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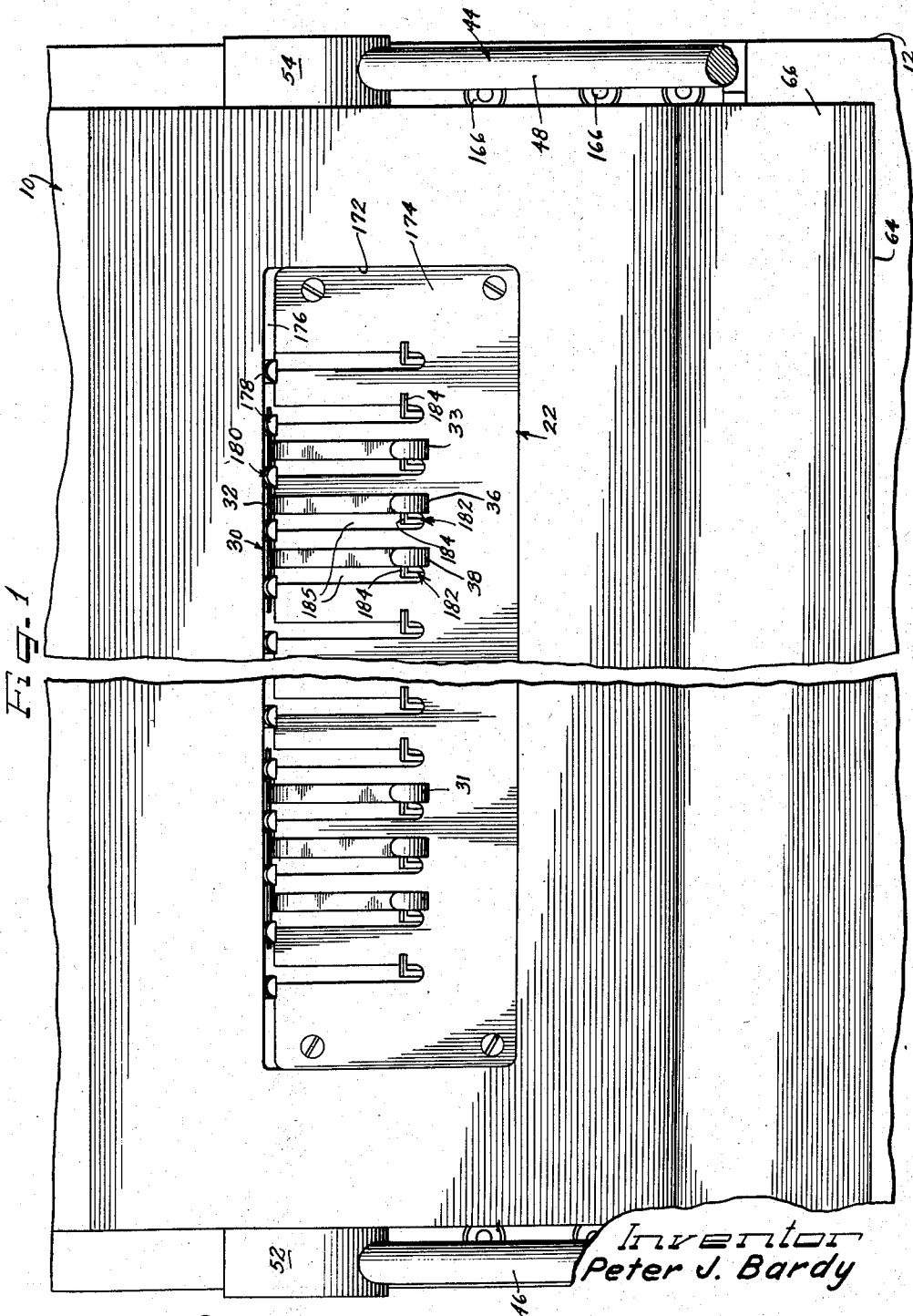
P. J. BARDY

2,908,173

COMBINED PUNCH AND BINDING MACHINE

Filed March 12, 1958

5 Sheets-Sheet 1



Inventor
Peter J. Bardy

By Hill, Sherman, Droni, Gross & Simpson Attys.

