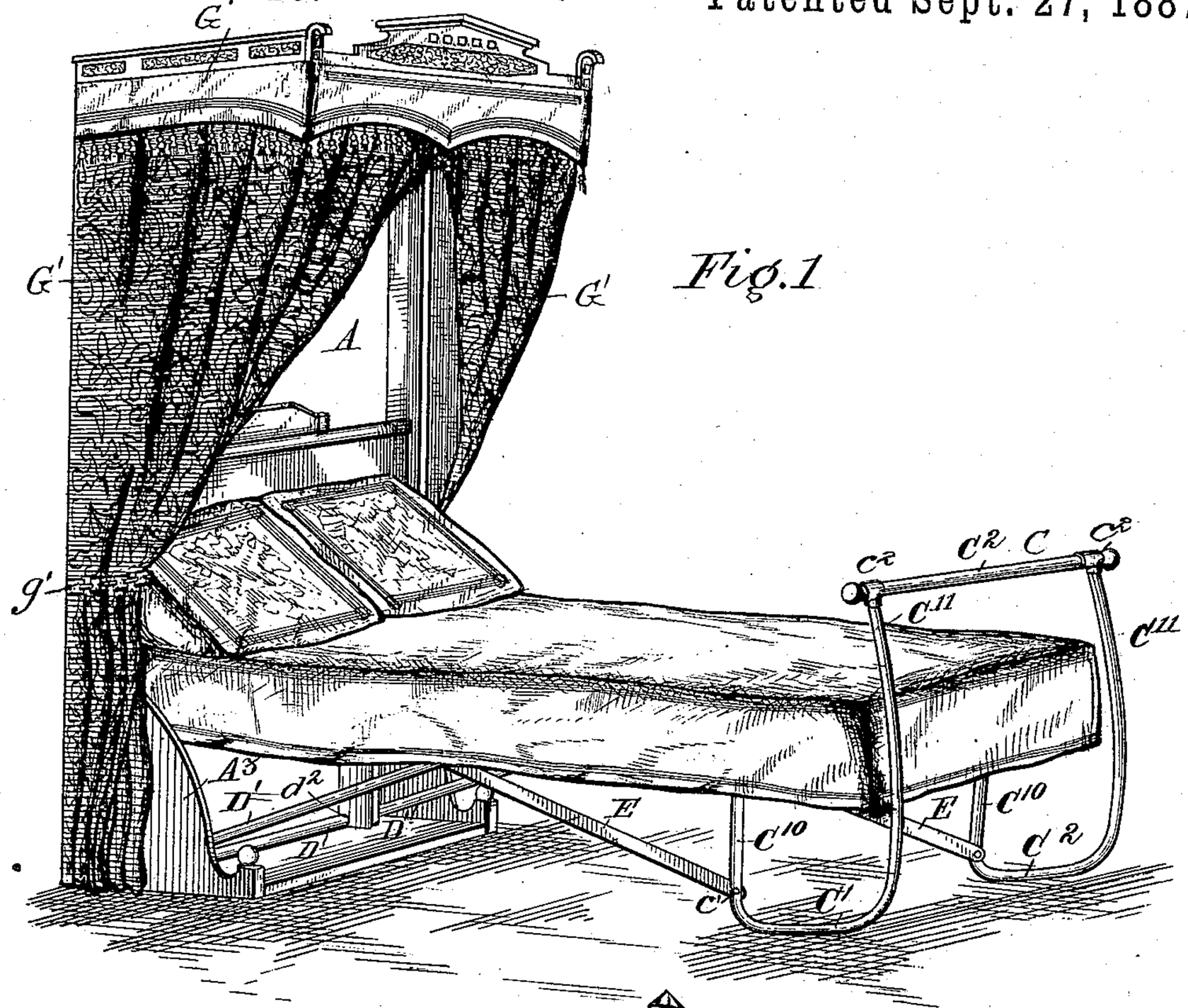

Fig. 1.

