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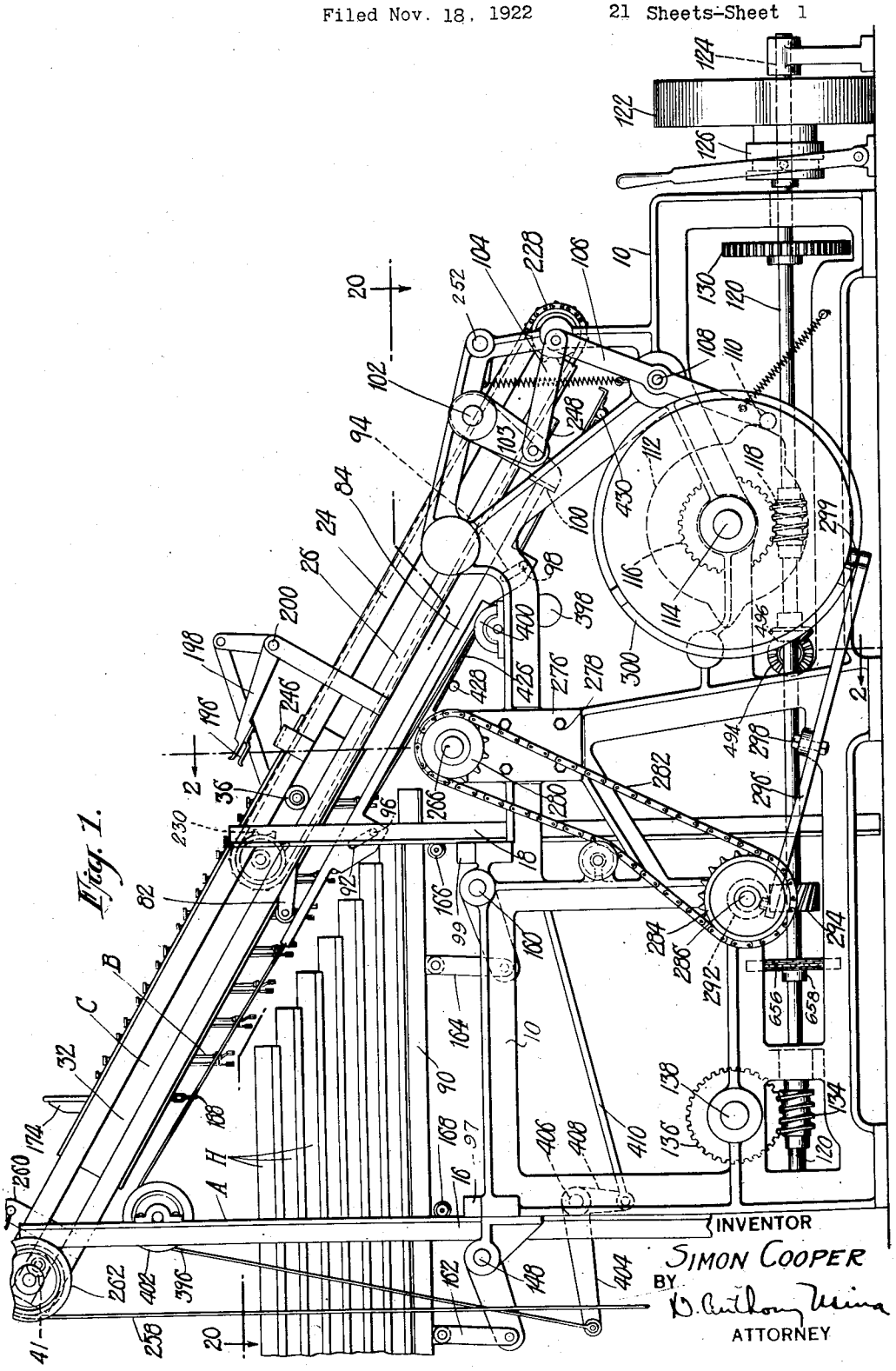


Fig. 1.

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SIMON COOPER
BY
D. Anthony Mina
ATTORNEY

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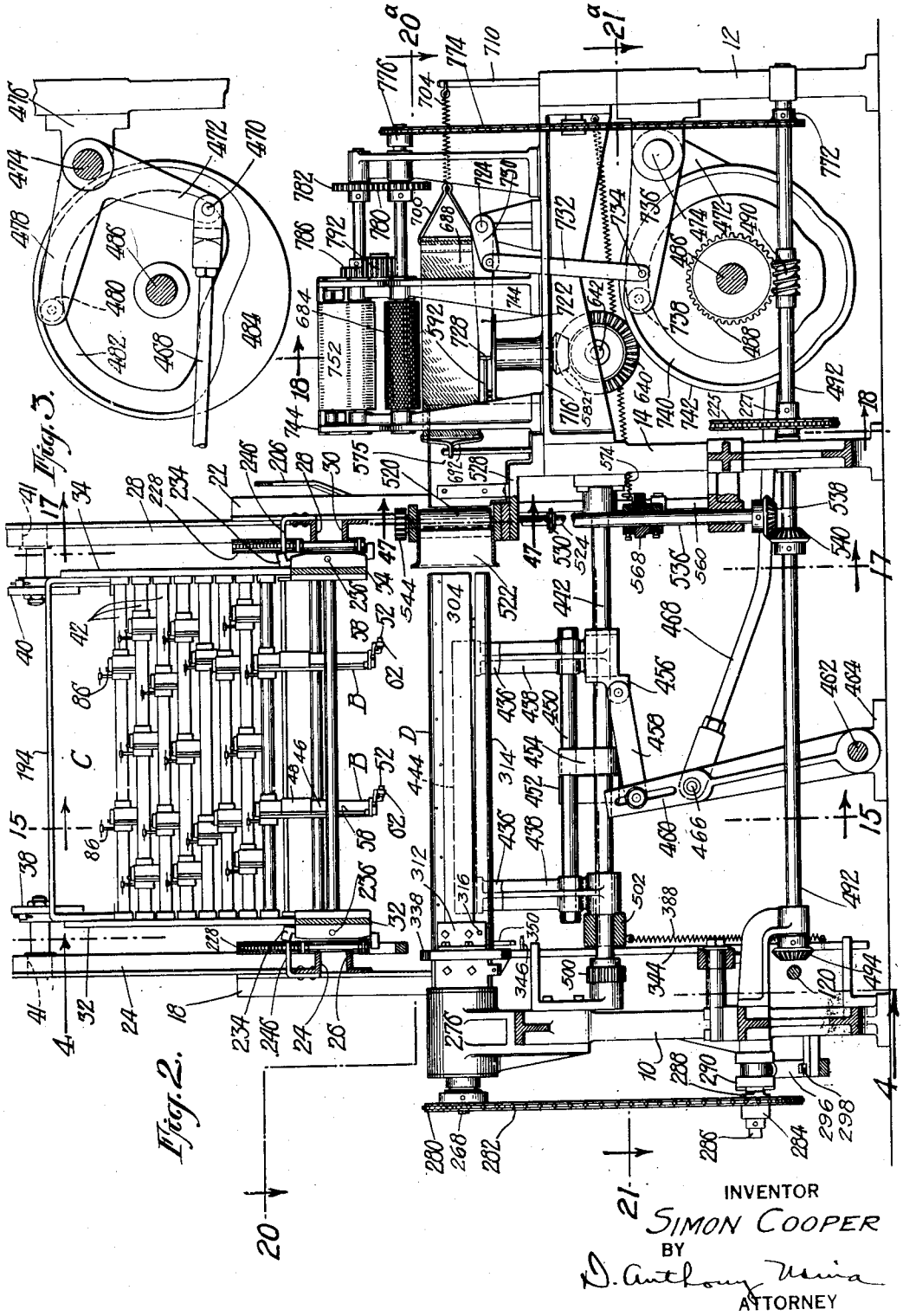


Fig. 3.

Fig. 2.

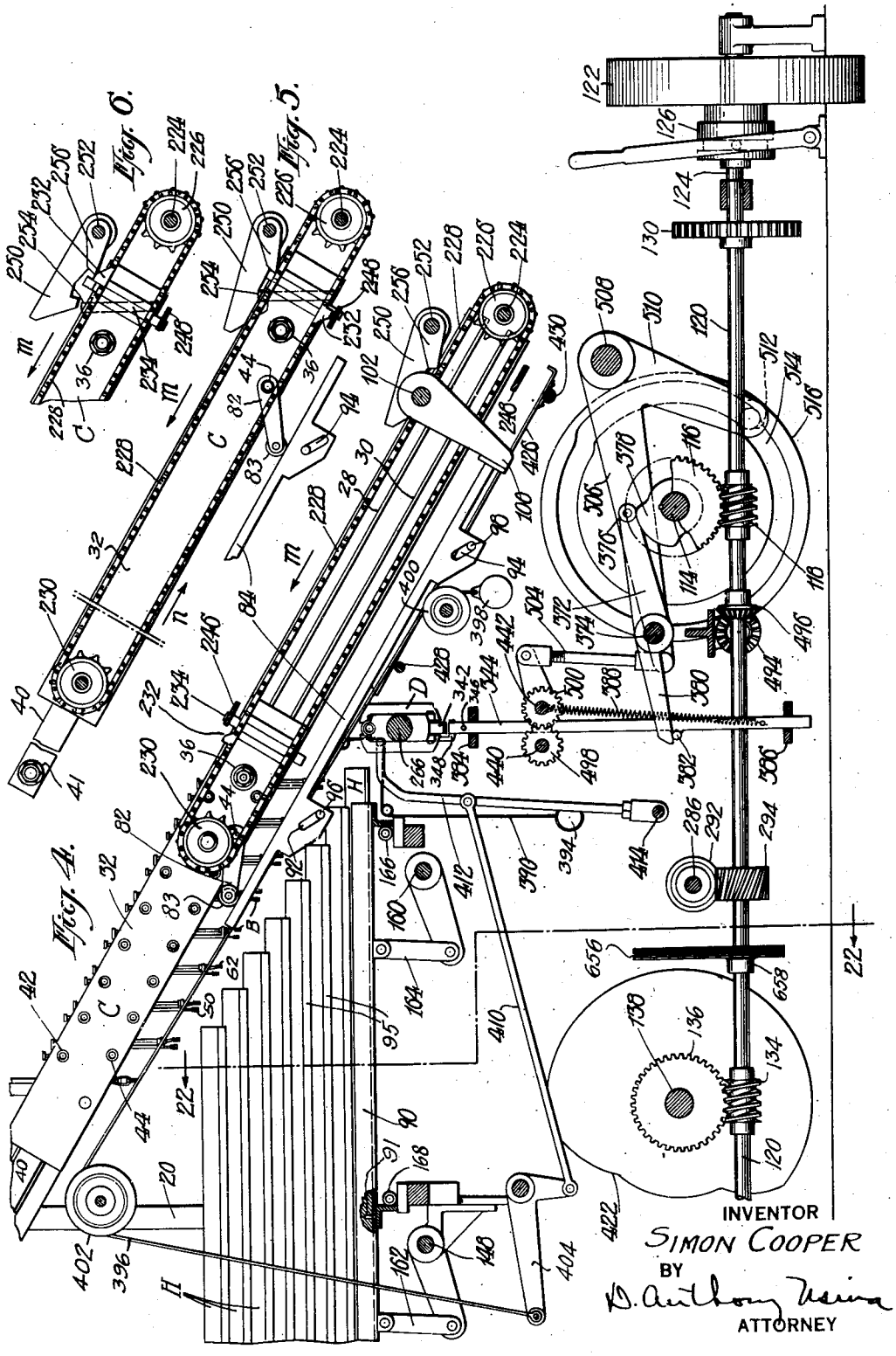
INVENTOR
SIMON COOPER
BY
D. Anthony Mina
ATTORNEY

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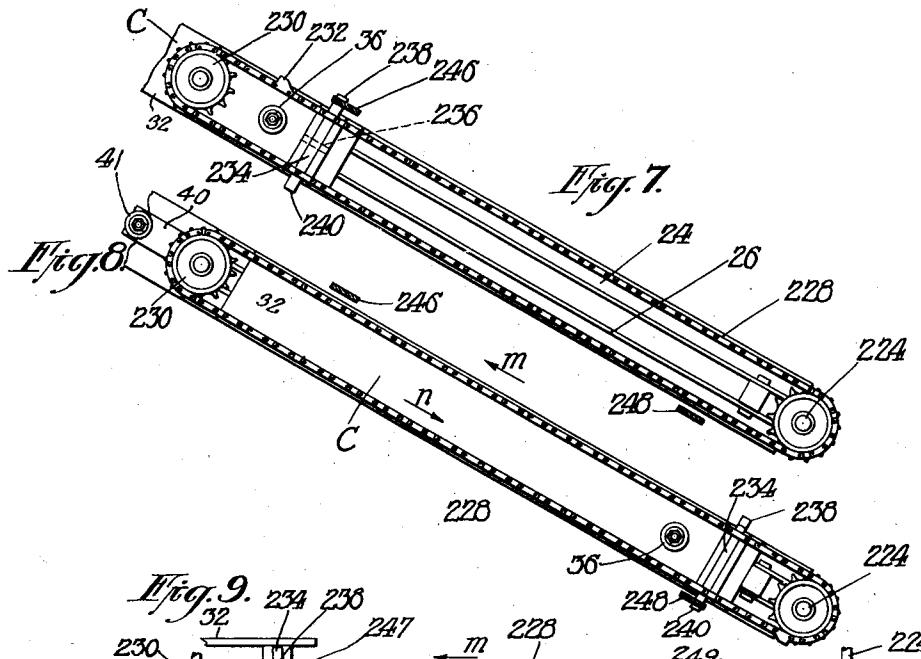


Fig. 7.

Fig. 8.

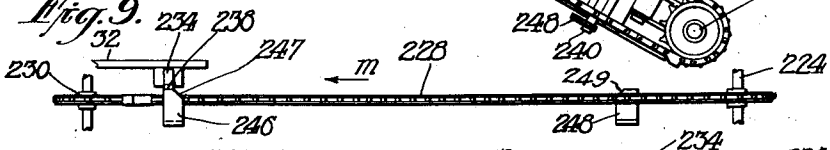


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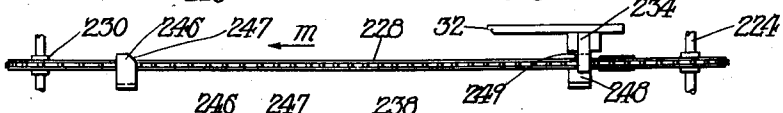


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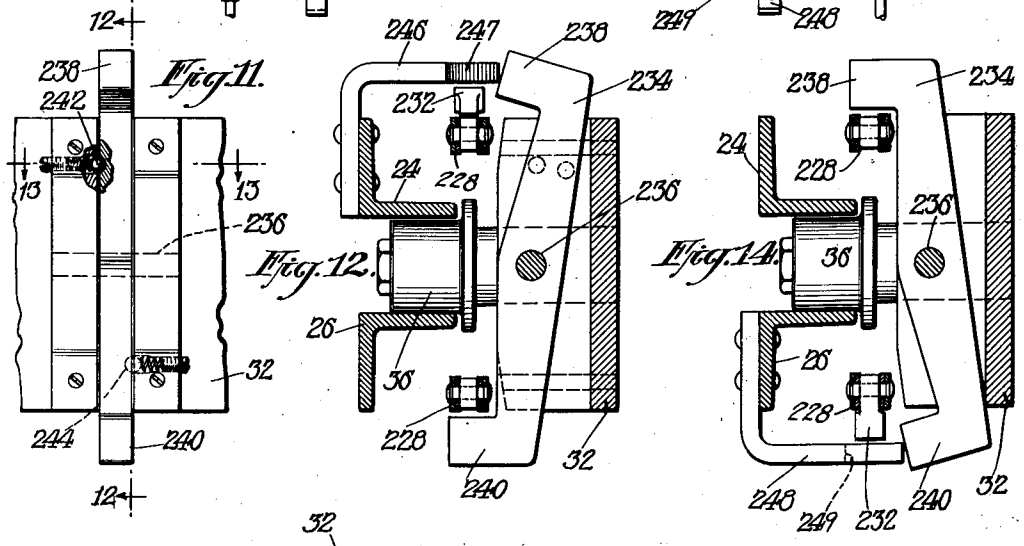


Fig. 11.

Fig. 12.

Fig. 14.

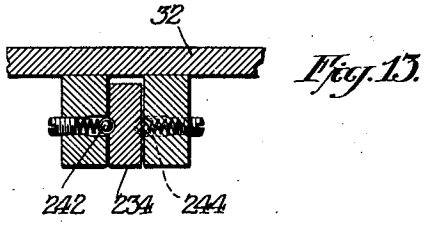


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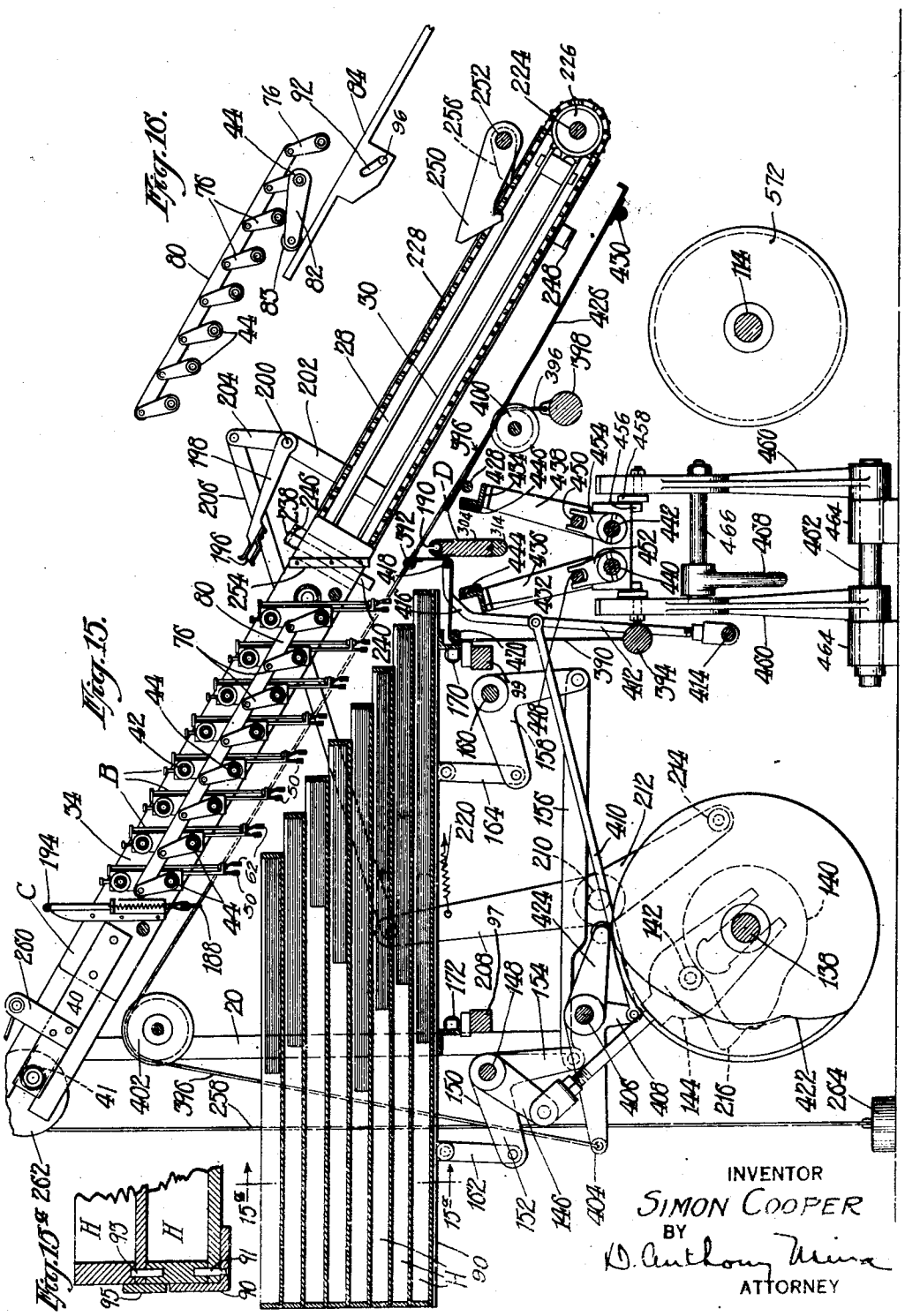
INVENTOR
SIMON COOPER
BY
W. Anthony Mecina
ATTORNEY

