(No Model.)

9 Sheets—Sheet 1.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

Fig. 1

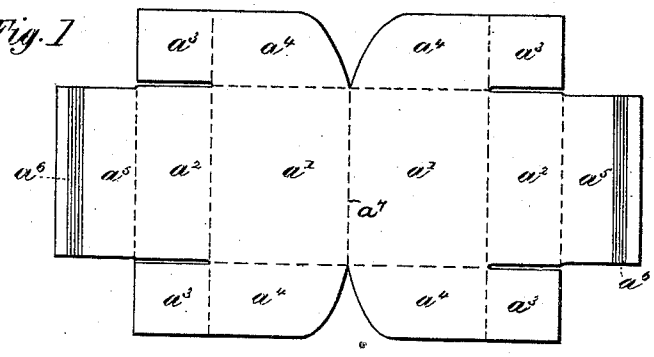


Fig. 2

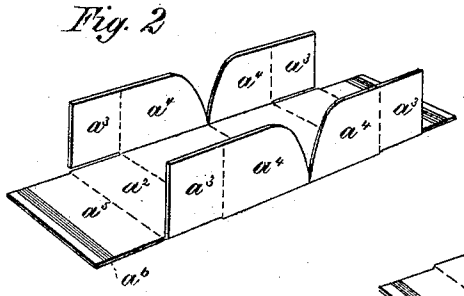


Fig. 3

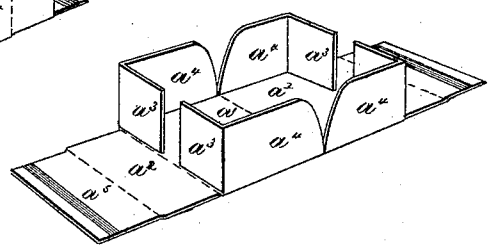


Fig. 4

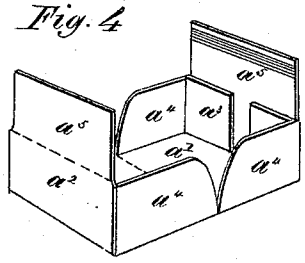


Fig. 5

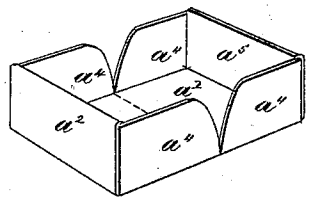
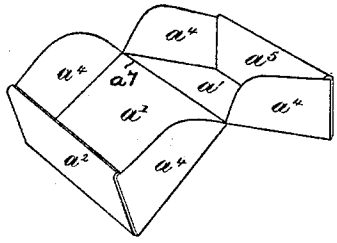


Fig. 6



Witnesses
Wm. A. Lowe
Nettie Marler

Inventor
Albert L. Munson

By his Attorney
Geo. H. Graham

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

(No Model.) 9 Sheets—Sheet 2.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

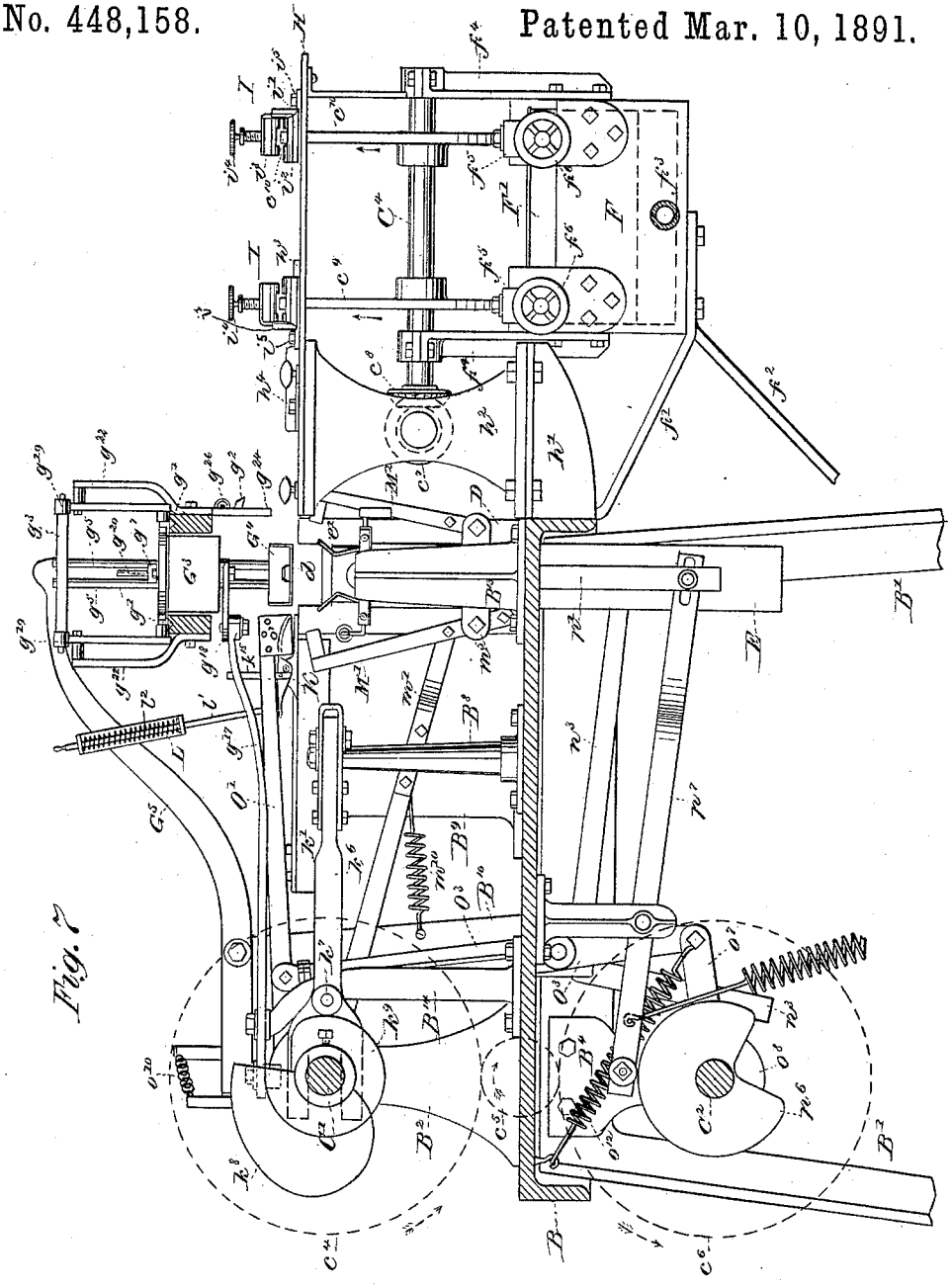


Fig. 2.

Witnesses
Wm. A. Lowe
Nettie Marler

Inventor
Albert L. Munson
By his Attorney
Edw. H. Graham

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

(No Model.)