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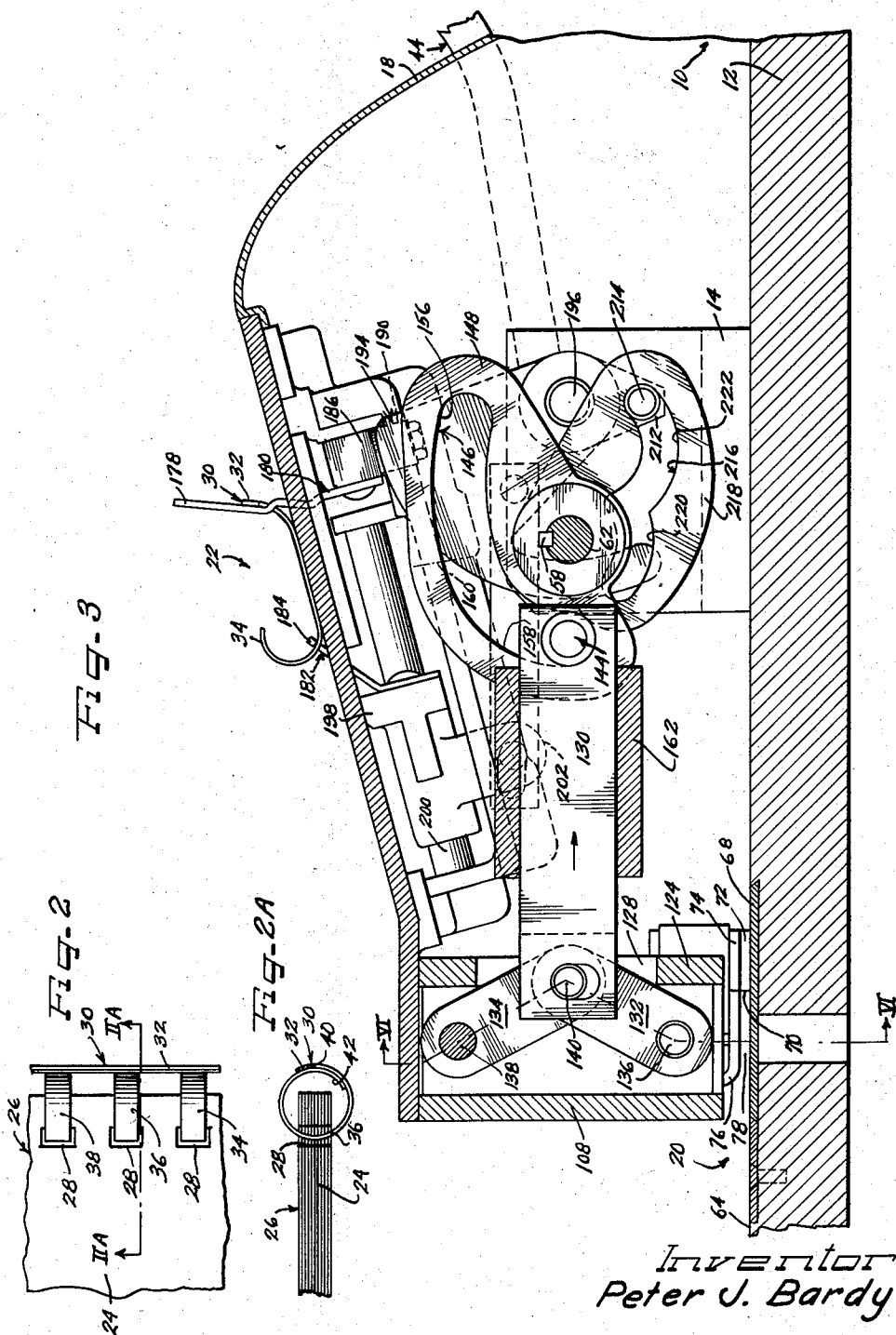
P. J. BARDY

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COMBINED PUNCH AND BINDING MACHINE

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5 Sheets-Sheet 2



By Hill, Sherman, Meroni, Gross & Simpson, Attys.

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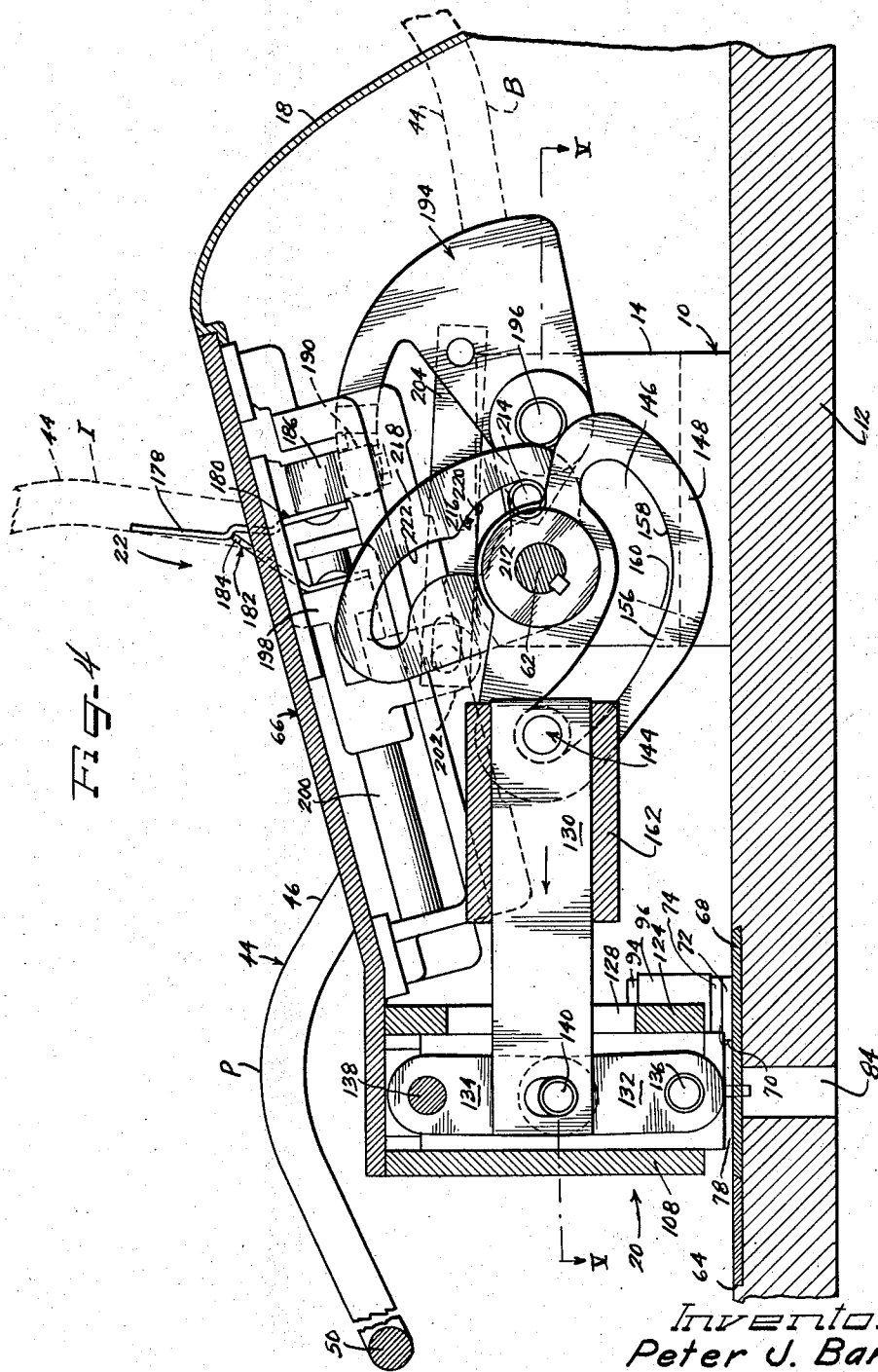
P. J. BARDY