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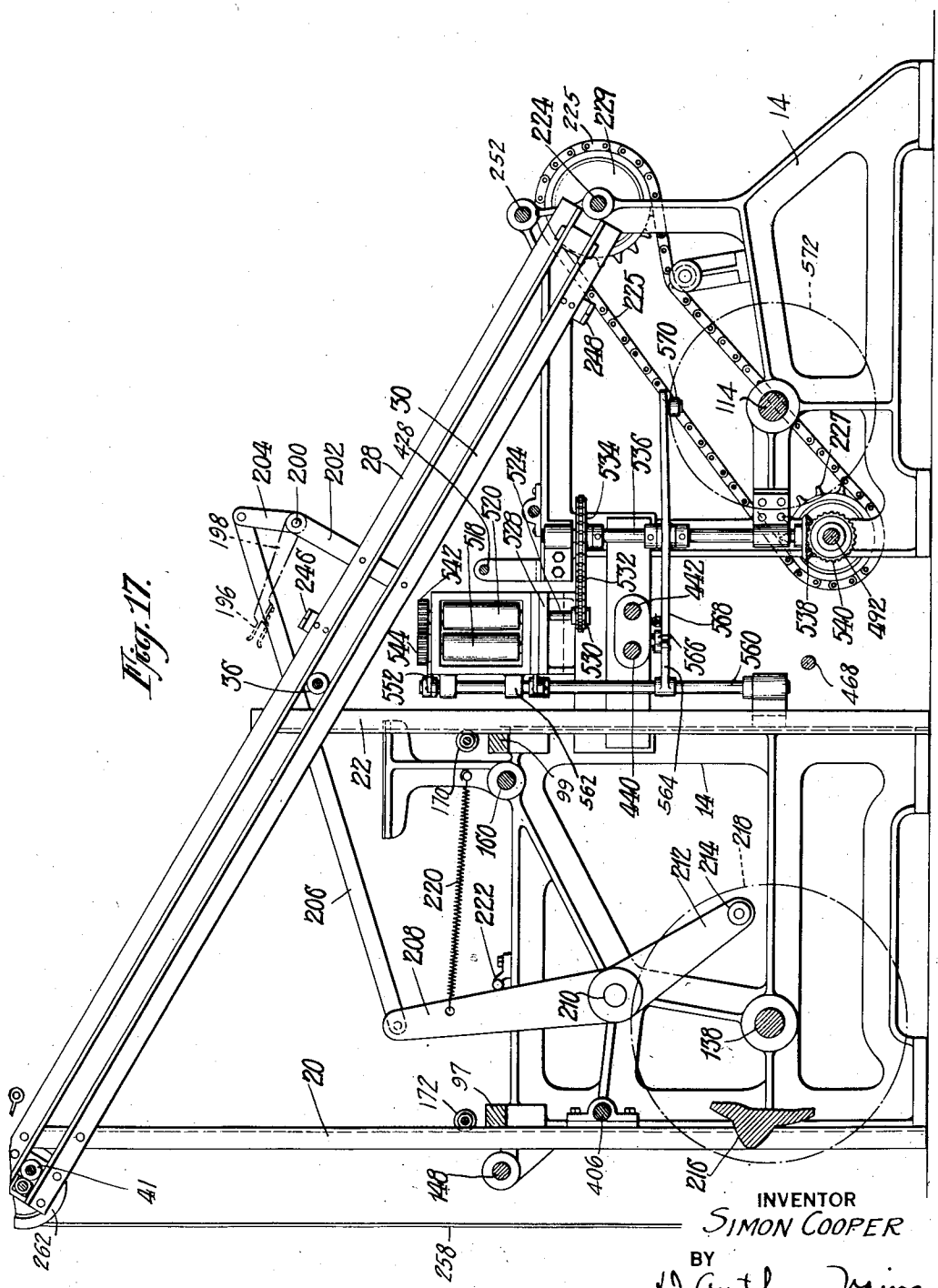


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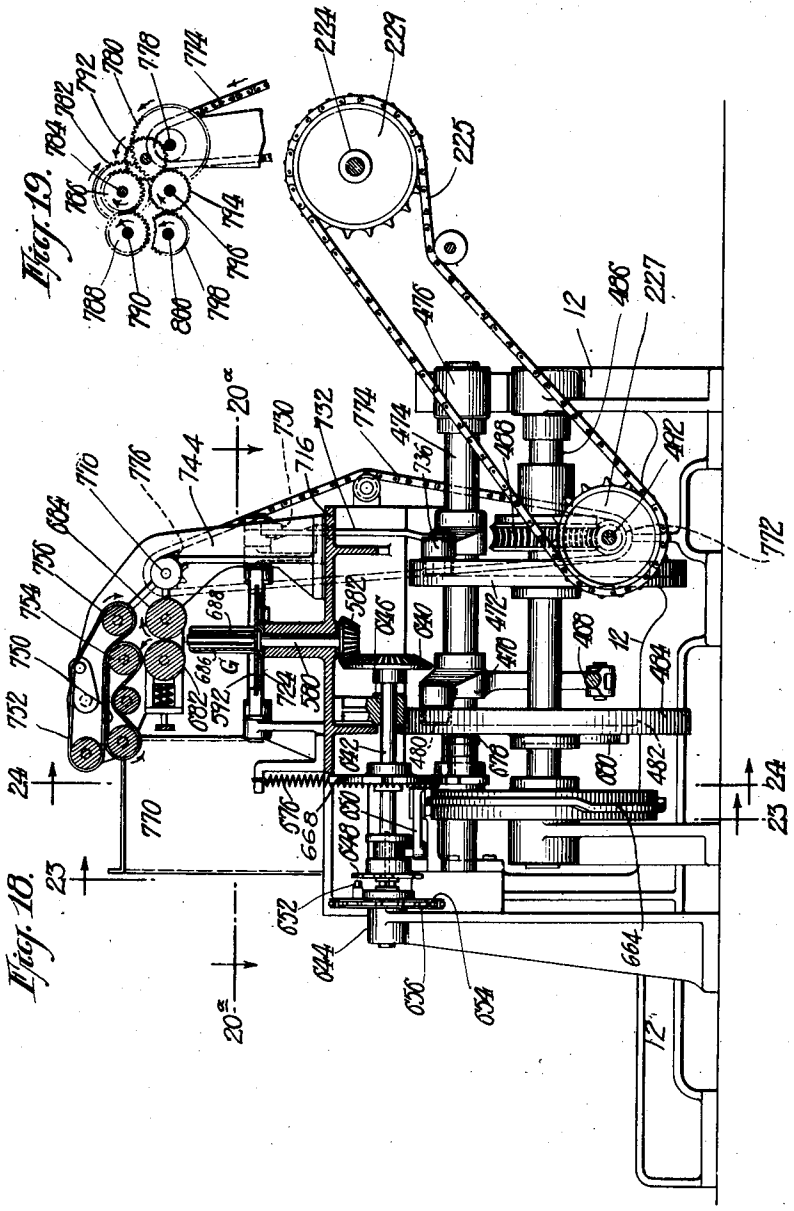


Fig. 19.

Fig. 18.

INVENTOR

SIMON COOPER

BY

D. Anthony Mina

ATTORNEY

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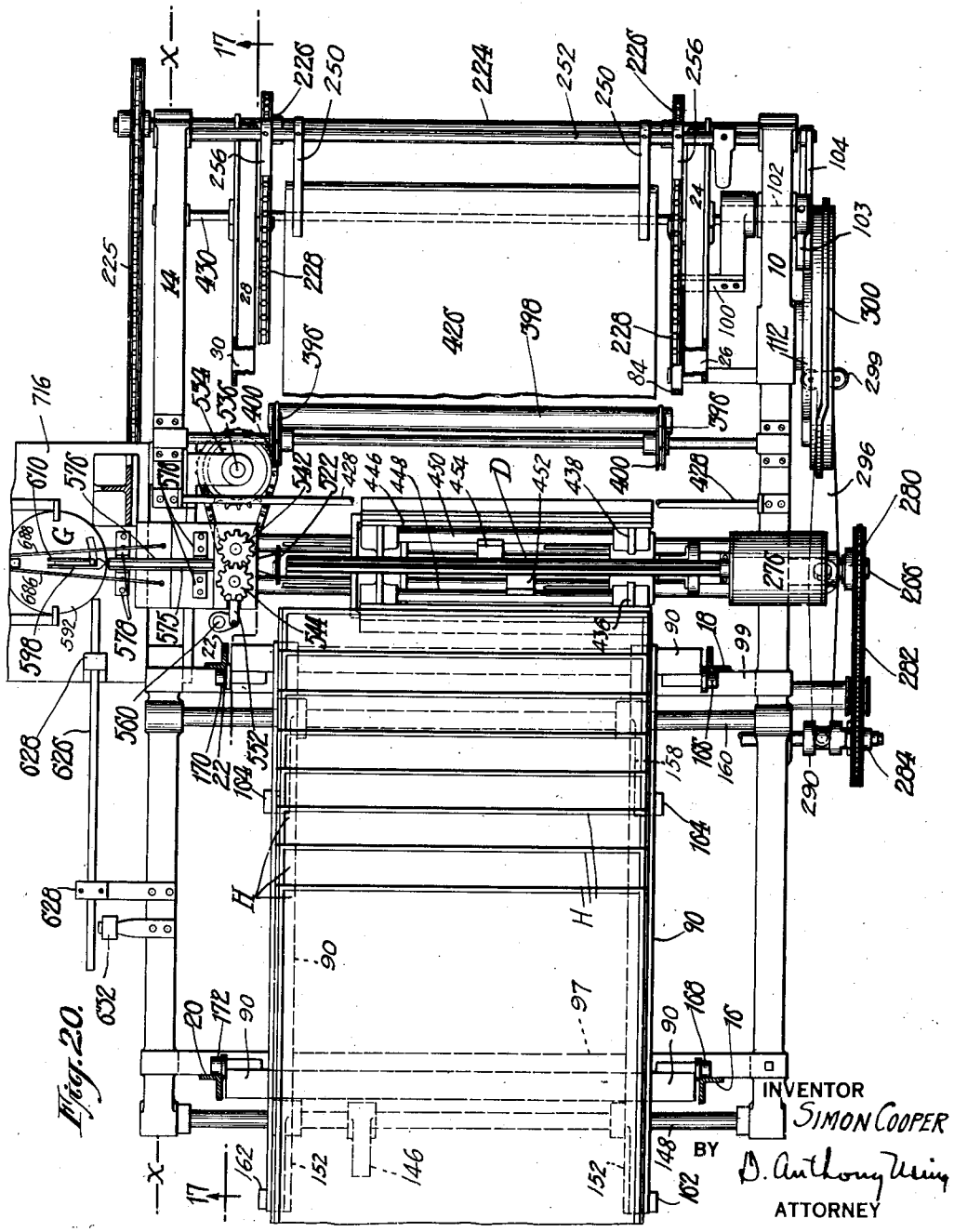


Fig. 20.

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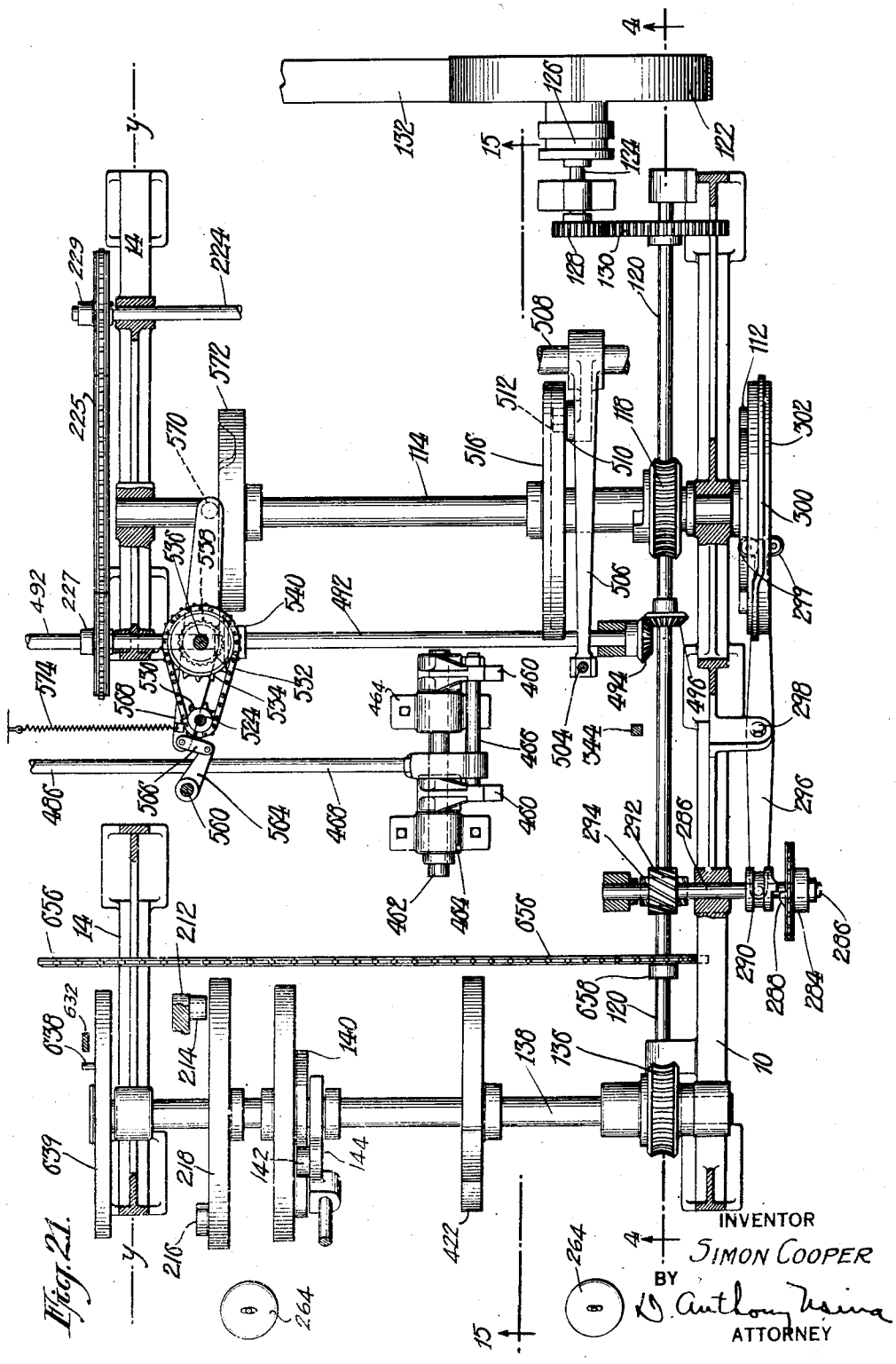


Fig. 21.

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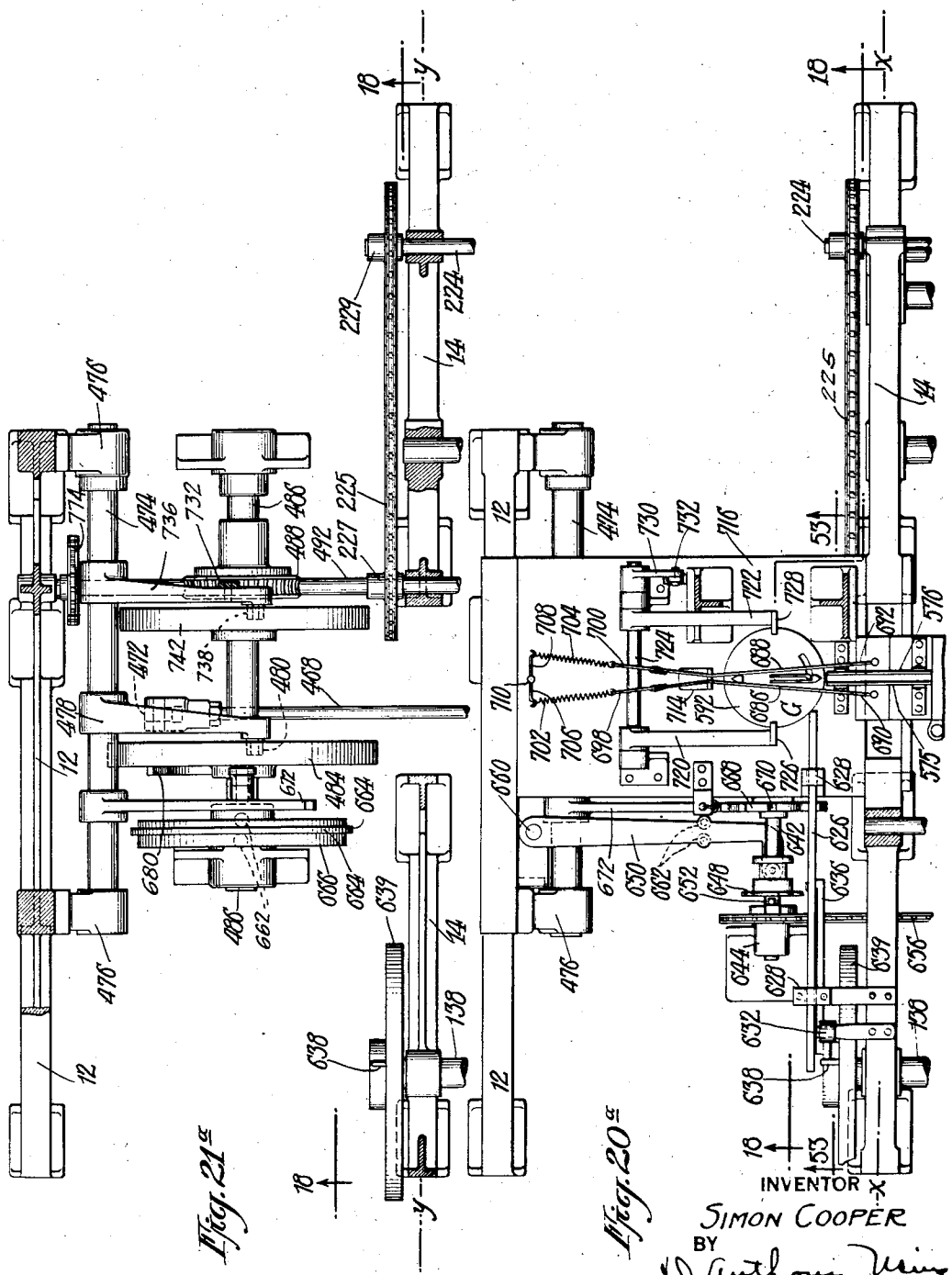


Fig. 21a

Fig. 20a

INVENTOR
SIMON COOPER
BY
D. Anthony Mann
ATTORNEY

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Fig. 23.

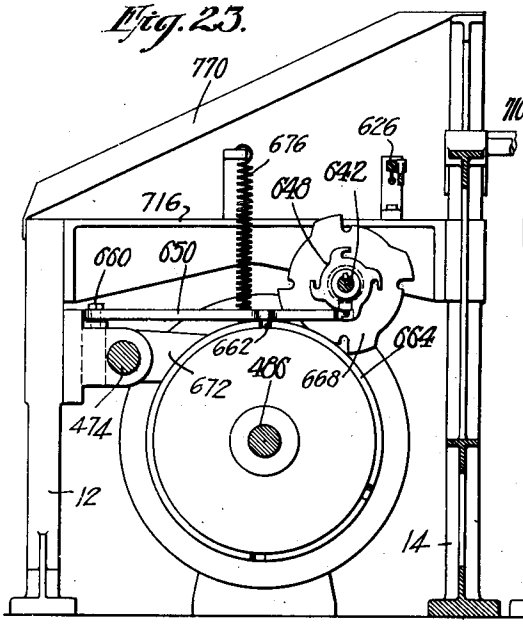


Fig. 24.