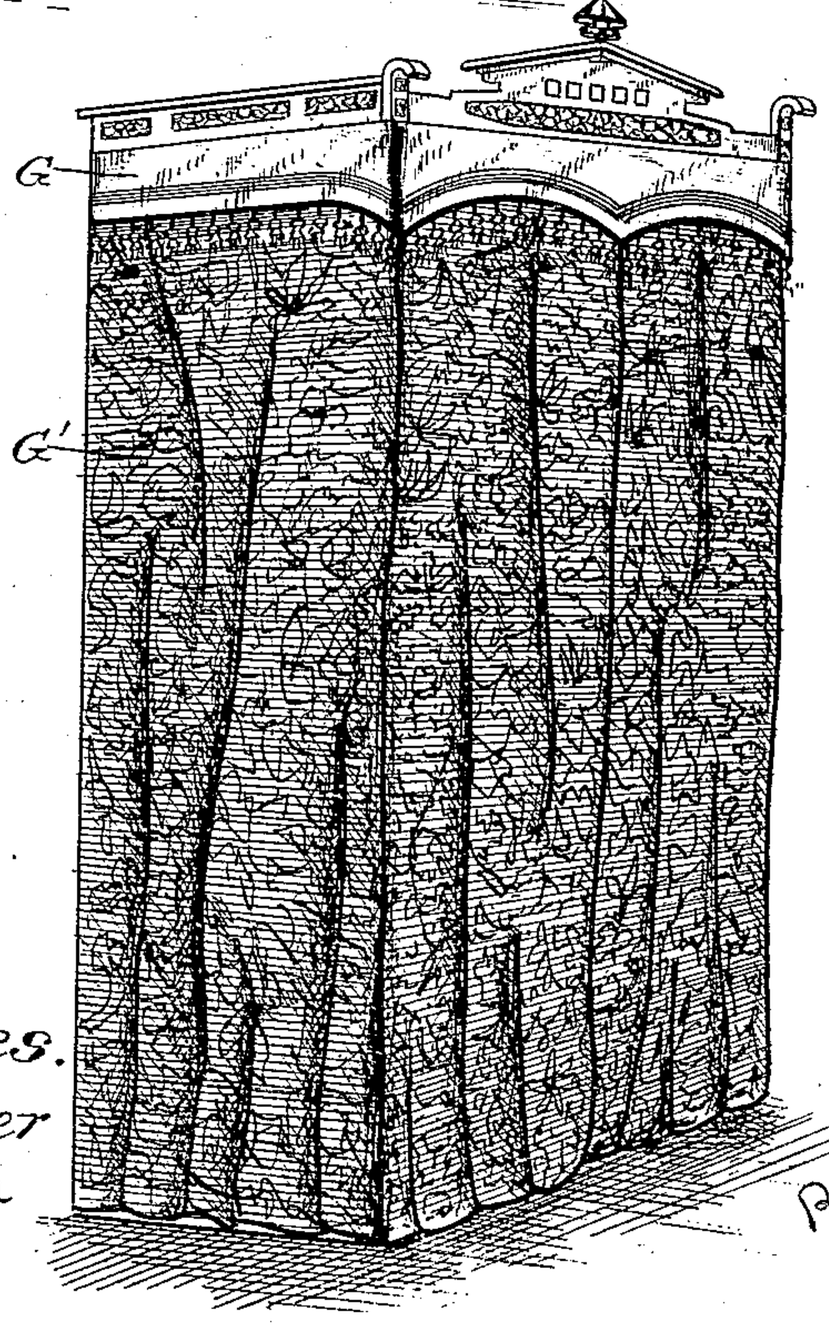

Fig. 2.

Witnesses.
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G. G. Jackson

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Att'y.

(No Model.) 3 Sheets—Sheet 2.

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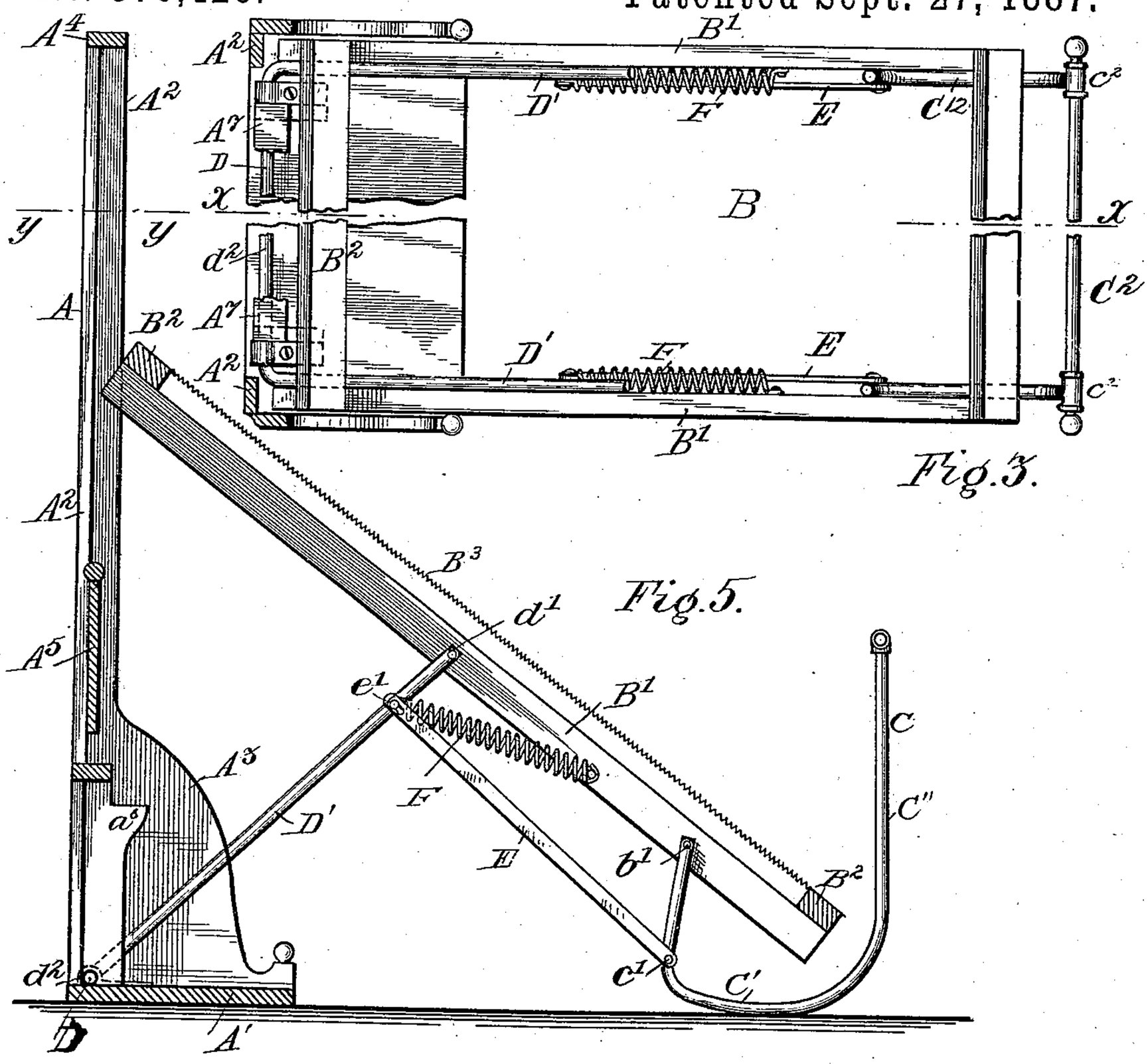