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COMBINED PUNCH AND BINDING MACHINE

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5 Sheets-Sheet 3



Inventor
Peter J. Bardy

by *Hill, Sherman, Meroni, Gross & Simpson* Attys.

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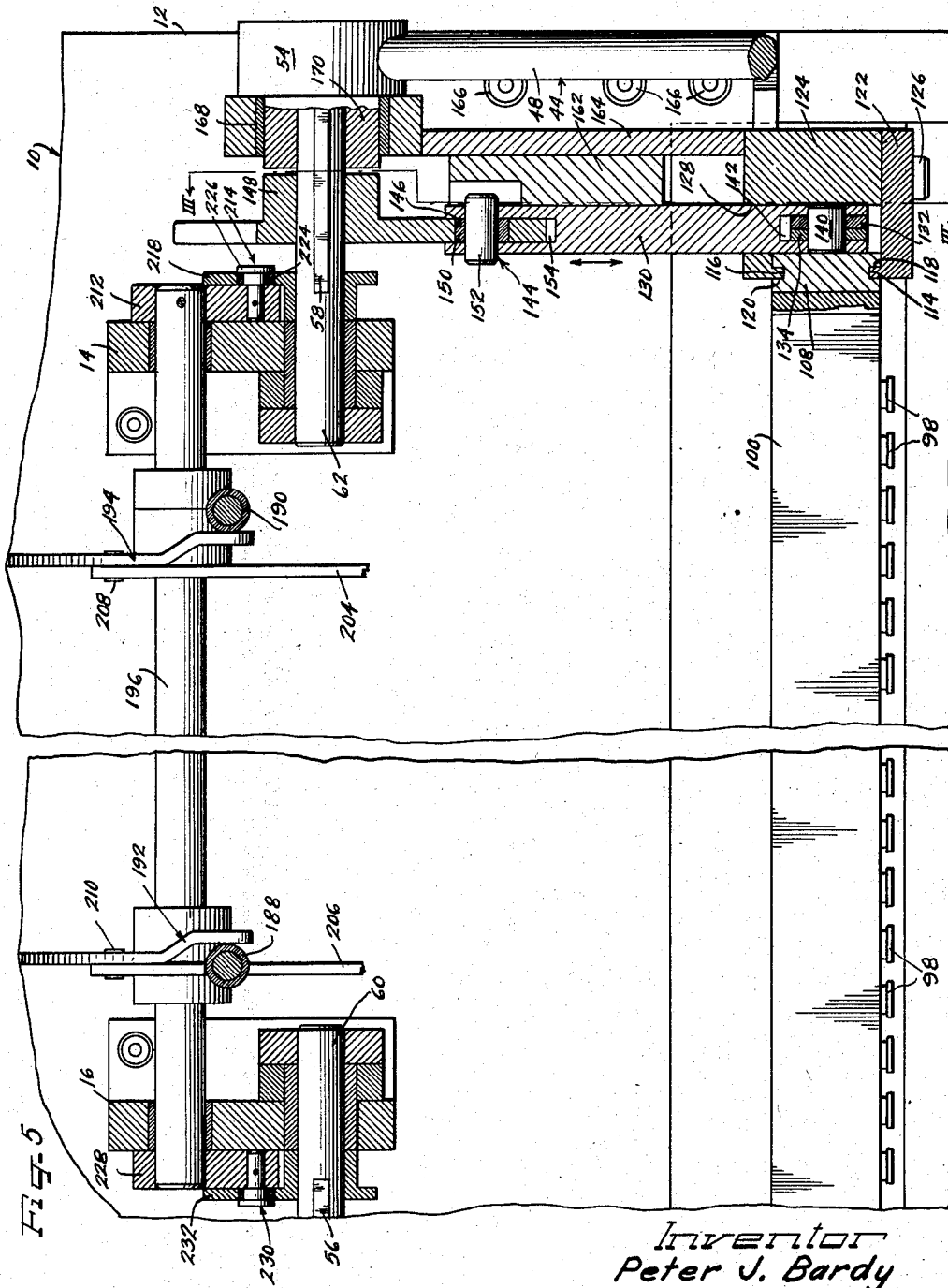
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P. J. BARDY