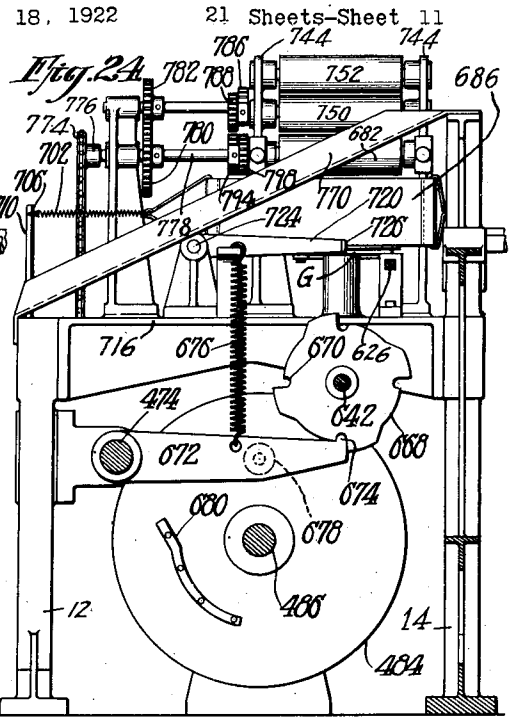
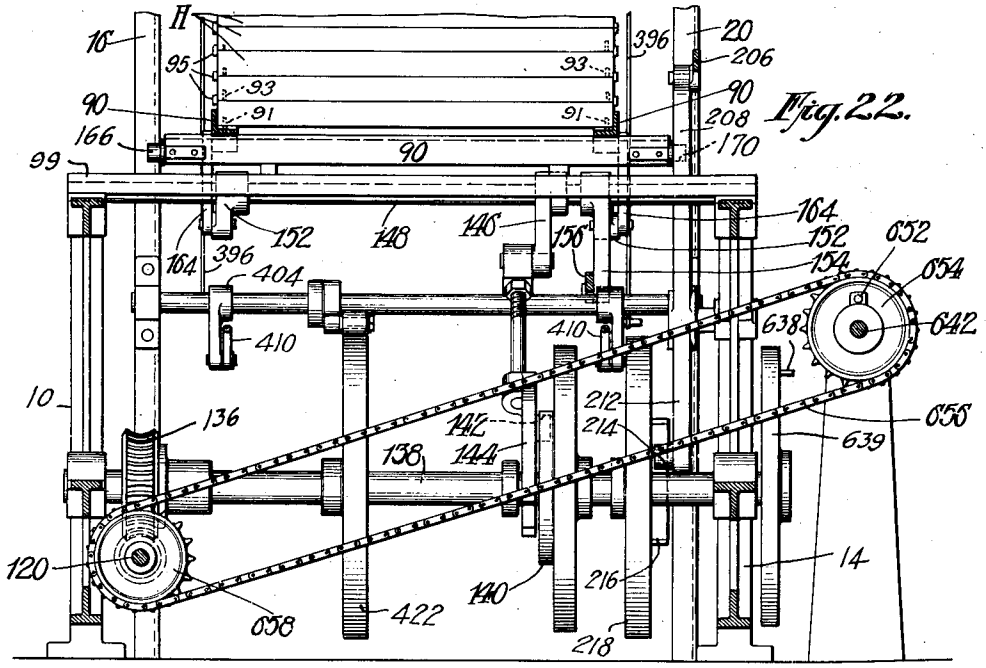


Fig. 22.



INVENTOR

SIMON COOPER

BY

W. Anthony Naima

ATTORNEY

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Fig. 25.

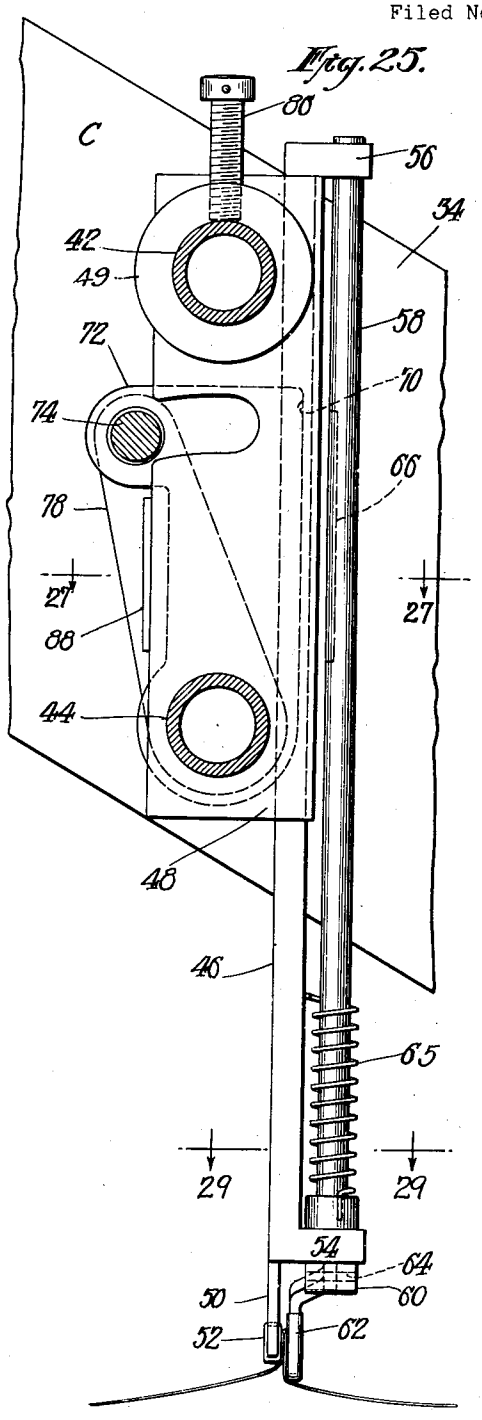
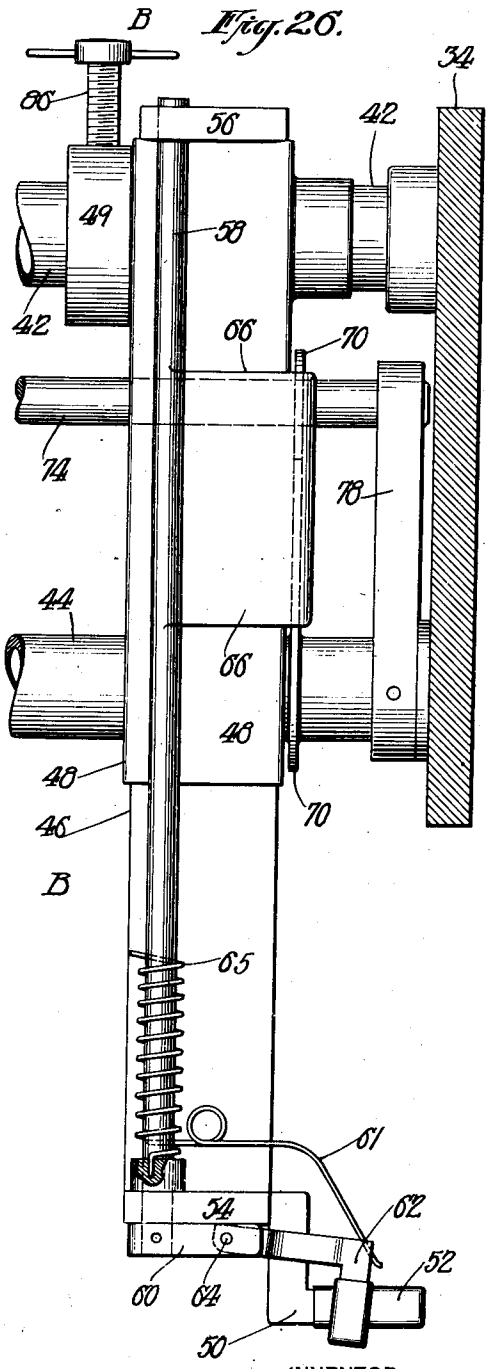


Fig. 26.



INVENTOR

SIMON COOPER

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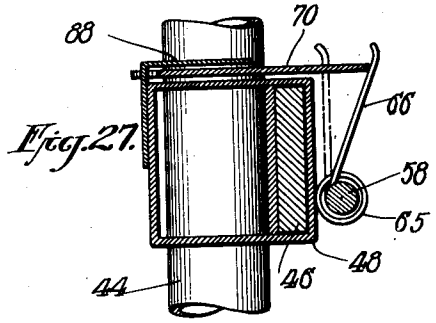


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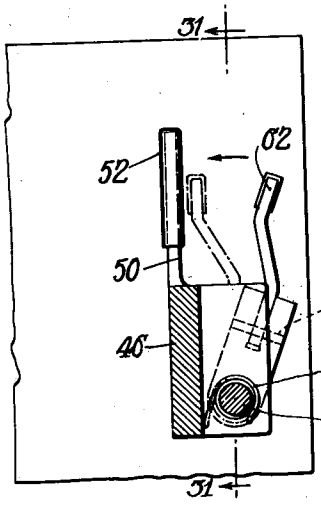


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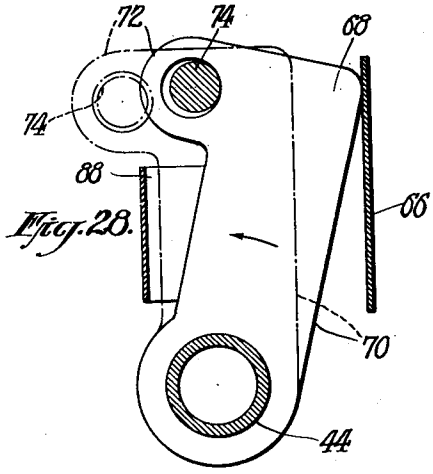


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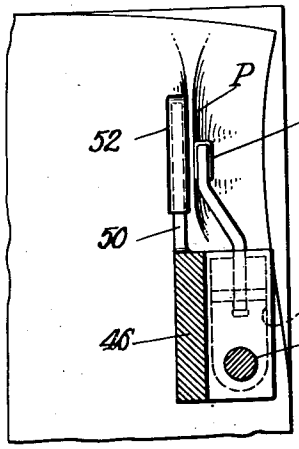


Fig. 30.

Fig. 31.

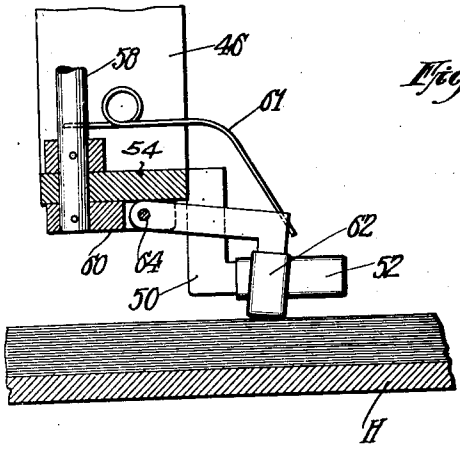
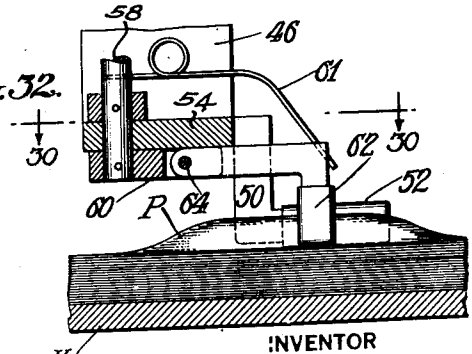


Fig. 32.



INVENTOR
SIMON COOPER
BY
W. Anthony Mina
ATTORNEY

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Fig. 33.

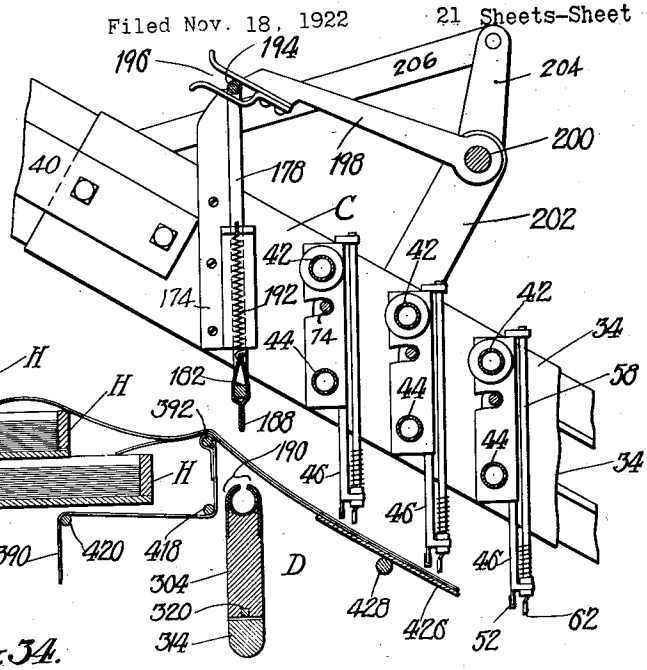
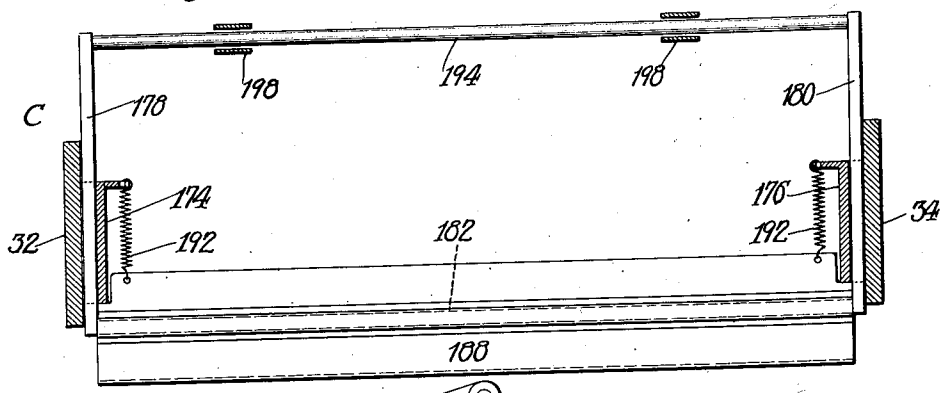


Fig. 34.



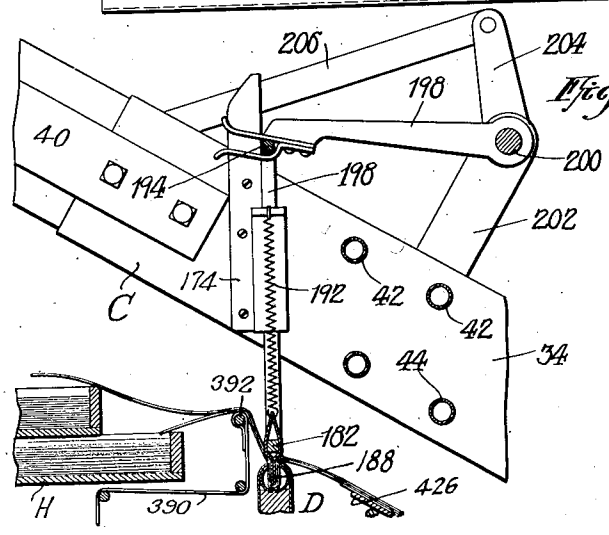
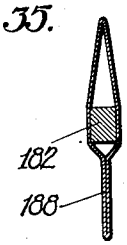


Fig. 35.

Fig. 36.



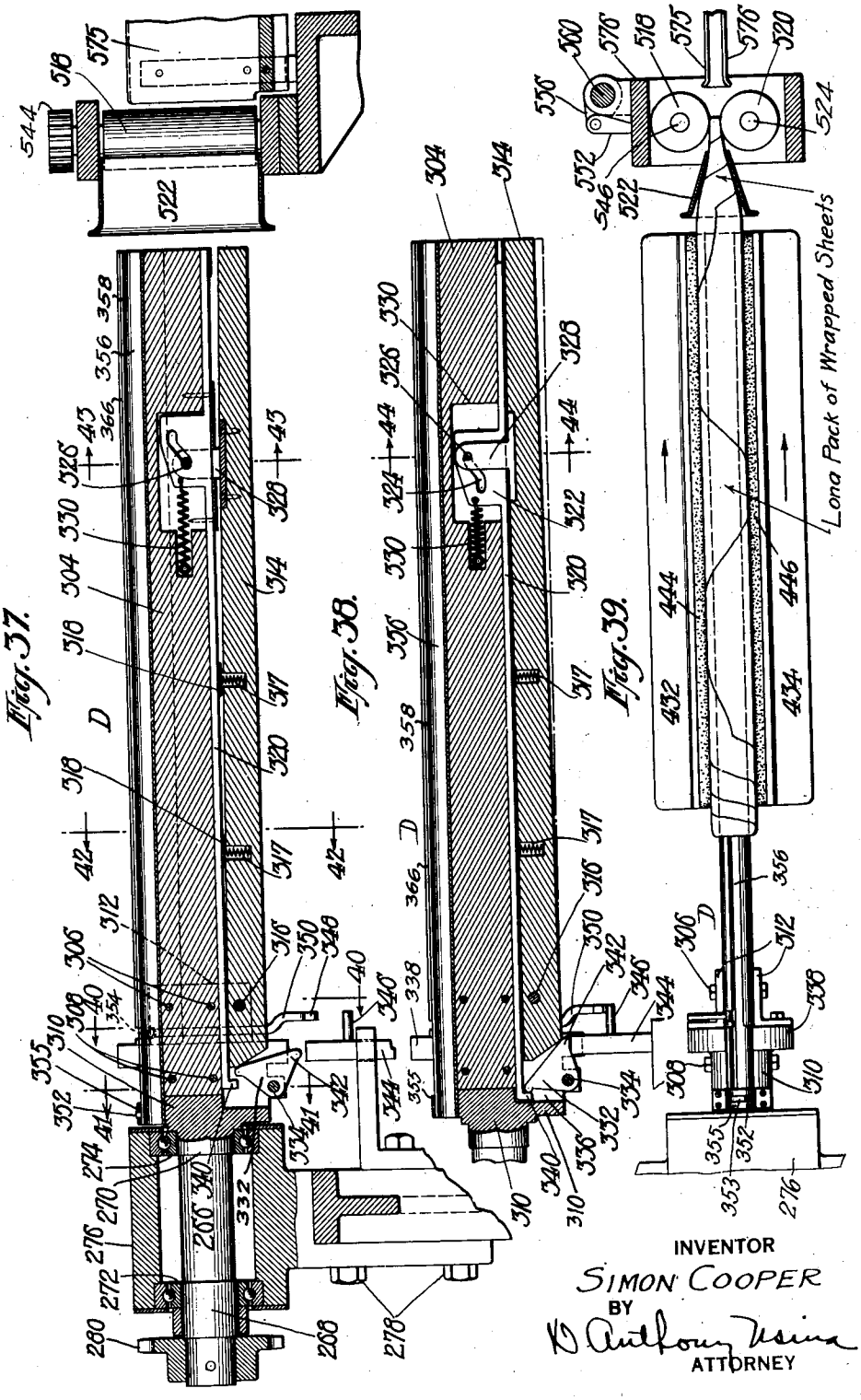
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SIMON COOPER
BY
D. Anthony Neira
ATTORNEY

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Fig. 40.