Fig. 3.

Fig. 5.

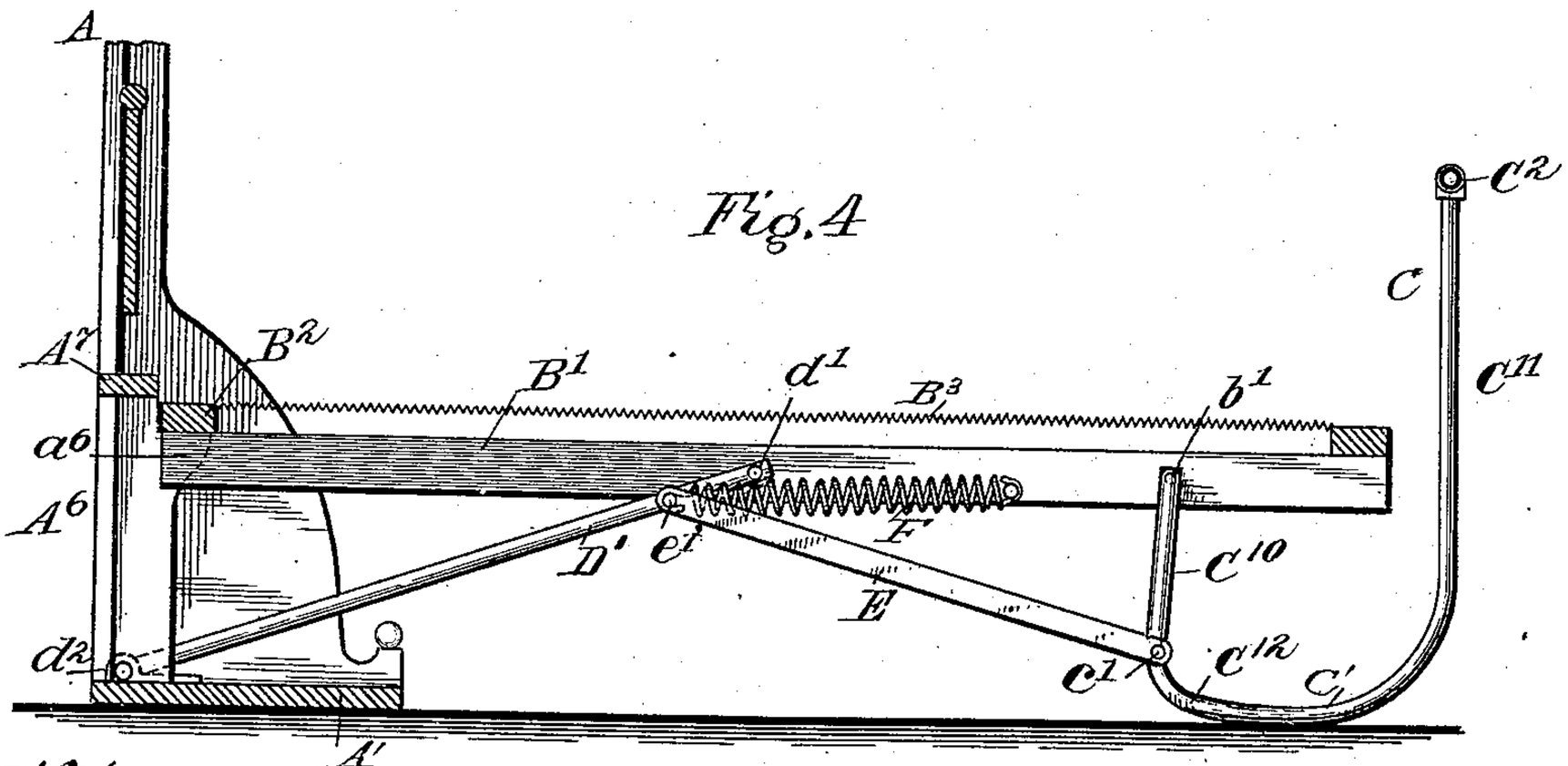

Fig. 4

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(No Model.) 3 Sheets—Sheet 3.