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COMBINED PUNCH AND BINDING MACHINE

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5 Sheets-Sheet 5

Fig-6

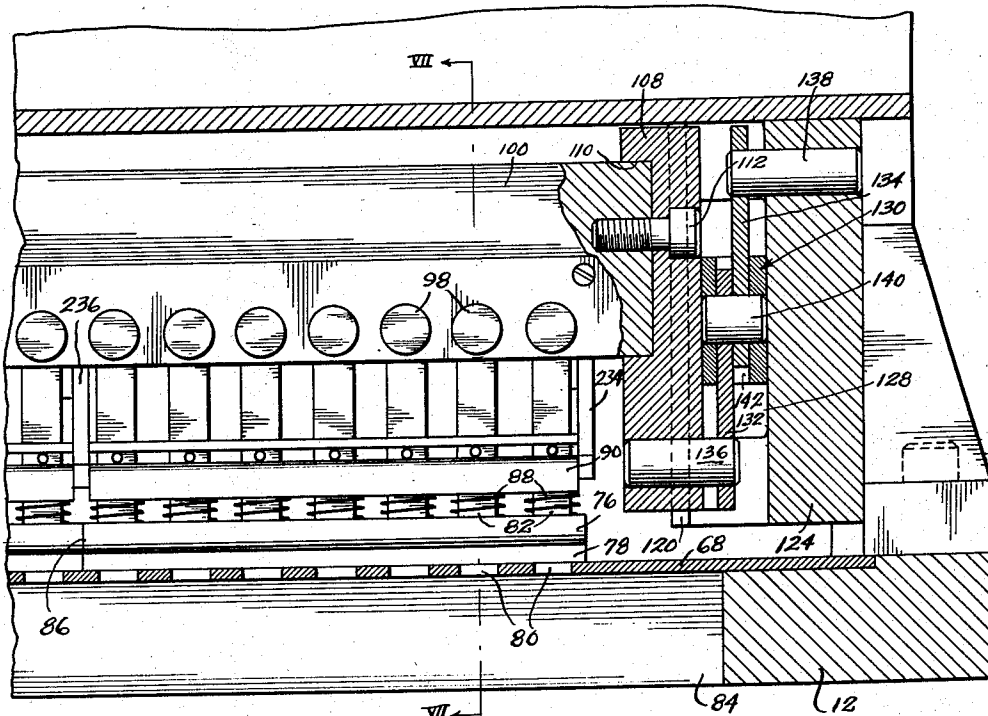
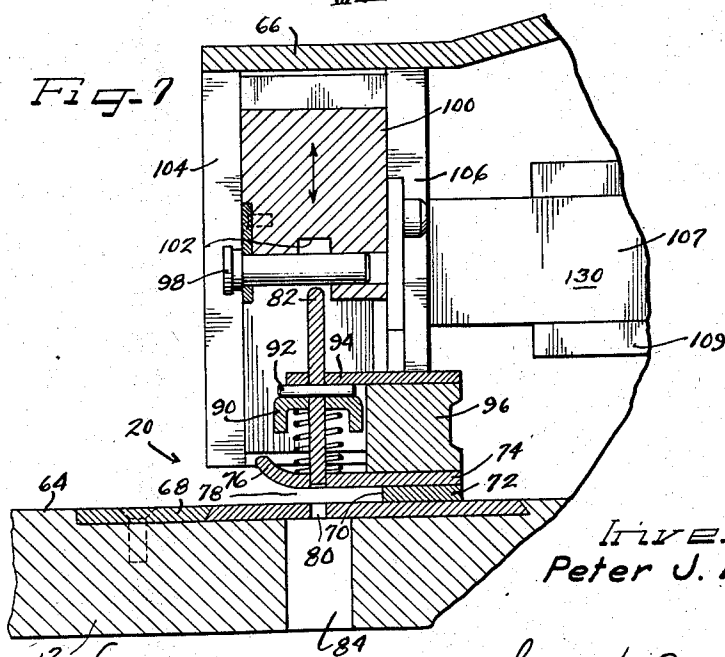


Fig-7



Inventor
Peter J. Bardy

By Hill Sherman Meroni, Gross & Simpson Attys.