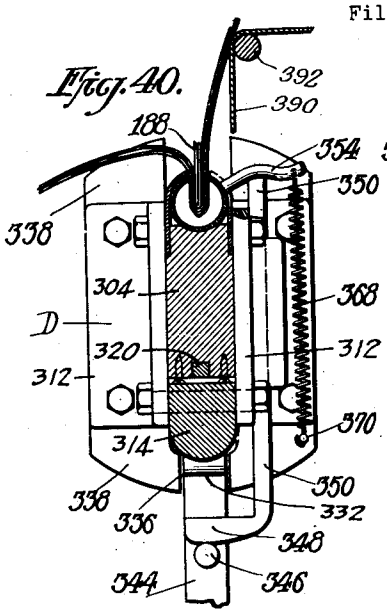


Fig. 41

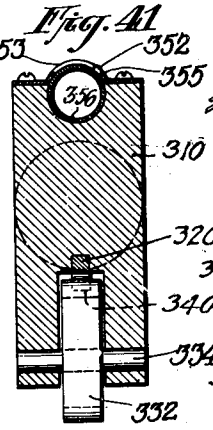


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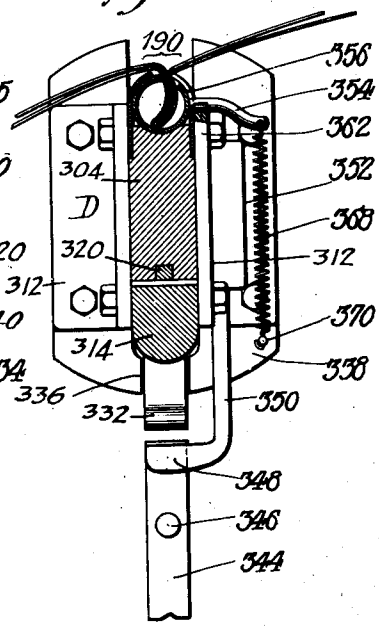


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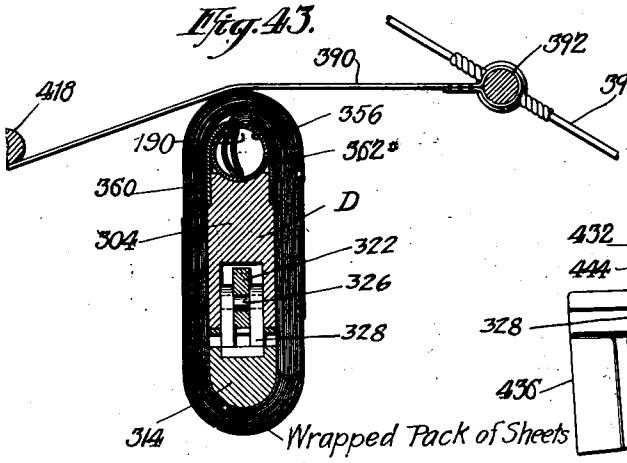


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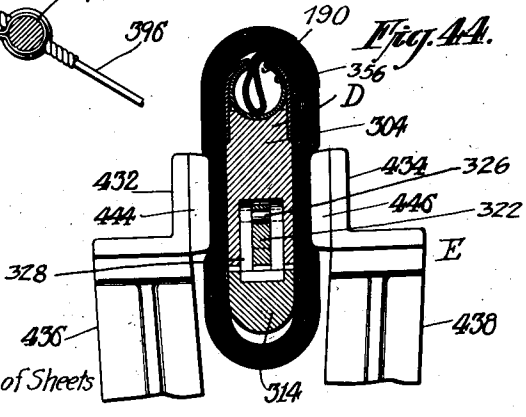


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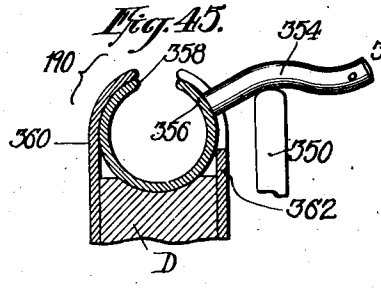
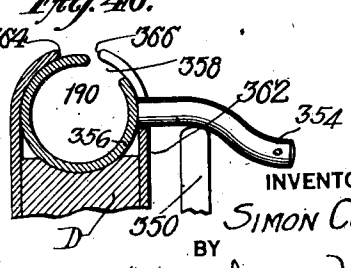


Fig. 46.



INVENTOR
SIMON COOPER
BY
D. Anthony Veeder
ATTORNEY

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Fig. 47.

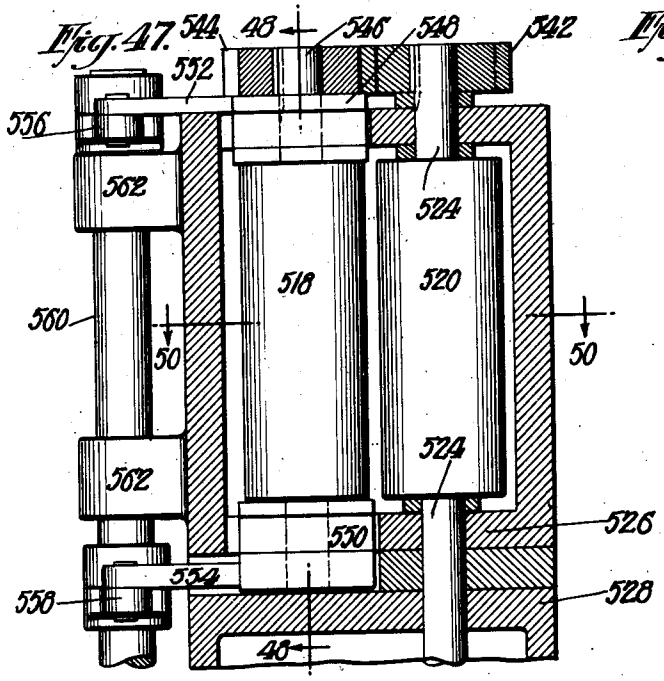


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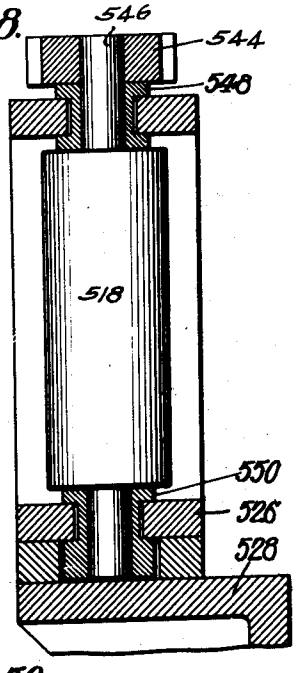


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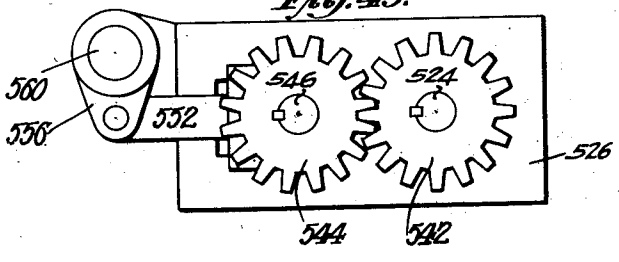


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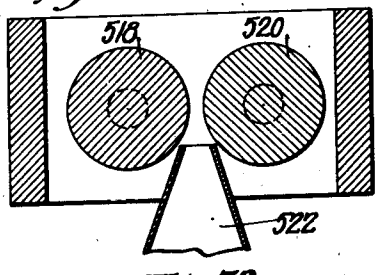


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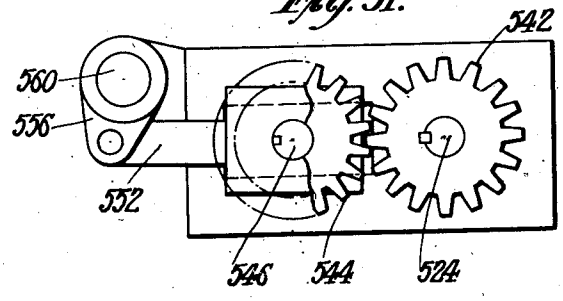
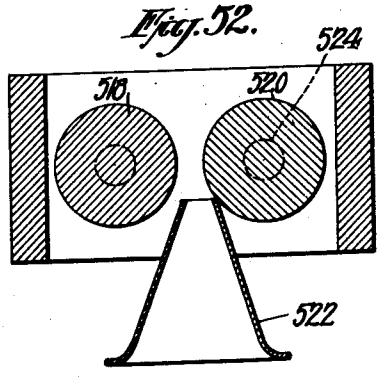


Fig. 52.



INVENTOR
SIMON COOPER
BY
D. Anthony Mina
ATTORNEY

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Fig. 53.

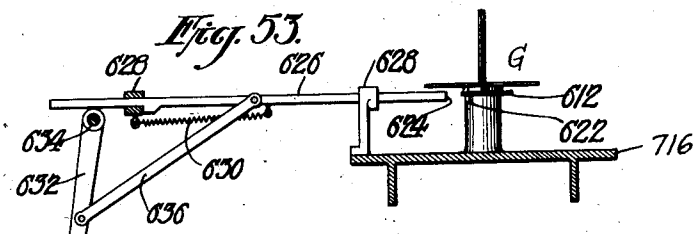


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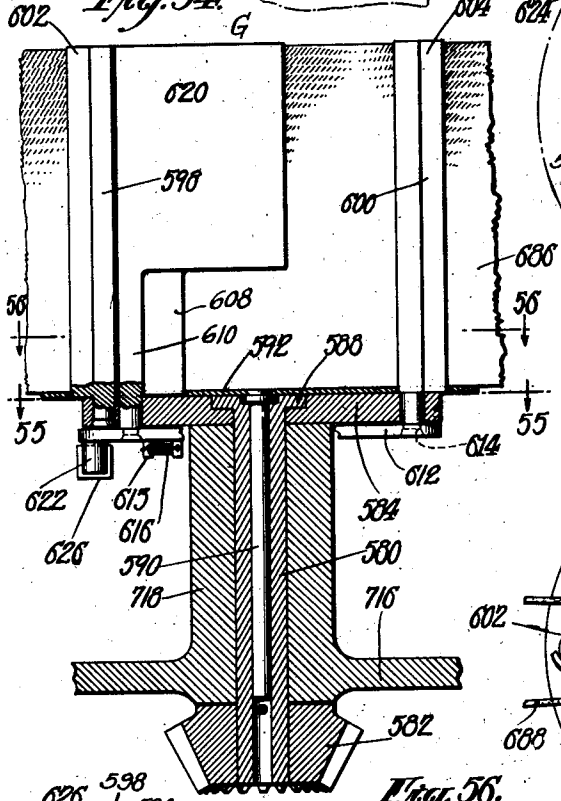


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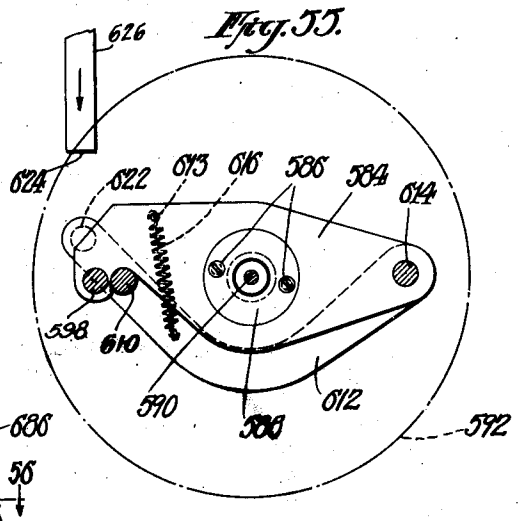


Fig. 57.

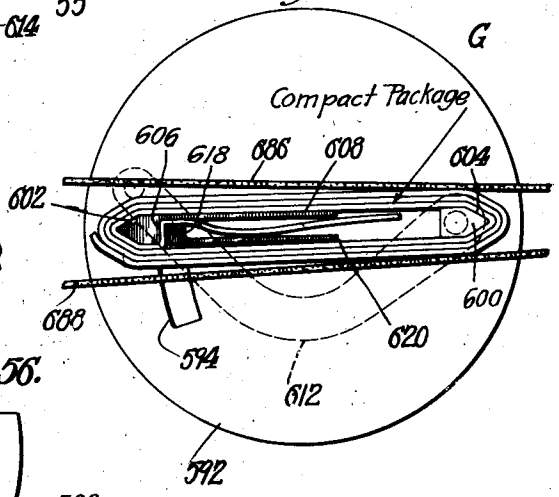
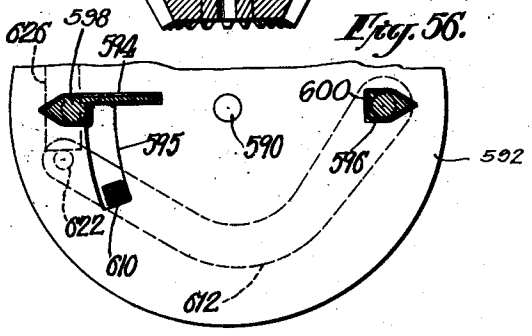


Fig. 56.



INVENTOR
SIMON COOPER
BY
D. Anthony Mina
ATTORNEY

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Fig. 58.

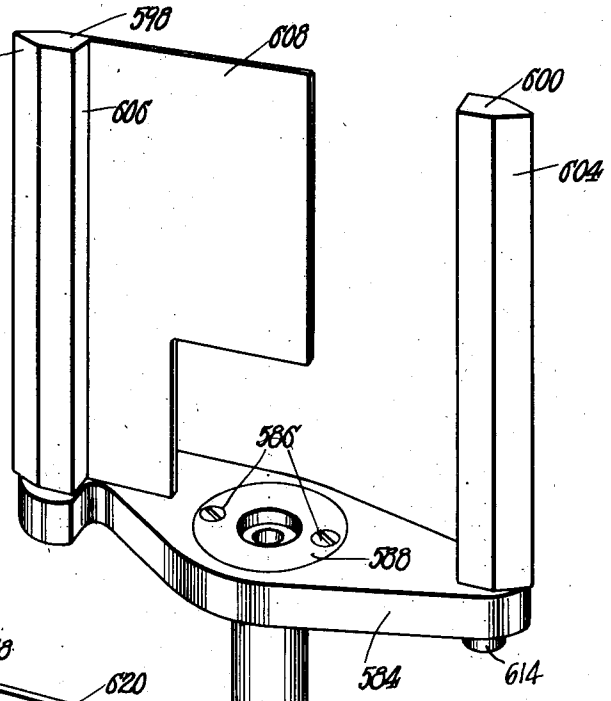
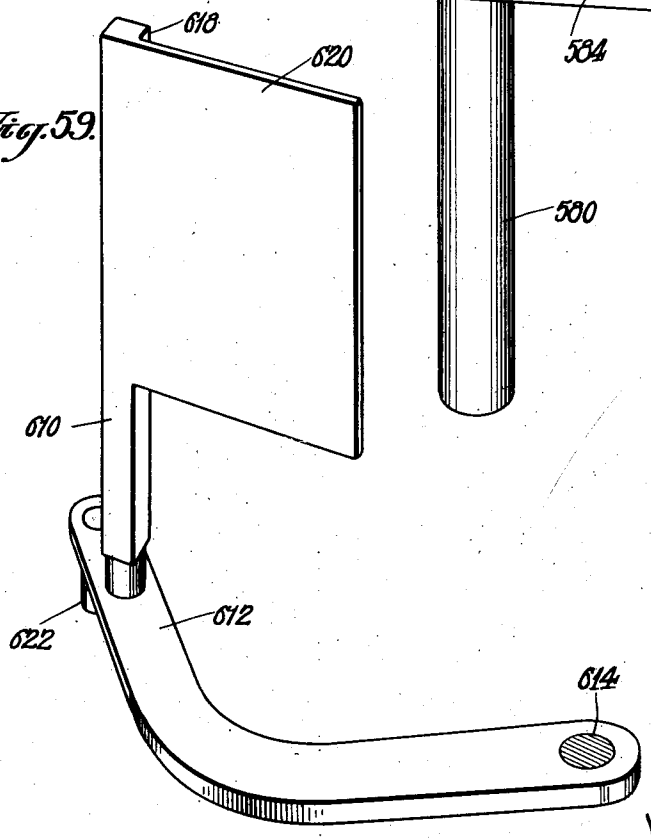


Fig. 59.



INVENTOR
SIMON COOPER
BY
K. Anthony Meiss
ATTORNEY

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Fig. 61.

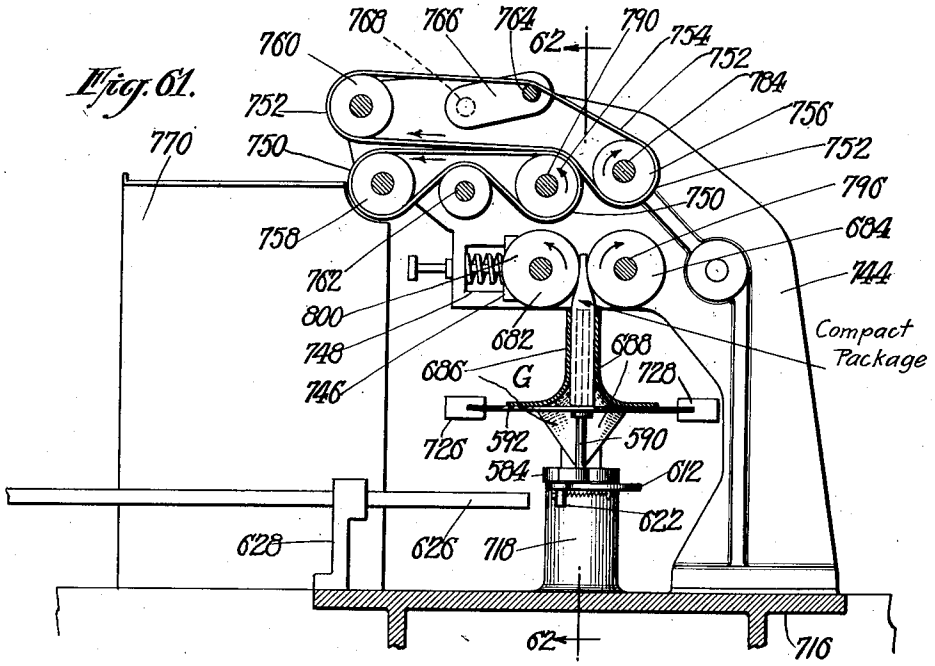


Fig. 62.

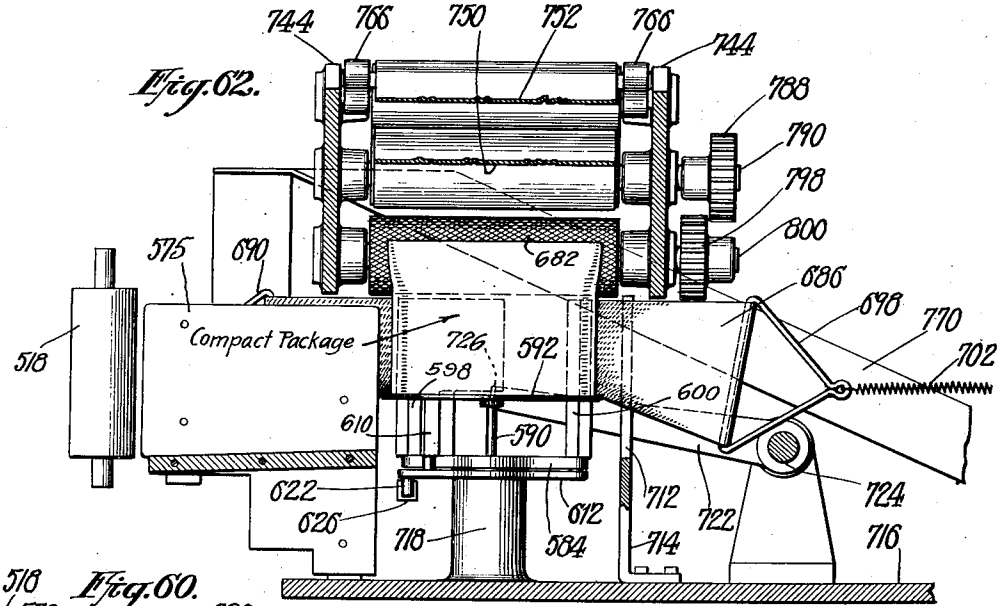
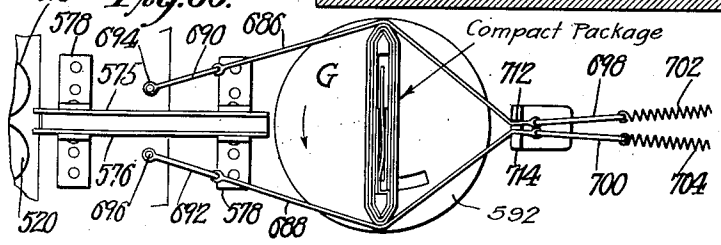


Fig. 60.