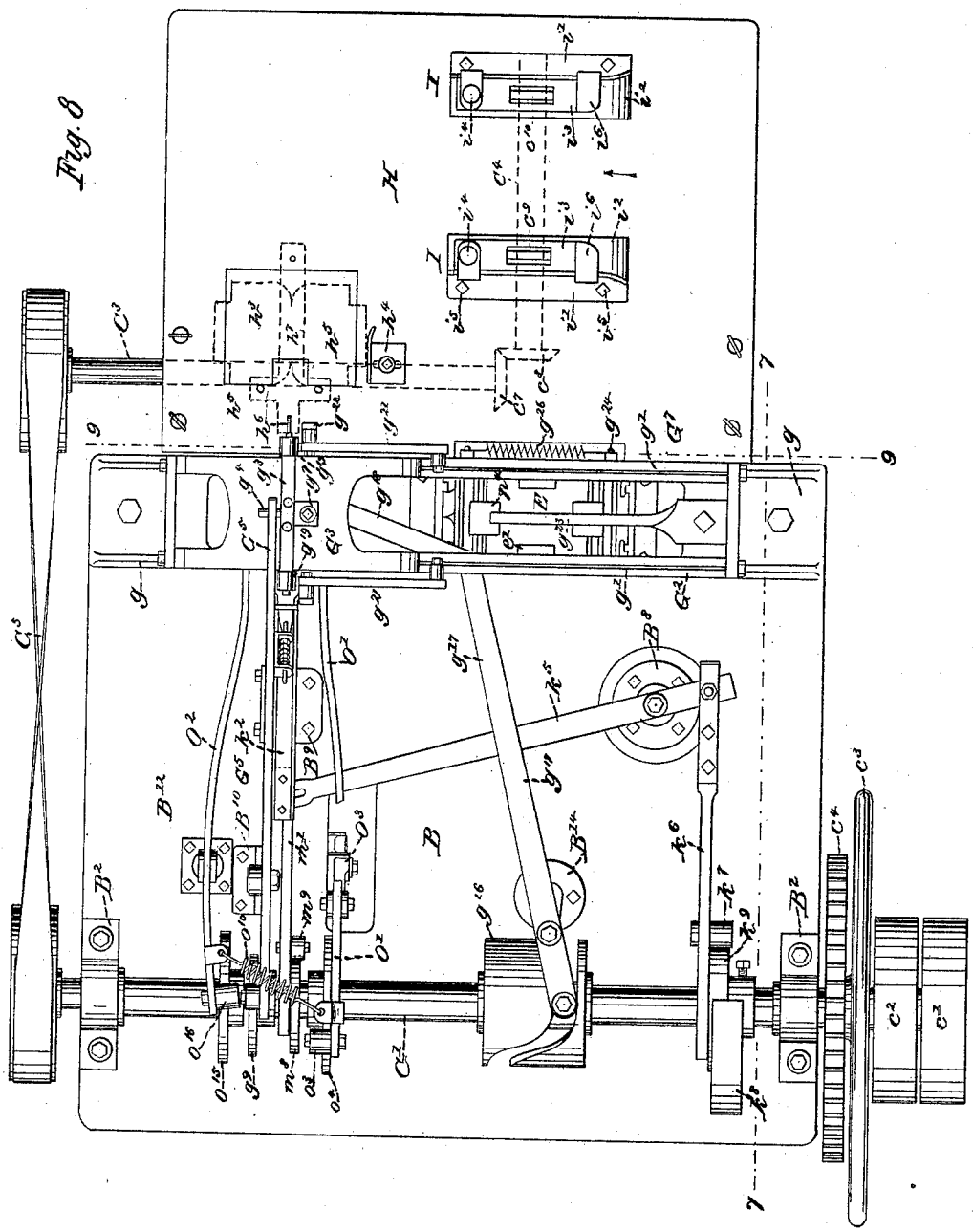
9 Sheets—Sheet 3.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

Fig. 8



Witnesses
Wm. H. Lowe
Hettie Marker

Inventor
Albert L. Munson
By his Attorney
Chas. L. Graham

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

(No Model.) 9 Sheets—Sheet 4.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

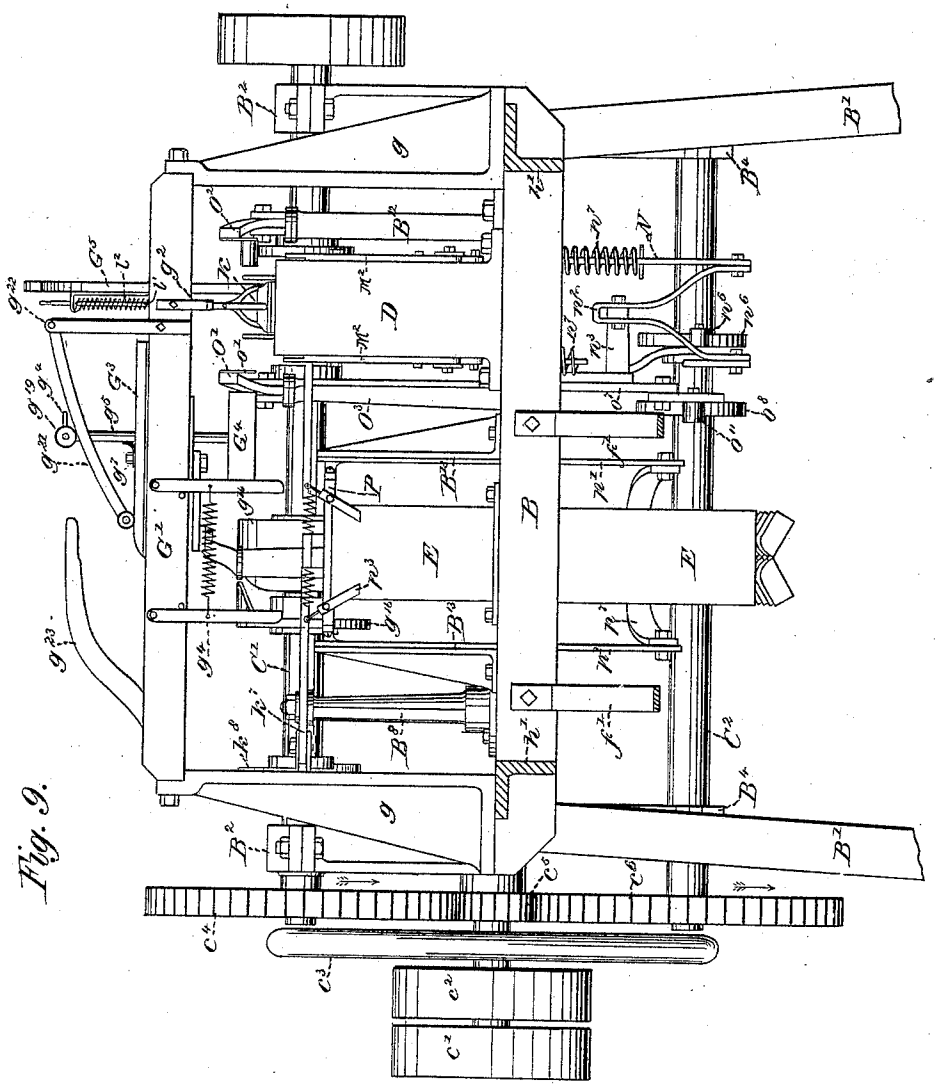


Fig. 9.

Witnesses
Wm. A. Lowe
Hettie Marler

Inventor
Albert L. Munson
By his Attorney
Fred H. Graham

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

(No Model.)

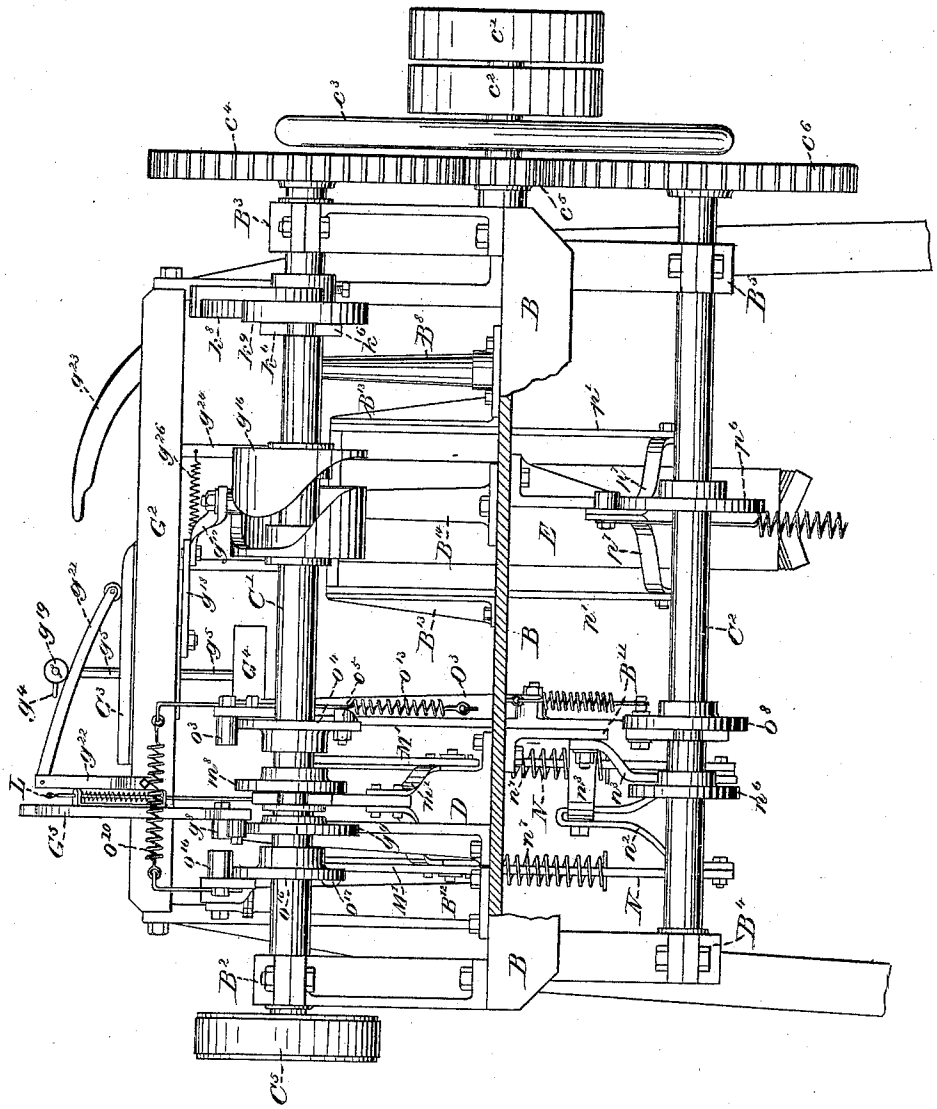
9 Sheets—Sheet 5.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

