March 10, 1964 E. K. SMITH, JR., ETAL 3,123,848

BUILDING-IN MACHINE

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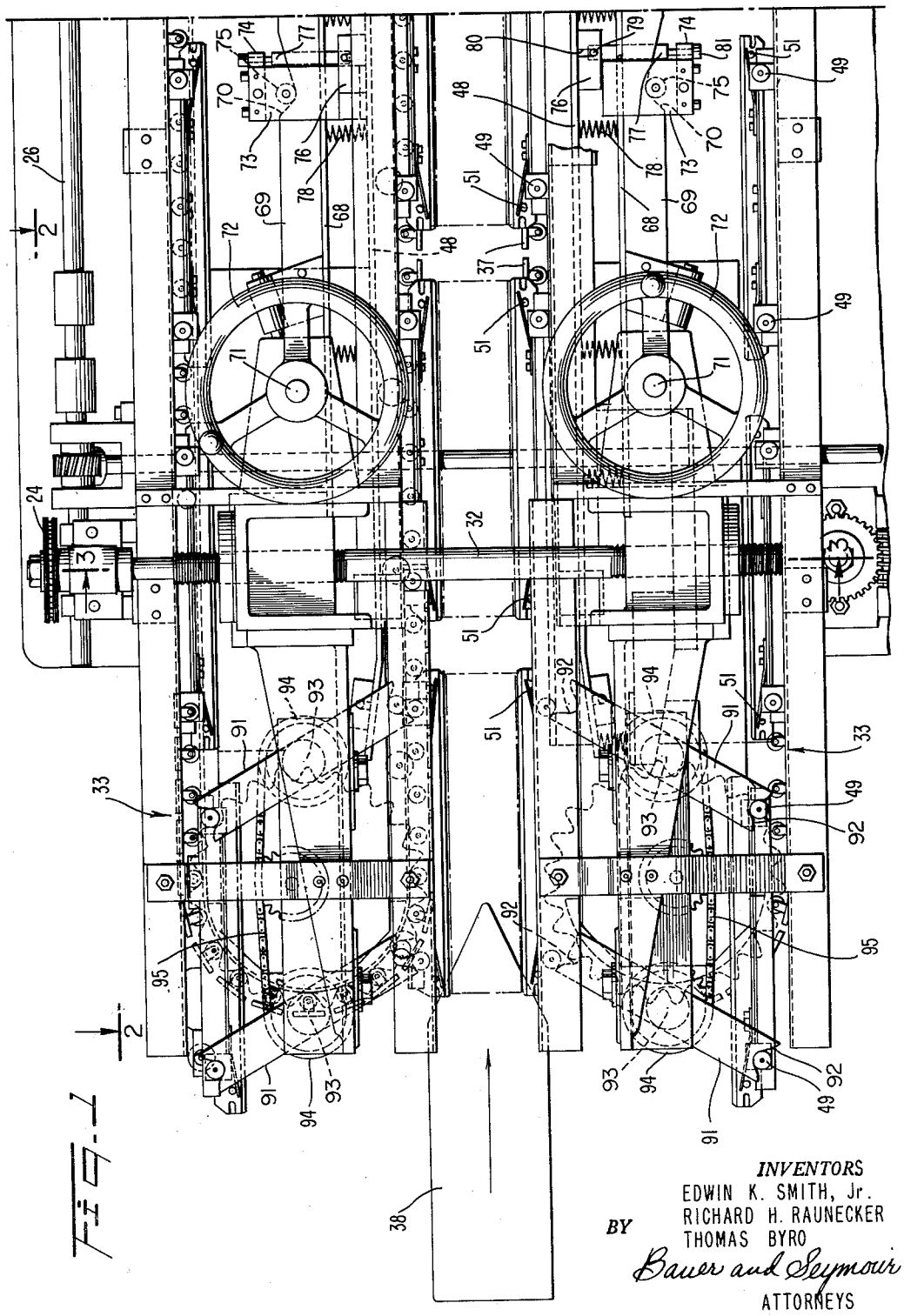