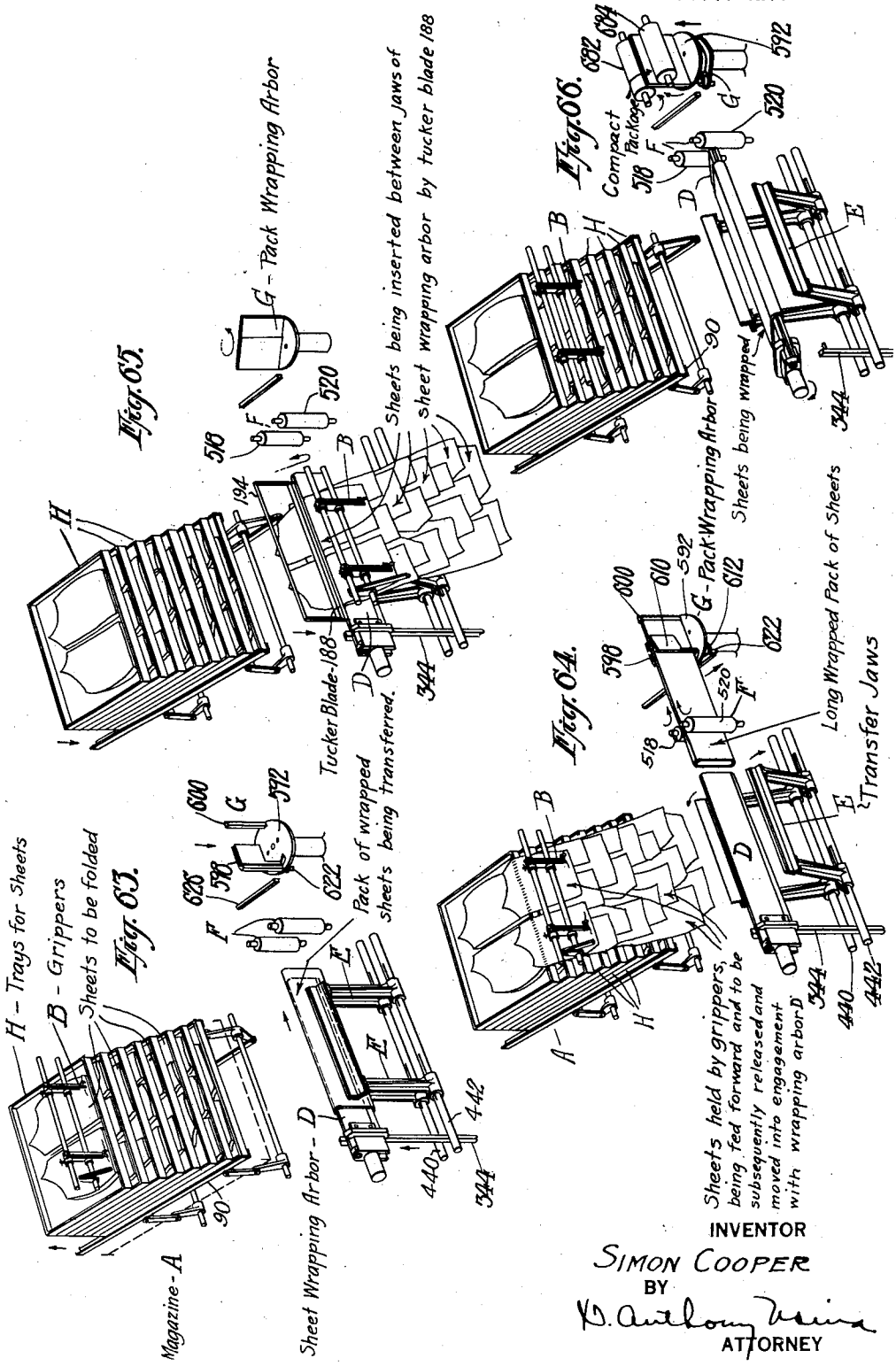
INVENTOR
SIMON COOPER
BY
D. Anthony Weiss
ATTORNEY

April 6, 1926. 1,579,468

S. COOPER

METHOD AND MACHINE FOR FOLDING SHEETS

Filed Nov. 18, 1922 21 Sheets-Sheet 21



INVENTOR

SIMON COOPER

BY

ATTORNEY

Patented Apr. 6, 1926. 1,579,468

UNITED STATES PATENT OFFICE.

SIMON COOPER, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE McCALL COMPANY, A CORPORATION OF NEW YORK.

METHOD AND MACHINE FOR FOLDING SHEETS.

Application filed November 18, 1922. Serial No. 601,858.

To all whom it may concern:

Be it known that I, SIMON COOPER, a citizen of the United States, and resident of the borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Methods and Machines for Folding Sheets, of which the following is a specification.

My invention aims to provide a novel method and machine whereby a multiplicity of sheets can be simultaneously folded into a comparatively small compact package.

A machine for folding tissue paper pattern sheets according to my improved method and embodying the several features of my invention is shown in the accompanying drawings.

Fig. 1 is a side elevation of the machine with parts in the rear omitted in the interest of clearness;

Fig. 2 is a sectional view at right angles thereto taken on line 2—2 of Fig. 1;

Fig. 3 is a detail of parts shown in Fig. 2;

Fig. 4 is a section on line 4—4 of Figs. 2 and 21;

Figs. 5 and 6 are details of mechanism for actuating the feeder;

Figs. 7, 8, 9, 10, 11, 12, 13 and 14 are further details of the feeder actuating mechanism; Figs. 12 and 13 being sections on the correspondingly numbered lines of Fig. 11, and Fig. 14 illustrating a different position of a part shown in Fig. 12;

Fig. 15 is a section on line 15—15 of Figs. 2 and 21;

Fig. 15ª is a detail section of a portion of the magazine, taken on line 15ª—15ª of Fig. 15;

Fig. 16 is a fragmentary detail of parts shown in Fig. 15;

Fig. 17 is a section on line 17—17 of Figs. 2 and 20;

Fig. 18 is a section on the line 18—18 of Figs. 2, 20ª and 21ª;

Fig. 19 is a fragmentary detail showing gearing for driving parts shown in Fig. 18;

Fig. 20 is a plan view of a portion of the machine, the carriage and its guides shown in Fig. 1 being sectioned off approximately on the line 20—20 of Fig. 1;

Fig. 20ª is a plan view of a portion of the machine the delivery mechanism being sectioned off approximately on line 20ª—20ª of Fig. 18, Figs. 20 and 20ª when joined on the line *x*—*x* to show a substantially complete plan of the machine with the carriage and delivery mechanism sectioned off;

Figs. 21 and 21ª when joined on the dotted line *y*—*y* show in plan the layout of the mechanism located in a plane below that illustrated in Fig. 20 and 20ª, the plane of section for Figs. 20 and 20ª and 21 and 21ª is approximately indicated by the lines 20—20ª and 21—21ª of Fig. 2;

Fig. 22 is a section on the line 22—22 of Fig. 4, the trays of the magazine being shown in elevation;

Figs. 23 and 24 are sections on the correspondingly numbered lines of Fig. 18;

Fig. 25 is an enlarged detail showing a portion of the feeder carriage and a gripper carried thereby;

Fig. 26 is another view of the same, viewed from the right of Fig. 25;

Fig. 27 is a section on line 27—27 of Fig. 25 with parts shown in full lines in a different position;

Fig. 28 is a detail of parts shown in Fig. 25 the positions corresponding with those shown in Fig. 27;

Fig. 29 is a horizontal section on the line 29—29 of Fig. 25, the gripper fingers however being shown open in this view;

Fig. 30 is a view similar to Fig. 29 showing the gripper fingers in closed position corresponding to Fig. 25;

Figs. 31 and 32 are fragmentary views illustrating the operation of the gripper fingers;

Figs. 33, 34, 35 and 36 are details illustrating mechanism for feeding sheets into engagement with a wrapping arbor;

Fig. 37 is a longitudinal section through a sheet wrapping arbor and showing certain related mechanism;

Fig. 38 is a sectional view showing the arbor in collapsed position;

Fig. 39 is a fragmentary plan view of the arbor and showing somewhat diagrammatically related mechanism for stripping a pack of wrapped sheets from the arbor;

Figs. 40, 41, 42, 43 and 44 are detail sectional views on an enlarged scale through the arbor at planes indicated by the correspond-

ingly numbered section lines of Figs. 37 and 38;

Figs. 45 and 46 are details showing the arbor clamp in open and closed positions respectively;

Figs. 47 and 48 are enlarged details showing pressure rollers arranged to receive the wrapped pack from one arbor and transfer it to another, Fig. 47 being a sectional view on line 47—47 of Fig. 2, Fig. 48 being a section on line 48—48 of Fig. 47;

Fig. 49 is a plan view of parts shown in Fig. 47;

Fig. 50 is a horizontal section on line 50—50 of Fig. 47;

Fig. 51 is a plan similar to Fig. 49 showing a different position of one of the driving gears;

Fig. 52 is a view similar to Fig. 50 showing a different position of one of the pressure rolls;

Fig. 53 is a fragmentary detail partly in section, the plane of section being indicated at line 53—53 of Fig. 20[a];

Fig. 54 is an enlarged detail of parts shown in Fig. 20[a];

Fig. 55 is a horizontal section on the line 55—55 of Fig. 54;

Fig. 56 is a section on line 56—56 of Fig 54; showing the arbor clamp in open position;

Fig. 57 is a plan view of parts shown in Fig. 54 showing the clamp in closed position and illustrating a wrapped package of sheets;

Figs. 58 and 59 are perspective detail views of parts of the pack-wrapping arbor shown in Fig. 54;

Fig. 60 is a plan view of the pack-wrapping arbor and showing means for exerting a tension on the pack as it is being wrapped;

Fig. 61 is a fragmentary view on an enlarged scale of parts shown in Fig. 18, showing a wrapped package in the act of being lifted from the arbor;

Fig. 62 is a section on line 62—62 of Fig. 61;

Figs. 63, 64, 65 and 66 are diagrammatic views illustrating my method and in a general way the operation of the machine.

General.—The machine illustrated provides a novel method and means whereby a multiplicity of tissue paper pattern pieces or sheets can be rapidly folded into a small compact package and is designed for simultaneously folding a number of sheets first into a long narrow pack and subsequently folding said pack into a comparatively short narrow package. The invention, however, is not limited thereto as it will be appreciated by those skilled in the art that many of the features of the invention are applicable to paper handling machines in general.

In general terms the machine illustrated comprises a feeder adapted to simultaneously move a plurality of sheets to an operative station and mechanism for first folding the sheets in one direction and subsequently folding the sheets in another direction.

The machine is provided, as diagrammatically illustrated in Figs. 63 to 66, with a magazine A, a feeder including grippers B which are carried by a carriage C (Figs. 1 and 4), a sheet-wrapping arbor D, transfer mechanism E adapted to remove a wrapped pack of sheets from the arbor D, pressure rolls F arranged to exert a pressure on the sheets after they have been folded and feed them forward to a pack-wrapping arbor G which is adapted to fold the pack at right angles to the previously formed folds. The magazine A includes a plurality of trays H superposed on one another and arranged so that their forward edges are offset in respect to one another. Each tray is adapted to hold one or more piles of pattern sheets and a varying number of trays may be employed. In the machine illustrated eight trays are shown and these are adapted to hold piles of all of the pattern sheets necessary for use in making one style of garment.

The pattern sheets or pieces are usually punched or cut out in large quantities and the general practice is to cut several hundred pieces of the same shape at one time. These pattern sheets are usually made of flimsy material such as light tissue paper, and heretofore it has been customary to place a number of piles of such sheets on a table or the like, and an operator has picked one sheet from each pile and folded them into a package by hand. This is a tedious and costly operation and the number of complete patterns wrapped in a given unit of time is largely a matter of endurance of the operator.

By my improved method the piles of pieces are collated and placed in several trays H of the magazine and mechanical means are provided for simultaneously feeding one sheet from each pile into juxatposition to a wrapping arbor D. The sheets are then automatically moved into engagement with said arbor which is then caused to rotate to wrap the multiplicity of sheets into a long narrow pack. The pack is subsequently transferred to another arbor G which folds the pack in another direction into a compact package, whereupon certain mechanism, hereinafter described, lifts the compact package into engagement with delivery mechanism which discharges said package from the machine.

Sheet feeder.—Referring first to Figs. 1 and 2 of the drawings, the machine includes out-board frames 10 and 12 and an intermediate frame 14. To the frames 10 and 14 are secured four uprights 16, 18, 20 and 22. These uprights support inclined tracks 24 and 26, 28 and 30 which serve as guides for

the carriage C. The carriage comprises side plates 32 and 34 which are provided at their lower ends with rollers 36 adapted to travel between the rails 24 and 26 and the rails 28 and 30. Extensions 38 and 40 are secured to the upper ends of the plates 32 and 34 and carry rollers 41 which also run between said rails. The plates 32 and 34 support a plurality of upper cross shafts 42 and lower cross shafts 44. These shafts carry the grippers indicated as a whole by the letter B. The grippers each include an arm 46, Fig. 25, which is slidable vertically in a corresponding guide 48 supported on cross shafts 42 and 44 above referred to. There are a multiplicity of these grippers as shown in Figs. 1, 2 and 4 and they are of identical construction and a description of one will suffice for all.

At the lower end of the gripper arm 46 is secured a presser finger 50 provided with a resilient cap 52 of rubber or other suitable material. Each arm 46 is formed with a lower projection 54 and an upper projection 56 forming pivotal bearings for a vertical shaft 58 carrying at its lower end an arm 60 to which a picker finger 62 is pivoted by a pin 64 as clearly shown in Figs. 25 to 32. A spring 65 surrounds the lower end of each shaft 58 and tends to press the picker finger 62 toward the presser finger 50. The shaft 58 carries a fin 66 near its upper end which is normally engaged by the end 68 of a lever 70 loosely pivoted on the cross shaft 44. The lever 70 is provided with a perforated extension 72 through which passes a rod 74. The rod 74 for each row of grippers is supported at its ends in arms 76 and 78 which are pinned or otherwise secured to the shafts 44. The several arms 76 (Fig. 15) at one end of the carriage are connected to one another by a link 80 so that all of the arms 76 and 78 of the carriage will move in unison. One of the shafts 44, namely the one next to the lower end of the carriage as shown in Fig. 16, carries a lever 82 having a roller 83 on its end adapted to be lifted by a bar 84 which is actuated by mechanism hereinafter described. The guides 48 in which the gripper arms 46 are mounted, are adjustable laterally along the rods 42 and 44 and said guides are each adapted to be held in a desired position of adjustment by means of a clamp screw 86 mounted in a hub 49 formed on said guide 48. The guide 48 carries an angle plate 88 overlapping the lever 70 so that as the guide 48 is adjusted laterally on the rods 44 the lever 70 will be moved along with it, it being remembered that said lever is loosely mounted on the shaft 44 and is provided at its upper end with a perforation permitting it to slide freely along the cross rod 74.

The above described gripper mechanism is capable of lifting the topmost sheet from a pile of pattern pieces or sheets carried on the trays H of the magazine A. The several trays H of the magazine are carried by a frame 90, Fig. 1, which is periodically lifted by mechanism hereinafter described so as to bring the multiplicity of piles of pattern sheets into engagement with the grippers.

The frame 90 as shown in Fig. 15[a] carries one or more dowel pins 91 which enter suitable holes formed in the lowermost tray so as to position it correctly thereon. Likewise the trays are each provided with one or more dowel pins 93 which enter suitable holes in the adjacent tray so as to position each tray correctly with respect to its neighbor. Each of the trays H, with the exception of the lowermost one, carries a side cleat 95 arranged to hold the several trays in proper nested position as shown in Fig. 15[a]. The frame 90 when in its lowered position, rests on a pair of fixed cross bars 97, 99, Fig. 20, so as to relieve the operating mechanism of the weight of the frame, the several trays H carried thereby and the sheets supported in said trays.

When the trays are lifted the gripper fingers are separated, as indicated in Fig. 29, and the lifting of the tray causes the picker finger 62 to rock on its pivot 64 against the action of a light spring 61, Figs. 26 to 32. Further lifting of the trays causes the topmost sheet of the pile to engage the presser finger 50 and lift the gripper arm 46 bodily a short distance as indicated between the different elevations of the tray H shown in Figs. 31 and 32. This action causes the finger 50 to exert considerable pressure on the pile of sheets and prevents the topmost sheet from slipping when the picker finger 62 is rocked on the axis of the shaft 58. After the trays H have been lifted to their high position the shaft 58 is rocked by the spring 65 due to the fact that the lever 70 has been moved from the full line position shown in Fig. 28 to the dotted line position, by the rod 74. The angular movement of the picker finger 62 causes it to pucker the sheet as shown at P in Figs. 30 and 32. The spring 65 exerts sufficient force to securely hold the sheet as the carriage C moves down its inclined track.

In the machine shown the carriage is provided with eight rows of shafts 42 and 44 and eight trays H for supporting piles of pattern sheets, each row of shafts carrying one or more grippers according to the width and number of sheets carried by the trays. Small patterns pieces or sheets like those of a pocket or collar, for example, will require only one gripper, while wider sheets such as a skirt front or side panel may require two or more grippers. The number of grippers carried by each row of shafts 42 and 44 will be governed according to the size of sheets and the number of piles in each tray.

The action of the fingers 50 and 62 in picking a sheet from a pile is analogous to the operation of picking a sheet by hand by first pressing the thumb on the top of the pile, to exert a slight pressure on the top sheet and drawing the forefinger toward the thumb to pucker the sheet to grasp it between the fingers.

The means for rocking the lever 82 which in turn rocks the shafts 44 carrying the arms 76 and 78 which support the several rods 74, includes the inclined bar 84 which bar is provided with cam slots 92 and 94. Pins 96 and 98 project through said slots, the pin 96 being secured to the upright 18 and the pin 98 being secured to the frame 10. When the carriage C is in its upper position as shown in Fig. 1, the rod 84 is also in its upper position with the pins 96 and 98 engaging the lower ends of the slots and holding the arm 82 in a position shown in Fig. 2 so as to hold the gripper fingers 50 and 62 in the open position illustrated in Fig. 29. The bar 84 is held in such raised position by means of an arm 100 carried on a shaft 102. This shaft carries a lever 103 connected with a link 104 to an arm 106 pivoted at 108 carrying a roller 110 arranged to co-act with a cam 112 mounted on a shaft 114. The cam 112 is so designed that when the carriage is in its upper position it holds the grippers open until the trays move up whereupon the grippers are closed. The grippers remain closed for approximately a half revolution of the cam at which time the sheets have been carried to an operative position by the movement of the carriage C, whereupon the cam causes an opening movement of the grippers through the connections 103 to 110 which results in releasing the sheets from the grippers.

The shaft 114 also carries a worm gear 116 meshing with a worm 118 carried by the main drive shaft 120. This shaft is driven from a belt pulley 122 on a jack shaft 124 carrying a clutch 126 and a gear 128 which gear meshes with a gear 130 carried on a shaft 120. The pulley 122 is driven by a belt 132 connected to a motor or any other suitable source of power. When the clutch 126 is shifted to operative position to start the machine the shaft 120 rotates continuously to drive the various mechanisms herein set forth, but means are provided whereby certain supplemental drive mechanisms can intermittently drive various elements hereinafter more fully described.

At the left end of Fig. 1 is shown a worm gear 134 meshing with a worm wheel 136 on a shaft 138 journalled in the frames 10 and 14. This shaft carries a number of cams including the one shown in dotted lines at 140 in Fig. 15. This cam is adapted to co-act with a roller 142 carried by a yoke 144 having extensions which straddle the shaft 138, said yoke being connected with an arm 146 carried on a rock shaft 148. This rock shaft also carries bell cranks 150 having arms 152 and 154. Each arm 154 is connected by a link 156 with a bell crank 158 carried on a shaft 160. The bell cranks 150 and 158 are connected by vertical links 162 and 164 with the frame 90 which supports the several trays H of the magazine. Through these connections it will be seen that rotation of the shaft 138 will periodically lift the frame 90 so as to bring the topmost sheet in each pile into co-action with the fingers of the grippers above described. There are two links 162 and two links 164 located in alignment with each other as shown in top plan in Fig. 20 so as to support the magazine at four points, and the motion transmitting mechanism is so proportioned that the trays move upwardly in a horizontal position, in other words a parallel motion is given to the magazine by the movement of the cam 140. The supporting frame 90 for the magazine carries front and rear rollers 166 and 168 which engage the uprights 18 and 16 respectively and similar rollers 170 and 172 which engage the uprights 22 and 20. These rollers serve to guide the magazine in its upward movement so that the piles of sheets carried by the trays H are moved vertically in a straight line to bring the sheets into proper position for engagement with the fingers of the grippers B.

