

Oct. 30, 1962

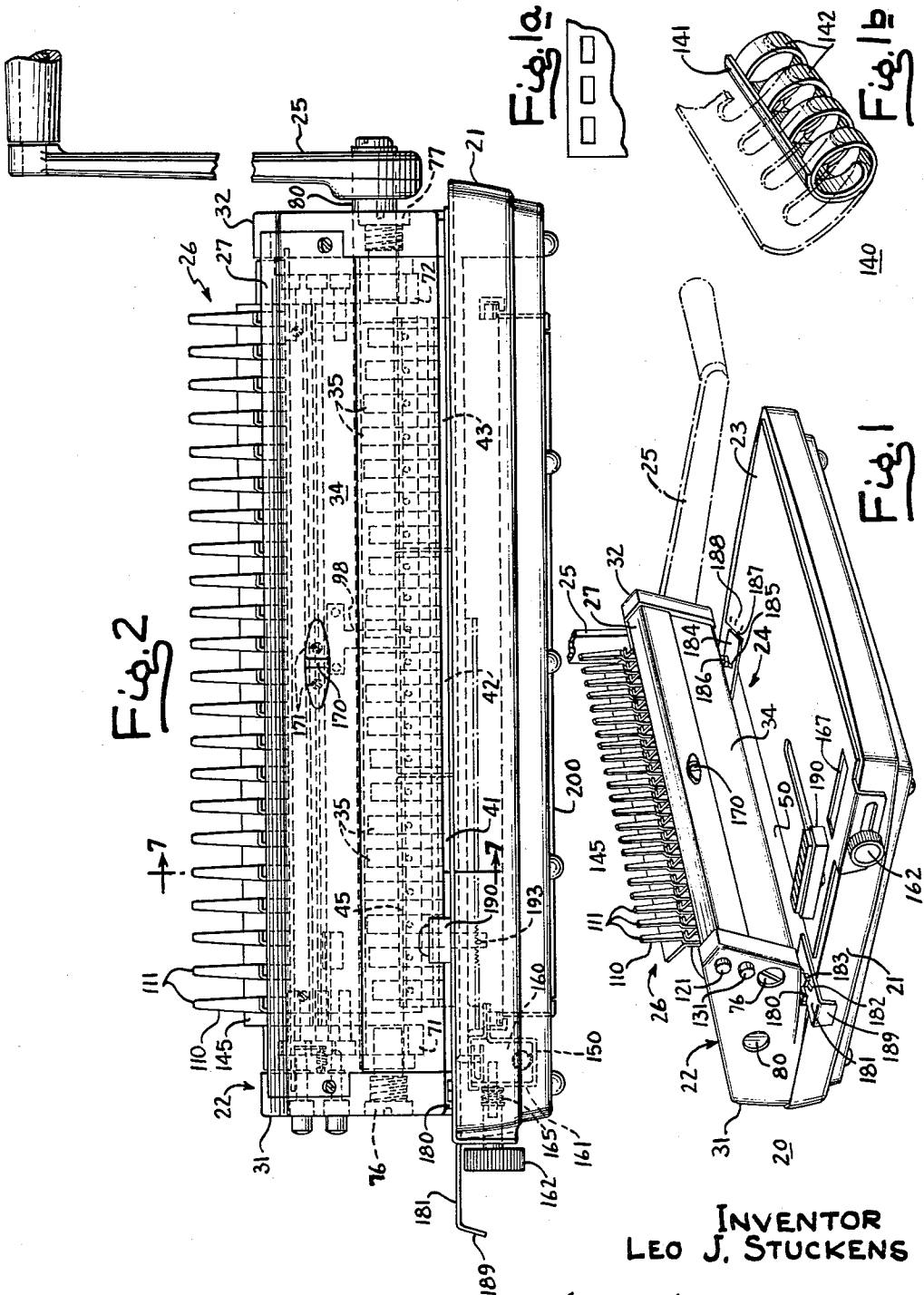
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3,060,780

PUNCHING AND BINDING MACHINE FOR OFFICE USE

Filed Feb. 1, 1960

5 Sheets-Sheet 1



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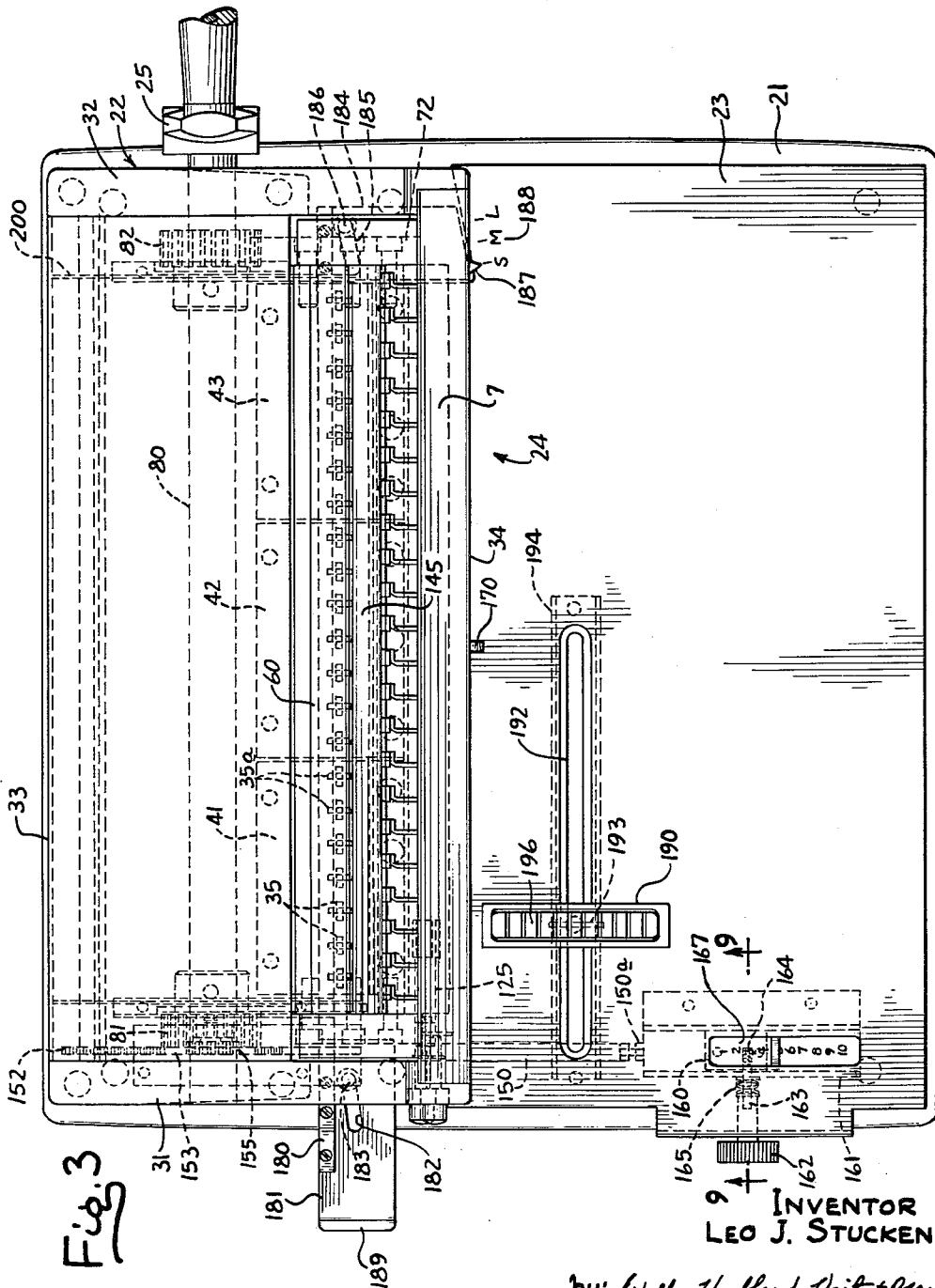
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5 Sheets-Sheet 2