FIG. 1

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BUILDING-IN MACHINE

Filed April 18, 1962 5 Sheets-Sheet 2

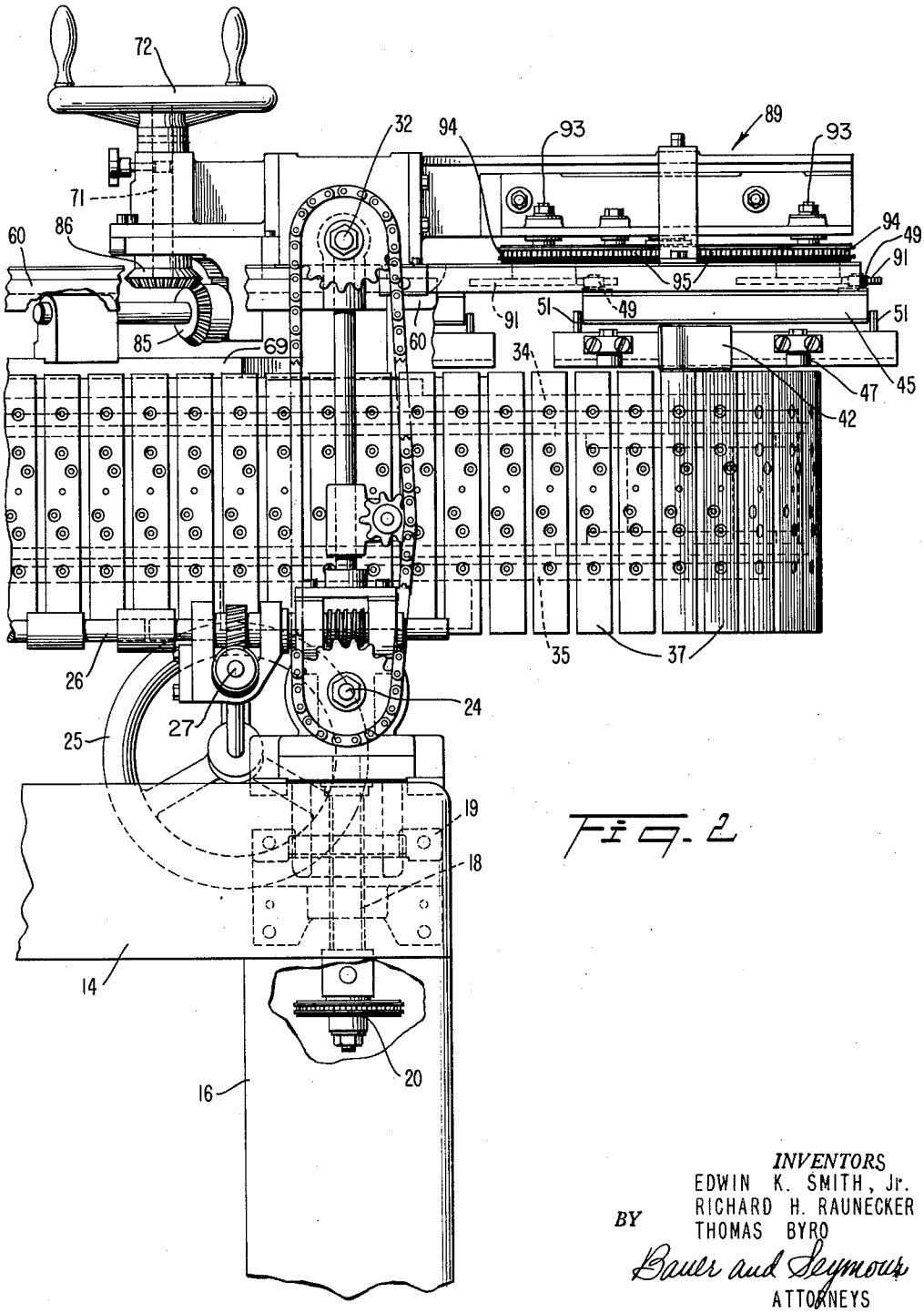


Fig. 2

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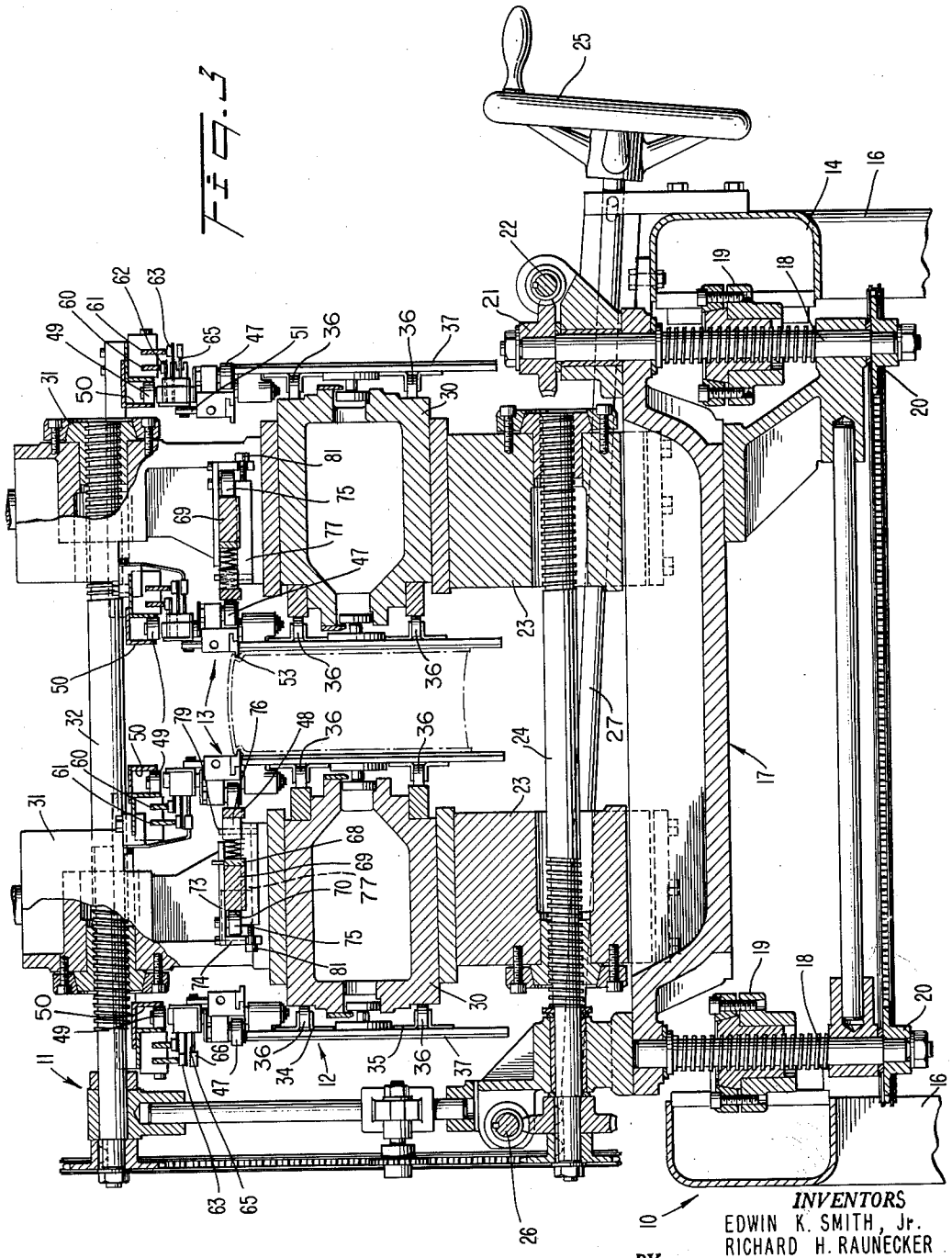
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BUILDING-IN MACHINE