As above stated the carriage C is provided with grippers adapted to pick the topmost sheet from the several trays simultaneously. After this has been done the carriage moves forward along the inclined tracks carrying the sheets with it to an operative station, the sheets overlapping one another as will be understood. The carriage is caused to dwell at said operative station while mechanism, to now be described, moves the sheets into engagement with the sheet-wrapping arbor D. This arbor carries a clamp which at this time is in open position ready to receive the sheets.

Figs. 15 and 33 to 36 show the carriage mechanism most clearly. The arbor and its clamp are illustrated clearly in Figs. 37 to 46. Referring first to the mechanism for moving the sheets into engagement with the arbor clamp, the carriage C supports near its upper end guides 174 and 176 in which are slidably mounted bars 178 and 180 connected at their lower end by a cross bar 182 to which is secured a tucker blade 188 which blade is adapted to tuck or insert the several sheets between the jaws of the clamp 190 carried by the arbor D. The blade 188 is normally held in the upper position shown in Figs. 33 and 34 by springs 192 se-

cured at one end to said blade and at their other ends to the guides 174 and 176. The upper ends of the bars 178 and 180 are connected by a transverse rod 194 which bar is arranged to enter the forked ends 196 of levers 198 when the carriage moves to its forward or lower position. The levers 198 are carried by a shaft 200 and means to presently be described are provided for rocking this shaft at the proper time to cause the tucker blade 188 to insert the sheets between the clamp jaws of the arbor D.

The shaft 200 is supported in brackets 202 secured to the outside of the inclined carriage tracks. At one end this shaft carries an arm 204 connected by a link 206 with the free end of a lever 208 pivoted at 210 to a suitable boss formed on the frame 14. The lever 208 has a lower arm 212 carrying a roller 214 adapted to be engaged by a cam projection 216 formed on the rear face of a disc 218 carried by the shaft 138 above referred to. A spring 220 normally holds the arm 208 in position to permit the rod 194 to freely enter the forked ends 196 of the levers 198 above referred to. A suitable stop 222 is provided to accurately position the parts. The active portion of the cam 216 is of very short length so that the sheets are quickly moved into engagement with the jaws 190 of the arbor D and the blade is quickly withdrawn from said arbor. Comparison of Figs. 33 and 35 illustrates the movement of the blade 188, but it is to be noted that in these figures only two sheets are shown as being moved into engagement with the arbor, but in practice it is to be understood that a much greater number of sheets are moved into such engagement, only two sheets being shown in this instance because the small scale of the drawing will not permit the clear showing of a greater number. It might be here stated, however, that it is not absolutely necessary that each and every sheet be engaged by the arbor clamp as some of the smaller pieces of short length can be supported between other sheets of greater length.

Feeder moving mechanism.—The carriage C must be periodically moved from the upper position shown in Fig. 1 along its inclined guide rails to a lower position in order to carry the sheets into juxtaposition to the arbor D. The carriage must dwell for a short time in this position to permit the tucker blade 188 to operate while the carriage and the arbor D are at rest. It is advantageous to lock both the carriage and the arbor against movement at different times. The means for intermittently moving the carriage and locking it will now be described with reference particularly to Figs. 2, 4, 5, 6 to 15 and Figs. 20, 20a, 21 and 21a.

Referring first to Figs. 4 and 20 a shaft 224 carries sprockets 226 near its ends adjacent the inclined tracks which guide the carriage in its movements. This shaft is journalled in suitable bearings in the frames 10 and 14. Chains 228 are constantly driven by the sprockets 226 and said chains pass around upper idler sprockets 230 mounted in suitable bearings secured to the guide rails 24, 26, 28 and 30. The shaft 224 which carries the sprockets 226 also carries on one end a sprocket 229 which is driven by a chain 225, Figs. 17 and 18, which passes over a sprocket 227 carried on a shaft 492, hereinafter referred to in detail.

Each chain 228 carries a driving lug 232 which is adapted to engage a respective dog 234 pivoted at 236 on the outer sides of the plates 32 and 34 respectively. The dogs are provided at their upper and lower ends respectively with extensions 238 and 240 which are alternately swung into the path of the lugs 232 carried by the respective chains 228. Impositive locks consisting of spring-pressed balls 242 and 244 are provided to lock the dogs in their different operative positions. Fixed cams 246 are secured to the intermediate portions of the rails 24 and 28 as shown in Figs. 2, 9 and 17. Similar cams 248 are secured near the lower ends of the rails 26 and 30. As hereinafter described these cams are arranged to move the dogs 234 into and out of position at the proper times so as to cause the carriage to move downwardly and carry the sheets to be folded to an operative station and permit the carriage to dwell for a short interval while the tucker blade, above referred to, inserts the sheets into engagement with the clamp of the arbor D. The dogs are tripped out of engagement with the chain during this interval and the chain rotates freely without moving the carriage. After this interval the dogs are swung into position to be engaged by the lug 232 so that the chain will move the carriage back to the position shown in Fig. 1 where the grippers are in position to again engage the sheets when the magazine carrying the trays H is elevated. In this position the dogs are again tripped out of engagement with the chain to permit the carriage to remain stationary although the chain is still moving.

This operation is illustrated in Figs. 4 to 10. The chain is constantly driven in the direction of the arrow *m*. Starting with the position of the carriage shown in Figs. 4 and 7, the upper end 238 of the dog has been moved by the inclined surface 247 of the cam 246 to throw the dog 234 out of the path of the chain lug 232 as shown clearly in Fig. 12. This action will throw the end 240 of said dog under the lower run of the chain in position to be struck by the chain lug 232 when it travels around the sprocket 230. The lower run of the chain, of course, travels in the opposite direction to the upper run as

indicated by the arrow *n* in Fig. 8, and when the chain lug 232 comes into contact with the lower end of the dog it will engage the extension 240 and thereby move the carriage C downward along its inclined guide rails. This downward motion will continue until such time that the said extension 240 of the dog engages the inclined surface 249 of the cam 248. Continued motion of the chain will cause the dog to be rocked on its pivot 236 to the position indicated in Fig. 14. In this position opposite end of the dog is set to be engaged by the chain lug after it has traveled around the sprocket 226. From the time that the cam 248 disengages the dog until the time that the chain lug travels around to strike the extension 238, the carriage will dwell or remain stationary in its lower position thus allowing sufficient time to permit the tucker blade above referred to to insert the sheet into engagement with the clamp on the arbor D, and also permit said tucker blade to be withdrawn by the arm 198 as above described. After this action has taken place the carriage will travel upward in the direction of the arrow *m* until the cam 246 again trips the dog. This completes the cycle of the carriage movements and leaves it at rest for a short interval during which the frame 90 and trays H are again elevated and the above described cycle is then repeated.

To insure accuracy of the movements of the carriage and to prevent overrunning of the chain, a carriage locking device is provided, including hooks 250 mounted on a rock shaft 252 and adapted to engage stops 254 secured to the side plates 32 and 34 of the carriage. When the carriage reaches its lowermost position, as indicated in Fig. 5, the hook 250 falls into engagement with the stop 254 and a pawl 256 also carried on the shaft 252 drops in front of the dog 234. By these means it will be seen that it is impossible to move the carriage in either direction during the time the chain is rotating freely. When it is time to again move the carriage to its upper position, the chain dog 232 has traveled around to the position illustrated in Fig. 6 where it engages the pawl 256 and lifts it, thus rocking the shaft 252 and disengaging the hook 250 from the stop 254. This permits the chain to move the carriage in the direction of the arrow *m* back to the starting position. Connected to the upper end of the carriage is a pair of cables, one of which is illustrated in Fig. 15 and indicated by numeral 258, each cable being secured to a carriage bracket 260 and passing around a sheave 262 mounted in a suitable bearing secured to the upper ends of the carriage guide rails. Each cable 258 carries a counterweight 264 of sufficient mass to hold the carriage in the upper position against a suitable fixed stop. This counterweight also serves to assist the chain in moving the carriage upward as will be understood.

Sheet winding arbor.—The winding arbor D as hereinbefore stated carries a clamp 190 between the jaws of which the multiplicity of superposed pattern sheets are inserted by the downward movement of the tucker blade 188.

After such insertion the winding arbor is given a plurality of revolutions and then it is collapsed to permit the wrapped pack of sheets to be readily stripped therefrom. The construction and operation of the winding arbor will best be understood by comparison of Figs. 4, 15 and 33 to 46 inclusive.

The arbor is supported on a spindle 266 having enlarged portions 268 and 270 on which are fitted ball-bearings 272 and 274. These bearings are carried by a bracket 276 which is secured by bolts 278 to the side frame 10. On its outer end the spindle 266 has secured thereto a sprocket 280 which is connected by means of a chain 282 with a sprocket 284 (Fig. 1). The sprocket 284 is loosely mounted on a shaft 286 and is provided with a clutch face 288 adapted to coact with a clutch 290 (Figs. 2 and 21), which is rotatable with the shaft 286 and splined thereto so as to permit longitudinal movement. The shaft 286 carries a spiral gear 292 which meshes with a similar gear 294 carried by the main shaft 120, previously referred to. The shaft 120 it will be remembered rotates continuously and in order to intermittently rotate the sheet winding arbor and permit it to dwell at predetermined intervals, means are provided to periodically shift the clutch 290 into and out of engagement with the clutch face of the sprocket 284. This clutch shifting mechanism includes a lever 296 pivoted at 298 to a suitable bracket secured to the side frame 10. This lever carries a pin at one end arranged to engage in an annular groove formed in the clutch 290, and at its opposite end, said lever carries a pair of opposed rollers 299 which engage the opposite faces of a raised cam ridge 300 formed on a circular disc 302 secured to the shaft 114 previously referred to. It will be remembered that the shaft 114 is continuously driven from the shaft 120 by means of the worm and gear 118 and 116. The cam ridge 300 is so shaped that the wrapping arbor will be periodically rotated so as to wrap the sheets thereon and it will cause the clutch 290 to be disengaged at the proper times to stop the wrapping movement so as to permit the sheets to be moved into engagement with the clamp 190 of the arbor while the same is at rest and will also permit the arbor to dwell, or remain

stationary for a sufficient interval to permit the wrapped pack of sheets to be stripped from the arbor.

As shown best in Figs. 2 and 37, the arbor D is of considerable length and is supported only at one end. It is of small depth and as shown in cross section (Fig. 43) it is of minimum thickness. This proportion permits of wrapping wide sheets into a comparatively long narrow package as will be hereinafter more fully described.

The main body portion 304 of the arbor consists of an elongated hard wood member which is rigidly secured by means of bolts 306 and 308 respectively to a head portion 310 and brackets 312 carried by said head portion. The arbor includes a collapsible section 314 of substantially the same length as the portion 304. This section is pivoted on a stud 316 secured to the brackets 312. Springs 317 carried in suitable recesses formed in the section 314 bear against guide plates 318 secured to the underside of the portion 304 of the arbor, and tend to move the section 314 to its expanded position, as shown in Fig. 37.

For collapsing the arbor a sliding member 320 is mounted adjacent the underside of the portion 304 and said member is formed with an upward extension 322 having a cam slot 324 formed therein which is adapted to coact with a pin 326 secured to the upper end of a bracket 328 carried by the collapsible section 314. Comparison of Figs. 37 and 38 will show that the movement of the extension 322 to the left from the position shown in Fig. 37 will cause the section 314 to be collapsed, that is to say, to be rocked on its pivot 316 to the position shown in Fig. 38. A compression spring 330 tends to push the member 320 to the right and a dog 332 is provided to move the member 320 to the left. This dog is pivoted at 334 in a slot 336 formed in the head and a flange 338 which is integral with the head 310. One end of the dog engages a lip 340 formed at the left extremity of the sliding member 320. The dog is rocked when its finger 342 is struck by the upper end of a tappet 344, to be presently described. This tappet performs a number of separate functions, one of which is to actuate the dog 332 as above described to effect the collapsing movement of the arbor, another of which is to lock the arbor in its correct position to receive the sheets to be folded and at the same time to effect the opening movement of the arbor clamp. When the tappet 344 is in its lower position as shown in Fig. 37, the arbor is free to rotate and none of the parts thereof are affected by a tappet. However, when the tappet is lifted to the position shown in Figs. 38 and 40 its upper end will move into the slot 336 formed in the flange 338 and thereby positively prevent rotation of the arbor as long as the tappet is in this position. As the tappet moves up it rocks the dog 332 as above described thus collapsing the arbor and a pin 346 secured to the tappet engages the offset end 348 of a striker 350 which is slidable in a suitable guide 352 secured to the head of the arbor. The upper end of the striker 350 is arranged to engage a pin or arm 354 which is secured to and extends laterally from a tube 356 forming one part of the clamp 190 previously mentioned. This tube extends the full length of the arbor and is formed with a longitudinal slot 358 through which the pattern sheets are adapted to be inserted by the tucker blade 188. The tube 356 is prevented from moving endwise and its turning movement is also limited by a pin 352 secured thereto which projects into a slot 353 formed in a curved plate 355 fixed to the arbor head as shown in Fig. 41. Side plates 360 and 362 of substantially the same length as the tube 356 are secured to the body portion 304 of the arbor and the upper ends of these side plates are formed to fit the cylindrical surface of the tube 356 and form sort of a bearing which permits the tube to rotate relatively to said plates. The opposed edges 364 and 366 of the plates 360 and 362 respectively are separated by such a transverse distance that the tucker blade 188 can insert the multiplicity of superposed sheets between said edges and through the slot 358 in the tube 356, without binding or tearing the sheets. In other words the transverse width of the slot between the edges 364 and 366 is much greater than the combined thickness of the inserted portions of the sheets and the tucker blade. Fig. 40 shows the tucker blade in the act of inserting two superposed sheets into engagement with the clamp. It is to be understood, however, that a greater number of sheets are inserted by the tucker blade, only two being shown because of the difficulty of illustrating a great number of sheets which are only actually a few thousandths of an inch in thickness.

The closing movement of the clamp 190 is effected by a spring 368 one end of which is secured to the arm 354 carried by the tube 356 which constitutes the moving part of the clamp. The other end of the spring is anchored to a pin 370 carried by the flange 338 of the arbor head. As thus arranged it will be appreciated that the closing movement of the clamp is effected by the spring which turns the tube 356 on its axis thereby pinching the inserted sheets between one wall of the slot 358 and the edge 366 of the plate 362. The opening movement of the clamp is effected when the tappet 344 moves up and lifts the slide 350 a sufficient distance to engage and rock the arm 354 carried by the tube 356.

The mechanism for actuating the tappet

344 is best shown in Fig. 4 and includes a rocker arm 372 carried on a stud 374 which is secured to a suitable boss on the frame 10. This rocker arm carries a roller 376 on one end which co-acts with a cam 378 secured to the shaft 114 previously referred to. On its opposite end the rocker arm has a finger 380 adapted to engage a stud 382 secured to the tappet 344. The tappet is mounted for vertical movement in suitable guide brackets 384 and 386 which are secured to the side frame 10 in any suitable manner. A spring 388 is secured near the lower end of the tappet and tends to lift the same. The upper end of this spring may be secured to any fixed member. As shown in the drawings, however, the upper end of this spring is conveniently anchored to a cross-shaft which has a comparatively small angular movement. The cam 378 is provided with suitable dwell portions which are proportioned to periodically hold the tappet 344 in its extreme upper and lower positions respectively.

From the above it will be clear that when the tappet moves upwardly the clamp 190 will be opened so as to permit the insertion of sheets by the tucker blade, and the wrapping arbor D will be locked against rotation at this time due to the fact that the upper end of the tappet is within the slot 336 of the arbor head. It is also clear that the movement of the tappet will rock the dog 332 so as to collapse the arbor. At the time the sheets are being inserted in the clamp this collapsing movement is really not necessary. After the sheets have been inserted by the tucker blade and after the tucker blade has been lifted, the cam 378 causes the rocker 372 to depress the tappet and thereby unlock the arbor and permit the spring 368 to rock the clamp tube 356 from the position shown in Fig. 40 to the position shown in Fig. 42, thus securely gripping the multiplicity of sheets to be wrapped. At this time the arbor is expanded, that is to say, the collapsible section 314 thereof is in the position shown in Fig. 37. The clutch 290 will now be automatically shifted by the cam 300 so as to cause sprockets 284, 280, and chain 282 to rapidly turn the arbor through a sufficient number of revolutions to wrap the superposed sheets into a long narrow pack as shown in Figs 43 and 63. During this wrapping operation a tension web, to be presently described, is moved to such position that it prevents the free ends of the sheets from flying about in haphazard manner.

After the sheets have been completely wound on the arbor the clutch 290 is disengaged by the cam 300 and lever 296. At this time the cam 378 has turned to such position that the spring 388 is permitted to lift the tappet 344 which results in positively locking the arbor against rotation, rocks the tube 356 to the position shown in Fig. 45 so that the pack can subsequently be stripped from the arbor, and the dog 332 is rocked to retract the slide 320 thereby collapsing the arbor as shown in Figs. 38 and 44. This collapsing movement is important as it removes the tension from the closely wound pack of sheets carried by the arbor, and thus permits them to be readily stripped by the transferring mechanism, hereinafter described.

The tension web which prevents the free ends of the sheets from flying about as the arbor is rotated consists of a fabric belt 390 of approximately the same transverse width as the length of the winding arbor. One end of the tension web is secured to a cross rod 392 and the other end of the web carries a tension weight in the form of a transverse bar 394, as best shown in Fig. 15. The bar 392 is supported at each end in a suitable loop formed in a flexible cable 396, the lower end of which carries a weight in the form of a cross bar 398. Each cable 396 is trained over a guide sheave 400 near its lower end and over a similar sheave 402 near its upper end. The sheaves 400 and 402 are loosely mounted on suitable cross shafts as shown. The cable after passing around sheave 402 extends downwardly to the left and the extreme end thereof is secured to an arm 404 of a bell crank mounted on a shaft 406. This bell crank also is provided with a second arm 408 which is connected by a pitman 410 with an arm 412 which is pivoted on a cross rod 414. The upper end of this arm is offset as shown at 416 and is provided with a cross bar 418 around which the tension web 390 passes. The arm 412 is in reality a bale-like member, the lower ends of which are pivoted on the rod 414 and the upper ends of which are joined by the cross member 418. The tension web 390 is also trained over a fixed cross rod 420 secured to suitable brackets not shown. For controlling the movement of the tension belt across the top of the winding arbor a cam 422 is provided on the shaft 138. This cam co-acts with a lever 424 secured to the shaft 406.

It will be perceived from the above description that when the cam 422 revolves, the lever 424 will move clockwise thus moving the lever 404 clockwise which will permit the weight 398 to pull the cable 396 down so as to bring the cross-bar 392 across the top of the winding arbor substantially to the position shown in Fig. 43. At the same time arm 408 and pitman 410 will withdraw the arm 412 so as to swing the cross bar 418 to the left from the position shown in Fig. 15 so as to permit the rotation of the arbor without interfering with

said cross bar. It is apparent that with the web 390 extending across the top of the arbor, when the same is rotated a gentle yielding tension will be exerted on the sheets being wrapped. The amount of this tension can be varied by varying the weight of the respective tension weights 394 and 398. In addition to exerting a tension on the sheets being wrapped the web 390 and cross bar 392 also serve as a guide when the sheets are being inserted into engagement with the clamp 190 of the wrapping arbor. At this time the carriage of course is in its lowermost position and the forward ends of the several sheets are prevented from falling down into the interior of the machine after they are released by the gripper fingers by a sheet metal tray 426 which is supported on cross rods 428 and 430. The upper ends of the released sheets will hang over the cross bar 392 as shown in Fig. 33 and the extreme ends of some of the longer sheets will perhaps rest on the forward edges of the trays H. At this time the cross bar 392 and the cross member 418 will be substantially in vertical alignment and the portion of the tension web therebetween will naturally form a vertical guide wall which will assist the operation of neatly inserting the sheets between the jaws of the clamp 190.

Pack transfer mechanism.—After the several sheets have been wrapped on the arbor and the same has been collapsed a pair of opposed stripping jaws are moved so as to engage the opposite sides of the wrapped pack, these jaws are then moved longitudinally so as to move the wrapped pack into the bite of a pair of opposed rollers which will completely strip the pack from the collapsed arbor.