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2,908,173

COMBINED PUNCH AND BINDING MACHINE

Peter J. Bardy, Park Ridge, Ill., assignor to General Binding Corporation, Northbrook, Ill., a corporation of Illinois

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1 Claim. (Cl. 74—107)

The present invention relates to an improved binding machine and more particularly to an improved machine which binds together a stack of aligned sheets by forming a row of binding holes through the sheets and attaching a binding member having a backbone with curled, resilient fingers which are inserted through the holes.

The invention relates, in one form, to a binding mechanism having a frame with a punching station thereon and a binding station thereon cooperatively related to completely bind a stack of aligned sheets with a binding member. A complete operation requires both punching and attaching of a binder. Punching is performed at the punching station, and binder attachment at the binding station. The punching station is provided with a supporting platform and a plurality of longitudinally aligned, spaced punch members coacting with a die member, with the punch members actuated by a driving means including a toggle linkage and an operating cam. The binding station is provided with a comb member having a plurality of teeth projecting above a supporting platform and spaced to enter the spaces between the curled fingers attached to the backbone of a binding member. A plurality of hook members are positioned adjacent the teeth and the teeth move longitudinally forcing the hook members over the fingers of the binding member. The hook members then move laterally to draw open the curled fingers. Longitudinal movement of the teeth and lateral movement of the fingers are caused by driving means operated by an operating cam. The entire mechanism is driven by an operating shaft carrying a punching cam operating the punch mechanism and positioning and holding the punching mechanism in a paper receiving position during a binding portion of rotation of the operating shaft. The operating shaft also carries a binding cam which operates the binding members and positions and holds the binding mechanism in a binder receiving position during a punching portion of rotation of the operating shaft.

An object of the invention is to provide an improved portable machine which is used for a complete binding operation.

Another object of the invention is to provide an improved binding machine which performs a complete operation including punching aligned openings in stacked sheets and applying a binding member having a backbone with flexible, curled fingers which enter the openings in the sheets.

A further object of the invention is to provide an improved punching and binding machine which is manually operated through a single operating handle moved in the direction of a binding station on the machine for a binding operation, and moved in the direction of the punching station on the machine for a punching operation.

Another object of the invention is to provide an improved operating mechanism for a binding machine which employs a unit mechanism to positively position and hold either the punching or binding members in

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a fixed operating position while operating the other of the members.

Another object of the invention is to provide an improved driving apparatus for driving the functional elements of a punching and binding mechanism.

A further object of the invention is to provide a binding machine having punching and binding stations which are correlated in a unique, improved manner to simplify the complete binding operation.

Other objects and advantages will become more apparent with the teaching of the features and principles of the invention in the disclosure and showing of the preferred embodiment in the specification, claim and drawings, in which:

Figure 1 is a plan view of a binding mechanism embodying the features of the invention and illustrating certain details of the punching station;

Figure 2 is a plan view of a stack of sheets bound in booklet form by the binding member;

Fig. 2a is a vertical sectional view taken along line IIa—IIa of Figure 2 which is through the stack of sheets bound into a booklet by the binding member;

Figure 3 is a vertical sectional view taken along line III—III of Figure 5, and illustrating the internal relationship of the operating and driving mechanisms;

Figure 4 is a sectional view also taken along line III—III of Figure 5, and is similar to Figure 3 except that in Figure 3 the punching mechanism is positioned to receive sheets stationary while the binding mechanism is operating, and in Figure 4, the binding mechanism is positioned to receive sheets while the punching mechanism is being operated;

Figure 5 is a sectional view taken along line V—V of Figure 4;

Figure 6 is a vertical sectional view taken along line VI—VI of Figure 3, and illustrating certain details of construction at a punching station of the binding mechanism; and,

Figure 7 is a sectional view taken along line VII—VII of Figure 6.

As shown in the drawings:

The binding machine embodying the principles of the present invention is illustrated with certain details of both a punching station 20 and a binding station 22 in Figures 1 through 5, with Figures 6 and 7 illustrating certain details of the punching station. The mechanism is provided with a frame 10 having a base plate 12. Rising from the base plate are supporting pedestal members 14 and 16 which carry certain operating elements of the machine. A rear shroud 18 forms a protective enclosing for the back portion of the machine. At its front end, the machine has the punching station 20, and located at the upper portion of the machine is the binding station 22.

The machine operates to bind together a stack of individual sheets 24, Figures 2 and 2a, to form a booklet 26, or the like. A series of elongated holes 28 are punched along one edge of the stack of sheets 24 for attaching a binder 30. The binder has a backbone 32 to which is attached, at spaced intervals, a plurality of curled resilient fingers, such as 34, 36 and 38. The fingers are attached or integral to project from one edge 40 of the backbone and curl in a generally annular form with a free end 42 curled down along the inner surface of the backbone 32. The sheets are thus held together by the binding member 30, and can be turned freely with their openings sliding over the curled fingers 34, 36 and 38.

In operation of the machine, the aligned row of holes 28 is punched in the sheets, and the binding member 30 is applied by opening the curled fingers 34, 36 and 38, and sliding the ends 42 through the openings. The curled fingers are then released and resiliently returned to

their curled position to complete the binding of the stack of sheets.