Filed April 18, 1962 5 Sheets-Sheet 3

FIG. 3



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BUILDING-IN MACHINE

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Fig. 4

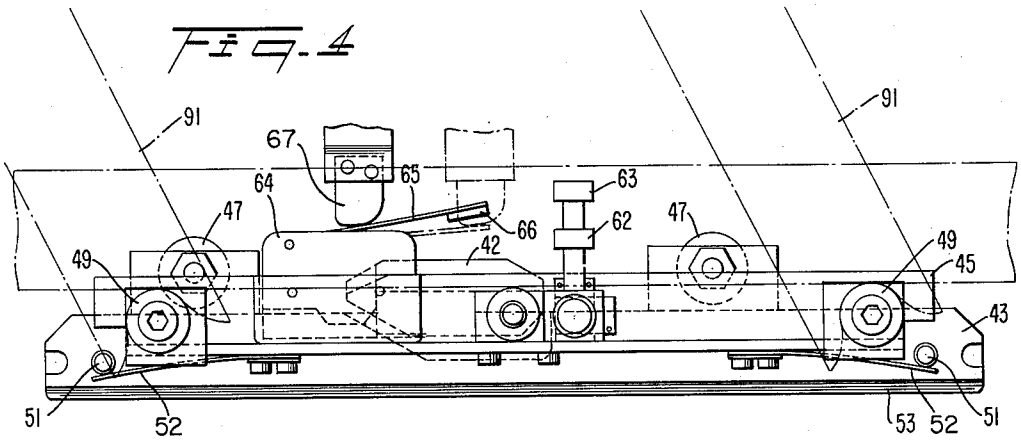
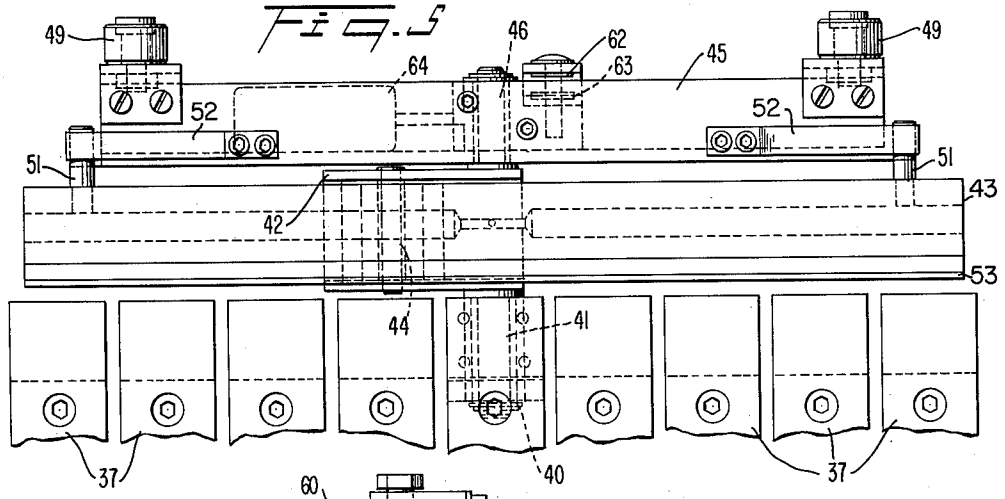