This mechanism is best shown in Figs. 2, 4, 15, 21, 39, 44, 47 to 52 inclusive. The gripping jaws are formed of angle bars 432 and 434 secured to the free ends of arms 436 and 438 which are slidably mounted on cross shafts 440 and 442. The jaws are provided with resilient pads 444 and 446 of rubber or other suitable material which engage the opposite sides of the wrapped pack as shown in Figs. 39 and 44. The arms 436 and 438 are arranged in pairs, that is to say, there are two arms 436 carried by the shaft 440 and two arms 438 carried by the shaft 442. Each pair of arms is connected at its upper end by the angle bar jaws 432 and 434 respectively. Near their lower ends the arms 436 are connected by a cross rod 448 and the arms 438 are similarly connected by a cross rod 450. Rigidily secured to the shafts 440 and 442 respectively are short bifurcated arms 452 and 454 which slidingly engage the cross rods 448 and 450 carried respectively by the arms 436 and 438. This arrangement permits the arms 436 to partake of the rocking movement imparted by the shafts 440 and 442 and also permits said arms to be shifted longitudinally with respect to the shafts on which they are sildably mounted. The arms 436 and 438 as shown at the right in Fig. 2 are each provided with a lug 456 and each lug is connected by a link 458 with a rocker arm 460 pivoted on a rock shaft 462 mounted in suitable bearings 464 secured to the base of the machine. Connecting the two rocker arms 460 is a rod 466 to which one end of a pitman 468 is connected. The other end of this pitman is pivotally secured at 470 (Fig. 3) to the arm 472 of a bell crank loosely mounted on a shaft 474 which is supported in suitable fixed bearings 476. The other arm 478 of the aforesaid bell crank, carries a cam roller 480 which rides in a cam groove 482 of a cam 484 secured to a shaft 486. This shaft carries a worm gear 488 (Fig. 2) which meshes with a worm 490 secured to a cross shaft 492. On the forward end this shaft carries a miter gear 494 which meshes with a similar gear 496 secured to the main drive shaft 120.

The shafts 440 and 442 have secured to their forward ends spur gears 498 and 500 respectively which mesh with one another as shown in Fig. 4. The shaft 442 carries an arm 502 which is connected by a pitman 504, the lower end of which is secured to an arm 506 of a bell crank pivoted on a fixed stud 508. The lower arm 510 of this bell crank carries a cam roller 512 which coacts with a groove 514 formed in a cam 516 secured to the shaft 114.

The above connections provide means whereby the opposed jaws 432 and 434 move from the position shown in Fig. 15 to that shown in Fig. 44 so as to engage the wrapped pack of sheets wound on the arbor. This engaging movement is effected by the cam 516 which through the bell crank arms 510 and 506, pitman 504 and arm 502 rocks the shafts 440 and 442 in the proper direction to cause the closing movement of the stripper jaws. After the jaws have engaged the wrapped pack the cam 482 comes in play causing the arm 472 of the bell crank carried by the shaft 474 to swing to the right and thereby move the arms 436 and 438 longitudinally on their supporting shafts 440 and 442. This action moves the wrapped pack longitudinally with relation to the arbor D a sufficient distance to bring the forward end of said wrapped pack into the bite of a pair of opposed rollers 518 and 520 which are arranged to rotate on vertical axes located on opposite sides of the projected axis of rotation of the sheet wrapping arbor D. To guide the pack into the bite of the rollers 518 and 520 a flared sheet metal housing 522 is provided which is secured to a fixed bracket 528 as shown in Fig. 2.

The roller 520 is carried on a shaft 524 which extends downwardly through a supporting housing 526 and through a bracket 528 which is secured to the intermediate frame 14. To the lower end of the shaft 524 is secured a sprocket 530 which is connected by a chain 532 with a sprocket 534 on the upper end of a shaft 536, Fig. 17. To the lower end of the shaft 536 is secured a bevel gear 538 which meshes with a similar gear 540 carried by the shaft 492 above mentioned which is driven continuously from the main shaft 120.

The shaft 524 has keyed on its upper end a spur gear 542 which meshes with a similar gear 544 carried on the upper end of a shaft 546 which carries the roller 518. This shaft 546 is mounted in sliding bearings 548 and 550 respectively which are suitably guided in the housing 526. Links 552 and 554 connect the above mentioned bearings with short arms 556 and 558 carried on a rock shaft 560 supported in suitable bearings 562 secured to the housing 526. To the lower end of the shaft 560 is secured an arm 564 (Fig. 21) which is connected by a link 566 to the outer end 568 of a rocker arm loosely pivoted on the above mentioned shaft 536. This arm carries a roller 570 which bears against the side face of a cam 572, a spring 574 being provided as shown to hold the roller in contact with the cam. The above described connections provide means whereby the roller 518 may be moved toward and away from the roller 520. When the rollers are separated as shown in Fig. 52, their upper gears 542 and 544 are not moved entirely out of mesh. This condition is illustrated in Fig. 51. When the roller 518 is moved to the position shown in Fig. 50 the gears 542 and 544 are in proper mesh for driving said rollers. At the time that the stripping jaws insert the forward end of the wrapped pack between the rollers 518 and 520 as shown in Fig. 39, the said rollers are separated to allow the pack to freely enter the bite thereof. The cam 572 then comes into play to rock the shaft 560 and cause the roller 518 to move toward the roller 520, whereupon the rotation of the rollers will strip the wrapped pack from the arbor D and at the same time pressure exerted by the rollers will crease the folds of the pack. The wrapped pack is now ready to be acted on by the pack-wrapping arbor G.

Pack-wrapping arbor.—This mechanism is located chiefly in that section of the machine which is situated between the intermediate frame 14 and the outboard frame 12, as shown in Figs. 2, 18, 20ª, 24 and illustrated in detail in Figs. 53 to 62 inclusive.

When the creased pack passes the rollers 518 and 520 it enters a passageway formed by spaced plates 575 and 576 which guide the pack into position to be engaged by the pack-wrapping arbor G. The plates of the passageway are supported by brackets 578 which are secured to any suitable fixed part of the framework of the machine.

The pack-wrapping arbor is shown in detail in Figs. 53 to 59 inclusive, and includes a vertical spindle 580 to the lower end of which is fastened a bevel gear 582 and to the upper end of which is secured a head 584, the head being secured by flat-head screws 586 which pass through a flange 588 formed on the upper end of the spindle 580. The spindle 580 is formed with an axial bore to guide a stem 590 which is riveted to the underside of a stripper plate 592 which normally rests on the upper surface of the head 584. This stripper plate is provided with openings 594 and 596 to permit the free upward movement of the plate and also to permit the movement of the other parts to be presently described.

Rigidly secured to the head 584 and projecting upwardly through the openings 594 and 596 respectively of the stripper plate are uprights 598 and 600. The outer edges of these uprights are bevelled as at 602 and 604 so as to present a narrow edge around which the previously wrapped pack of sheets can be again wrapped or folded. The upright 598 is formed with a shoulder 606 and an inwardly extending fin 608. This upright forms the fixed jaw of the clamp for the pack-wrapping arbor. The movable jaw of the clamp comprises an upright 610 which is rigidly secured to a swinging arm 612 which is pivoted at 614 below the head 584. A spring 616 is secured at one end to the arm 612 and at the other end to a pin 613 carried on the underside of the head 584 and tends to press the jaw 610 toward the fixed jaw. The upright 610 is provided with a shoulder 618 and an inwardly extending fin 620. When the jaw is in its closed position the fin 608 of the fixed jaw and the fin 620 of the movable jaw are substantially parallel, and these members together with the upright 600 form a short narrow arbor around which the pack of pattern sheets can be wrapped so as to fold the same into a short compact package.

The arm 612 is of curved formation as shown in plan in Fig. 56 so as to straddle the supporting bearing for the spindle 580 and thus permit of supporting the upright 610 substantially diametrically opposite the upright 600 when the clamp is in closed position. As shown in Fig. 56 the opening 594 in the stripper plate conforms in shape to the cross-section of that portion of the upright 602 which extends therethrough. Part of this opening as indicated at 595 is of arcuate shape so as to permit of slight angular movement of the upright 610 carried by the arm 612. The outer end of arm

612 carries a downwardly projecting pin 622 which is adapted to be struck at the proper time by the end 624 of a slidable rod 626 operating in fixed guides 628, shown in detail in Fig. 53. The slide-rod is normally held in its retracted position by a spring 630, one end of which is anchored to the underside thereof and the opposite end of which is secured to an eye carried by the guide as shown. An arm 632 pivoted on a shaft 634 is connected by means of a link 636 with the slide and at the proper time the lower end of the arm is struck by a pin 638 secured to a disc 639 on shaft 138 so as to swing said arm to the left, as shown in Fig. 53, and thereby cause the slide 626 to strike the pin carried by the arm 612 and thus open the movable jaw 610 of the arbor clamp. The length of the arm 632 is such that the pin 638 holds the jaw of the clamp open for a sufficient interval to permit the forward end of the folded pack to be fed between the jaws 602 and 610 of the arbor. And after the pin 638 rides off the end of the arm 632 the spring 616 will cause the jaw 610 to snap to the position shown in Fig. 57, thus securely clamping the end of the wrapped pack. It will be noticed that the shoulder portions 606 and 618 of the uprights are substantially the same width in plan so that when one jaw closes against the other they will nest together as shown in Fig. 57 and will offset or kink the forward end of the wrapped pack and therefore secure a good hold thereon. This offset grip makes it possible to wind the previously wrapped pack on this arbor without danger of the jaws losing their hold and permits the use of a comparatively light spring 616 for holding the movable jaw in closed position. It is desirable to use such a light spring because after the arbor has made a sufficient number of revolutions to wrap the pack into a package, said package must be stripped from the arbor while the spring pressure is exerted thereon. Of course means could be provided for giving a slight open movement to the movable jaw at the time the pack is stripped but this would add complication to the mechanism and the offset grip described securely holds the end of the pack during the wrapping operation and yet permits the same to be stripped while the spring pressure is exerted on the movable jaw.

Means are provided for periodically rotating the pack-wrapping arbor G a sufficient number of revolutions to wrap the pack into a short narrow package. Locking means are also provided to hold this arbor stationary while the forward end of the pack of sheets is being transferred from the sheet-wrapping arbor D to the said pack-wrapping arbor G. And other means are provided for stripping the completely wrapped package from the arbor G and feeding it into the bite of pressure rollers which will crease the folds of the package and deliver said package to a conveyor which will discharge the package from the machine.

The driving and locking means for the arbor G will first be described with reference particularly to Figs. 2, 18, 23 and 24, 20 and 21ª. Referring first to Fig. 18 the bevel gear 582 carried by the arbor spindle 580 meshes with a similar bevel gear 640 carried by a shaft 642 mounted in bearings 644 and 646. This shaft has splined thereto a clutch member 648 which is adapted to be shifted by a shift-lever 650 so as to engage said clutch with a pin 652 carried by a sprocket 654 mounted to rotate loosely on the shaft 642. This sprocket is driven by a chain 656 from a sprocket 658 on the shaft 120, Fig. 22.

The shift lever 650 above referred to is pivoted at 660 to a lug secured to the bearing 476 and said lever carries a pair of rollers 662 which are adapted to engage opposite sides of a cam rib 664 formed on the periphery of a disc 666 which is secured to the shaft 486, previously referred to. This cam ridge is shaped in such a way that it causes the shift lever 650 to periodically move the clutch 648 into engagement with the pin 652 on the sprocket 654. A dwell portion of the cam permits the clutch to remain in engagement with the sprocket for a sufficient length of time to permit the pack-wrapping arbor G to make enough revolutions to completely fold the long narrow pack, stripped from the arbor D, into a short compact package. After the package has been formed, cam 664 disengages the clutch 648 and thereby stops the rotation of the arbor G. When the arbor G stops its rotation the jaws thereof are located in approximate alignment with the axis of rotation of the sheet-winding arbor D, hence when the jaws are opened they will receive the wrapped pack of sheets which are carried forward by the transferring mechanism hereinbefore described.

It is important that the pack-wrapping arbor G be accurately positioned and locked when it comes to rest. To these ends a locking disc 668 having a plurality of notches 670 formed therein is fixedly secured to the shaft 642. An arm 672 is loosely pivoted on a shaft 474 and is provided with a locking finger 674 adapted to engage the notches 670 of the locking disc. The arm 672 is pulled upwardly by a spring 676 and it carries a cam roller 678 adapted to co-act with a cam plate 680 carried on the face of the cam 484, previously referred to, which is secured to the shaft 486. The ratio of the sprockets 658 and 654, and of the gears 640 and 582 is such that one and one-quarter

revolutions of the shaft 642 will give an even number of revolutions to the spindle 580 so that when the arbor G comes to rest the movable jaw will always stop opposite to the guide passage formed by the plates 574 and 576. There are four notches 670 in the disc 668 and as the shaft 642 which rotates this disc makes one and one-quarter revolutions for each cycle of the machine it will be understood that the finger 674 engages a different notch during each successive cycle. It will be further understood that the cam 680 is proportioned so as to hold the finger out of engagement with the locking disc 668 for sufficient time for it to make almost one and one-quarter revolutions whereupon the roller 678 will ride from under cam surface and the spring 676 will snap the finger against the locking disc in time to accurately position the shaft 642 after it has made the required one and one-quarter revolutions. Of course other types of locking devices such as a Geneva movement or the like could be employed to perform this function.

From the above it is clear that when the jaws 598 and 610 of the arbor G are in the open position, the rollers 518 and 520 can feed the wrapped pack of sheets from the arbor D between said jaws, and that when the slide 626 is retracted the spring 616 will cause the movable jaw 610 to grip the forward end of the wrapped pack. After this has taken place the clutch 648 will be moved into engagement with the pin 652, the locking finger 674 having previously been disengaged by the cam 680. Bevel gear 640 will now rotate gear 582 and the arbor spindle 580 through a sufficient number of revolutions to completely wrap the pack into a short package as shown in Fig. 57. After this has taken place the stripper plate 592 will be lifted by mechanism to be presently described so as to lift the package from the arbor G into the bite of a pair of opposed pressure rollers 682 and 684 shown in Figs. 18 and 61.

While the pack is being wrapped on the arbor G it is advantageous to exert a slight tension on the sides thereof to prevent centrifugal force from forcing the different convolutions of the pack outwardly. For this purpose I have provided canvas belts 686 and 688 which are secured at one end to fixed bridles 690 and 692. These bridles are fastened to upright pins 694 and 696, best shown in Fig. 60. The outer ends of the tension belts are secured to bridles 698 and 700 and springs 702 and 704, yieldingly connect the last mentioned bridles to fixed hooks 706 and 708 carried by an upright rod 710. The tension belts 686 and 688 pass through a slot 712 formed in a standard 714 which is secured to the top plate 716. This top plate bridges a space between the intermediate frame 14 and the outboard frame 12 and forms a supporting structure for the stripper mechanism and delivery mechanism to be presently described. The bearing for the pack-wrapping arbor also is carried by this supporting plate and comprises an integral hub or boss 718 through which the arbor spindle 580 extends as shown in Fig. 54.

As illustrated in Figs. 57 and 60, the belts 686 and 688 will bear on the outer surface of the pack as it is being wrapped on the arbor G, it being understood that the springs 702 and 704 will yield as the arbor rotates.

For lifting the stripper plate 592 a pair of oppositely disposed arms 720 and 722 are mounted on a rock shaft 724 and provided at their free ends with forked plates 726 and 728 which engage the outer portion of the circular stripper plate 592. The connection is such that the stripper plate can freely revolve with respect to the forked plates without exerting undue friction. In other words the plates are forked or slotted in such a way as to permit the stripper plate 592 to revolve freely.

After the pack has been completely wrapped into a package on the arbor G, the shaft 724 is rocked (it being understood that the arbor is locked stationary at this time by the finger 674 and disc 668) by means of an arm 730. This arm is connected to a link 732 which at its lower end is pivotally secured to a stud 734 carried by an arm 736 loosely pivoted on the shaft 474 as shown in Fig. 2. On its free end the arm 736 carries a roller 738 which rides in a cam groove 740 formed in a cam 742 keyed or otherwise secured to the shaft 486.

After the pack of sheets has been completely wrapped into a compact package the cam 742 through the connection just described causes the arms 720 and 722 to lift the plate 592 to the position shown in Figs. 61 and 62. This action partially strips the wrapped package from arbor G and moves the upper end thereof into the bite of the rollers 682 and 684. These rollers are supported by upright standards 744, the roller 682 being carried by spring pressed bearing blocks 746 which are arranged to slide on the bearing surfaces 748 formed on the standards. When the plate 592 is lifted, the tension webs 686 and 688 are flexed as shown in Figs. 61 and 62 and the springs 702 and 704 are slightly stretched as will be understood.

The rollers 682 and 684 exert a pressure on the compact package and crease the folds which were made by the wrapping arbor G. These rollers then deliver the completely wrapped and creased package to the bite of a pair of opposed conveyor belts 750 and 752. At their inner ends these belts are guided

over rollers 754 and 756 respectively and at their outer ends said belts are trained over similar rollers 758 and 760. A slack take-up roller 762 is provided for the belt 750 and a take-up device including a rod 764 carried on a link 766 pivoted at 768 is provided to guide and take up the slack of the belt 752. The rollers 760 and 758 are located in juxtaposition to an inclined discharge chute 770 which is adapted to receive the wrapped packages from the conveyor belts and guide them by gravity to a suitable station outside of the machine.

The drive for the rollers 756 to 760 inclusive is best shown in Figs. 18 and 19 and includes a sprocket 772 which is connected by means of a chain 774 with a sprocket 776 mounted on a shaft 778 carried by the standards 744. This shaft carries a spur gear 780 which meshes with a gear 782 secured to a shaft 784, this shaft being the one that supports the above-mentioned roller 756. This shaft also carries a gear 786 which meshes with a gear 788 carried on a shaft 790 which shaft supports the roller 754. This gearing is so arranged that the conveyor belts will be driven in the proper direction as indicated by the arrows in Fig. 61, to discharge the wrapped package from the machine. The drive for the pressure rollers 682 and 684 is from gear 786 through an idler 792 to gear 794 carried on the shaft 796 on which the pressure roller 684 is supported. Said gear 794 meshes with a gear 798 carried by shaft 800 which shaft supports the pressure roller 682. As indicated in Fig. 61 and Figs. 18 and 19 this gearing drives the pressure rollers in the proper direction to strip the wrapped package from the arbor G and deliver it to the conveyor belts 750 and 752. The gears 788 and 798 are offset from one another as indicated in Fig. 62 so as to avoid interference with one another as will be understood.

The above concludes the specific description of the various instrumentalities, many of which embody novel features and contribute means whereby the novel method herein claimed can be accomplished in a satisfactory manner.

In the foregoing specification, as far as possible, I have attempted to describe in detail the construction and operation of the various instrumentalities in the sequence in which they come into play, hence it is only necessary in closing to give a brief résumé of the operation of the machine as a whole.

Operation.—All the pattern sheets required to form a number of complete patterns of the same size and style are placed in separate piles or stacks. For example, if patterns for a waist, say size 36 are to be folded, all the waist fronts are placed in one pile, the backs in another pile, sleeves in the third pile, collars in the fourth pile, cuffs in another pile, and so on. If the pattern is for a dress or the like, the skirt front, panels, pockets and so forth are arranged in respective piles.

Each pile therefore constitutes a multiplicity of sheets which are duplicates of one another. The size, that is, the length and width of the sheets in the several piles are quite different and the shapes of said sheets in the different piles are quite different. This lack of uniformity of size and shape of the sheets in the different piles presents problems not usually encountered in paper folding machines such as used in connection for example with newspaper presses, paper bag machinery and the like. The pattern sheets are generally made of thin flimsy paper such as tissue paper and the handling of this material presents problems in handling, not usually encountered in other folding machines.

The feeding device herein described provides means for solving the problem of picking the topmost sheets from each of the several piles. The wrapping arbor provides means for wrapping sheets of different sizes in a single long narrow pack and the pack wrapping arbor G provides means for folding this pack into a short compact package.