The machine is preferably of the portable type which may be rested upon or bolted to a bench or operating table, and is manually operated by an operating handle or arm 44. The operating arm 44 has a general U-shape and extends as a yoke with side arms 46 and 48, Figure 1, extending at each side of the machine and connected by a bar 50, extending across the ends of the arms and providing a handily graspable bar for swinging the side arms 46 and 48 through their operating arc for operating the machine.

The side arms 46 and 48 are secured at their lower ends to connecting hubs 52 and 54 which have openings through the center, and have key slots to receive locking keys 56 and 58, which are shown in Figure 5. The keys 56 and 58 are locked in keyways in operating shafts 60 and 62. Thus, when the operating handle 44 is swung through an arc, the operating shafts 60 and 62 will be rotated.

The handle or arm 44, in operation, swings through an arc from the punching position shown at P in Figure 4 to the binding position shown at B in Figure 4. At an intermediate position shown at I, neither the punching station 20, nor the binding station 22 is in operation. Thus, when the handle and operating shafts swing through the binding arc from I to B, the punching mechanism is fixedly held in a position to receive sheets of paper, and the binding mechanism is attaching the binding member 30. While the handle is swung from the intermediate position I, to the punching position P through the punching arc, the binding mechanism is positioned and fixedly held to receive the binding member and the punching mechanism is operated.

When a stack of sheets is bound by the machine, it is first placed on a first platform area 64 at the punching station, Figures 1 and 4, and then raised to a second platform 66 at the binding station 22. The second platform is vertically offset from the first platform 64, and raised slightly for convenience of handling the sheets.

The binding station 20 includes a die plate 68 which is set into the surface of the base 20, so as to be substantially flush with the top. As illustrated in Figures 3, 4 and 7, the stack of sheets will be slid into place over the die plate 68 until its edge reaches the stop face 70 of a spacer bar 72. The spacer bar rests on the die plate 68, and carries on it a die stripper plate 74. The stripper plate curves upwardly at its forward end 76 to define a throat 78 into which the stack of sheets is conveniently fed against the stop face 70.

As illustrated in Figure 6, the die plate 68 has a series of die openings 80 which are entered by punches 82. The base 12 has an elongated slotted opening 84 cut therein in order that the punched slugs of paper which are cut from the stack of sheets may drop downwardly.

The punches are mounted in unit sub-assemblies with each sub-assembly being suitably mounted on the frame of the machine. The separation between the sub-assemblies is shown at 86 in Figure 6. When aligned in a row, the sub-assemblies form a complete longitudinally aligned series of punches 82, which are separated and spaced from each other to correspond with the die openings 80 and form the longitudinally aligned row of openings in the stack of sheets. The punches 82 work in unison and are normally held in their uppermost poised position by coil compression springs 88 surrounding each of the punches and bottoming on the upper surface of the stripper plate 74, and pushing upwardly on a punch retraction plate 90, Figures 6 and 7. Each of the punches is provided with a lateral opening through which is passed a retraction pin 92 which rests on the upper surface of the retraction plate so that the punches are lifted in unison. The punches are limited in their movement by a punch guide plate 94 supported on a bar 96 which rests on top of the stripper plate 74.

Each of the punches 82 is pushed downwardly by an

individual operating pin 98, which engages the upper end of the punch, and which is carried in a punch-operating bar 100. If desired, individual punches 82 may be temporarily or permanently taken out of operation by withdrawing individual pins 98. When the individual pins 98 are withdrawn, the punch-operating bar 100 will descend, and the upper end of the punch 82 will be received by a recessed slot 102 in the lower surface of the operating bar 100, and the punch will not be pushed downwardly. However, if the punch operating pin 98 is in position, the individual punch 82 will be forced downwardly to punch a hole in the stack of sheets when the operating bar 100 is pushed downwardly.

The operating bar is supported at its ends in bearing blocks which are guided in vertical movement to hold the bar in alignment as it moves up and down. It will be understood that the guiding mechanism and the operating mechanism for each end of the punch operating bar 100 are identical in construction and, therefore, only one end need be described in detail.

As shown at the right end of the machine in Figures 5 and 6, secured to the end of the bar 100 is a vertically sliding bearing block 108. The block has a recess 110 to project above and below the bar for firmly transmitting vertical motion thereto, and a bolt 112 extends through the side of the block 108 and threads into the end of the bar 100. The vertical sliding block 108 has vertical grooves 114 and 116 cut into its side into which project ridges 118 and 120 of supporting frame members 122 and 124. The frame members are held together by bolts, such as shown at 126, and are rigidly mounted to extend upright from the base 12.

The frame member 124 has a laterally opening slot 128 to accommodate reciprocating movement of a driving link 130, as will be described.

The bearing block 108 which carries the punch operating bar 100, is moved up and down by toggle links 132 and 134. The lower toggle link 132 is pivotally connected to the bearing block by a pin 136. The upper toggle link 134 is pivotally connected to a fixed pin 138 which is mounted on the frame piece 124. The toggle links 132 and 134 are joined to each other by a pin 140 which also connects them to the driving link 130, which has a bifurcated end so as to provide a slot 142. The pin 140 connecting the links extends across the slot 142. Reciprocation of the driving link 130 will pivot the toggle links to move the punch-operating bar in a vertical direction. When the driving link 130 is moved to the right, as shown in Figure 3, the toggle links 132 and 134 are broken to lift the punch-operating bar 100. When the driving link 130 is moved to the left, as shown in the position of Figure 4, the toggle links 132 and 134 are straightened to push the punch-operating bar 100 downwardly and operate the punches 82.