Fig. 10



Witnesses
Wm. A. Lowe
Hetter Marker

Inventor
Albert L. Munson
By his Attorney
Geo. H. Graham

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

(No Model.) 9 Sheets—Sheet 6.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

Fig. 13

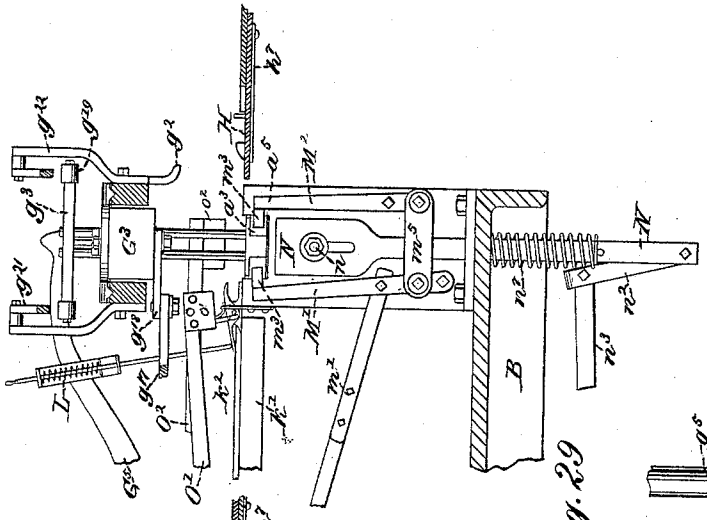


Fig. 29

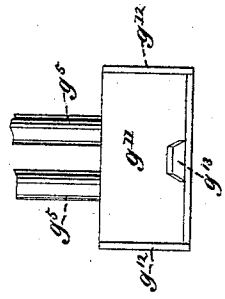


Fig. 12

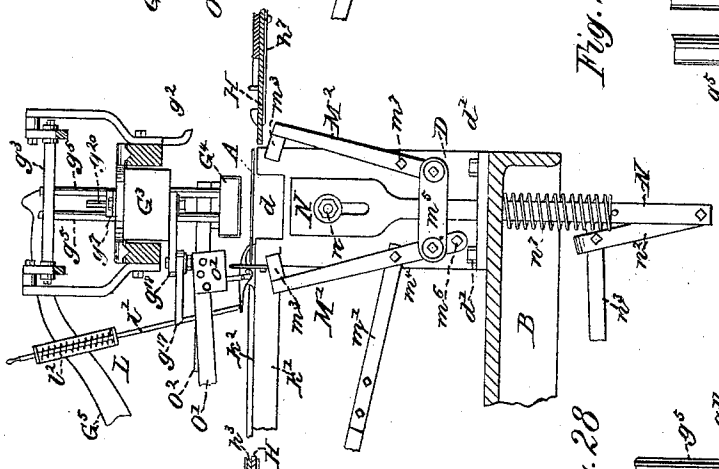


Fig. 28

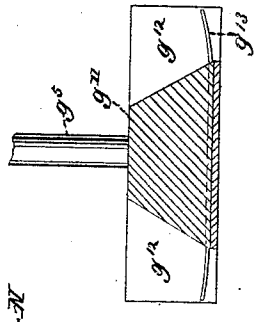
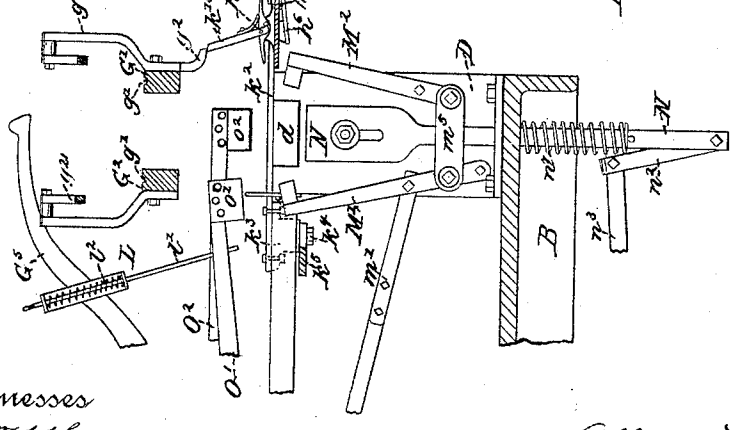


Fig. 11



Witnesses
Wm. A. Lowe
Hettie Marber

Inventor
Albert L. Munson
By his Attorney
E. H. Graham

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

(No Model.)

9 Sheets—Sheet 7.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

Fig. 16

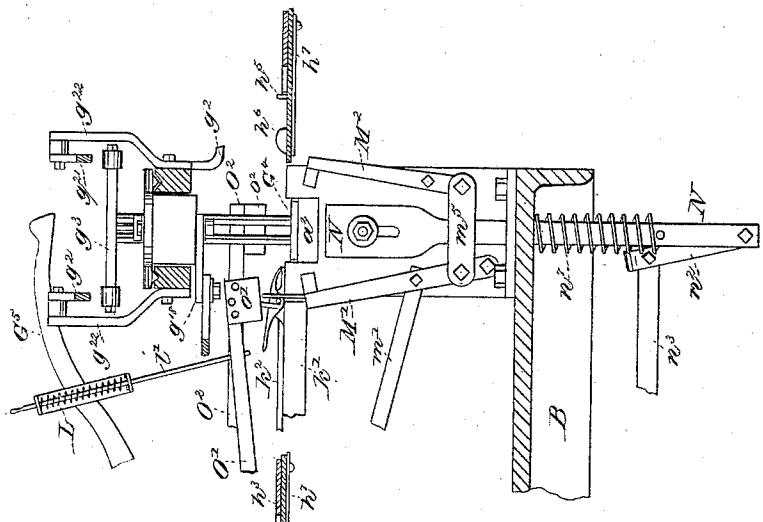


Fig. 15

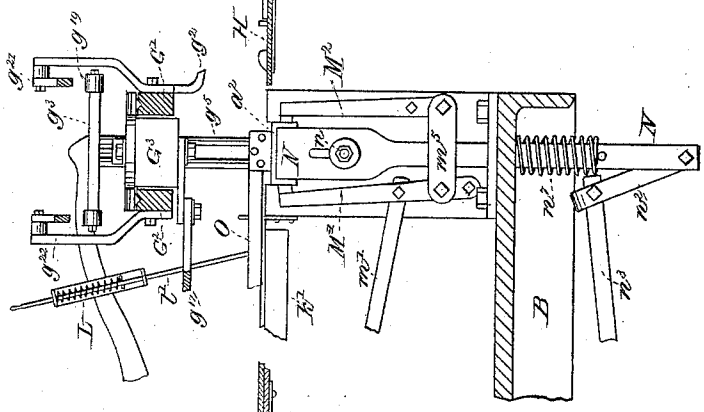
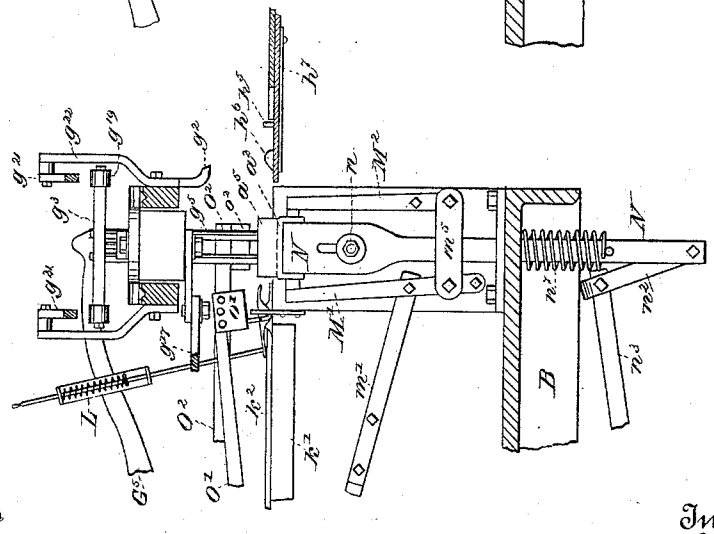


Fig. 14



Witnesses
Wm. A. Lowe
Nettie Marker

Inventor
Albert L. Munson
By his Attorney
Geo. H. Graham

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

(No Model.)