Fig. 5



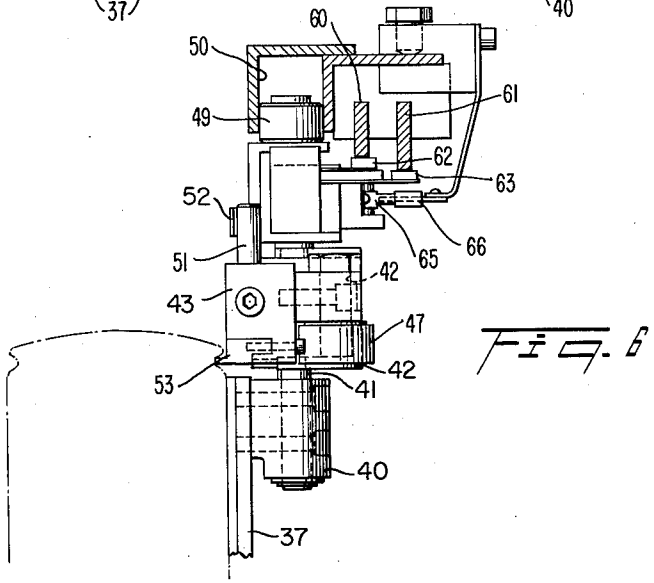


Fig. 6

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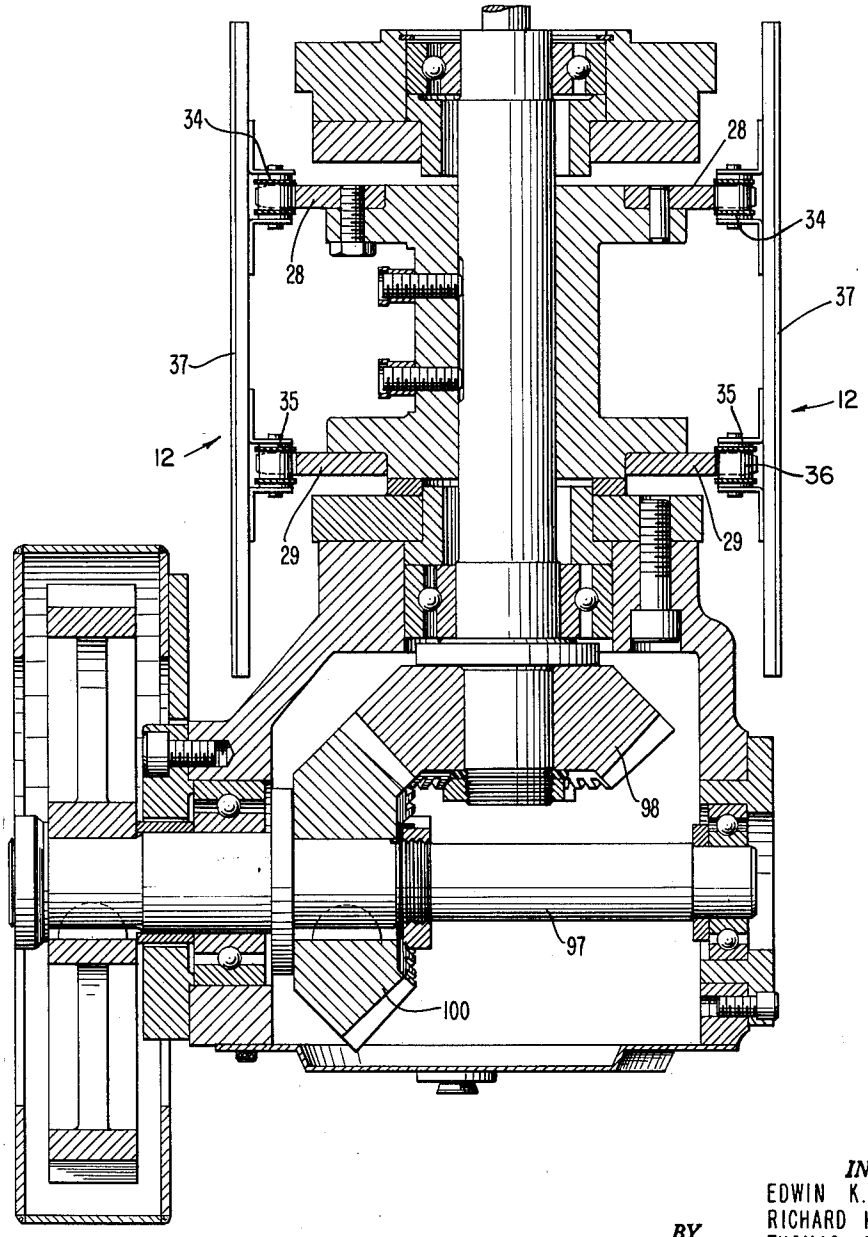
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Fig. 1



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3,123,848

BUILDING-IN MACHINE

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Filed Apr. 18, 1962, Ser. No. 188,349
16 Claims. (Cl. 11—1)

This invention relates to the manufacture of books and more particularly to the apparatus for forming hinge joints in hard cases or covers which have been positioned over the book page blocks.

The operation of applying hard cases or covers to books is referred to as "casing-in" and "building-in". The term "casing-in" includes the operations of applying adhesive coatings to the end sheets, hinges and crash of the page block and the placing of the case in registry on the page block. The expression "building-in" refers to the operations for pressing or ironing the hinge into the case of the books after the case has been placed on the page block, and firmly pressing the covers to the end sheets of the page blocks. Since the formation of the hinge in the cased book is the last operation in the process of binding a book any damage to the case is very costly. In the present practice this operation is carried out by machines which drag the cased book between stationary hinge forming irons or by machines which intermittently feed cased books to hinge forming irons which close upon each cased book while it is at rest and forms the hinge. The stationary forming irons are unsatisfactory because they may cause marring and scuffing of the case. If this marring is to be avoided the amount of pressure which can be applied is substantially limited which is also undesirable. Other prior casing-in machines require intermittent operation of the hinge forming mechanism during only a portion of the time that the book is in the machine. If the machine is required to be intermittently stopped the capacity of the machine is greatly decreased. If the time that the hinge forming mechanism can operate is reduced while the book is in the machine the capacity of the machine to produce a variety of types of books is substantially reduced. The apparatus forming this invention overcomes these objections. An important object of this invention is to provide an apparatus which will form hinges in a supply of cased books which are continuously moving through a fixed path at a high speed of operation.

Another object of the invention is to provide an apparatus for forming hinges in cased books while the books and the hinge forming nippers are simultaneously in continuous movement at the same speed.

Another object of the invention is to provide an apparatus wherein the pressure on the book covers is independent of the pressure on the hinge area by the hinge forming nippers.