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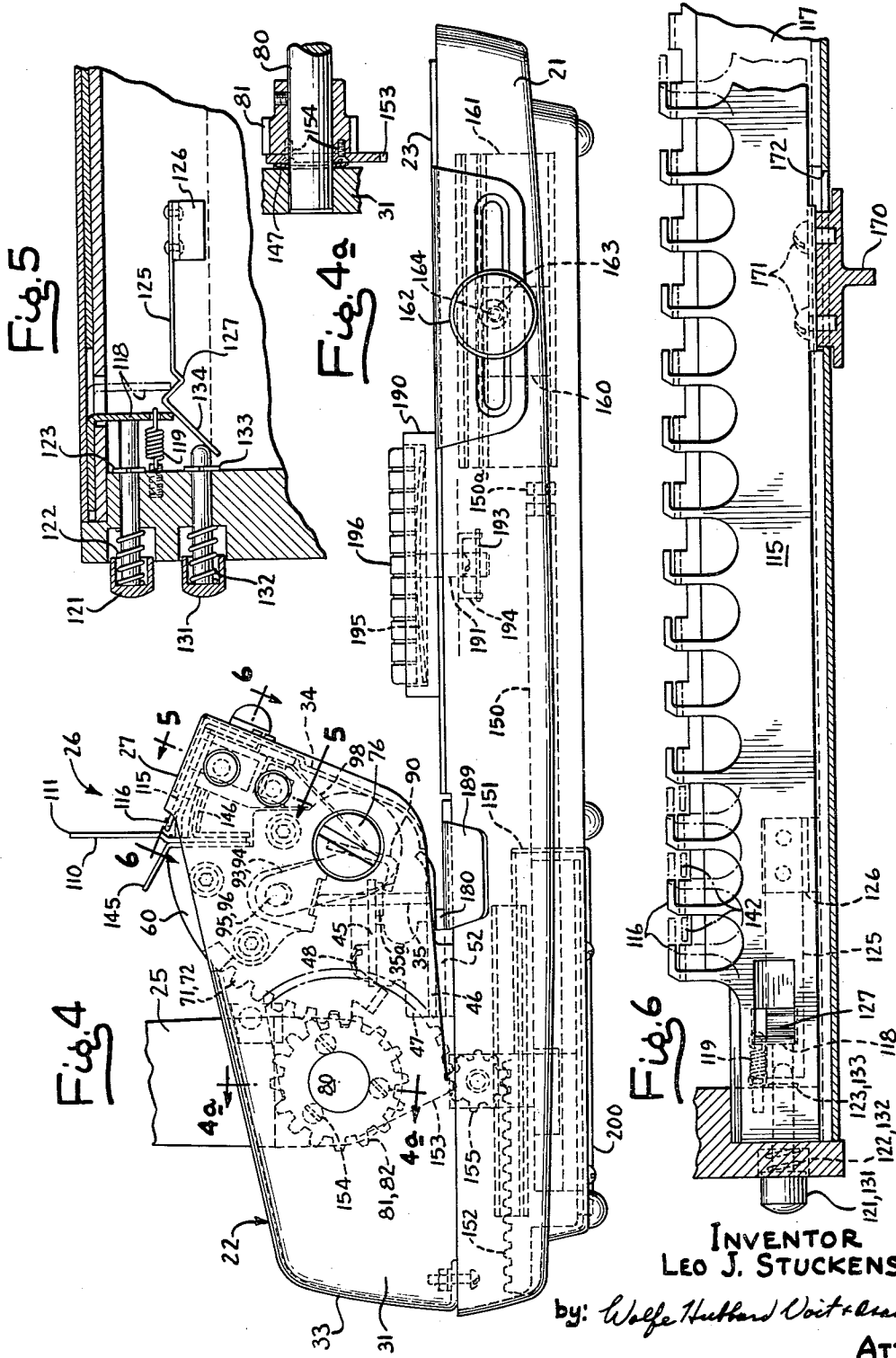
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PUNCHING AND BINDING MACHINE FOR OFFICE USE