9 Sheets—Sheet 8.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

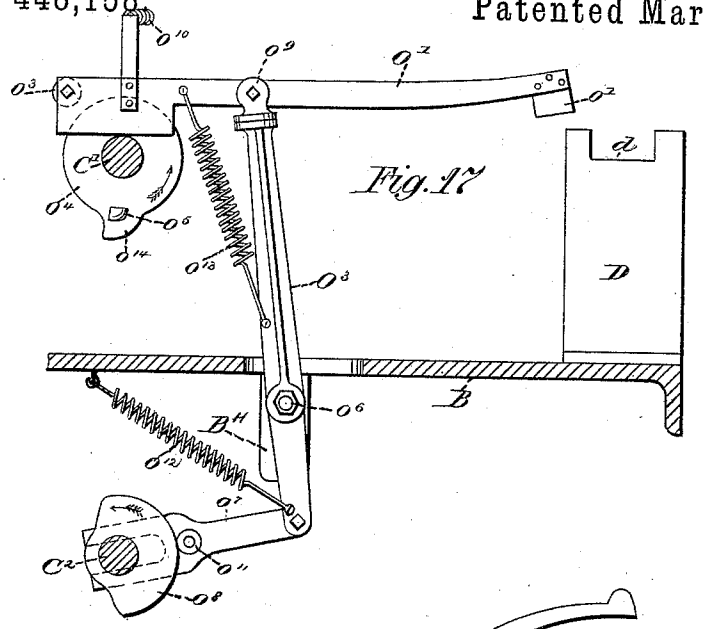


Fig. 17

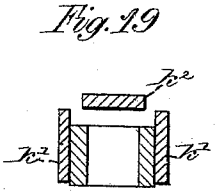


Fig. 19

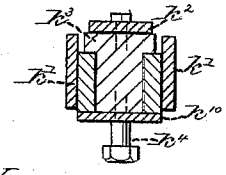


Fig. 20

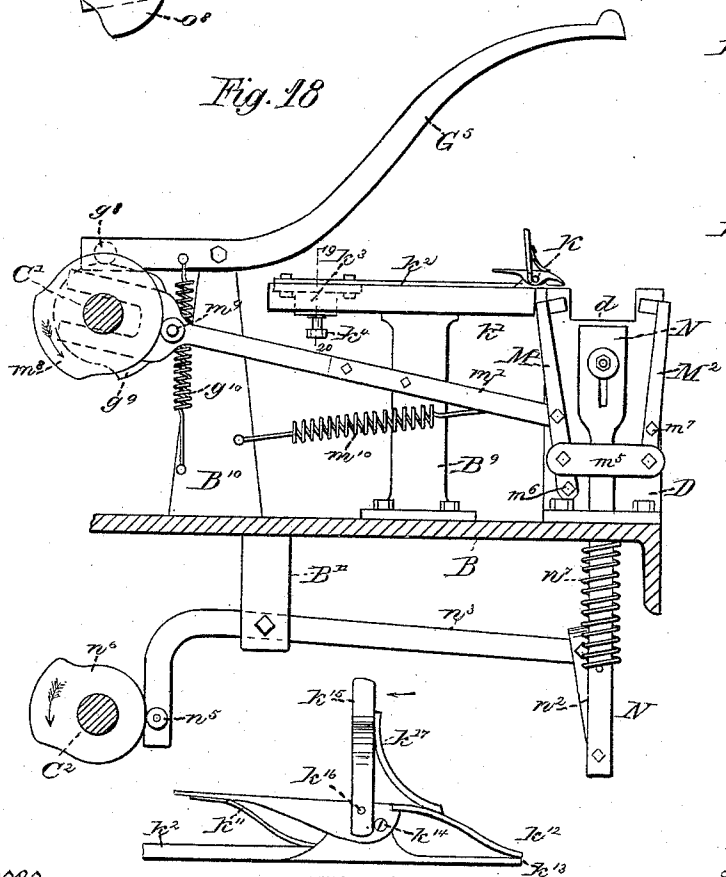


Fig. 18

Fig. 21

Witnesses
Wm. A. Lowe
Hettie Marber

Inventor
Albert L. Munson
By his Attorney
Ed. H. Graham

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

(No Model.) 9 Sheets—Sheet 9.

A. L. MUNSON.

PAPER BOX MACHINE.

No. 448,158. Patented Mar. 10, 1891.

Fig. 22

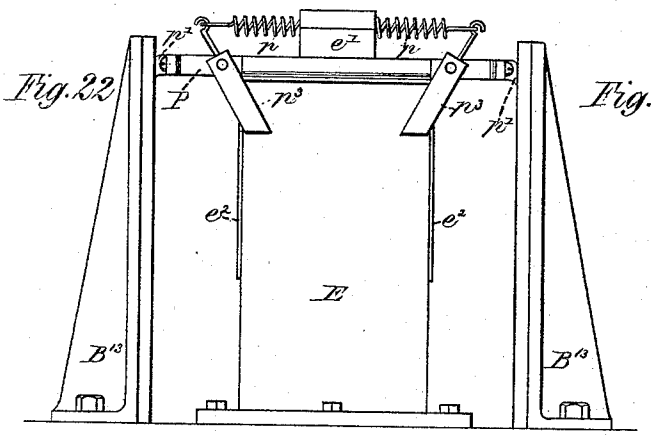


Fig. 23

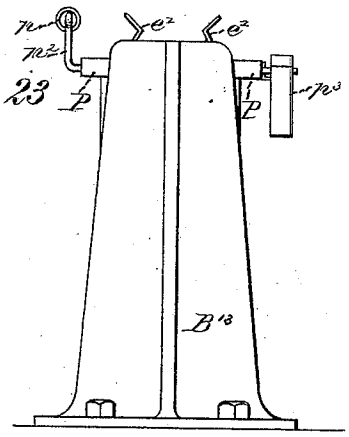


Fig. 24

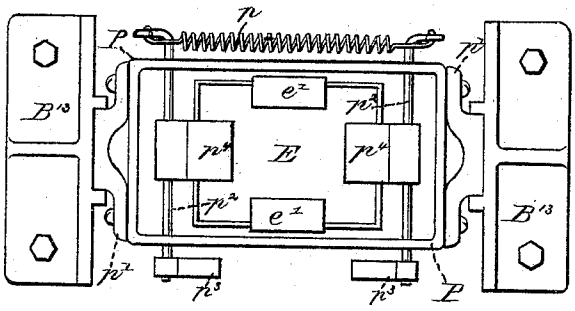


Fig. 25

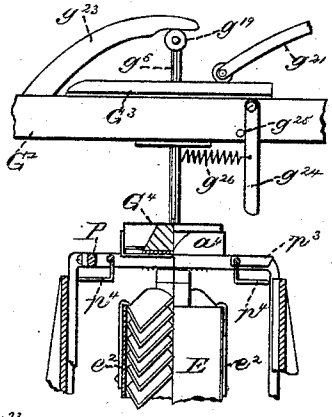


Fig. 26

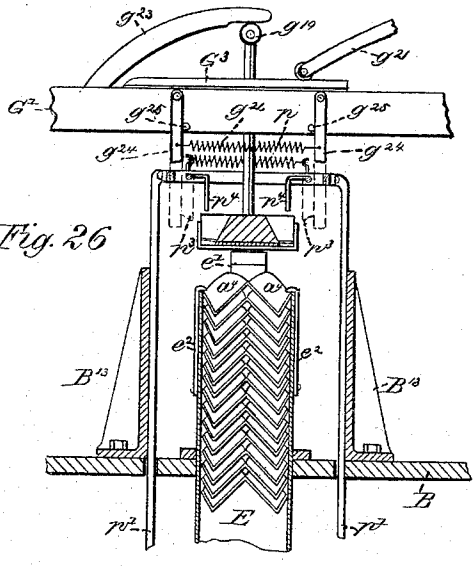
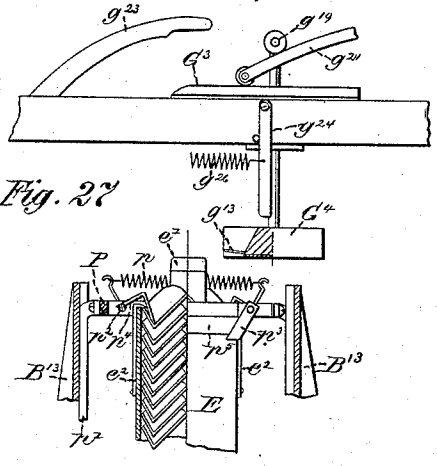


Fig. 27



Witnesses
W. A. Lowe
Hetter Marker

Inventor
Albert L. Munson
By his Attorney
Edw. M. Graham

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

UNITED STATES PATENT OFFICE.