Another object of this invention is to provide a machine for forming hinges in cased books wherein the hinge forming nippers are maintained at an even predetermined temperature during the time that they are in contact with the hinge area.

Another object of this invention is to provide a cased book hinge forming machine having means for assuring that the entire area of the hinge forming nippers is evenly pressed into the hinge area of each cased book.

Another object of this invention is to provide a cased book hinge forming machine having means for applying different and variable pressures to the hinge area and to the book page area.

Another object of this invention is to provide an apparatus for forming hinges in cased books that will simultaneously operate on a plurality of cased books positioned end

to end and continuously moving at a rapid rate through a predetermined path.

Another object of this invention is to provide means for the continuous application of pressure on the book hinge during the entire time that the book is in the apparatus.

Another object of this invention is to provide a hinge forming apparatus wherein the pressure to be applied to the hinge of a cased book is adjustable.

Another object of this invention is to provide a hinge forming apparatus wherein the pressure to be applied by the hinge forming means is dependent upon the positioning of the hinge forming means in relation to the cased book in the apparatus together with a predetermined pressure.

A still further object is to provide an apparatus for forming hinges in cased books wherein the entire area of the hinge forming nippers is simultaneously brought into contact with the hinge area of the cased books.

Reference is made to an embodiment of the invention illustrated in the drawings wherein:

FIG. 1 is a top plan view of one end of said apparatus;

FIG. 2 is a side elevational view taken along line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a top plan view of the nipper structure;

FIG. 5 is a side elevational view of the nipper structure as viewed from the nipper or working face;

FIG. 6 is an end elevational view of the nipper structure;

FIG. 7 is an end elevational view in cross-section of the main drive mechanism.

Referring now to the drawings and more particularly FIGS. 1, 2 and 3, the hinge forming apparatus consists of a base 10, a frame 11, a book block conveyor 12 and hinge forming nippers 13.

The base 10 consists of a rectangular frame having longitudinally extending frame members 14 and transversely extending frame members suitably secured together. The rectangular frame is supported by legs 15. Extending transversely of frame member 14 are four transverse support beams 17, one being positioned at each end of the member 16 and the others evenly spaced therebetween. Each of the support beams is vertically secured at each end to the rectangular frame by a downwardly extending threaded screw 18. Screws 18 are threadedly engaged with blocks 19 which are in turn secured to frame members 14 and which have a suitably threaded aperture for receiving the threaded screw 18. Each end of the screws 18 is mounted in suitable bearings which are secured to and are a part of the support beams 16. Sprockets 20 are secured to the lower end of each screw and an endless chain operatively connects the sprockets on either end of each of the support beams. A gear 21 is secured to the upper end of the screw 18 situated at one side of the support beam 17. A shaft 22 extends parallel to frame member 14 and is supported thereon in suitable bearings. Shaft 22 has secured to it worm gears which mesh with each of the gears 21 located on each of the support beams 16. A handle or other means is secured to one end of shaft 22 for rotating the same in either direction. Thus, through rotation of shaft 22 the screws 18 positioned at the end of each support beam 17 are rotated to evenly raise or lower the support beams and the building-in apparatus which it supports.

Slidably mounted to the upper surface of each of the support beams 17 are a series of pairs of spaced apart conveyor supports 23 spaced along the length of the apparatus. A shaft 24 having its end portions oppositely threaded engages threaded portions extending through

each pair of supports 23. One end of shaft 24 extends through a bearing block and has a worm gear and a chain sprocket secured thereto. A longitudinally extending shaft 26 has secured to it a series of worm gears each of which engages the worm gear on the shaft 24 for each pair of conveyor supports 23. A pair of hollow beams 30 extend the length of the apparatus and are supported by and secured to each pair of supports 23. Several pairs of upper supports 31 are spaced along and secured to the upper surface of beams 30 at positions in vertical alignment with the pairs of conveyor supports 23. As in the case of pairs of supports 23, a shaft 32 having its end portions oppositely threaded extends through and operatively engages threaded portions in each pair of upper supports 31. The outer end of each shaft 32 has secured to it a chain sprocket which is in vertical alignment with the corresponding chain sprocket on shaft 24. The chain sprockets on each of the shafts 24 and 32 are operatively connected by a chain. As shown in FIG. 2 the shaft 24 is rotated by means of a shaft 27 which has a worm gear at one end which meshes with a gear on shaft 26. A wheel 25 at the other end of shaft 27 facilitates the rotation of shaft 27. Thus the beams 30, which support the book conveyor are selectively moved toward or away from each other to accommodate a variety of book thicknesses. The movement of the conveyor support beams is accomplished by a positive drive means from above as well as below the beams.

The book conveyor 12 comprises two endless and spaced apart conveyor units each of which rotates about one of the beams 30 and each of which is so positioned in relationship with each other that each has one run which is spaced from the run of the other a distance substantially equal to a book thickness so that a book may be carried therebetween. Each conveyor unit is composed of an upper endless chain 34 and a lower endless chain 35, which engage sprockets 28 and 29 at each end of the apparatus. Each chain has a plurality of rollers 36 rotatably mounted to its inner surface. The rollers ride on suitable track surfaces formed on the outer surface of the beams 30 so that by adjustment of the beams continuous pressure can be exerted to the book pages to obtain a firm bond between the covers of the case and the end sheets. A plurality of spaced apart and vertically extending slat members 37 are secured to the outer surfaces of chains 34, 35. There are thus formed two endless belts each of which has a run parallel to the other and between which the book pages are compressed while being moved along the conveyor path. A book feed table 38 is positioned adjacent the converging ends of the endless belts comprising the conveyor and is vertically positioned to feed books into the bite of the moving and spaced apart conveyor by conventional feed means (not shown). The table 38 is vertically adjustable so that the level at which the books are fed into the bite of the conveyors is controlled in such a manner as to leave the hinge area of each book exposed above the upper end of the slats 37 of the conveyors.