Filed Feb. 1, 1960

5 Sheets-Sheet 3



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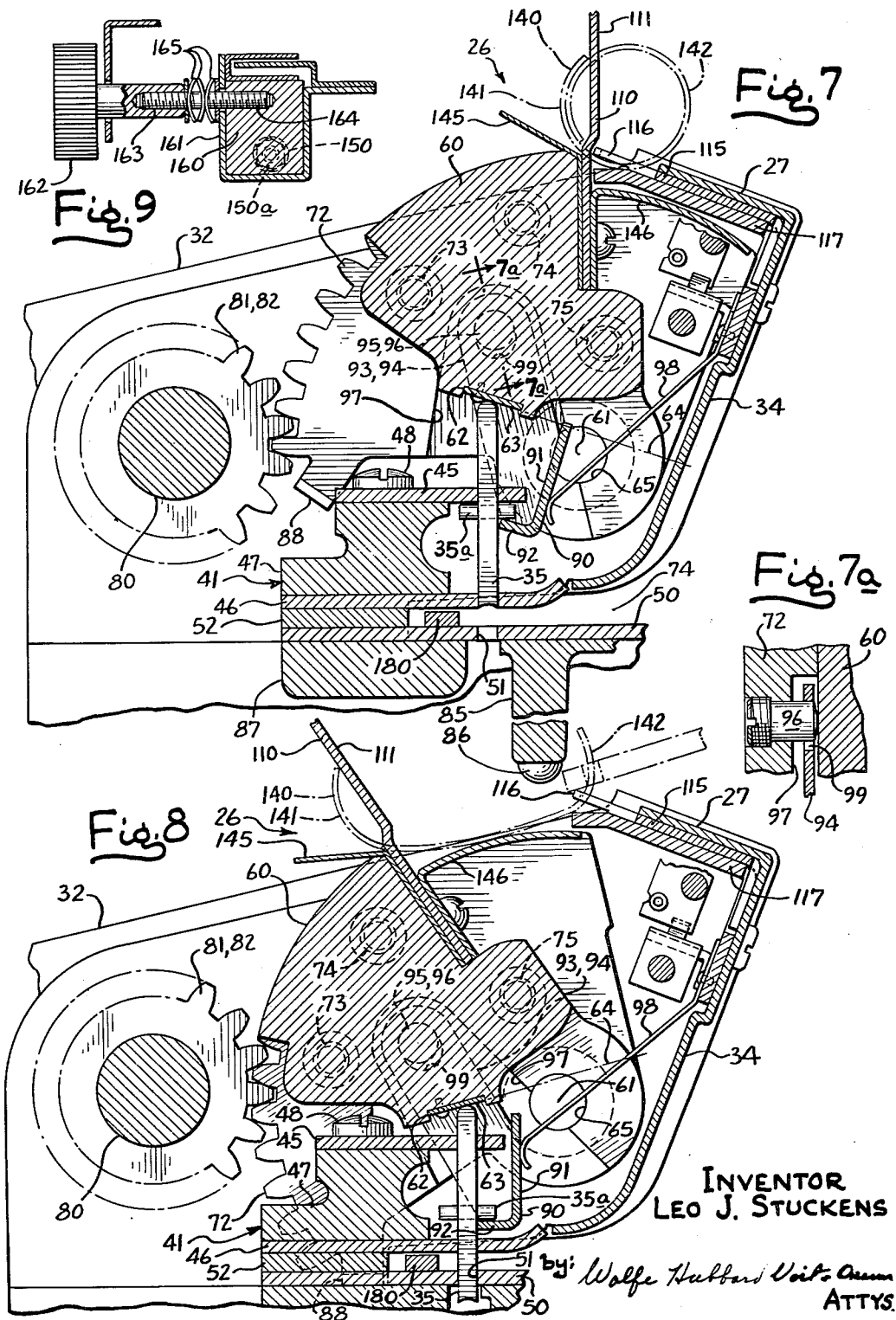
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PUNCHING AND BINDING MACHINE FOR OFFICE USE

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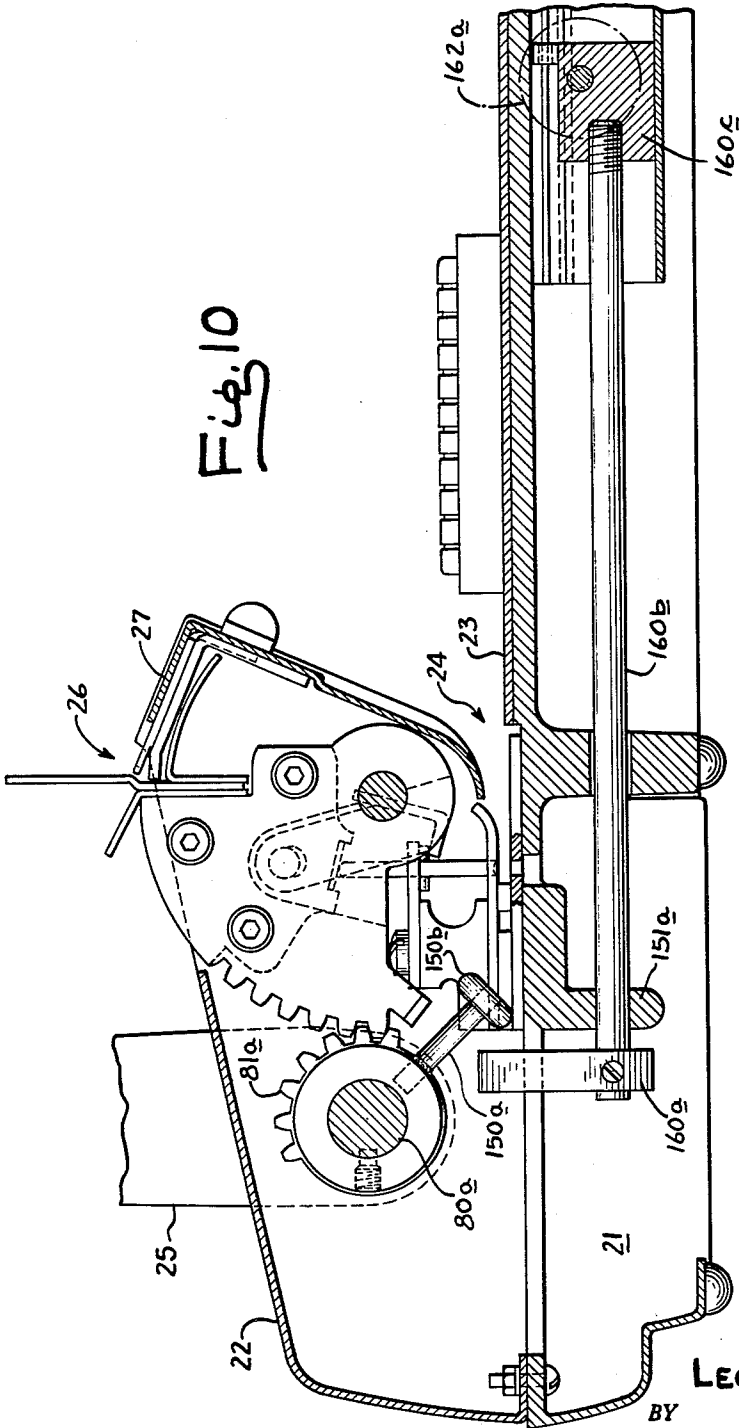
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PUNCHING AND BINDING MACHINE FOR OFFICE USE

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5 Sheets-Sheet 5



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PUNCHING AND BINDING MACHINE FOR OFFICE USE

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Filed Feb. 1, 1960, Ser. No. 5,988

2 Claims. (Cl. 83-590)

The present invention relates to machines for punching marginal holes in a stack of sheets and for engaging the punched sheets with a binding element made of flexible plastic or the like.