ALBERT L. MUNSON, OF NEW YORK, N. Y., ASSIGNOR TO MUNSON & CO., OF NEW HAVEN, CONNECTICUT.

PAPER-BOX MACHINE.

SPECIFICATION forming part of Letters Patent No. 448,158, dated March 10, 1891.

Application filed January 9, 1890. Serial No. 336,454. (No model.)

To all whom it may concern:

Be it known that I, ALBERT L. MUNSON, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Paper-Box Machines, fully set forth in the following description and represented in the accompanying drawings.

This invention relates to that class of machines that are adapted to make a rectangular box, the body of a box, or a box-cover from a single piece of material.

The present invention while adapted to make boxes of a general character is more especially capacitated to operate upon box-blanks that have previously been cut or cut and scored or creased on suitable lines before being presented to the box-forming mechanism to form slide boxes or trays for use with tubular covers; and it is the object of this invention, among other things, to provide an automatic mechanism that will apply a line or lines of cement to a box-blank presented to the machine, and then take such blank and fold or form it into box or tray shape and nest the formed boxes together, so that the space they will occupy for packing or storing will be reduced to the minimum.

To this end the invention consists in the novel method of nesting boxes, hereinafter described and claimed, and in the novel structure, arrangement, and combination of parts, hereinafter fully set forth and claimed, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a blank on which the present improvements are particularly capacitated to operate to form it into a suitably-shaped box or tray. Figs. 2, 3, and 4 are perspective views illustrating the various steps taken in the formation of the box. Fig. 5 is a like view of the completed box or tray, and Fig. 6 is a similar view, the box or tray being shown in the form it is shaped or it assumes when nested with other like boxes or trays. Fig. 7 is a sectional elevation of the machine, the section being taken on the line 7 7 of Fig. 8. Fig. 8 is a plan view of the same. Fig. 9 is a sectional elevation taken on the line 9 9 of Fig. 8. Fig. 10 is an end elevation, a portion of the base-plate being removed to disclose underlying parts. Figs. 11, 12, 13, 14, 15, and 16 are sectional elevations of the same devices in different positions and illustrating a portion of the devices shown assembled in Fig. 7. Fig. 17 is a sectional detail, hereinafter referred to. Fig. 18 is a sectional elevation of a portion of the devices shown in Fig. 7, many immediate parts being omitted for the sake of clearness. Figs. 19 and 20 are enlarged sections of the parts, taken on the line 19 20 of Fig. 18. Fig. 21 is an enlarged elevation of the blank-carrier. Figs. 22 and 23 are elevations of the nesting-holder and its immediate connections. Fig. 24 is a plan view of the same. Figs. 25, 26, and 27 are sectional elevations of the nesting devices, the parts being in different positions. Fig. 28 is a sectional elevation of the box former or plunger. Fig. 29 is an elevation of the same looking at one end.

Before entering into a detailed description of the construction and operation of the various devices composing the machine illustrated, it may be stated briefly that the blanks are fed into the machine in contact with a pair of paste-applying disks, which impart two lines of paste to the surface of a pair of flaps, which in the present form of box serve to secure the box in its formed or made-up condition. After being thus operated upon, the blanks are presented to a pair of gages in position to be taken by the blank-carrier. One of these gages is adjustable with respect to the center of the blank and the other is movable with respect to the surface of the table upon which the blank rests, so that at the time the blank is taken by the carrier it will move out of the way.

The blank-carrier is mounted to reciprocate horizontally, and in its forward position grasps the blank and carries it to the box-forming mechanism. This mechanism consists of a female former, provided by a recess in the face of a suitable support, over which the blank is fed, and a male former adapted to press the blank into the recess of the female former, and thus turn or bend up the longitudinal sides of the blank and support the blank during the succeeding forming op-

erations, serving also as a carrier to present the finished box to the nesting devices. Coacting with these formers are a pair of laterally-moving side-flap folders, which in the present instance are duplicated upon the opposite sides of the female former and which are adapted to simultaneously fold inwardly the free side flaps of the box; also coacting with the formers is an end folder for turning up the end of the box at right angles to the bottom, which is also duplicated at the opposite side of the female former, and a pair of end-flap folders for turning over and downwardly the securing-flaps against the side flaps previously bent inwardly, thus completing the box-forming operations. The folders return to their normal positions, and the male former will then move with the finished box to present the latter to the nesting devices. These devices consist of a holder or pocket for the nested boxes and a stripper for taking the box from the male former and depositing it into the holder. As soon as the male former arrives in position at the nesting devices it is securely held in position while the stripper is removing the finished box therefrom. The stripper thereupon moves up and strips the box from the male former and carries it downward into the mouth of the holder. In doing so the box is bent at its middle, so that the outer portions of its bottom are bent downward toward each other, so as to enable them to enter the box previously delivered into the holder. As soon as the stripper removes the box from the male former and is depositing it in the holder the male former commences to return to its original position, ready to act upon the next blank presented in position by the blank-carrier. At the time the male former has moved with the finished box to the nesting devices another blank will have been deposited in position to be taken by the blank-carrier, and the latter will have been moved up to grasp it to carry it into position over the female former, which will have been effected by the time the male former has returned to its normal position ready to operate upon that blank. The parts are so proportioned and timed that the cam-shafts will have made one-half of a revolution in forming the box and will have made another half-revolution while the nesting operation has taken place and the male former moved back to its normal position, so that at every complete revolution of the cam-shafts a box will have been formed and carried to the nesting-holder and nested with the boxes previously formed and nested.

With this understanding of the nature and function of the improved machine a detailed description of its construction and operation will now be given, aided by the accompanying drawings. Before entering into such description, however, it should be stated that the blank upon which the present machine is specifically adapted to operate consists, as shown in Fig. 1, of a central portion a' for the bottom of the box or tray, two longitudinal side portions a^4 for the sides of the box or tray, said sides terminating at their opposite ends in flaps a^3, end portions a^2, forming the end of the box, and securing-flaps a^5, forming extensions of the end portions a^2, which are turned inwardly and downward into the box to complete its formation. In the practice of the peculiar method of nesting such boxes hereinafter described the blanks will preferably, also, be provided with or adapted to be bent upon a central line a^7, as indicated in Fig. 1, and the sides will be divided either by the V-shaped cut shown or by a straight incision, so as to permit the box to take the angular form necessary to the proper nesting of the boxes. While it is recognized that the blank so shaped or any blank upon which the machine is adapted to operate may be introduced to the folding or nesting devices without a previous defining of the lines upon which the blank is to be formed or made up, yet the necessary scored or creased lines are preferably imparted to the blank by proper dies either simultaneous with the cutting of the blank or by a separate operation. The blank thus formed and scored or creased in the manner indicated by the dotted lines in Fig. 1 is first passed or fed to a cementing device adapted to apply a line of paste or glue, as a^6, to each of the end flaps a^5, as shown, and while these lines of paste may obviously be applied by hand or by a separate machine, the cementing device is preferably a part of the present machine, as is shown.

The various instrumentalities forming the machine are mounted upon and secured to a base-plate B, that is supported from the floor or from a suitable bench by legs B'. At the left hand of the machine, looking in the direction of Fig. 7, there are supported two cam-shafts C' C^2. The former above the base-plate is mounted to turn in suitable bearings B^2, extending from said plate, and the latter cam-shaft is supported below the base-plate in bearings B^4 extending therefrom. Suitable motion is imparted to both of these shafts from a pinion c^5, that meshes with toothed wheels c^4 c^6, one secured to the end of each of the shafts C' C^2, respectively. The shaft carrying the driving-pinion c^5 is provided with fast and loose pulleys c' c^2 and with a balance-wheel c^3, the said fast pulley being connected to the driving-pinion shaft by means of a pawl and ratchet or other suitable clutch mechanism, (not shown,) by which only the proper forward motion may be imparted to the driving-shaft. The machine as illustrated is also provided with two other shafts C^3 C^4, arranged at right angles to each other and geared together by means of the beveled pinions c^7 c^8, and motion is transmitted to the shaft C^3 from the shaft C' by means of pulleys on the respective shafts and a crossed belt C^5, that passes around them, as seen in Fig. 8.