Figure 7 illustrates a view of the left end of the machine and the construction is identical with the punch-operating bar 100 being guided in frame members 104 and 106, and with toggle links, not shown, being operated by a driving link 107, guided in horizontal reciprocation by a bearing member 109.

The punch driving link 130, for the right end of the machine, as illustrated particularly in Figures 3, 4 and 5, is horizontally reciprocated by a follower 144 riding in a closed positive operation cam slot 146 in a punch-operating cam 148. The punch-operating cam 148 is keyed to rotate with the operating shaft 62. The follower 144 is illustrated as being in the form of a roller 150, carried on a pin 152 which extends across a slot 154 formed in the bifurcated end of the driving link 130.

The cam slot 146 is shaped to have an operating portion 156, Figures 3 and 4, and a holding portion 158. The holding portion 158 extends substantially to the point 160, and is at a constant radius from the center of the operating shaft 62, so that no lateral movement

of the follower 144 will occur when it is in that portion of the cam track. However, when the follower 144 is in the portion 156 of the cam track, it will be reciprocated laterally. The follower will be in the holding portion 158 during the time that the operating handle 44 is swung through the binding portion of its arc, which is from the position I to the position B, and will be in the operating portion 156 while the handle is swung from position I to position P.

The driving link 130 is guided in a bearing block 162, which is mounted on a frame member 164, Figure 5, the frame member being secured to the base 12 of the frame by bolts 166. The frame member 164 also has a journal 168 which supports a bearing 170 that is integral with the hub 54 of the handle, so as to provide additional support for the operating shaft 62.

The binding station 22 is provided with an opening 172 in the platform 66 on which the stack of sheets rests while the fingers, such as 32, 34 and 36 are being inserted into the slots in the sheets. In the opening 172 is a flush plate 174 which provides a gap 176 along one edge. Through this gap project teeth 178 of a comb member 180. The comb member 180 is suitably mounted beneath the platform 66, and the teeth 178 project upwardly therefrom, Figure 1.

The teeth 178 are spaced so as to enter the spaces between the fingers of the binding member 30 and engage the inner surface of the backbone 32. The backbone will thus be held while the fingers are being uncurled by hooks 182.

The hooks 182 project upwardly above the surface of the platform 66, and move through slots 185 which extend laterally from the comb teeth 178, and which are formed in the insert 174.

As may be viewed in Figures 1, 3 and 4, the hooks 182 have longitudinally extending hook ends 184 which before spreading, as shown in Figure 4, lie up against the fingers 178. The binding member 30 will be dropped over the teeth 178 of the comb member 180 and the comb member shifted longitudinally, so that the ends 184 of the hooks 182 will pass over the curled fingers of the binding member. The hooks 182 will then be drawn laterally from the position shown in Figure 4 to the position shown in Figures 1 and 3 to open the curled fingers.

The comb 180 is mounted on a carriage member 186 which is shiftable in a longitudinal direction. For shifting the comb, cam followers 188 and 190, Figures 3, 4 and 5, project below the carriage and are operated by cam plates 192 and 194. The cam plates are supported on a pivotally mounted shaft 196, which is carried at its ends in the pedestals 14 and 16. The cams 192 and 194 are arranged relative to the followers 188 and 190 so that the comb 180 is positively moved to the left, as shown in Figure 1, by the cam 192 acting on the follower 188, as shown in Figure 5. This movement will carry the binding member 30 to the left so that the hook ends 184 enter the curled fingers.

The comb 180 is positively moved in the opposite direction by the cam 194 acting on the follower 190 to shift the comb to the right away from the finger ends 184.

The resilient fingers 34, 36 and 38 are drawn to the spread or open position by sliding a hook supporting bar 198 to the left, as shown in Figures 3 and 4. The hooks 182 are each secured to the bar 198 which is slidably mounted on guide rods 200, 200. Bosses 202 extend downwardly from the ends of the hook supporting bar 198 to be connected to hook-operating links 204 and 206, Figure 5. The hook-operating links are pivotally connected at their ends by pins 208 and 210 to the face of the cams 192 and 194. Thus, pivotal movement of the shaft 196 will operate both the comb and the hooks. As the shaft 196, Figures 3 and 4, moves in a counter-clockwise direction from the position of Figure 4 to the position of Fig-

ure 3, the cam 192 will first push the carriage 186 and its comb 180 to the left, as shown in Figure 1. Continued pivotal movement of the shaft 196 will push the hook-supporting bar 198 to the left from the position of Figure 4 to the position of Figure 3, thereby opening the resilient fingers 32, 34 and 36. When the stack of sheets has been placed over the fingers with the ends of the fingers passing through the holes in the sheets, the shaft 196 is rotated back, whereby the fingers will be released to curl back to their normal position, and the comb teeth 178 will then be positively shifted to the right, Figure 1, by action of the cam 194 and the follower 190.