Binding elements of the type having a backing and a series of curled, flexible fingers for binding a stack of sheets into a booklet (as disclosed, for example, in United States Patent No. 1,970,285 to Douvry) have inherent advantages offering great potential for office use. Some of these advantages are convenience, positive retention of the sheets with the possibility of adding and subtracting, ability of the booklet to lie flat, and attractive appearance making the finished product well suited for advertising literature, sales presentations, catalogues and the like. Moreover, the binding elements are inexpensive and available in a wide range of sizes. The use of plastic binding elements has, however, tended to remain somewhat of a novelty largely because of the expense of separate punching and binding machines used in the past and because of the inconvenience and space requirements of such machines. Efforts have been made to combine the functions of the two machines, but such efforts have been successful because of the necessity for reconciling the diverse requirements of the punching and binding operations. The machines, in addition to being bulky and awkward to use, have been compromises of design, providing neither the inherent strength and accuracy required for punching nor the accessibility and fine degree of control required for binding.

It is, accordingly, an object of the present invention to provide a single machine capable of carrying out efficiently all of the punching and binding operations required in practical office usage. It is another object to provide a single punching and binding machine which is capable of meeting the diverse requirements of the two operations but in which most of the mechanical elements have a dual purpose, being employed in both of the operations. It is a related object to provide a punching and binding machine which is capable of handling sheets of a size employed in most offices but which is, nevertheless, of small dimension occupying minimum desk area and of flat, desk-hugging contour. Consequently it is an object to provide a punching and binding machine which is readily portable as a single unit enabling the machine to be carried to the work rather than requiring all of the work to be carried to a central machine location. This concept permits operating economies since it makes for more convenient work organization and less chance for mixup. Thus a few portable machines of the present design can service a large office having many separate departments where punching and binding operations may be carried out locally.

It is another object of the present invention to provide a punching and binding machine which is quick and convenient to use and which may be operated by relatively unskilled office personnel without any special training and yet with a high degree of reliability. In one of its aspects it is an object of the present invention to provide a novel punching and binding machine having a single operating arm for both punching and binding and in which the downward swing of the arm is utilized in both operations. In this connection it is an object to provide a

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machine intended for the separate operations but in which there is no compromise with efficiency, no interference of one function with the other. In the present machine there is no possibility that adjustments made for one of the operations will affect the usefulness of the machine for the other operation.

It is a further object related to the above to provide a punching and binding machine which cannot be broken because of carelessness or misuse. Thus to adapt the machine to a given size of binding element, stops must be adjusted to provide just the right amount of spreading of the fingers. However, when the machine is used for punching, large forces may be applied through the full stroke of the operating lever without risk of damaging the stops or associated parts. It is an object to provide a machine which, in spite of its small size, may nevertheless exert extreme punching pressures on the order of 10,000 pounds and may withstand the full weight of a 200 pound man without damage as may be applied, for example, when attempting to punch through metal or other sheet materials for which the device is not intended.

It is a related object to provide a punching and binding machine which is not only strong but which is mechanically efficient so that a thick stack of paper or the like may be punched with only a few pounds of effort on the operating arm. Thus the machine may be used for long periods on production runs without fatigue.

It is still another object to provide a punching and binding machine having a single operating arm but in which balanced torsional forces are applied at each end of the punching beam simultaneously, thereby equalizing the stress and distributing the small amount of wear which may occur as a result of many thousands of operations. It is a still further object to provide a punching and binding machine which is free of any wedging or binding action between the common operating member or beam and the individual punches which are operated upon by the beam. It is a related object to provide a machine capable of exerting large punching forces but in which the force is applied to an operating arm in a convenient downward direction and in which the machine is so constructed so that there is negligible deformation within the machine itself when the forces are applied and even distribution of the reaction force over a substantial area of the desk or table on which the machine is supported.

It is another object of the present invention to provide a novel punching and binding machine in which the punching operation occurs with the work flatly aligned on a worktable and in which the binding occurs in a position upraised from the worktable where the backing and the punched sheets are readily accessible for manual manipulation. Consequently it is an object of the present invention to provide a combined punching and binding machine in which both of the operations are performed with a degree of convenience which is equal to or greater than that of machines capable of accomplishing only a single function. In this connection it is an object to provide a punching and binding machine which is flexible in use having a wide range of adjustment for various diameters of binding element and various paper sizes and in which the adjustment may be accomplished quickly and conveniently, with the setting conveniently visible to the operator at all times. It is a more detailed object to provide a punching and binding machine which is capable of accepting binding elements regardless of condition and particularly where such elements have become warped or twisted due to lengthy storage in a heated environment.

It is an object of the invention in one of its aspects to provide, in a punching and binding machine, a novel punch retracting means capable of stripping the punches from the dies on the return stroke of the operating arm,

a retracting means which is positive in operation but which, nevertheless, provides a novel lost motion connection to prevent bottoming of the retractor at the end of the punching stroke.

It is still another object of the present invention to provide a machine which employs its materials of construction more efficiently than conventional machines, producing a machine which is not only compact and light in weight but which is made up of a minimum number of moving parts, enabling the machine to be economically manufactured and easily maintained. It is still another object to provide a machine which may be operated all day long over long periods of time without requiring any maintenance except for a few drops of lubricant from time to time.

Other objects and advantages will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIGURE 1 is a perspective view of a punching and binding machine constructed in accordance with the present invention.

FIG. 1a shows a fragment of a typical stack of punched sheets.

FIG. 1b shows a fragment of a typical binding element.

FIG. 2 is a front elevation of the machine shown in FIG. 1.

FIG. 3 is a plan view of the machine shown in FIG. 1.

FIG. 4 is a left side view.

FIG. 4a is a section taken along the line 4a—4a in FIG. 4 showing the friction loading means.

FIG. 5 is a fragmentary section taken along the line 5—5 in FIG. 4 and showing means for operating and releasing the hook bar.

FIG. 6 is a section taken along the line 6—6 in FIG. 4 showing the hook bar in profile.

FIG. 7 is a fragmentary transverse section taken along the line 7—7 in FIG. 2.

FIG. 7a is a fragmentary section taken along the line 7a—7a in FIG. 7.

FIG. 8 is a view similar to FIG. 7 but showing the mechanism in the extreme operated position.

FIG. 9 is a fragmentary section taken along the line 9—9 in FIG. 3.

FIG. 10 is a fragmentary vertical section illustrating a modified form of the machine.

While certain illustrative machines and modifications have been shown in the drawings and will be described below in considerable detail, it should be understood that there is no intention to limit the invention to the specific forms disclosed. On the contrary, the intention is to cover all modifications, alternative constructions, equivalents and uses falling within the spirit and scope of the invention as expressed in the appended claims.