The cementing device, as shown, consists of a pair of disks c^9 c^{10}, mounted a suitable distance apart upon the shaft C^4, which shaft is supported in bearings f^4 f^4, secured to the opposite sides of a reservoir F, which in turn is supported from the base-plate of the machine and other parts thereof by angular brackets f' f^2. The lower portions of the disks move in a receptacle F', that is adapted to contain the proper adhesive material, which receptacle is mounted within the reservoir F, so as to leave a space between their respective bottoms, into which steam or hot water may be admitted through an orifice f^3 for keeping the adhesive material in proper condition. Each of the disks will be provided with a scraper f^5, adjustable to and from their surfaces by means of a screw and nut through the medium of a hand-wheel f^6, and thus regulate the amount of adhesive material taken by the disks and applied to the blanks. The upper portions of the disks pass through openings and project above a table H, that is supported by a standard h^2, secured to a bracket h', extending from the base-plate, and also by a bracket extending from the bearing f^4. The table H supports a pair of guides I for directing the blank in proper position to the faces of the disks c^9 c^{10}, each of which guides has a flared mouth provided by a lower plate i^2, having a vertical guide-flange i', that is secured in place upon the table by screws i^5 and by an upper plate i^3, that is connected at one end to the flange i' by means of a bracket i^6, while the other end is free to be adjusted toward or from the lower plate by a set-screw i^4. The tendency of the upper plate i^3 is to spring upwardly, so that the set-screw may simply bear against its upper face to determine the extent of movement and the degree of pressure which it may exert upon the blank to insure its proper contact with the faces of the disks. Both the lower and upper plates will be slotted to permit the disk to extend through them, so as not to disturb or remove the adhesive material carried thereby. While this form of cementing device has been found to meet all the requirements of the machine, it is obvious that other forms of such devices may be employed for effecting the same result.

The box-blank after having passed between the guides I in contact with the disks of the cementing device, whereby the lines of paste or glue a^6 are applied thereto, is turned over so as to present the paste-lines uppermost, and is then placed upon a platen h^3, as shown in dotted lines, Fig. 8, against an adjustable side gage h^4 and front gage-pins h^5. These front gage-pins extend from a spring-plate h^7, mounted upon the under side of the table H, the pins extending through openings in the table and projecting above it sufficiently to form a gage for the blank. The outer free end of the spring-plate h^7 is provided with an inclined tongue h^6, that also projects upward through an opening in the table in position to be operated to withdraw the pins by the movement of a proper device, as will hereinafter appear. The blank in this position upon the platen is in proper line to be carried and presented in position to the box-forming devices, now to be described. These devices consist of a female former provided by a recess d in the upper face of a block or support D, held upon the base-plate of the machine, and a movable male former G^4, supported above the block and its recess and adapted to move into said recess. The recess d has open ends, a flat bottom, and two vertical sides of substantially the size of the exterior dimensions of the box to be formed, and the male former is of rectangular shape of substantially the dimensions of the interior of the box to be formed, and in the preferred construction has open ends to permit the operation of the nesting devices, hereinafter described. The box-blank is placed in its flat condition in proper position upon the block D and overlying its recess d, whereupon the male former will descend, and bearing against the center of the blank will carry it downward into its recess and against its bottom. In so doing the opposite sides a^4 of the box-blank will be bent upwardly at right angles to its bottom and against the sides of the male former G^4, so that each side of the blank will lie between the vertical wall of the recess and the side of the male former, and when in this position will be securely held during the remainder of the forming operations. The result of this operation of the formers is to bend the blank into the shape shown in Fig. 2.

The male former is mounted in a carriage G^3, that is adapted to move horizontally between a pair of guides G' G^2, so as to carry the male former G^4 to and from the female forming-block D and the nesting devices, to be hereinafter described. This former may consist, as shown, of a central support g^{11} with side plates g^{12}. The carriage G^3 is provided with V-shaped bearings which enter similar-shaped grooves g', formed in the upper faces of the guides G' G^2, thereby supporting and guiding the carriage G^3 in its movements. The male former G^4 is vertically movable with respect to its carriage, so that it may be moved downwardly to press the blank into the recess of the female former and upwardly to be in position to act upon the next blank. For this purpose the male former is secured to the ends of a pair of vertical rods g^5, that pass upward through openings in the carriage G^3, and are provided at their upper ends with a cross-bar g^8, having at its ends rolls g^{19}. The free downward movement of the male former is controlled by a friction-brake formed by a spring-plate g^7, secured to the carriage and bearing against each of the rods g^5, so that the movement of the male former downward by gravity is prevented. The carriage G^3 also supports a limiting-stop g^{20}, against which the cross-piece g^8 will strike and prevent any further down-

ward movement of the male former. The vertical rods g^5 guide the male former in its vertical movements, so that it will properly enter the recess of the female former. This downward movement of the male former is imparted by the vibration of a lever G^5, that is pivotally mounted to the end of a standard B^{10}, projecting from the base-plate, the free end of which lever bears against a stud g^4, projecting from the cross-bar g^3. Suitable and timely motion is imparted to the lever G^5 by means of a cam g^9, secured to the cam-shaft C′, against which cam a roll g^8, that is mounted at the end of the lever, bears under the influence of a spring g^{10}, as best seen in Fig. 18.

The horizontal movement of the carriage G^3 is imparted by the vibration of a lever g^{17}, that is pivoted at the end of an arm B^{14}, extending from the base-plate, and a link g^{18}, one end connected with the carriage and the other end to the lever g^{17}. Suitable and timely motion is imparted to the lever g^{17} by means of a cam g^{16}, secured to the cam-shaft C′, a roll from the lever extending into the groove of the cam.

While it is obvious that the box-blank, instead of being placed in position on the platen h^3 against the gages before referred to, may be placed directly upon the female forming-block D in position to be operated upon by the forming devices, it is preferred to have the blanks carried automatically thereto. Thus there is provided a blank-carrier K, that is adapted to reciprocate in suitable bearings toward the blank, grasp it, and move backward with the blank and deposit it in position over the female former. Suitable and timely motion is imparted to the carrier K from a two-part cam k^8 k^9, the former of box form and the latter a surface-cam upon the shaft C′, through a rod k^6, the bowl k^7 of which is acted upon by said two-part cam, the opposite end of which rod is connected to the short end of a lever k^5, that is pivoted upon a standard B^8, the opposite end of which lever is slotted to embrace the bolt k^4, projecting from the lower side of the carrier, as shown in Figs 8 and 18. This blank-carrier is provided by a pair of gripping-jaws k^{12} k^{13} at the end of a horizontal bar k^2. The latter jaw is formed by the end of the bar k^2, that is secured to a reciprocating guide-block k^3, adapted to move between a pair of guides k', supported at the upper end of a bracket B^9, extending from the base-plate, as best seen in Figs. 18 to 20. The gripper-jaw k^{12} is pivoted at k^{14} to ears projecting from the bar k^2, (see Fig. 21,) and held in gripping-contact with the other jaw k^{13} by a spring k^{11}. Any suitable means for opening and closing the jaws at the proper times may be employed. Thus the movable gripping-jaw carries an upwardly-extending tongue k^{15}, that is pivoted to the movable jaw at k^{16}, so that a portion of the tongue below the pivot may be held in contact with the pivot k^{14} of the jaw under the influence of the spring k^{17}, carried by the tongue, the construction of which is such that when the tongue is moved in the direction of the arrow, Fig. 21, it will be substantially rigid with the movable jaw and will rock the jaw to its open position, while a movement in the reverse direction will be an idle one, the tongue simply yielding.

In the path of the tongue k^{15} of the blank-carrier, when the latter arrives at the limit or substantially at the limit of its forward movement to grasp a blank, there is provided an arm g^2, that is secured to and depends from the guide G′, so that the movable gripping-jaw is opened to permit the jaws to extend upon opposite sides of the blank, as shown in Fig. 11, when a slight further movement of the carrier will take the tongue from contact with the arm and permit the jaw to close under the influence of its spring. In moving to this position the end of the carrier-bar strikes the inclined projection h^6 of the front gage-pins and depresses the spring-plate, so that the pins are withdrawn below the surface of the table and out of the way of the passage of the blank. The carrier and its bar are then reciprocated in the opposite direction, carrying the blank with them until the carrier and blank arrive in the position shown in Fig. 12, the blank immediately overlying the recess of the female former and under the male former. As soon or immediately before the male former strikes the blank thus positioned the grippers of the carrier should be opened to release the blank, so that upon the further movement of the male former the blank will be free to be pressed into the recess of the female former. For this purpose the lever G^5 carries a spring-pressed rod l', the end of which as the lever moves downward to carry the male former down contacts at the proper time with the tail of the movable gripper-jaw and rocks it open, thus freeing its hold upon the blank. This rod l' is mounted to have a limited movement in a bearing L, secured to the lever G^5, a spring l^2 being interposed between one end of the bearing and a pin on the rod. This mode of mounting the rod to the lever is had to permit the rod to operate the gripper during the downward movement of the lever and to permit the lever to continue its movement downward after the gripper has been opened, as is seen in Fig. 13. The effect of the movement of the male former in pressing the blank into the recess of the female former is to bend up the two longitudinal sides of the blank and into the shape shown in Fig. 2. When in this position in the female forming-block, it will be understood that the side flaps a^3 of the blank, as well as the end portions a^2 and the flaps a^5, will extend beyond the vertical walls of the block, so that they are free to be operated upon by the devices now to be described.