Pivotal movement of the binding drive shaft 196 is obtained by a crank 212 at the end of the shaft.

The crank 212 carries a follower 214 which rides in a positive action closed cam track 216 on a cam 218. The cam 218 is mounted on the operating shaft 62. The cam track 216 has a holding portion 220 which is of constant radius from the center of the operating shaft 62, and an operating portion 222 which is of varying radius from the center of the shaft 62.

While the operating handle 44 is being swung through the arc from position I to position B, which is the binding portion of the arc, the follower 214 is in the operating portion 222 of the cam. This forces the cam follower 214 from the position shown in Figure 4 to the position shown in Figure 3, and back. While the operating handle 44 is swung through the arc from position I to position P, the follower 214 is in the portion 220 of the cam track, and the binding elements are held in fixed positions for receiving a binding member 30.

As illustrated in Figure 5, the crank arm 212 is secured to the end of the shaft 196, and the follower 214 at the end of the crank is in the form of a roller 224, journaled on a follower pin 226 mounted at the opposite end, also carrying a follower 230, operated by a cam 232, and the cam 232 operates in a manner identical to the cam 218 and, therefore, the parts need not be described in detail.

In operation of the mechanism, the operator begins with the handle 44 in the position shown at I, and places a stack of sheets to be bound in the throat 78 against the stop surface 70. The handle 44 is then brought down to position P, whereupon the operating shaft 62 is pivoted to pivot the punch-operating cam 148 from the position of Figure 3 to the position of Figure 4. This straightens the toggle links 132 and 134, and the operating bar 100, Figure 7, drives the punches 82 downwardly into the die openings 80. When the handle 44 is brought back to the position I, the punches 82 are released by the operating bar 100 moving upwardly. The punches are positively lifted in a positive stripping action through links such as 234 and 236, which are connected between the operating bar 100 and the ends of the punch lifting bars 90. The stack of punched papers is then lifted from the lower platform 64 to the upper platform 66. During the time the papers are being punched, the comb 180 and the hooks 182 are held in position to receive the binding member 30 which may be placed on the machines by an operator or by an assistant, since this may be done simultaneously with punching the sheets. The binding member 30 is dropped over the teeth 178 of the comb member 180. The punched sheets are transferred from the punching platform 64 to the binding platform 66. The handle 44 is then swung through the binding arc from the position I of Figure 4 to the position B. By operation of the binding cam 18, the binding shaft 196 is pivoted in a counter-clockwise direction from the position of Figure 4 to Figure 3, to first move the teeth 178 to the right, as shown in Figure 1, and then to draw the hooks 182 which have engaged the resilient fingers of the binding member from the position of Figure 4 to the position of Figures 1 and 3. The individual fingers 34, 36 and 38 are then inserted into the holes in the stack of sheets and the operating handle 44 is brought back from the position B to the position I. This returns the hooks 182 to the position of Figure 4,

and also shifts the teeth longitudinally so that the fingers of the binder move out from under the ends 184 of the hooks. The binding of the stack of sheets is thus completed to form a bound booklet. During the time the handle is operating the binder elements, the punching elements are positioned so that a new stack of sheets can be positioned for another cycle. Thus, the machine can be operated continuously or selectively.

Thus, it will be seen that I have provided an improved binding device which operates in an improved manner performing both punching and binding operations, and which achieves the objectives and advantages hereinbefore set forth.

The mechanism is simple to operate, and forms a positive operation and control for the members operating at the punching and binding station. The operator draws the operating handle toward the punching station for the punching operation, and forces the handle toward the binding station for the binding operation.

The mechanism employs an improved operating device formed of parts related as to not require adjustment and to have a long operating life. Each of the parts is positively operated and positively positioned through a complete binding operation. While the mechanism is preferably designed and finds advantages in use as a portable binding machine, certain of the inherent features of the invention may be used to advantage in other environments.

I have, in the drawings and specification, presented a detailed disclosure of the preferred embodiments of my invention, and it is to be understood that I do not intend to limit the invention to the specific form disclosed, but intend to cover all modifications, changes and alternative

constructions and methods falling within the scope of the principles taught by my invention.

I claim as my invention:

- 5 In a mechanism for successively operating a plurality of elements such as, a punching mechanism and a binding mechanism, and maintaining one element inoperative during operation of the other; a frame, a rock shaft pivotally mounted on said frame, a drive member rectilinearly guided in said frame on one side of said rock shaft and adapted to have operative connection with a device to be operated; a rockable shaft on the opposite side of said rock shaft and adapted to have connection with a second device to be operated, for operating said device alternately of operation of said first mentioned
- 10 device to be operated, and means on said rock shaft for alternately operating said drive member and said rockable shaft, comprising two cams mounted on said rock shaft in angularly spaced relation with respect to each other, each having a closed cam track formed therein,
- 20 a follower roller rotatably mounted on said drive member and engageable with one cam track, a crank on said rockable shaft, a follower roller on the end of said crank engageable with the other cam track, said cam tracks having oppositely arranged operating portions and holding portions forming continuations of said operating portions, effecting operation of one member and holding the other member from operation during reciprocable movement of said rock shaft.

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Great Britain ----- Apr. 20, 1955