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Fig. 7.

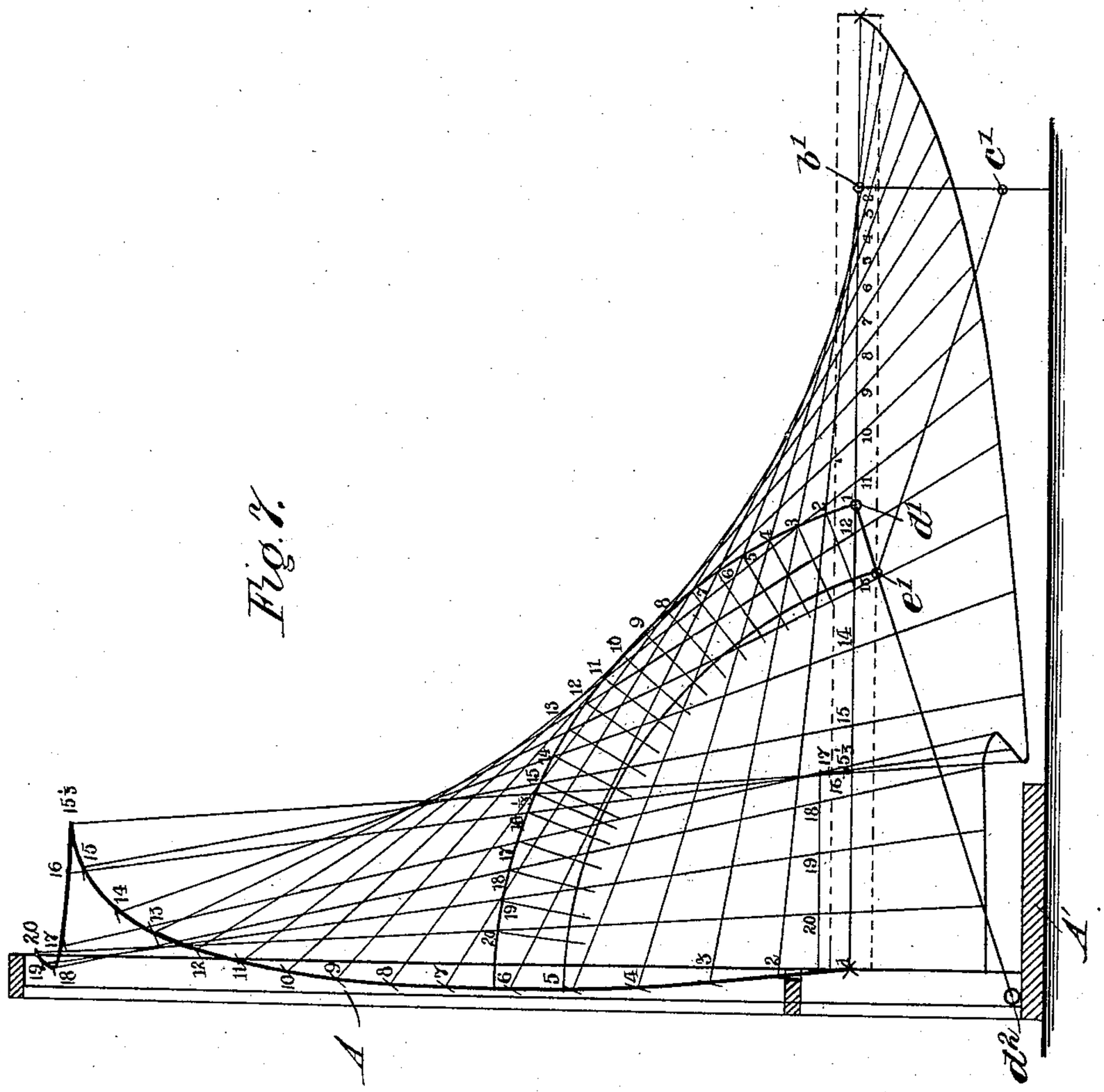
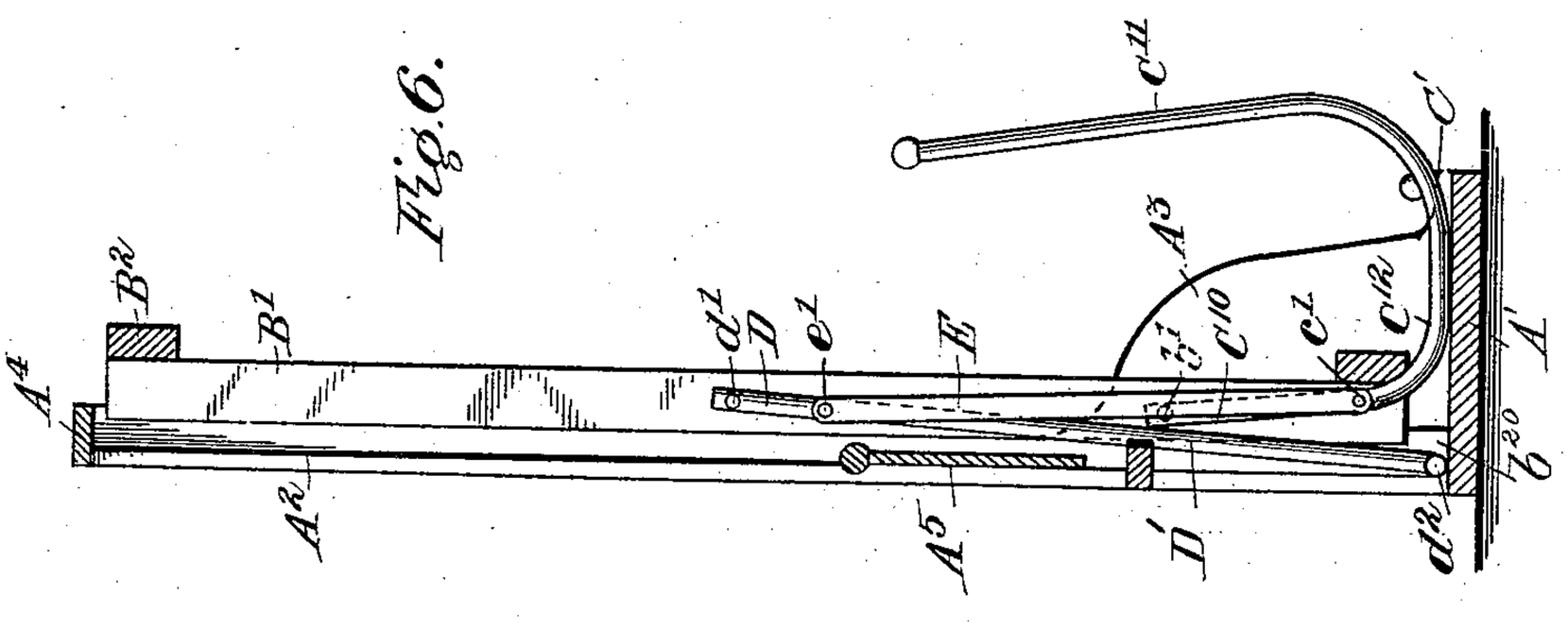