The construction of the hinge forming nippers is best shown in FIGS. 4 through 6. Since all of the nippers are of identical construction a description of one will be sufficient for an understanding of the invention. A bearing block 40 is mounted to the upper inside surface of one of the conveyor slats 37 rotatably supporting one end of a vertically extending pin 41. The upper end of pin 41 is secured to the lower surface of a channel member 42 which has its open area facing outwardly toward the slats 37 as shown in FIG. 5. The nipper support 43 is positioned within channel 42 and is rotatably suspended between the flanges of the channel 42 by means of a pin 44 at a point off-center of said channel. A guide plate 45 is mounted to the channel member 42 above the nipper support by means of a pin 46 which is secured at its lower end to the top surface of the channel 42 and is in axial alignment with pin 41 secured to the bottom surface of the channel. The upper end of pin 46 is rotatably secured in a bearing which is mounted to the guide plate 45. A pair of rollers 47 are mounted to the rear surface of the nipper support 43 and make rolling contact with tracks 48 which in turn are mounted to the upper conveyor supports 31 in a manner hereinafter to be described. A pair of rollers 49 are secured to the top surface of the guide plate 45 and are confined in a channel 50 which extends longitudinally of the apparatus and above the work run of the conveyors. A pin 51 extends upwardly from the top surface of and at each end of the nipper support 43. A leaf spring 52 is mounted to each end of guide plate 45 and has one end of each secured to the front surface of said plate. The other end of each spring 52 extends past pin 51. The guide plate 45 and nipper support 43 are thereby resiliently retained in parallel relationship to each other. As shown in FIG. 5 the guide bar 43 is pivotally mounted at its center to a slat 37 on the conveyor through the channel support 42. The guide plate 45, through rollers 49 riding in channel 50 and by means of spring 52 moves and maintains the nipper support 43 in a plane parallel to a plane extending through the working surfaces of slats 37 in the conveyor and in turn parallel to the books carried in the conveyor. On the front surface of nipper support 43 is mounted a nipper bar 53 with a confronting surface having a suitable configuration to form the hinge. The position of the track 48 will determine how far the nipper bar and its support will be moved toward the hinge area of a book carried in the conveyor. Because of the aforementioned mounting of the nippers the nipper bar 53 will always be moved squarely into contact with a book hinge and the pressure applied thereby will be evenly distributed over the length of the book hinge area.

The heating of nipper bar 53 is accomplished by the following mechanism. A pair of bus bars 60, 61 extend the length of the apparatus and are fixed in relation to the nippers. A pair of resilient contact members 62, 63 are secured to each of the nipper structures and provide an electrical contact to the nipper bar 53 through the bus bars 60, 61. A microswitch 64 is mounted to the top of each nipper and controls the flow of current to the nipper bar 53. A spring loaded actuator arm 65 is mounted to the microswitch so that the arm is normally in the solid line position as shown in FIG. 4 and in such position the microswitch is in the off position. A resilient holding bar 66 is mounted to the nipper below the microswitch in such a manner that it is held slightly depressed and against the lower surface of the outer end of arm 65 when said arm is in its normal outward position. Thus when the arm 65 is moved inwardly beyond the edge of bar 66 said bar moves up and locks arm 65 in the "on" position as shown in dotted lines in FIG. 4. Arm 65 is moved by a horizontally extending plate 67 which in turn is mounted to the fixed frame. Plate 67 has a curved face so that as the nipper approaches it the arm 65 is gradually moved until it clears the edge of bar 66. Plate 67 is adjustably mounted to the frame so that the proper location in the path of the nippers may be selected. When it is desired to close the microswitch 64 and turn off the source of electrical heat to the nipper bars 53 the bar 66 is depressed thus permitting the arm 65 to move over the top surface of the bar and to assume the outermost position. A downwardly extending finger (not shown) is adjustably mounted to the frame and positioned in alignment with the path of movement of the bar 66. Since the finger and the plate 67 are selectively movable along the path of the nippers the length of time that the nipper bars 53 receive electrical heat is selectively predetermined.

The mechanism for mounting the tracks 48 whereby the pressure to be applied by the nipper bars 53 on the book hinge is shown in FIGS. 1 and 3. Since this mechanism is the same for each of the tracks 48 a description of one will be sufficient for an understanding of both.