Turning now to the drawings, a punching and binding machine constructed in accordance with the present invention is generally indicated at 20 in FIG. 1. It includes a flat rectangular frame 21 having an upstanding housing 22 extending across its rear portion. At the front of the machine is a flat work table 23 having a work receiving throat 24 into which a stack of sheets is inserted for punching of a marginal series of holes. The punch structure will be spelled out in detail at a later point, and it will suffice to say that the punching mechanism is operated by pressing down an arm 25 at the right hand side of the machine through an angle of about 90° to produce a stack of punched sheets (FIG. 1a). In upraised position along the front edge of the housing 22 is a spreading assembly generally indicated at 26 provided with a narrow elevated work table 27. In use the spreader assembly 26 spreads apart a binding element (FIG. 1b) uncurling the fingers so that they extend upwardly to receive a stack of punched sheets registered thereon, the fingers being subsequently allowed to curl into closed position to form the completed, bound booklet.

For mounting the mechanism to be described, the rear

portion of the frame includes a pair of end members 31, 32 mounting a back cover plate 33 and a front cover plate 34. Extending from one side of the machine to the other between the end members is a series of punches 35. These punches may, for example, be twenty-one in number and serve to perforate the edge of the sheets with a series of rectangular holes of the proper size and spacing to employ binding elements of the type commercially available. Because of the large total number of punches, as is conventional in punching machines intended for this usage, the punches are divided up into three sets or banks indicated at 41, 42, and 43 respectively. Taking the bank 41 as representative (FIG. 7) it will be noted that the punches are mounted for reciprocation in an upper guide plate 45 and a lower guide plate 46 having registering holes and separated by a spacer block 47. This assembly is held together by means of suitable screws 48. For cooperating with the punches, each bank has a die plate 50 having die openings 51. The leading edge portion of the guide plate 46 is preferably bent upwardly as shown to prevent the inserted sheets from getting "hung up" as they are inserted. To determine the thickness of the throat 24 into which the sheets are inserted, a spacer plate 52 is provided, sandwiched between the plates 46, 50. The depth of insertion, and hence the spacing between the perforations and the edge of the stack of sheets is determined by an insertion stop which is adjustable and which will be described in detail at a later point.

For the purpose of operating all of the punches 35 a beam is provided which extends the length of the punch row and which is pivoted about a horizontal axis laterally spaced from the punches for broadwise rocking movement. The downward component of this rocking movement is utilized to press the punches through the sheets. In the present embodiment the beam, generally indicated at 60, is pivoted about a horizontal axis 61 spaced in front of the punches 35. It will be understood that this beam has a cross section as illustrated in FIG. 7 which, while irregular in shape, is constant from end to end and hence easily machined. Formed in the underside of the beam 60 is a groove 62 which seats a flat wear plate 63, the latter being preferably formed of hardened steel. The geometrical plane of this wear plate, as shown at 64 in FIG. 7, preferably lies slightly above the axis of pivoting 61. As will be apparent to one skilled in the art, this offset provides additional clearance for the punches which lie directly below, making it possible for the beam to be pivoted at a lower level than would otherwise be possible while at the same time achieving a maximum vertical force component as covered more fully below.

Prior to describing the operation of punches, more detailed reference may be made to the means for mounting the beam 60. For this purpose gear sectors 71, 72 are provided at each end of the beam 60, being secured thereto by means of machine screws 73—75. Each of the sectors 71, 72 has a central or hub portion which is located below the level of the beam 60 and which is bored, as indicated at 65, for reception of a stub shaft on the axis 61. One such stub shaft is shown at 76 in FIG. 2, the other at 77. Thus each of the sectors is separately pivoted to the adjacent frame plates 31, 32 respectively.

For the purpose of rocking the beam 60 rearwardly with a good mechanical advantage and with convenient downward direction of movement of the operating arm 25, an operating shaft is provided to the rear of the sectors having individual pinions thereon for engaging the sectors. In the present instance, the operating shaft, indicated at 80 and which is journaled at its ends in the end plates 31, 32, carries pinions 81, 82. At its right hand end the operating shaft is preferably extended as shown in FIGS. 2 and 3 for engagement by the operating arm 25, which is preferably of sturdy construction. If desired, shaft 80 may be reversed end for end to put the operating arm on the left-hand side. The pinions 81, 82

and the sectors 71, 72 are preferably made of steel, while the beam is made of aluminum alloy. The gear ratio between the pinions and sectors is preferably on the order of 2.5:1. Because of the gear ratio, movement of the operating arm through about 90°, from a vertical position to a horizontal position, is effective to produce approximately 35° of rearward rocking movement of the beam 60. In order to insure that force is applied to the punches as nearly as possible "in line," in other words, in order to minimize the side thrust applied to the upper ends of the punches 35, the wear plate 63 is so oriented that the thrust angle between the plate and an individual punch is equally divided on both sides of the ideal "in line" condition. Thus in the present device, the thrust angle varies from about 17.5° at the upper end of the stroke (FIG. 7), through zero, to 17.5° at the completion of the stroke (FIG. 8). The punches are rounded at their upper ends. This achieves an optimum condition, minimizing friction and minimizing any tendency toward binding between the punches and the guide plates in which they slide. Stated in other terms, a directly "in line" force is applied to the punches approximately midway in the movement of the beam and at the time of maximum loading. Moreover, the maximum "free" or upwardly extended length of the punches 35 is kept to a very low value in the present construction to reduce the bending moment and to remove the possibility that a punch will be bent or broken when unusual force is applied as, for example, when punching through sheets other than paper.

It is to be noted that efficient force transmission is achieved with a simple flat wear plate of spring steel or the like without going to the complexity and expense of an arcuate or specially profiled wear plate. And while the two pinions operate on the sectors in unison, it will be appreciated by one skilled in the art that perfect phase positioning of pinions and sectors is not necessary to secure balanced loading, since there is sufficient resilience in the shaft to compensate for minor non-symmetry.

In spite of the relatively light, portable construction of the punching mechanism, the device is capable of developing punching forces as high as 10,000 pounds without damage or permanent deformation corresponding the application of a 200 pound force at the end of the operation arm. In order to resist the reaction force and to spread the force over the supporting surface, the frame structure preferably includes a beam 85 extending along the underside of the die and having supporting pads 86 of rubber or the like closely spaced thereon. A cooperating beam 87 provides additional support.

Using the structure described herein, adequate punching force for penetration of a stack of sheets filling the throat 24 may be secured with only a few pounds of operating pressure. Thus the device may be used by an office girl for production runs without fatigue. To further reduce the force required, the punching is caused to be progressive within each of the banks of punches 41, 42, 43 by making the punches of unequal length so that they enter the stack of sheets in succession. Upon completion of the stroke, rubber pads 88 on each of the gear sectors cushion the impact.