Fig. 6.



Witnesses:
Saml. B. Dover
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Inventor.
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UNITED STATES PATENT OFFICE.

ANDREW STARK, OF CHICAGO, ILLINOIS.

FOLDING BED.

SPECIFICATION forming part of Letters Patent No. 370,426, dated September 27, 1887.

Application filed October 4, 1886. Serial No. 215,249. (No model.)

To all whom it may concern:

Be it known that I, ANDREW STARK, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Folding Beds, which are fully described and claimed in the following specification, reference being had to the accompanying drawings, forming a part thereof.

Figure 1 is a perspective view showing the bed embodying my invention in horizontal position as when unfolded and ready for occupancy. Fig. 2 is a perspective view of the device, showing the appearance when folded up in a vertical position and draped. Fig. 3 is a sectional plan of the mechanism, parts broken away, the bed being in horizontal position, all upholstery and drapery being removed. Fig. 4 is a longitudinal vertical section showing the bed horizontal. Fig. 5 is a similar section showing the bed half-raised—that is, about midway between the horizontal and vertical positions. Fig. 6 is a similar section showing the bed vertical. Fig. 7 is a diagram illustrating the course of the several parts in their movement from the horizontal to the vertical position and their relative proportion for the purpose of causing such movement.

The purpose of my invention is to provide a bed and means for sustaining it, such that the bed may be raised from the horizontal position to the vertical by elevating the head and keeping the upper surface outward, so that when vertical and standing close against the wall the covers of the bed, rather than the under side, shall be exposed to view, whereby expensive or elaborate cabinet-work may be made unnecessary to conceal the bed, as is usual when folding is so effected that in the vertical position the under side is exposed. I also so construct the mechanism that the bed may be shifted from one position to the other without changing the position of its supporting head-frame and by the application of very little force, however heavy the bed and its covering may be, and, also, so that in the vertical as well as in the horizontal position it shall be stable without using any locking device. Incidentally, also, I aim to cheapen the construction without diminishing the serviceability or ornamental appearance of the structure.

A is the head-frame, which is designed to stand against the wall and not to be required to be moved in order to change the bed from horizontal to vertical or from vertical to horizontal position. It will be obvious from the hereinafter-contained description that this head-frame may be entirely dispensed with and the bed and its operating mechanism be secured to the floor or wall and supported in the horizontal position merely by a bracket upon the wall or any simple support resting upon the floor. The only additional purpose of the head-frame is to sustain the drapery by which the bed may be concealed when vertical.

B represents the bed proper, which in Fig. 1 is shown with bedding and covers complete, and in Figs. 3, 4, 5, and 6 is shown merely in skeleton, of which B′ B′ are the side frame-bars, B^2 B^2 the head and foot bars, and B^3 a woven-wire bed-spring stretched between the bars B^2.