Track 48 comprises a plurality of sections which extend the length of the path of the books through the apparatus. A plate 68 extends the length of the apparatus and is parallel to and spaced from the track sections 48. A cam plate 69 also extends the length of the apparatus and is so constructed that a sliding contact is maintained between one edge of said plate and plate 68. Cam plate 69 has a plurality of cam surfaces 70 formed in said plate along the other edge. A gear member 85 (FIG. 2) is secured to the top surface of cam plate 69 and meshes with a gear 86 secured to one end of vertically extending shaft 71. A hand wheel is secured to the other end of shaft 71 whereby the cam plate 69 may be manually reciprocated in a horizontal plane. Positioned along the length of the cam plate 69, and in alignment with each of the cam surfaces 70 is a horizontal frame 73 and a vertical frame 74 which is secured to upper support 31. A cam follower 75 is rotatably mounted in frame 73 and operatively engages a cam surface 70. Each of the track sections 48 has secured to its rear face a block 76. A plate 77 is slidably retained on support 31 and is operatively secured to block 76 and plate 68 in the following manner. A pin 79 is fixedly mounted to the outer end of plate 77 and extends upwardly through an elongated slot 80 in block 76. A bolt 81 freely extends through frame 74 and threadedly engages the inner end of plate 77. A plurality of springs 78 retain track 48 and plate 68 in a spaced apart relationship. Through bolt 81 the track sections 48 may be moved toward or away from a book in the apparatus. By moving cam plate 69 to the left as viewed in FIG. 1, the plate 68 is moved at right angles to the path of the books to cause an increased compression of the spring 78 which in turn increases the pressure of the nipper bars 53 on the book hinge as the nipper structure rides on track 48.

A novel mechanism for turning each of the nipper structures is located at each end of the apparatus and on each side of the path of travel for the books whereby each nipper is moved from one conveyor run to the opposite conveyor run. Since each of these turning mechanisms are of identical construction a description of one will be sufficient for an understanding of all. As previously described, a roller 49 is rotatably mounted at each end of the guide plate 45 of the nipper structure. As shown in FIGS. 1 and 2 the turning mechanism is mounted in a frame section 89 positioned above each end of the conveyors 33 and consists of a pair of turning bars 91. The end surface of each turning bar 91 has a concave configuration 92 for receiving rollers 49. Each bar 91 is secured to a shaft 93 which is mounted in a suitable bearing on frame 89. A sprocket 94 is also secured to each shaft 93. A chain 95 operatively connects the sprockets 94 whereby turning bars 91 are moved in parallel movement in relation to each other. The turning mechanism is so constructed that one half of the circumferential path of movement of the outer ends of each turning bar is equal to the distance between the centers of the nipper structures. This enables the nipper structure itself through rollers 49 to drive the turning bars so that when one end of a pair of the turning bars has engaged the rollers 49 on a nipper structure and has moved that nipper structure into contact with a book, the other end of the turning bars is engaging the rollers 49 on the following nipper structure. With this novel turning mechanism the nipper bar 53 is always oriented in the same direction and thus it always approaches a fed book at right angles thereto, assuring equal pressure on the book hinge area throughout the length of the nipper bar.

Conveyors 33 are simultaneously driven from a main shaft 97 which extends transversely of the apparatus adjacent one of the ends of the conveyors 33. The sprockets 28, 29 of each of the conveyors is secured to a shaft 98 which is in turn mounted in suitable bearings in the frames 23, 31. A bevel gear 99 is secured to shaft 98 and meshes with a bevel gear 100 secured to shaft 97.

The parallel conveyor 33 is simultaneously driven by an identical gear arrangement so that upon rotation of main shaft 97 both conveyors are simultaneously operated. Main shaft 97 may be driven from an independent source of power or it may be driven from companion bookmaking machines.

The foregoing detailed description is given to describe and understand the invention and no unnecessary limitations are to be inferred therefrom, as some modification will be obvious to those skilled in the art.

What is claimed is:

1. A book forming apparatus comprising a continuously moving conveyor means for gripping and compressing the page blocks of successively fed cased books and moving the same in a straight path with their hinge areas exposed and longitudinally aligned with each other, a plurality of pairs of nippers for engaging the hinge area of each of said books and continuously movable with said conveyor, and means independent of said conveyor to move the nippers of each pair toward each other and into continuous pressing engagement with each of said books on each side of the hinge area of each book and through said straight path.

2. A book forming apparatus comprising a frame, a pair of endless continuously operating conveyor means operatively secured to said frame and having one run of each positioned in parallel spaced apart planes to each other, means on said conveyors to engage and compress the page block of each book with the hinge areas exposed and to continuously carry an endless succession of books through said one run of said conveyors, a plurality of pairs of nippers movable with said conveyors with each pair of nippers engaging the hinge area of a book throughout its movement through said one run, and means to move the nippers into engagement with the hinge area of each book continuously during the movement of each book through said one run, and nipper pressure means independent of the pressure means for the conveyor on the page block of each book for exerting a predetermined pressure on said hinge areas.

3. An apparatus as defined in claim 2 comprising means to heat said nippers during a predetermined portion of said one run.

4. A book forming apparatus comprising a frame, a pair of endless continuously operating conveyor means mounted to said frame and having one run of each in opposing alignment with each other and in parallel spaced apart planes to each other for forming a book path, means on said conveyors to engage and compress the page block of each book and to continuously carry an endless succession of books through said book path, a plurality of pairs of nippers movable with said conveyors for engaging the hinge area of each book throughout its movement through said path, means to selectively predetermine the pressure to be applied between the nippers of each pair and the book hinge, and means to evenly distribute the nipper pressure throughout the length of each book hinge.

5. A book forming apparatus as defined in claim 4 wherein said means to selectively predetermine the pressure to be applied to each pair of nippers and to the book hinge comprises rollers mounted on each nipper, a track and a rail member slidably mounted to said frame on each side of said path, each track positioned in the path of movement of said nipper rollers, resilient means positioned between said track and said rail, means to move each said track toward and away from said rail whereby the compressive force of said resilient means may be adjusted, and means to move both said rail and said track toward and away from said book path.