In accordance with one of the aspects of the present invention, a retractor member pivoted to the gear sectors 71, 72 at an eccentric position is provided for retracting all of the punches 35 on the return stroke. Such retractor member indicated at 90 (see FIG. 7) is of L-shaped cross section having a back 91 and a lip 92 with the lip extending closely along the front surfaces of the punches 35. The retractor is supported at its ends on integral hangers 93, 94 respectively pinned to the respective gear sectors by pins 95, 96. In order to provide clearance between the end of the beam and the face of the sector sufficient to accommodate the hangers, each sector is preferably channeled out on its inside surface as indicated at 97 (see also FIG. 7a). In order to couple the

lip 92 of the retractor to the individual punches, each of the punches 35 has a transverse pin 35a pressed therein, and the retractor is biased toward the punches by a leaf spring 98. Because of the eccentric location of the pivot axis of the retractor, the retractor tends to move downwardly upon rocking of the beam at a slightly greater rate than the punches and consequently the retractor does not interfere in any way with the downward thrust of the punches. In order to prevent bottoming of the retractor 90 at the end of the stroke, a slight amount of lost motion is provided as indicated at 99 (FIG. 7) between the hangers and the pins which they engage. When the beam is rocked upwardly (clockwise) for retraction of the punches, the lost motion is first taken up, following which the lip 92 hooks under the punch pins 35a pulling the punches out of the work and restoring them to the position shown in FIG. 7.

Turning next to the binding function, and in accordance with one of the important features of the present invention, two sets of cooperating spreading elements are provided, one being located along the upper edge of the beam 60 for movement therewith, and the other being mounted in the frame of the machine so that when a binding element is engaged between them, the fingers are spread into open position incident to rocking the beam about its axis. From the viewpoint of an operator, it is sufficient to grasp the stack of sheets which has been punched by the machine, lifting them a few inches from the work table and threading them onto the presented tips of the binding fingers, following which the fingers are allowed to curl inwardly to complete preparation of the bound booklet. In the present construction the spreader assembly indicated at 26, includes a comb 110 which is mounted along the upper edge of the beam 60 and which has spaced, upwardly projecting teeth 111. Arranged on the frame to cooperate with the comb is a second, relatively stationary spreader member 115 in the form of a hook bar having hooks 116 (FIG. 6) which normally register with the teeth 111 of the comb. Means are provided for producing relative endwise movement between the comb 110 and the hooks 116 so that the hooks engage the individual fingers of the binding element when the element is inserted in seated position on the comb 110. In the present instance such movement is brought about by mounting the hook bar 115 for sliding movement on a hook bar supporting plate indicated at 117. The front cover plate 34 is rearwardly bent along its upper edge to overlie the hook bar and to form, in effect, the narrow elevated work table 27 previously referred to.

In order to understand the means employed for biasing a hook bar into its normal position and for latching the same endwise in its operating position, reference is made to the latching mechanism shown in FIGS. 5 and 6. There it will be seen that the hook bar 115 is provided with a downwardly bent tab 118 to which is secured a biasing spring 119 connected to the left hand end member 31. To move the hook bar into active position from its normal retracted position, a latching plunger 121 is provided which is urged outwardly by a spring 122 and which is maintained captive by a clip 123. It will be apparent that upon pressing the plunger 121, the tab 118 which it engages, along with the hook bar itself, will be moved to the position shown dot-dash in FIGS. 5 and 6 in which the hooks engage the fingers of the binding element. To retain the hook bar in its active position, a latch is provided in the form of a leaf spring 125 mounted on a small bracket 126 and having an upraised catch 127 formed by a depression or detent in spring 125. To return the hook bar to its normal position, a release plunger 131 is used having a spring 132 and kept captive by a clip 133. To deflect the spring 125 for release, the spring has an angularly bent cam portion 134 arranged in the path of movement of the plunger 131. It will, therefore, be apparent that upon pressing the plunger 131, the spring 125 will be cammed downwardly, thereby causing the hook 127

to slip clear of the catch 127, so that the hook bar is restored to its normal left-hand position.

In use, a binding element indicated at 140 in FIG. 7 and having a backing portion 141 with integral curled fingers 142, is seated on the comb 110 with the backing portion being firmly seated against the back of the comb and with the fingers projecting forwardly through the teeth of the comb. In order to make it easier to seat a binding element on the comb, a rearwardly extending support plate 145 is provided, sandwiched between the comb and the beam and providing a rearwardly extending "shelf." In a typical case after a binding element 140 is seated as shown in FIG. 7, the locking plunger 121 is pressed to engage the hooks with the individual fingers 142 (FIG. 6).

It is one of the features of the present device that the same movement of the operating arm 25 which produces punching of the sheets is utilized to produce spreading of the binding element, with the vertical component of movement of the beam being used for punching and the horizontal component being used for spreading. Thus downward movement of the operating arm produces rearward movement of the beam 60 and the comb thereon. As a result, the binding element is spread so that the fingers are uncured into the position shown in FIG. 8 where the tips of the fingers are upwardly projecting ready for threading of a stack of punched sheets thereon. In order to provide support for the intermediate portions of the fingers during the uncurling, a curved support plate 146 is provided, secured to the front surface of the comb member 110. This supporting plate 146 also performs the function of keeping the gap in front of the comb closed so that foreign objects cannot drop into the machine. In order to retain the comb in its rearwardly rocked position so that both hands of the operator may be employed to thread the stack of sheets onto the tips of the binder fingers, a friction element is used which, in the present instance, is in the form of a friction spring washer 147 interposed between the pinion 81 and the adjacent frame member 31 (see FIG. 4a).

In accordance with one of the aspects of the present invention, novel stop means are provided for limiting the degree of rearward rocking movement of the beam 60 and the attached comb 110 including a yieldable connection so that the beam may be swung through its entire range of movement in a subsequent punching operation without damage in the event that the operator fails to release the stop. In order to understand the structural features of the stop, particular reference is made to FIGS. 2, 3, 4 and 9. Extending forwardly within the frame and under the table at its left hand side is a stop member or plunger 150 which has a rack 152 at its rear end mounted in a guide 151. For the purpose of coupling the rack to the operating shaft, a sector gear 153 is provided which may be secured to the shaft by any desired means, for example, by machine screws 154 threaded into the side wall of the pinion 81 (see FIGS. 4, 4a). In order to produce the proper direction of movement of the plunger 150, an idler pinion 155 is interposed between the sector 153 and the rack 152. It will therefore be apparent that when the operating arm 25 is rocked downwardly there will be proportional forward movement of the plunger 150. For the purpose of stopping such movement at a predetermined point, a stop 160 (FIGS. 3 and 9) is arranged in the path of movement of the plunger and in a slide 161 which lies underneath the table of the machine.