C is a foot-frame, which is preferably formed, as represented, of gas-pipe, comprising the end bows, C′ C′, having their shorter arms, C^{10}, pivoted to the bars B′ at b' b' at a distance from the front end of the side bars, which is something less than the height of the bars B′ from the floor when said bars are horizontal, that distance being also substantially equal to the length of the shorter arms of the bows C′. The upper end of the longer arms, C^{11}, of said bows C′ are connected by the foot-rail C^2.

D′ are two parallel equal lever-arms of a rock-shaft, D, said shaft and arms together forming a U-shaped frame. The rock-shaft D is held in the bearings d', which are secured to the floor A′ of the frame A, close in the angle between the said floor and the rear uprights, A^2 A^2. Said uprights are preferably braced by the end brackets, A^3, which form with them, respectively, angles or corners, said corners being connected at the top by the top bar, A^4. The head-frame is further stiffened by the head-bar A^5, which is of such width and is connected to the rear uprights, A^2, at such a height as to extend from a point below the level of the upper surface of the bedding as high as desired, in order that it may appear as an ornamental head-board, as seen in Fig. 1. To the floor of the frame A, inward from the two ends, are secured the upright brackets A^6, which are connected at their upper ends by the bar A^7, and are provided with the ledges a^6, upon which

the head-bars B^2 of the bed rest when the latter is horizontal, and these brackets may be connected by the cross-bar A^1, which serves as a further stiffening for the frame A. The lever-arms D′ are pivoted at their outer ends, respectively, to the side bars, B′, on the inner surface thereof at the point *d′* approximately midway of the length of the bed. The exact position will be hereinafter explained. The lever-arms D′ are connected, respectively, to the arms C^{10} of the bows C′ by the links E. Said links are pivoted to the lever-arms, respectively, at *e′ e′*, a short distance inward from the pivots *d′*, and are pivoted to the arms C^{10} at *c′ c′* distant from the pivots *b′ b′* somewhat farther than the pivots *e′ e′* are from the pivots *d′ d′*. The relation of these several distances will be hereinafter more specifically explained.

F F are heavy spiral springs connected to the side bars, B′, at a point forward of or below the pivots of the lever-arms D′ to the said bars, and at the other end to the lever-arms D′, preferably or most conveniently at the pivots *e′*.

The operation of this structure is as follows: When the bed is horizontal, as in Fig. 4, the head-bar B^2 rests upon the ledge a^6 of the bracket A^6, and the bed is prevented from escaping from that support by the connection of the lever-arms D′, link E, and foot-frame C, as follows: The bed must move toward the foot in order to escape from the ledge. The lever-arms D′, which are connected to the bed and must move with it, can move toward the foot only by moving in a curve about the axis of their rock-shaft. If they should thus move, the foot of the bed would thereby be depressed before the head had escaped from the ledge; but the foot is sustained by the frame C, whose arms C^{10} are nearly vertical under the bed. In order that the foot may descend, therefore, the frame C must swing on the pivots *b′*, either toward the foot or toward the head. The links E connect the arms C^{10} and the lever-arms D′, so that the frame cannot swing toward the foot, and so that they cannot swing toward the head without swinging the lever-arms D′ upward; but, as stated at the beginning, in order that the bed may escape, said lever-arms must swing downward. The bed is therefore stable in the position shown in Fig. 4. When it is desired to shift it to the vertical position, the foot-rail C^2 being seized by the hand and a slight pressure being exerted upon the foot of the bed, the foot-frame C being simultaneously pushed toward the head, the bed will tip head uppermost, and the head will follow the course indicated by the curved line 1 15½ 18 20 in Fig. 7, until the position of all parts is as shown in Fig. 6. In this position the bed is vertical. The links E are approximately vertical, but have swung just past the pivot of the arms C^{10} of the side bars, B′, and the lever-arms D′, also nearly vertical, lean slightly forward, while the foot C^{12} of the end bows of the frame C′ rest upon the floor A′ of the head-frame A. In order that this position may be possible, obviously the length of the lever-arms D′ must be slightly greater than the distance of the pivots *d′* from the foot of the bed-frame and must be equal substantially to the sum of the link E and the distance between the pivots *e′* and *d′* and the distance from the extreme foot of the bow C′ vertically to the pivot *c′*. It is also obvious that the said distance cannot vary much from the sum of the distance between the pivots *d′* and *b′* and the length of the arm C^{10} from its pivot to the extreme bottom. In making this movement the head of the bed follows very nearly a vertical course until the position of the parts is that indicated by the numeral 15 in Fig. 7. From this point until the arm C^{10} reaches the front edge of the floor A′ the head of the bed describes a short curve forward. (Shown between the numerals 15 and 19 in Fig. 7.) At the latter point the link E is vertical, and since the lever-arm D′ is still swinging upward, further movement will lift the foot-frame from the floor. This movement being slightly assisted by the hand of the operator, will cause the foot-frame to run onto the floor A′ of the head-frame, direct vertical movement being substituted for the gradual upward-swinging movement which would result from the continued movement of the foot-frame toward the head-frame in the absence of the floor A′. While the foot rises thus vertically, the bed swings on the pivots *d′*, while the lever-arms rock over their shaft toward the head-frame, causing the head of the bed to describe the curve 15½ to 18, and while the foot thus moves over the floor inward the head moves outward through the curve m^2, so that at its final position the bed is substantially vertical, being suspended in that position on the pivots *d′* the greater portion of its length, and therefore its weight being below said pivots. The link E having passed forward of the pivot *b′*, if the lever-arms D′ should now rock forward under the weight of the bed swinging on the pivots *d′*, they would necessarily swing the foot-frame about the pivots *b′* forward, instead of backward over the course by which they reached their present position; but said frame is stopped against such forward swinging movement by the contact of its arm C^{10} with the cross-bars B^2 of the bed-frame. In some cases I use a small block, b^{20}, in order to effect the stoppage at exactly the right point to hold the bed vertical. Neither the weight of the bed, therefore, nor any pressure applied directly to it, either downward or by pulling it forward at the head, can cause it to swing from a vertical position; but when it is desired to lower the bed to horizontal position, the operator, seizing the foot-frame and drawing it forward, will cause it to retrace the course before described until it reaches again the horizontal position.