6. A book forming apparatus as defined in claim 4 wherein each nipper comprises a nipper support and a nipper bar secured thereto, a mounting member, and a guide plate, means at one end of said mounting member for rotatably securing the same to said conveyor, means for rotatably securing said nipper support at a position

off-center of said mounting member, means positioned at the center of said guide plate for rotatably securing the same to said mounting member in alignment with the means for securing said mounting member to the conveyor, and wherein the axis of said mounting member securing means and said guide plate mounting means is in the same plane as a plane passing through the center of said nipper support.

7. In an apparatus for forming the hinges in cased books comprising a pair of continuously moving conveyors for engaging and compressing the page blocks of successively fed books therebetween with the hinge areas exposed and for moving said books through a predetermined path, a plurality of pairs of nipper means to form the hinge in each book, each nipper comprising a nipper support and a nipper bar secured thereto,, a mounting member, a guide plate, means at one end of said mounting bar for rotatably securing the same to said conveyor for movement therewith, means for rotatably securing said nipper support to said mounting member at a position off-center of said mounting member, means positioned at the center of said guide plate for rotatably securing the same to said mounting member and in axial alignment with the means for securing said mounting member to the conveyor, wherein the axis of said mounting member securing means and said guide plate mounting means is in the same plane as a plane passing through the center of said nipper support, and means for moving said nipper bar toward said book path and into contact with a hinge area of a book carried by said conveyor.

8. An apparatus as defined in claim 7 comprising resilient means to maintain said nipper support and said guide plate in longitudinal alignment with each other.

9. In an apparatus for forming hinges in cased books comprising a conveyor for engaging and compressing the page blocks of a series of books and moving the same through a predetermined path, means to form a hinge in each of said books comprising a plurality of hinge forming means movable through said path, each of said hinge forming means comprising a nipper support and a nipper bar secured thereto, a mounting member, a guide plate, means at one end of said mounting bar for securing the same to said conveyor, means for securing the nipper support to said mounting member at a position off-center to said mounting member, means positioned at the center of said guide plate for securing the same to said mounting member and in axial alignment with the means for securing said mounting member to the conveyor, wherein the axis of said mounting member securing means and said guide plate mounting means is in the same plane as a plane passing through the center of said nipper support, and means for moving said nipper bar toward said book path and into a book hinge area.

10. In an apparatus for forming the hinges in cased books comprising a frame, a pair of conveyors mounted to said frame for engaging and compressing the page blocks of a series of books therebetween with the hinge area exposed, a plurality of nipper means movably mounted to said conveyor for engaging the hinge area of each book in said conveyor, means for moving each of said nipper means into engagement with a book hinge in said series of books comprising a track member in operative contact with said nipper, a rail spaced from said track, resilient means for maintaining said track and rail spaced apart, means to move said track toward and away from said rail whereby the tension on said resilient means may be adjusted, and means to move said rail and said track toward and away from said book.

11. A book forming apparatus comprising a frame, a pair of continuously operating endless conveyor means each of which has one run which is parallel to the other, means for feeding books in succession between said conveyors and along said one run, means on said conveyors to engage and compress the page block of each book

wherein the hinge area of each book is exposed, a plurality of nipper means operatively secured to each conveyor for engaging the hinge area of a book, means to advance each of said nipper means into contact with each book as it is fed into said conveyor so that the entire surface of the nipper means simultaneously engages the book hinge, means to apply a predetermined pressure between the nipper means and the book hinge continuously as said book and said nipper means travel through said one run, and means to evenly distribute the nipper pressure on each book hinge during passage through said run.

12. An apparatus as defined in claim 11 wherein said nipper advancing means comprises a pair of spaced apart arms each of which is rotatably mounted at its center, means operatively connecting said arms whereby the rotation of one causes the rotation of the other, means at each end of each arm for engaging an end of each nipper whereby upon movement of said conveyors and said nippers the nipper bar remains parallel to the path of movement of the books and said nipper bar.

13. An apparatus as defined in claim 9 comprising means to heat said nipper means during a predetermined portion of said one run.

14. An apparatus for forming hinges in books comprising a first and a second endless conveyor means each of which has a straight run parallel to and spaced from each other to form a book path and adapted to compress therebetween successively fed cased books, means for continuously moving said first and second conveyors at the same speed, a plurality of nippers movably mounted on each of said endless conveyors for compressing the cased books at their hinge areas, each of the nippers on said first endless conveyor being positioned opposite a nipper on said second conveyor along the straight run of said conveyors, and means to move the opposed nippers on said conveyors toward each other and into pressing engagement with the hinge areas of said books continuously during the movement of said nippers and said books through said straight run.

15. An apparatus for forming hinges in books comprising continuously moving conveyor means to engage each surface of the page blocks of successively fed books and to compress the same and to move said books through a predetermined path, a plurality of nippers mounted on said conveyor means and positioned on each side of said book path for compressing the cased books at their hinge areas, each of the nippers on one side of said book path being positioned opposite a nipper on the other side of said book path, means to guide said nippers in a plane parallel to said book path, and means to move said opposed nippers toward each other and into pressing engagement with the hinge areas of said books whereby all portions of the surface of each nipper engages the hinge area with equal pressure continuously as said nippers and books move through said book path.

16. A book forming apparatus comprising a frame, conveyor means to engage and compress the page blocks of successively fed books and move the same through a predetermined path, a plurality of pairs of nipper means movable with said conveyor means whereby each pair of said nippers will engage the hinge area of a book, means independent of said conveyor to selectively predetermine the pressure to be applied between each nipper and the book hinge, and means to evenly distribute the nipper pressure throughout the length of each book hinge.

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