For the purpose of clamping the slide 160 in an adjusted position, a clamping and setting knob 162 is used, such knob having a threaded connection 163 with a stud 164 mounted in the stop 160, the wall of the guide member 161 being appropriately slotted to clear the stud 164. In use, the knob 162 is loosened enabling the knob to be moved forwardly or backwardly to prop-

erly position the stop 160. The proper setting is visible at the top of the table on a scale indicated at 167, the scale being calibrated in terms of the standard sizes of binding elements. To insure accuracy of calibration, contact between the plunger 150 and stop 160 does not take place directly but rather through an adjustable screw 150a mounted at the tip of the plunger. When the plunger is opposite the size of binding element being used, the knob 162 is screwed tight thereby fixing the stop 160 in blocking position. However, in carrying out the invention, a yieldable friction connection is provided in the form of a stack of spring washers 165 interposed between the knob and the wall of the guide member and the threaded connection 163 is designed to "bottom" after a predetermined amount of stress is applied to the spring washers. This limits the amount of friction which can be applied by the spring washers against the guide 161, and consequently the stop 160 is frictionally positioned rather than being positively positioned in the path of movement of the plunger.

The friction provided by the stop 160 is sufficient so that when the arm 25 is swung downwardly a point of resistance is felt by the operator, and the arm is not swung beyond this point. The arm stays in this position due to the friction provided by the friction washer 147 on the operating shaft so that the binding element 140 remains spread to just the right degree. Thus it is possible to employ both hands to assemble the punched stack of sheets on the fingers of the element. Following this the operating arm may be returned to its upwardly extending position and the release button 131 may be pressed enabling the hook bar to snap back into its normal position, following which the assembled booklet may simply be lifted off of the comb member 110.

In the above discussion it has been assumed that the binding element is straight so that it may be seated against the comb 110 without difficulty for engagement by the hooks on the hook bar. However, it sometimes happens that due to storage in a heated environment a binding element is warped or twisted so that the back portion thereof does not seat flatly against the comb. This is particularly true in the bindings of smallest diameter. Under such circumstances seating requires that all of the fingers of the operator be used to press the element against the comb. In order to make it possible for the hook bar to be operated when this is done, an auxiliary hook actuator is provided at the center of the machine easily engageable by the thumb of the operator. In the present instance this is accomplished by an auxiliary hook actuating member in the form of a small projection 170 (see FIG. 6) which is secured to the hook bar at its center by means of screws 171, and which projects through an opening 172 in the front cover plate 34 of the machine. While the projector 170 is primarily intended for moving the hook bar into return position, it is to be noted that the projector may be moved in the opposite or releasing direction without any damage to the latching mechanism. This is due to the fact that a latch 127 of the detent is non-positive rather than a positive latch.

It will be apparent that if the operator of the machine screws the knob 162 into a tight, bottomed position and forgets to release the knob after the binding operation is completed, damage to the machine in a subsequent punching operation will, nevertheless, be avoided because of the fact that the stop 160 is only frictionally maintained in position and may yield when a force is applied to it by the plunger 150 which exceeds the frictional retaining force. In this connection it may be noted that a man weighing, say, 200 pounds applying his full weight at the end of the operating arm 25 develops a torque of approximately 200 pound-feet, which torque would be capable of damaging the plunger 150 or some other element of the stop mechanism if

yielding did not occur. Note that in the first punching operation which occurs following binding, the stop 160 will be moved to the extreme end of the stroke of plunger 150 so that this frictional force will not have to be overcome each time the operating arm is moved. Thus, the punching and binding operations may be performed one after the other without risk and without any special care or attention on the part of the operator. Nonetheless, since the position of the stop 160 is at all times indicated on the scale 167 on the work table, the operator will normally be reminded to release the knob 162 before the punching is done.

Having understood the manner in which the mechanism is integrated for both the punching and binding operations, more detailed attention may be given to the means for positioning the sheets on the machine prior to punching. For the purpose of controlling the inward spacing of the perforations from the edge of the stack of sheets, i.e., for limiting the degree of insertion into the throat 24 of the machine, a stop bar is provided having angled cam surfaces at each end so that the position of the bar with respect to the punches is varied over a small range as the bar is moved endwise. Referring to FIG. 3 the stop bar is indicated at 180. For manipulating and guiding the bar at its left hand end, it is secured to a plate 181 having an angled slot 182 engaging a pin 183 in the frame of the machine. At the opposite or right hand end of the bar there is a plate 184 having an angled slot 185 engaged by a pin 186, the two slots of 182, 185 being parallel to one another. The right hand end plate is extended forwardly carrying a pointer 187 cooperating with a scale 188. At its left hand end the stop bar is provided with a downwardly turned tab 189 so that it may be easily grasped. In use, the stop bar is moved inwardly or outwardly by the tab to produce a desired setting at the scale 188, the latter being calibrated in terms of the size of the binding element with which the sheets are to be used. If desired, a detent may be provided at the common settings, but in any event friction will be sufficient to hold the stop bar 180 in a desired adjusted position. With the stop bar properly set, the sheets are simply inserted into the throat 24 of the machine as far as they will go.

For the purpose of laterally positioning the sheets on the table 23 a left hand stop is provided in the form of a stop bar 190 which is mounted on a carrier 191 slideable in a slot 192 formed in the table. For the purpose of locking the bar 190 in an adjusted position, the carrier 191 carries a shoe 193 which rides against the edge of a track in the form of an inverted channel 194, with the shoe being upwardly biased by a leaf spring 195. The edges of the channel may be either frictional, roughened or serrated. To relieve the pressure between the shoe 193 and the channel, the carrier 191 is preferably connected to a release knob 196 which is recessed in the bar 190 and which contacts the leaf spring 195. In use, downward pressure on the knob 196 releases the pressure at the shoe so that the bar 190 may be moved in one direction or the other. When it is released the force exerted by the spring 195 again brings the shoe into gripping position against the track so that the stop is locked in the desired position until intentionally released. Proper placement of this stop insures that the punches are centered with respect to the sheets being punched so that the holes do not "run off the edge" of the sheets. The bar 190 may be provided with a suitable scale on the table 23 calibrated in terms of the various sizes of paper to be handled.

For the purpose of collecting the "confetti" resulting from the punching operation, a drawer 200 is provided which extends under the table and below the die openings 51.

While the operation of the device will be apparent from the above description, it may be helpful to summarize it briefly. The initial consideration is the thick-

ness of the stack of sheets to be bound, and an appropriate diameter of binding element is selected. The insertion stop 181 is next adjusted to produce a suitable reading on the scale 188 thereby to adjust the inward spacing of the perforations from the edge of the sheet. Next, the stop bar 190 at the left side of the machine is released and moved to one side or the other in order to center the perforations so that a perforation does not "run off the edge." With the machine thus adjusted a stack of sheets is placed on the worktable with the binding edge in the throat 24, and the operating arm 25 is swung downwardly until it "bottoms." The arm is then intentionally upraised to retract the punches and to free the stack of sheets for withdrawal.