The piles of sheets above referred to are placed in the trays H. Some of the trays may contain only one pile of sheets when the pattern piece is a large one and other trays may contain two or more piles of sheets of smaller pattern pieces. After the several piles have been arranged in the several trays, said trays are stacked one upon the other as shown in Figs. 15 and 20. As best shown in Fig. 15, the forward edges of the trays are offset from one another so as to leave the top of the piles in each tray exposed at one end. Suitable locating pins, 93 are carried on the underside of each tray and adapted to correctly position each tray with respect to its neighbor. The lowermost tray rests on the frame 90 which is provided with suitable locating pins 91 adapted to position the tray on said frame. When the several trays constituting the magazine have been placed in position the clutch 126 is shifted to operatively connect the main shaft 120 with the driving motor. Through the connections previously described the shafts 148 and 160 are rocked, which action lifts the frame 90 and trays carried thereby so as to cause the topmost sheet in each of the several piles to be engaged by the fingers of the grippers B, the fingers at this time being open. The arm 100 is now rocked to the right from the position shown in Fig. 4 thus permitting the bar 84 to slide downward on its pins 96 and 98. Due to the inclination of slots 92 and 94 the bar travels away from the carriage C; that is to say, its perpendicular distance from the carriage

is increased. The roller carried by arm 82 which is pivoted on one of the carriage shafts 44 follows the bar 84 and hence rocks said cross shaft. This rocking movement is communicated to all of the other cross shafts 44 through the arms 76 and connecting rod 80, said rocking movement permits all of the fingers 62 to close and grip the topmost sheet. Frame 90 carrying the trays H, is then lowered and the carriage moves downward under the influence of chains 228 and the driving lug 232 carried thereby. When the carriage reaches its lowermost position the driving dog for said carriage is tripped and the carriage dwells for a short interval in this position. The downward movement of the carriage brings the topmost sheet of each pile forward so that they lie over the top of the sheet-wrapping arbor D, and the tucker blade 188 is aligned with the open clamp 190 of said arbor. On the downward movement of the carriage, the cross bar 194, which is operatively connected with the tucker blade, enters the forked end 196 of the arm 198. This arm is now rocked by the cam 216 through arm 208, link 206 and arm 204. This action inserts the multiplicity of pattern sheets into engagement with the clamp 190 of the arbor D. At this time the tappet 344 is in its upper position, therefore holding the clamp 190 open and locking the arbor against rotation. The clutch 290 is also disengaged from the sprocket 288.

After the tucker blade is lifted the tappet 344 is depressed by the action of cam 378 and lever 372 thereby permitting the clamp 190 to close and grip the pattern sheets and at the same time unlocking the arbor. The clutch 290 is now shifted so as to cause the driving connection between the sprocket 284 and the sprocket 280 to be established so as to rotate the arbor D. In the meantime, the carriage is returned to its upper position. While the arbor D is rotating and wrapping the sheets thereon into a long narrow pack the tension web 390 is exerting a gentle yielding pressure to prevent the loose or free ends of the sheets from flying.

After the arbor D has made a sufficient number of revolutions to fold the multiplicity of sheets into a long narrow pack, as shown diagrammatically in Fig. 63, the clutch 290 is again disconnected and the tappet 344 moves upward which action results in locking the arbor against rotation, collapsing the arbor, and opening the clamp 190. The wrapped pack of sheets is now ready to be stripped from the arbor D. The transfer mechanism now comes into play and the arms 436 and 438 are swung inward by the partial rotation of shafts 440 and 442. This action brings the stripping jaws into engagement with the wrapped pack on the arbor and the resilient pads provide means whereby a frictional grip is exerted on the pack. The arms 460 are now rocked to the right from the position shown in Fig. 2 thus moving the arms 436 and 438 longitudinally on their supporting shafts 440 and 442. This action moves the wrapped pack longitudinally with respect to the arbor D and inserts the forward end of said pack through the guide 522 and into the bite of the rollers 518 and 520. As the pack is inserted the roller 518 is spaced away from the roller 520 a sufficient distance to permit the pack to freely enter. After the pack has entered between the bite of the rollers the shaft 560 is rocked and through link 552 moves roller 518 toward roller 520. In this position the rollers exert a pressure on the wrapped pack and crease the folds formed by the arbor D, the rotation of said rollers also feeds the pack forward through the passageway formed by the plates 574 and 576 and guides the long narrow pack toward the pack-wrapping arbor G. At this time the movable jaw 610 of the clamp of said arbor is in its open position so as to receive the wrapped pack. After the pack has been inserted between the jaws 598 and 610 of this arbor the slide 626 is withdrawn thus permitting the arm 612 to swing inward thereby causing the jaws to kink the end of the wrapped pack and secure a good hold thereon.

While the pack is being inserted into position to be engaged by the jaws of the arbor, said arbor is positively locked in its stationary position by co-action of the finger 674 with a corresponding notch 670 in the disc 668, and at this time the clutch 648 of course is disengaged from the pin 652 carried by the drive sprocket.

As soon as the jaws have clamped the end of the pack the clutch 648 is automatically shifted so as to engage the pin 652 whereupon the shaft 642 is rotated, and through bevel gearing 640, 582, the arbor G is rotated a sufficient number of revolutions to wrap the long narrow pack received from the arbor D into a comparatively short compact package. After this act the clutch 648 is disconnected and the arbor is locked stationary whereupon the arms 720 and 722 are raised, thus lifting the stripper plate 592 and causing the wrapped package to enter the bite of the rollers 682 and 684. These rollers exert a pressure on the package and crease the folds formed by the arbor G and deliver the completely wrapped and creased package into the bite of the conveyor belts 750 and 752, which carry said package laterally and discharge it into the inclined chute 770 along which the package travels by gravity to a table or other suitable station. This completes the operation of the machine and the multiplicity of pattern sheets which constitute one garment pattern, are thus neatly and quickly wrapped or fold-

ed into a compact package which can subsequently be inserted into the usual pattern envelope or other container.

The construction and operation of the sheet wrapping arbor and the pack-wrapping arbor have been described in minute detail but it is not to be construed that I am limited to the constructions shown and the operations described. The scheme of folding one or more sheets by wrapping or rolling them is thought to be broadly new. The term arbor as used in the specification and claims is intended to include any structure on which sheets are rolled or wrapped. In fact while the various elements hereinbefore referred to have been shown and described with great particularity it is to be understood that the drawings and descriptions are to be interpreted in an illustrative rather than a limiting sense and that various mechanical equivalents may be employed to perform the functions set forth without departing from the invention as defined in the following claims.

I claim:

1. The method of folding sheets which consists in wrapping them first in one direction with a winding motion and then wrapping them with a winding motion in another direction.

2. The method of folding sheets which consists in stacking them in separate piles, feeding one sheet from each pile to an operative station, wrapping them in one direction on an arbor, stripping them from the arbor and wrapping them in another direction to form a compact package.

3. The method of folding sheets which consists in wrapping them first in one direction with a winding motion, to form a long narrow pack, subjecting them to pressure to crease the folds and then wrapping them in another direction to form a short compact package.

4. The method of folding tissue paper patterns or the like which consists in simultaneously feeding the topmost pattern sheet from a multiplicity of superposed piles to an operative station, simultaneously wrapping them and subjecting the wrapped pack to pressure to crease the folds.

5. The method of folding tissue paper patterns or the like which consists in simultaneously feeding the topmost pattern sheet from a multiplicity of piles to an operative station, simultaneously wrapping them and subjecting the wrapped pack to pressure to crease the folds and then wrapping the creased pack substantially at right angles to the first folds to form a compact package.

6. The method of folding tissue paper pattern sheets or the like which consists in collating and stacking the different sheets of the pattern in separate piles, simultaneously moving one sheet from each of the several piles, folding the several sheets in one direction and then folding them in another direction to form a compact package.

7. The method of folding tissue paper pattern sheets or the like which consists in collating and stacking the different sheets of pattern in separate piles, smultaneously moving one sheet from each of the several piles to an operative station, engaging the sheets with an arbor, wrapping the sheets on the arbor, stripping them from the arbor and subjecting them to pressure to crease the folds, wrapping the pack substantially at right angles to the first folds to form a compact package and subjecting the package to pressure to crease the folds formed by the second wrapping.

8. The method of folding paper articles which consists in wrapping them in one direction on a collapsible arbor, collapsing the arbor and stripping them from said arbor and then wrapping them in another direction to form a compact package

9. The method of simultaneously folding a multiplicity of flimsy sheets which consists in stacking them in separate piles, simultaneously feeding one sheet from each of the piles to an operative station, engaging the multiplicity of sheets with and wrapping them on a wrapping arbor, in one direction, stripping them from said arbor and wrapping them in a different direction and subjecting the wrapped sheets to pressure to crease the folds.

10. The method of folding tissue paper patterns which consists in stacking the several sheets which make up a complete pattern in individual piles, simultaneously feeding one sheet from each pile to an operative station, engaging them with and wrapping them on a winding arbor in one direction to form a long narrow pack, stripping the pack from the arbor and then wrapping the pack to form a short compact package.

11. The method of folding tissue paper patterns which consists in stacking several sheets which make up a complete pattern in individual piles, simultaneously feeding one sheet from each pile to an operative station, engaging them with and wrapping them on a collapsible arbor in one direction, to form a long narrow pack, collapsing said arbor and stripping the wrapped pack therefrom, subjecting the pack to pressure, then wrapping the pack to form a short compact package and subjecting the package to pressure.

12. The method of folding paper patterns which consists in simultaneously feeding the multiplicity of sheets which constitute one complete pattern to an operative station, wrapping said sheets in one direction into a long narrow pack, and then wrapping said pack in another direction to form a short compact package.

13. In a folding machine rotating means

for folding a plurality of sheets in one direction into a long narrow pack, and a rotary device for folding said pack in another direction to form a compact package.

14. In a folding machine rotating means for simultaneously wrapping a plurality of sheets in one direction to form a pack and winding means for wrapping said pack in another direction to form a small compact package.

15. A folding machine including an arbor around which flimsy sheets of tissue paper or the like are adapted to be folded are wrapped, means for collapsing said arbor, means engaging the opposite sides of the wrapped pack of flimsy sheets and moving them longitudinally of the arbor, rollers adapted to engage the wrapped pack to withdraw it from the arbor and exert a pressure on the pack to crease the folds.

16. A machine for folding paper sheets including two wrapping arbors, means for supporting said arbors so that the axis of rotation of one is substantially perpendicular to the other, means for simultaneously moving a plurality of said sheets into engagement with one arbor, means for intermittently rotating said arbors, and means for transferring the sheets after they have been wrapped on one arbor to the other arbor.

17. A machine for folding paper sheets including two wrapping arbors, one of which is arranged to wrap a multiplicity of sheets into a long narrow pack and the other of which is arranged to wrap said pack into a shorter compact package and means for transferring the wrapped pack from one arbor to the other.

18. A machine for folding paper sheets including two wrapping arbors, one of which is arranged to wrap a multiplicity of sheets into a long narrow pack and the other of which is arranged to wrap said pack into a shorter compact package and means for transferring the wrapped pack from one arbor to the other and means for exerting a pressure on the pack while it is being transferred from one arbor to the other.

19. A folding machine including an arbor for wrapping a multiplicity of sheets into a long narrow pack, a second arbor for folding said pack into short compact package, means for transferring the pack from the first named arbor to the second named arbor, and means for removing the compact package from the second arbor.

20. A folding machine including an arbor for wrapping a multiplicity of sheets into a long narrow pack, a second arbor for folding said pack into short compact package, means for transferring the pack from the first named arbor to the second named arbor, means for removing the compact package from the second arbor, and means for exerting a pressure on the compact package to crease the folds.

21. A folding machine including a sheet-wrapping arbor and a pack wrapping arbor, means for transferring the wrapped pack of sheets from the first named arbor to the second named arbor, means for exerting a tension on the sheets being wrapped on the sheet-wrapping arbor and means for exerting a tension on the pack being wrapped on the pack-wrapping arbor.

22. A folding machine including a sheet-wrapping arbor and a pack wrapping arbor, means for transferring the wrapped pack of sheets from the first named arbor to the second named arbor, means for exerting a tension on the sheets being wrapped on the sheet-wrapping arbor and means for exerting a tension on the pack being wrapped on the pack-wrapping arbor, means for exerting a pressure on the wrapped pack after its transfer from the sheet-wrapping arbor, means for removing the compact package from the pack-wrapping arbor and exerting a pressure thereon to crease the folds.

23. A folding machine including a sheet-wrapping arbor and a pack wrapping arbor, means for transferring the wrapped pack of sheets from the first named arbor to the second named arbor, means for exerting a tension on the sheets being wrapped on the sheet-wrapping arbor and means for exerting a tension on the pack being wrapped on the pack-wrapping arbor, means for exerting a pressure on the wrapped pack as it is being transferred from the sheet-wrapping arbor, means for removing the compact package from the pack-wrapping arbor and exerting a pressure thereon to crease the folds and delivery mechanism for discharging the compact package from the machine.

24. A folding machine including a sheet feeder including a multiplicity of grippers mounted on a movable carriage in separate rows, a plurality of trays each adapted to support one or more piles of sheets in position to be engaged by the grippers in one of said rows, and means for elevating said trays to engage the topmost sheet in each pile with the corresponding gripper or grippers, a sheet-wrapping arbor, means for moving said carriage to bring the sheets in juxtaposition to said arbor and means for moving said sheets into engagement with said arbor.

25. A folding machine including a sheet feeder including a multiplicity of grippers mounted on a movable carriage in separate rows, a plurality of trays each adapted to support one or more piles of sheets in position to be engaged by the grippers in one of said rows, and means for elevating said trays to engage the topmost sheet in each pile with corresponding gripper or grippers,

means for closing the grippers to pick the topmost sheet from each pile, a sheet-wrapping arbor, means for intermittently moving said carriage toward and away from said arbor, means for opening the grippers after the sheets have been carried into juxtaposition to the arbor and means for moving said sheets into engagement with the arbor.

26. In a folding machine, a carriage supporting a plurality of grippers each having a presser finger and a picker finger, trays each supporting a pile or piles of sheets, means for lifting and lowering said trays, means for moving the picker fingers to grip the sheets when the trays are lifted, means for moving the carriage when the trays are lowered and means for moving said picker fingers to release the sheets after the carriage has moved forward, a wrapping arbor, and means for engaging the sheets with said arbor.

27. In a folding machine, a carriage supporting a plurality of grippers each having a presser finger and a picker finger, trays each supporting a pile or piles of sheets, means for lifting and lowering said trays, means for moving the picker fingers to grip the sheets when the trays are lifted, means for moving the carriage when the trays are lowered and means for moving said picker fingers to release the sheets after the carriage has moved forward, a wrapping arbor adapted to receive said sheets carried forward by said grippers, a blade carried by said carriage for moving the sheets into engagement with said arbor and means for moving said blade when the carriage is in forward position.

28. In a folding machine, an arbor adapted to simultaneously wrap a multiplicity of sheets into a pack, means for collapsing said arbor to facilitate the removal of the pack, stripping jaws, means for moving said jaws transversely into engagement with the pack on the arbor, rolls adapted to withdraw the wrapped pack from said arbor and crease the folds of said pack and means for moving said jaws longitudinally to engage the pack with said rolls.

29. In a folding machine, an arbor adapted to simultaneously wrap a multiplicity of sheets into a pack, means for collapsing said arbor to facilitate the removal of the pack, stripping jaws, means for moving said jaws transversely into engagement with the pack on the arbor, rolls adapted to withdraw the wrapped pack from said arbor and crease the folds of said pack, means for separating one roll from the other to permit the pack to freely enter the bite thereof, and means for moving said jaws longitudinally to move the pack into the bite of said rolls.

30. In a folding machine, including a collapsible arbor adapted to wrap a multiplicity of sheets into a pack, means for withdrawing the pack from said arbor and exerting a pressure thereon, in combination with a pack-wrapping arbor for wrapping the pack into a small package comprising a member on which the pack is adapted to be wrapped and a clamp member adapted to hold the pack while the arbor rotates and means for moving said clamp member to engage and disengage it at the proper times.

31. In a folding machine, two arbors, means for supporting and rotating said arbors on axes perpendicular to each other, means for transferring sheets wrapped on one arbor to the other arbor, means for locking each of said arbors against rotation while the transfer is being effected and means for intermittently rotating each of said arbors.

32. In a folding machine. a sheet-wrapping arbor mounted for rotation on a horizontal axis, rolls located on opposite sides of the axial center line of said arbor and beyond the end of the arbor, means for moving a wrapped pack of sheets from said arbor to a position to be engaged by said rolls, a pack-wrapping arbor mounted for rotation on a vertical axis and arranged to receive the pack from said rolls.

33. In a folding machine, a sheet-wrapping arbor mounted for rotation on a horizontal axis, rolls located on opposite sides of the axial center line of said arbor and beyond the end of the arbor, means for moving a wrapped pack of sheets from said arbor to a position to be engaged by said rolls, a pack-wrapping arbor mounted for rotation on a vertical axis and arranged to receive the pack from said rolls, a pair of rolls above the pack-wrapping arbor to exert a pressure on the compact package wrapped by said arbor and means for lifting the package into engagement with said last named rolls.

34. In a folding machine, a sheet-wrapping arbor mounted for rotation on a horizontal axis, rolls located on opposite sides of the axial center line of said arbor and beyond the end of the arbor, means for moving a wrapped pack of sheets from said arbor to a position to be engaged by said rolls, a pack-wrapping arbor mounted for rotation on a vertical axis and arranged to receive the pack from said rolls and a pair of rolls above the pack-wrapping arbor to exert a pressure on the compact package wrapped by said arbor and means for lifting the package into engagement with said last named rolls and delivery mechanism arranged to receive the wrapped package of sheets from said last named rolls and discharge it from the machine.

35. In a folding machine, a magazine comprising a plurality of horizontally disposed trays for supporting a multiplicity of piles

of sheets, means for picking one sheet from each of said piles, a sheet-wrapping arbor rotating on a horizontal axis, means for simultaneously moving said sheets to a position above said arbor, a clamp carried by said arbor, means for moving the sheets into position for engagement with said clamp, pressure rolls adjacent the end of the arbor, means for moving the wrapped pack into the bite of said rolls, a pack-wrapping arbor rotating on a vertical axis adjacent said rolls adapted to receive the sheets wrapped by the first named arbor and wrap them into a compact package, means for removing the package from the pack-wrapping arbor, and means for exerting a pressure on the wrapped package.

36. In a folding machine, a magazine comprising a plurality of horizontally disposed trays for supporting a multiplicity of piles of sheets, means for picking one sheet from each of said piles, a sheet-wrapping arbor rotating on a horizontal axis, means for simultaneously moving said sheets to a position above said arbor, a clamp carried by said arbor, means for moving the sheets into position for engagement with said clamp, pressure rolls adjacent the end of the arbor, means for moving the wrapped pack into the bite of said rolls, a pack-wrapping arbor rotating on an axis perpendicular to the axis of the sheet wrapping arbor and arranged to receive the sheets wrapped thereby and means for removing the wrapped package from the pack-wrapping arbor.

37. In a folding machine, a sheet feeder including a plurality of trays each of which support the sheets to be folded, a plurality of grippers, means for effecting a relative vertical movement between the grippers and the trays to cause said grippers to engage the topmost sheet in each of said trays, a rotary folding element, means for moving the grippers to carry the sheets into juxtaposition to said rotary folding element, and means for simultaneously moving said sheets into engagement with said rotary element.

38. In a folding machine means for simultaneously feeding a multiplicity of sheets of different sizes and shapes to an operative station, and means for simultaneously engaging intermediate portions of the sheets so fed with a rotary element adapted to wrap them together into a pack.

39. In a folding machine, a wrapping arbor, means for simultaneously feeding a multiplicity of sheets to a position above said arbor, means for engaging said sheets intermediate their ends with the latter and means for compressing the wrapped sheets into a flat pack.

40. In a folding machine, a plurality of superposed trays each adapted to hold a plurality of sheets, means for simultaneously picking at least one sheet from each tray and simultaneously feeding the superposed sheets to a predetermined station, a rotary arbor, and a blade arranged to engage the top of the superposed sheets and move them into engagement with said rotary arbor.

41. The method of folding paper patterns into a package of a certain maximum length and breadth which consists in collecting together a stack of the different pieces of the pattern, winding them together into a pack of a width within one of said maximum dimensions and of a length corresponding to that of the pattern pieces, and then winding such pack transversely into a package of a width within the other of said maximum dimensions.

42. In the folding of a number of sheets together the method which consists in gripping the sheets intermediate their ends and wrapping them together on an arbor.

43. In the folding of a number of sheets together the method which consists in buckling the sheets intermediate their ends and gripping the buckled portion and rolling said sheets together into a roll and compressing the roll into a flat pack.

In witness whereof, I have hereunto signed my name.

SIMON COOPER.