The spring F tends to fold the bed up as soon as the head is lifted clear of the bracket A^6, but it is not sufficiently strong to prevent the bed resting solidly on the ledge a^6. It is

calculated, however, to be strong enough to substantially relieve the operator of the weight of the bed while raising it from horizontal to vertical position, so that in the operation only sufficient force is required to overcome the inertia and friction of the mechanism, except at the commencement of the lifting movement, while the bed is nearly horizontal, and then but little force is required with the assistance of the spring to move it. By the time the bed reaches the position shown in Fig. 5 the force exerted by the spring is sufficient to sustain it without the assistance of the operator, the loss of contractile reaction of the spring up to that point being more than compensated by the gain in leverage due to the change of angle between the lever-arms D′ and the line of construction of the spring. As the bed rises from this point, its center of gravity, which is about at the middle point of its length, rises but little, and consequently but little force is required to complete the movement of the bed to its vertical position.

An important purpose of the head-frame is to sustain the inclosing-drapery, and for this purpose a cornice, G, may be secured to the upper end of the head-frame, and curtains, as G′ G′, hung therefrom, and when the bed is horizontal they may be drawn aside and secured by the loops *g′*, as shown in Fig. 1. When the bed is vertical, the curtains may, if desired, be released from the loops and fall in front of the bed, as seen in Fig. 2, or they may be allowed to remain, as seen in Fig. 1, the bed-covers and foot-frame presenting, with the obliquely-draped curtains, a sufficiently ornamental appearance.

The advantage of the above-described construction of the bed-frame and its operating mechanism, when considered in relation to the cornice and curtains sustained thereby, is that by reason of the fact that the head or end of the bed next to the curtain-supporting frame is uppermost when the bed is vertical, and rises to that position by following an approximately vertical course from the position where it rests when the bed is horizontal, the bed is capable of being passed up behind the curtains from below, so that they need not be drawn aside at the top in order to allow the bed to be shifted from one position to the other.

It will be apparent upon inspection that the relative lengths of the several parts and the distance between their pivots must either be carefully computed or ascertained by experiment, in order to give the head of the bed the described movement—that is, along a line approximately vertical, and which does not at any point pass back of the vertical plane of the back of the head-frame—and at the same time to permit the closing of the bed without materially varying the foot-frame from its upright position, and to cause the structure to be stable in the upright position, by reason of the links E having passed forward of the pivots *b′*. The exact proportions necessary to produce these results can be mathematically calculated for each case, depending upon the height of the head and foot of the bed from the floor when the bed is horizontal, the length of the bed, the rise from the floor of the room to the floor of the head-frame, and the proximity of the bed when vertical to the head-frame. Such calculation, however, will not usually be necessary; but the proportions can be ascertained with sufficient accuracy by experiment. The proportions shown in the drawings are substantially those which I have found most convenient and best adapted to secure the desired results. It will be seen that when the link E passes the pivot *b′* the arm C^{10} is exactly, and the lever-arm D′ is nearly, in line with the pivots *d′* and *c′*, and since the distance *b′* to *c′* is greater than the distance *d′* to *e′*, if a slight error has been made in the proportions of the parts, the bearings of either *e′* or *c′* must be slightly slotted to allow the link E to pass the pivot *b′*. The difficulty arising from a slight error in the proportions of the several parts may be thus corrected.

I consider it preferable to pivot the arms D′ to the bed-frame near the middle of the length, for the reason that if pivoted below the middle the bed will be lifted higher than necessary in order to be brought into the vertical position, and if pivoted much below the middle the lower end of the lever-arms D′ must be pivoted much farther back than the head of the bed, thereby compelling the bed to stand farther out from the head-frame, and thus preventing the compactness which is one of the chief advantages of folding the bed into upright position.