The devices for bending the side flaps inwardly toward the center of the blank consist

of a pair of laterally-moving plates m^3, which, moving up in contact with the flaps, bend them around the corners of the male former until they assume the position shown in Figs. 3 and 13. In the normal position of the plates m^3 they lie away from the end of the recess in the female forming-block, as shown in Figs. 11 and 12. These plates are mounted at the ends of arms M′ M³. The arm M′ is pivoted at its lower end to the block D by a stud m^6, and the latter is pivoted to the same by a stud m^7 slightly above its end, and the two arms are connected together by a link m^5, so as to move in unison to and from each other. Motion is imparted to the arms by a rod m', connected at one end to the arm M′, and the opposite end carrying a roll m^9, that bears upon and is held in contact by a spring m^{10} with a cam m^8 upon the cam-shaft C′, as best seen in Fig. 18, by which cam suitable and timely motion is imparted to the arms and their plates m^3. There are two pairs of arms M′ M³, one pair on each of two opposite sides of the female forming-block D. The one pair is a duplicate of the other, and the rod m' is forked at its end, so as to be connected to the arms M′ of both pairs, so that both pairs are moved in unison. The plates m^3 hold the side flaps a^3 of the blank in position against the male former long enough to permit the bending up of the end portions a^2 and the folding down of the flaps a^5 of the blank. The bending up of the end portions a^2 is effected by the operation of vertically-reciprocating blades N, one upon two opposite sides of the block D. These blades are guided vertically by studs n, that pass through slots in the blades and are tapped into the block. At the proper time the blades N move upward, their upper ends meeting the projecting flaps a^2 of the blank and bending them upwardly over the lower corners of the male former, so that said portions a^2 lie against the side flaps a^3, as in Figs. 4 and 14, the end flaps a^5 extending upward therefrom. This motion of the blades N is imparted by a lever n^3, pivoted to a bracket B¹¹, extending from the under side of the base-plate, and one end of said lever connected by a yoke n^2 to the ends of both of the blades N, as shown in Fig. 18. Suitable and timely motion is imparted to the lever, and from this to the blades by a cam n^6, secured to the cam-shaft C², which bears upon a roll n^5, secured to the end of the lever, and is held in contact therewith under the influence of a spring n^7, surrounding the lower end of the blades N, which also tends to return said blades to their normal position, as shown in Figs. 11 to 13 and 18. The projecting securing end flaps a^5 are folded downward in contact with the inner sides of the side flaps a^3 by means of end-flap folders, consisting of a pair of plates o' o^2. These plates to effect this operation normally lie upon the outside and above the end of the flaps, so that they are first rocked horizontally to bear against the outer face of the flap to bend it over the upper edge of the side flaps, and then rocked downward to carry the flap downward into contact with the side flaps, so that they will occupy the position shown in Fig. 5. The plate o' has a further movement to and from one of the flaps, in order that it may in its normal position lie out of the path of the carriage and male former when they are moved to and back from the nesting devices. Both of the plates o' o^2 are mounted at the end of independent levers O′ O². The lever O² is pivoted upon a universal joint mounted at the upper end of an arm B¹², secured to and rising from the base-plate, and the other lever O′ is similarly pivoted at o^9 to a universal joint that is mounted at the end of a lever O³, that is pivoted at o^6 to the bracket B¹¹, extending from the lower side of the base-plate. The opposite end of the levers O′ O² are each provided with a roll o^3 o^{16}, respectively, that are adapted to bear against cams o^4 o^{15}, secured to the cam-shaft C′ under the influence of springs o^{13}, and by which cams the levers are rocked on their pivots, so that the plates o' o^2 are moved vertically. The roll end of the levers are each extended or widened in the manner shown in Fig. 17, so that they may be borne upon sidewise by a cam projection o^5 o^{17}, secured to the face of their respective cams, so that in the revolution of the cams the projections will bear against the sides of the widened faces of the levers and rock them against the force of a spring o^{10} on their universal joints, so that their plates o' o^2 are moved toward each other and toward the center of the box-blank. The horizontal reciprocating movement of the lever O′ and its plate o' is had by the vibration of the lever O³, imparted by a suitably-shaped cam o^8, secured to the cam-shaft C², which bears upon a roll o^{11}, projecting from the face of a rod o^7, connected to the lower end of the lever O³, said roll being held in contact with the cam by a spring o^{12}. In the idle position of the lever O′ its roll o^3, as shown in Fig. 17, is away from the cam, but will be brought in contact therewith so as to be acted upon to vibrate the lever O′ vertically. As soon as the plates o' o^2 have folded down the securing-flaps a^5 of the blank, as in Figs. 5 and 15, the said plates will bear with sufficient force against the flaps, so that the lines of glue which have heretofore been applied thereto will cause them to adhere to the end flaps a^3, and thus complete the formation of the box or tray. In order, however, to insure the complete adhesion of the flaps together, so that the plates o' o^2 may return to their normal positions as soon as possible, the male former carries a yielding blade g^{13}, the function of which is to catch and hold the flaps a^5 down in contact with the end flaps a^3. In the action of the plates o' o^2 the flaps a^5 will be pressed down past the ends of the blade g^{13}, so that the latter will bear against said flaps and resist any tendency to leave their folded-down position. As before stated,

the parts are so proportioned and timed that these forming operations will be performed during half of the revolution of the cam-shafts, so that each movement will follow the other in close succession, and as soon as the flaps a^5 have been folded down in the manner indicated, the various forming devices described, with the exception of the male former, will return to their normal positions, as shown in Fig. 16, ready to act in a similar manner upon the next blank. The result of these forming operations will be to form the box snugly around the male former sufficient, with the aid of the blade g^{13}, to hold the box to the male former, so that the latter may be moved to take the finished box or tray from the female forming-block to the nesting devices. This movement of the male former is had through motion imparted to its carriage G^3 by means of the lever g^{17} and its connections, before described. The movement imparted to the carriage is sufficient to carry the male former and the completed box from the recess in the female forming-block to a point immediately over the nesting devices, as shown in Fig. 26, and in order to hold the male former against movement in this position, there is provided an overhanging arm g^{23}, which bears against the cross-bar g^3 of the former or its rolls g^{19}.

The nesting devices consist of a tubular pocket E, suitably supported from the base-plate and extending therethrough and of sufficient length to support and receive a quantity of nested boxes. Upon two opposite sides of the tubular pocket there is provided vertical brackets B^{13}, rising from the base-plate and forming guides for a pair of bars p', supporting at their upper ends a rectangular frame P, as shown in Figs. 22 to 27, inclusive. This rectangular frame supports a pair of rock-shafts p^2, each of which supports at its outer end an arm p^3, the tendency of which is to swing apart under the influence of a spring p, that is connected to the upturned bent ends of the rock-shafts. Between the sides of the rectangular frame the said rock-shafts each support a stripper p^4 in the form of an angular plate, the said strippers being also under the influence of the spring p, tending to rock the ends away from each other, as shown in Fig. 25, which the said spring will do under certain contingencies, which will be referred to hereinafter.