The selected binding element is placed upon the supporting plate 145 behind the comb and manipulated with the finger tips so that the binding fingers extend through the teeth of the comb. The pushbutton 121 at the left hand side of the machine or the auxiliary hook actuator 170 at the front of the machine is operated, whichever is more convenient. This latches the hook bar in its right hand or locking position in which each of the binder fingers is held captive by a hook on the hook bar. The adjusting knob 162 at the left hand side of the table is then moved backwardly or forwardly to an appropriate setting on a scale 167 indicating the nominal diameter of the binding element, following which the knob 162 is screwed tight. The arm 25 is then rocked forwardly and downwardly until the stop 160 is engaged, i.e., felt by the operator, at which point the fingers of the binding element will be uncured to just the right degree to allow threading of the stack of sheets. The sheets are then placed on the binder fingers with the rear portion thereof being supported on the auxiliary worktable. If the stack is unusually thick the tips of the fingers may be additionally extended by nudging the operating arm upwardly through a small distance. When the stack is fully assembled, the arm 25 is swung upwardly, allowing the fingers of the backing to curl into closed position. The release knob 131 at the left hand side of the machine is then pressed, tripping the latch and allowing the hook bar to snap to its left hand or open position, following which the completed booklet may simply be lifted from the comb.

In removing or replacing pages, the operation is equally simple. The completed booklet is threaded on the comb so that it rests on the auxiliary worktable 27 just in front of the comb. Assuming that the stop 160 is appropriately set for the binder diameter, the hooks are engaged by button 121 and the operating arm is drawn downwardly until resistance is felt, at which time the sheets may be lifted from the fingers or replaced as necessary. The arm 25 is then restored to its upraised position and the hook bar latch is tripped to enable the booklet to be removed.

In spite of the fact that the punching and binding stations are located one above the other, maximum convenience is afforded in each of the operations. That is to say the presence of the binding mechanism does not affect the punching and the punches are in an out-of-the-way position during binding. Each function is at least as readily performed as in machines intended for a single function. Note, for example, that the binding portions of the device are upraised in a convenient and accessible position while still enabling a low, desk-hugging contour for the overall machine.

In spite of the fact that two separate functions are performed by the machine, the machine weighs little more than single-purpose machines, and because of the light weight and compact dimensions, the machine may be readily moved from one department or work station to another as the need arises just as readily as a portable typewriter. The machine is, in effect, a portable "binding factory," completely self-contained and self-sufficient. Since both portions utilize the same movement of the

operator and since the adjustments are self-explanatory, the operation may be grasped immediately, even by untrained office personnel. Workers find the machine pleasant to use and even long production runs may be completed without fatigue.

While the invention has been described above in connection with a rack-actuated stop mechanism, it will be apparent to one skilled in the art that other specific coupling arrangements may be employed for the stop without departing from the invention. For example, in the interest of simplicity and economy the arrangement shown in FIG. 10 may be used, reference numerals corresponding to the first embodiment being applied with the distinguishing suffix "a." In this embodiment the member which engages the stop is rigidly connected to the operating shaft 80a and comprises a swinging arm 150a. The arm 150a is in the form of a pin press-fitted into the pinion 81a which is preferably of special profile and made of sintered metal. Arranged in the path of movement of the arm is a stop 160a having a plunger 160b which extends forwardly under the table and which carries a sliding block 160c captively secured at its forward end. The plunger is mounted for reciprocating movement in a slide 151a formed integrally in the frame. The frictional clamping arrangement for the block 160c may be the same as in the preceding embodiment (FIG. 9). The scale 167 should, however, be reversed, since increasing spreading movement is accompanied by rearward rather than forward movement of the plunger.

In order to accurately calibrate the stop arrangement at time of manufacture, stop 160a may be provided with a set screw enabling the stop to be adjusted backwardly or forwardly on the plunger. Moreover, to insure localized contact between the arm 150a and the stop 160a over the range of arm movement, the arm is preferably provided with a headed annular enlargement 150b which may be in the form of an annular collar pressed in place.

In use the operation is the same as that previously described. The adjusting knob 162a is screwed tight at a desired position of adjustment. A binding element is registered with the comb and the hooks are "set" in the usual way. The operating arm is then pulled down until a point of resistance is felt, indicating that the arm 150a has engaged the stop 160a. The sheets are then placed on the extended fingers. The arm is swung upwardly, the hook bar is tripped for release, and the completed booklet may be removed. If additional sheets should then be punched without releasing the knob 162a, the continued movement of the arm 150a will exert a force on the stop 160a which is greater than the frictional clamping force so that the block 160c will be moved to its end position, after which the stop 160a will remain in an out-of-the-way position during successive punching operations.

I claim as my invention:

1. In a punching and binding machine for use with binding elements having a backing portion and having a series of flexible curled fingers, the combination comprising, a frame having a work table, a series of punches and cooperating dies in the edge of the work table for perforating the margin of a stack of sheets on said work table, an elongated beam member overlying said punches for operating the same and journaled on the frame for

swinging movement about a horizontal axis adjacent said punches, means for swinging said beam about said axis including a sector gear fixed on said beam at each end thereof, an elongated punched retractor member generally L-shaped in cross section, means swingably mounting said retractor member parallel to said series of punches between said sector gears for free swinging movement about an axis spaced from and parallel to the axis of rotation of said beam, one leg of said retractor member comprising an intumed lip engaging each of said punches, a leaf spring biasing said retractor member towards the punches, said retractor member being pivoted to said sector gears along an axis spaced from the axis of rotation of said gears so that said retractor member is eccentrically located with respect thereto, said eccentric location of the pivot axis of the retractor member causing said retractor member to move downwardly upon rocking of the beam at a slightly greater rate than the punches so that said retractor member does not interfere with the downward thrust of the punches, said hangers being mounted on said pins for lost motion movement thereby to prevent said retractor member from bottoming on said work table.

2. In a punching and binding machine for use with binding elements having a backing portion and having a series of flexible curled fingers, the combination comprising, a frame having a work table, a series of punches and cooperating dies at the edge of the work table for perforating the margin of a stack of sheets on said table, an elongated beam member overlying said punches for operating the same, means journaling said beam on said frame for swinging movement about a horizontal axis adjacent said punches, a manual operator for said beam including a sector gear fixed at each end of said beam and rotating about said horizontal axis, a punch retractor member extending along said punches and having means for engaging the same when the retractor member is moved upwardly, and means including a lost motion connection mounting said retractor member on said sector gears for free pivotal movement in unison therewith, said pivotal mounting means being spaced from the horizontal axis of said sector gears and of said beam member thereby eccentrically pivoting said retractor member with respect to said beam, whereby said retractor member moves downwardly upon punch actuating swinging movement of said beam at a rate slightly greater than the rate of movement of the punches so that the retractor member does not interfere with the downward thrust of the punches, and said lost motion connection prevents said retractor member from bottoming on said work table.

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