In order that the operation of the bed in raising or lowering may be easy and reliable, and in order that the tendency to swing laterally and cramp the pivots may be prevented, it is essential that the two lever-arms D′ should be rigidly joined, so that they shall with certainty move alike, and be kept in the same plane throughout the entire movement; and for this purpose the construction shown, which makes them rigid arms of a common rock-shaft, is important. I prefer to make said lever-arms and their rock-shaft of one continuous piece of metal tubing bent into the required form, since thereby I obtain the desired rigidity and fixedness of the relation between the arms at very small cost. For a like reason I prefer to make each of the bows C′ of gas-pipe, and to connect them by a cross-rail, C^2, also of pipe, rigidly jointed to both bows by the T's e^2. Obviously the longer arm, c^2, of the foot-frame and the cross-rail C^2 might be dispensed with; but, in addition to improving the appearance, the foot-rail makes a most convenient handle by which to operate the bed, and by keeping the arms C^{10} in rigid relation to each other causes them to operate precisely alike, and thus avoids cramping or twisting the bed.

I am aware that heretofore there have been constructed folding beds having the bed con-

nected to the head-frame by parallel links or levers, and having the foot-frame also pivoted to the bed, so that the foot-frame being moved toward the head-frame causes the bed to swing upward at the head and downward at the foot, and thus assume an upright position with the top or cover outward; but in all such structures heretofore made, so far as I am aware, the two parallel levers or links which connected the bed to the head-frame and caused it to have the peculiar movement described were independent of each other—that is, were not connected rigidly together—so that their parallelism throughout the entire movement of the bed was assured independently of the parallelism of the head and foot frames in such movement. The result in all such former structures is that it is necessary to move the foot-frame with great care to keep it parallel with the head-frame, or else the levers or links become cramped on their pivots, and not only is the operation rendered very laborious, but danger is incurred of breaking the pivots or links. In the structure herein shown, on the contrary, the two parallel lever-arms D′ being rigidly joined to a common rock-shaft, and preferably, as illustrated, formed integrally with such shaft, no such difficulty or danger is encountered, and it results that this structure may be changed from the position wherein the bed is horizontal to that in which it is vertical by seizing the foot-frame even at one corner only, and without any pains or effort to preserve its parallelism with the head-frame, and notwithstanding such one-sided application of the force, the bed can be raised and the structure closed up into the position shown in Fig. 6 by a child using only one hand; and I do not claim, broadly, the structure which yields the general movement hereinabove described, but wish to be understood as claiming it only when the lever-arms are rigidly joined.

I am also aware that curtained cornices have heretofore been employed to drape the head of or top of a folding bed when folded into upright position; but such devices have heretofore been used only in connection with beds adapted to fold up by swinging in an arc about a center located underneath such cornice, so that it was necessary to draw aside the curtains or drapery in order to admit the bed behind them; but in the present structure the movement which the bed receives, permitting it to enter endwise upward from below the cornice, allows it to pass behind the draping-curtains without the necessity of first withdrawing them, thereby dispensing with the necessity for mechanism to adjust the curtains and simplifying the mode of hanging them, and permitting a much greater variety of ornamentation and greater range in the choice of material for curtains than if it were necessary to provide for their withdrawal every time the bed was raised. I do not therefore claim, broadly, the use of such draped heading or cornice, but only the combination of it with the bed when constructed, as described, to enter behind the drapery from beneath.

I claim—

1. The combination, with a rigid bed-frame, of lever-arms D′, rigidly connected and pivoted to the bed-frame at one end, and at the other end pivoted at a fixed line below one end of the bed-frame, and supports for each end of the bed-frame, substantially as set forth.

2. In combination with a rigid bed-frame, rigidly-connected lever-arms D′, pivoted at one end to the bed-frame, and at the other end pivoted at a fixed line below one end of the bed-frame, a fixed support for that end of the bed-frame, and a pivoted support for the other end pivoted to the bed-frame, and links connecting said pivoted support to the lever-arms, said links being longer than the distance, measured longitudinally on the bed-frame, from the pivots of the lever-arms to the pivots of said pivoted supports, whereby said pivoted supports may remain substantially vertical while the lever-arms change their direction as the bed is swung upward, substantially as described.

3. In combination with the rigid bed-frame and the head-frame, the U-frame made of one piece of metal pipe, comprising the rock-shaft D, and bent to form its lever-arms D′, made of metal pipe and pivoted to the head-frame and to the rigid bed-frame, whereby the bed-frame may be operated relatively to the head-frame without danger of cramping, substantially as set forth.

4. In combination, the bed-frame, the lever-arms D′, the foot-supporting arms C^{10}, and the links E, connecting the arms D′ and C^{10}, the bed-frame having a stop, as b^{20}, to arrest the foot-support C^{10}, the several parts being relatively pivoted and proportioned, substantially as set forth, whereby, when the bed-frame is vertical and the foot-support is against the stop thereon, the link E is forward of the pivot b', substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, this 30th day of September, A. D. 1886, in the presence of two witnesses, at Chicago, Illinois.

ANDREW STARK.

Witnesses:
CHAS. S. BURTON,
G. G. JACKSON.