In the normal position of the parts the rectangular frame P occupies substantially the position shown in Fig. 27, the strippers p^4 extending within the box last nested, as shown. As soon as the carrier G^3 arrives with the male former and finished box in position over the tubular holder, the frame is moved vertically upward into the position shown in Fig. 26, so that the strippers are above the male former or the box held thereby. In moving into this position the arms p^3 of the rock-shafts are struck by a pair of guides g^{24}, which depend from the side of the guide G'. These guides g^{24} are held in their normal position against stops g^{25} by a spring g^{26}, connecting them together. In striking the ends of these guides g^{24} the strippers p^4 are rocked to the position shown in said figure and held in that position so long as their arms bear against the sides of the guides g^{24}. As the length of the guides g^{24} is sufficient to rock the strippers into the position shown before they arrive at the limit of their upward movement, the spring connecting the guides will permit the latter to yield, so that the strippers may pass the male former and box; but as soon as they arrive in the position shown the said spring g^{26} will cause the guides to bring the strippers back to their proper position. In this position of the rectangular frame and the strippers the ends of the latter will be in position to enter the box supported by the male former, and upon the downward movement of the frame, which now takes place, the said strippers will take or strip the box from the male former and carry it downward. In doing so the center of the bottom of the box will strike a pair of spring or yielding plates e', projecting from the end of the tubular holder, so as to retard the further movement of the box, the result of which will be, upon the continued downward movement of the strippers and frame, that the box will be bent centrally across its bottom, so that the ends will approach each other and form an inverted **V**. The movement of the frame and strippers will finally overcome the retarding action of the springs e', will bend the box in the manner shown in Fig. 6, and carry the ends of the box downward into the tubular holder until it rests in the position shown in Fig. 27. In doing so the boxes previously nested will of course be moved downward sufficient to accommodate the box just moved into the nested position. Two opposite sides of the holder may be provided with a pair of spring-detents e^2, the ends of which overlie the end of the holder and catch the last box nested and prevent it from moving out of the holder. It should be stated that the width of the holder is a little greater than the width of the box, so that the longitudinal sides of the box may be allowed to bulge slightly, which they will tend to do normally, owing to the central bend imparted to its bottom. This bulging of the box sides permits the succeeding box to be entered between the sides of the preceding one, so that the boxes will lie close together and the nesting be more compact. Suitable and timely motion is imparted to the rectangular frame through a lever p^7, that is pivoted on a bracket extending from beneath the base-plate, one end of which lever is connected by its forked end to the lower ends of the vertical bars p', and the opposite end of the lever is provided with a roll that bears under the influence of a spring against the face of the cam p^6, secured upon the cam-shaft C^2, as shown in Figs. 7, 9, and 10. It is to be observed that in the

practice of this method of nesting boxes, while it is not essential, the line a^7 upon which the box is bent shall be previously defined, yet the operation of bending the boxes and nesting them together will be facilitated by providing the blank with such a scored or creased line.

Should the male former arrive in position over the nesting devices without a box it will be apparent that the strippers will effect nothing, and as soon as the arms p^3 leave the ends of the guides g^{24} the spring p will rock them into the position shown in Fig. 25, so that when the frame descends they will pass outside of the tubular holder. The next time the frame rises to its high position the strippers, of course, will be moved to their active position, as usual, by the operation of the guides g^{24}.

The box or tray formed by the improved machine is practically a permanent one, in so much as it may not be knocked down in the manner common with knocked-down boxes, so that it becomes essential that some method may be employed to assemble the boxes together, so that they may occupy as little space as possible. The method of assembling or nesting such boxes hereinbefore described and practiced by the machine effects this close assembling in a ready and effective manner, as has been made apparent by the foregoing description. It also provides a means of confining the flaps together while the glue is drying. The assembled or nested boxes may be withdrawn from the tubular holder at any time, and when so withdrawn each box will occupy the same position with respect to the other as it does when within the holder, so that a quantity of nested boxes may be handled in their nested condition and stored or packed for shipment. The nested boxes each box supporting the other provides a compact and reasonably strong structure, which will prevent the boxes from being injured in handling.

As soon as a box has been stripped from the male former and the frame moved into the position shown in Fig. 27 the carrier G^3 and the male former may be moved back to its normal position above the female former by the instrumentalities heretofore described. In order to raise the male former, so that at the time it reaches its normal position it will be in position to move down upon the blank to be next operated upon, there is provided a pair of inclined guides g^{21}, Figs. 9 and 10, which lie in the path of the rolls g^{19} of the cross-bar of the male former, so that in moving back to its normal position the said rolls bear against the upper face of the inclined guides and raise the male former during its travel. These guides g^{21} are pivoted to the ends of brackets g^{22}, extending inwardly from the guides G' G^2, so that the said inclined guides may be rocked to permit the rolls g^{19} to pass under them in the movement of the carriage G^3 and male former to the nesting devices, and as soon as they arrive at this position, the rolls g^{19} having passed beyond the ends of the guides g^{21}, the latter will fall into the position shown in Figs. 26 and 27, ready to act upon the rolls to raise the male former to its high position. In some classes of boxes it will be only necessary to bend up and secure one end thereof, the other end remaining open. In such case, of course, only one set of the end folders need be used.

It will be obvious to skilled mechanics that the particular mechanisms herein described and shown may be modified within wide limits without departing from the essential features of the invention.

What is claimed is—

1. The herein-described method of assembling or nesting boxes or trays, the same consisting in bending the box so that its ends approach each other and holding it in such condition to receive within it the succeeding box similarly bent.

2. In a box-forming machine, the combination of a cementing device, substantially as described, for applying a line or lines of paste to the blank, a blank-carrier, box-forming devices, substantially as described, and movable carriage carrying part of the forming devices for moving the finished box away from the remaining forming devices, substantially as described.

3. The combination of a box-former and coacting box-forming devices, box-nesting devices, substantially as described, and a carriage carrying said box-former for moving the finished box from the coacting devices to the nesting devices, substantially as described.

4. In a box-forming machine, the combination of a box-former and coacting box-forming devices, box-nesting devices, substantially as described, situated in a different vertical plane therefrom, and means, substantially as described, for moving the box-former laterally to the nesting devices, substantially as described.

5. In a box-forming machine, the combination, with a male former and devices coacting therewith for permanently forming boxes, of box-nesting devices, substantially as described, and a carriage for carrying the permanently-formed boxes to the nesting devices, substantially as described.

6. The combination of a laterally-movable box-former and coacting box-forming devices, a tubular holder for receiving the nested boxes, and box-nesting devices, substantially as described, for removing the box from the box-former and depositing it in the holder and nesting it with others, substantially as described.

7. The combination, in a box-forming machine, of male and female formers, an end folding-blade, means, substantially as described, for folding the side flaps, and an end-flap folder adapted to fold the securing-flap inwardly and down, substantially as described.

8. The combination, in a box-forming ma-

chine, of male and female formers and a flap-folder adapted to rock horizontally and vibrate vertically, substantially as described.

9. The combination, in a box-forming machine, of male and female formers and an end-flap folder adapted to reciprocate and rock horizontally and to vibrate vertically, substantially as described.

10. The combination, in a box-forming machine, of male and female formers and two end flap-folders, both adapted to rock horizontally and vibrate vertically and one of them to reciprocate horizontally, substantially as described.

11. In a box-forming machine, the combination of a male former and box-forming devices, substantially as described, co-operating therewith, and a flap-securing blade carried by the male former, substantially as described.

12. In a box-forming machine, the combination of a male former and box-forming devices, substantially as described, co-operating therewith, and a yielding flap-securing blade carried by the male former, substantially as described.

13. The combination, in a box-forming machine, of a stationary female former, a horizontally-movable carriage, a male former carried by and vertically movable independent of said carriage, and means for moving the carriage and for moving the male former, substantially as described.

14. The combination, in a box-forming machine, of a stationary female former, a horizontally-movable carriage, a vertically-movable male former mounted in said carriage, and an inclined guide or guides for returning the male former to its high position during the return of the carriage, substantially as described.

15. The combination, in a box-forming machine, of a stationary female former, a carriage, a vertically-movable male former mounted in said carriage, and a friction-brake for sustaining the carriage in its high or low position, substantially as described.

16. The combination of a male former for sustaining the finished box, a vertically-movable stripper, a holder, and a retarding-plate for the center of the box, substantially as described.

17. The combination of a male former supporting the finished box, a vertically-movable stripper for removing the box from the male former, a guide for directing the stripper, and a retarding-plate for the center of the box, substantially as described.

18. The combination, with a platen for the blank and a side gage therefor, of a front gage adapted to withdraw from the front of the blank, and a blank-carrier and a projection from the front gage in the path of the blank-carrier, whereby the front gage is withdrawn as the carrier moves to grasp the blank, substantially as described.

19. The combination of a platen for the blank, a side gage, a spring-plate bearing a pair of gage-pins forming the front gage for the blank, a reciprocating blank-carrier, and a projection on the spring-plate in the path of the carrier, by which the gage-pins are temporarily withdrawn, substantially as described.

20. The combination of a fixed female former, a vertically-movable male former, means, substantially as described, for positively moving the male former downward and up, and a brake for sustaining the former in both of its positions, substantially as described.

In testimony whereof I have set my hand, this 2d day of January, 1890, in the presence of two witnesses.

ALBERT L. MUNSON.

Witnesses:
GEO. H. GRAHAM,
NETTIE MARLER.