June 2, 1925. 1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

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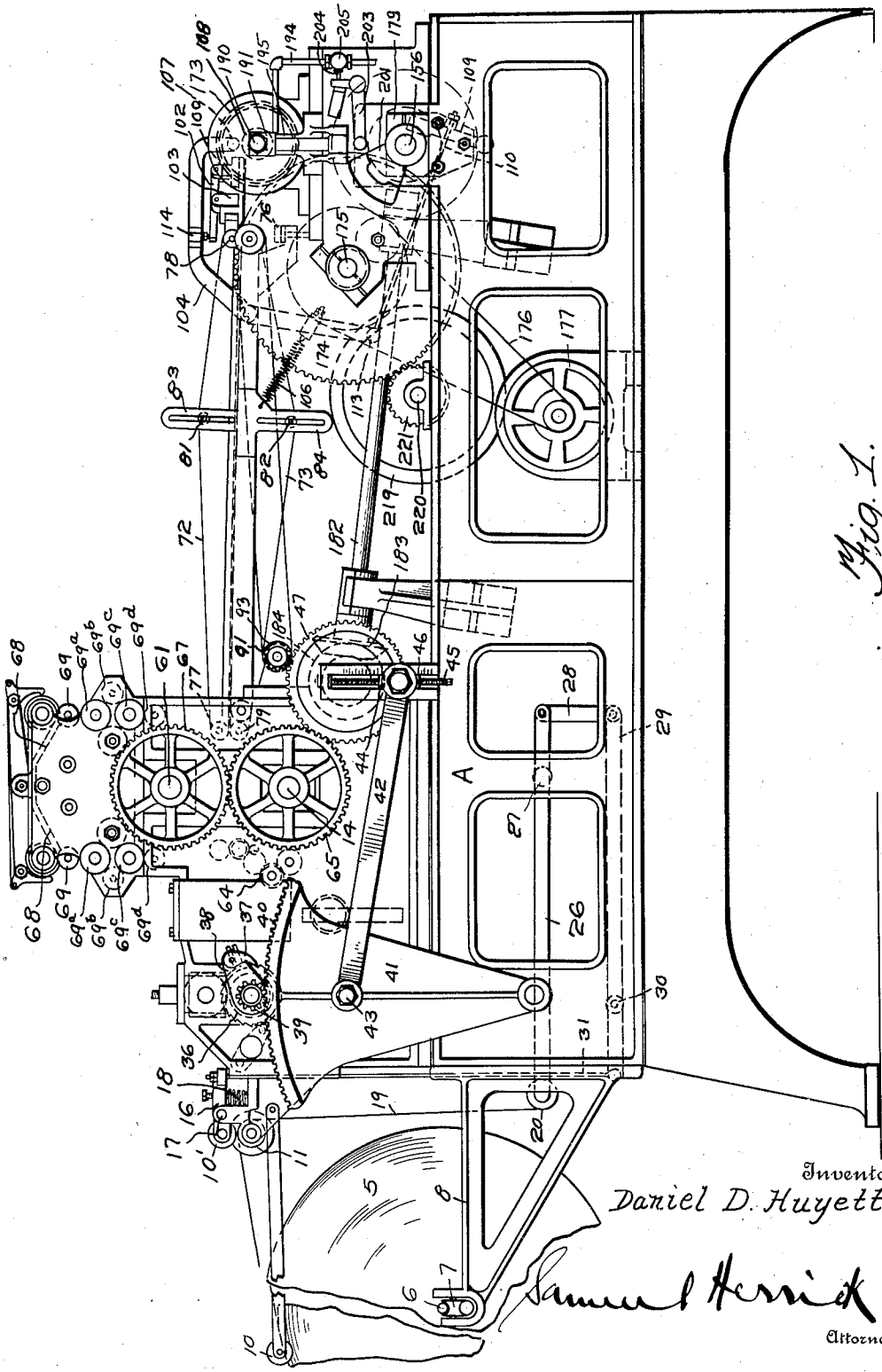


Fig. 1.

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June 2, 1925. 1,540,336

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PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 2

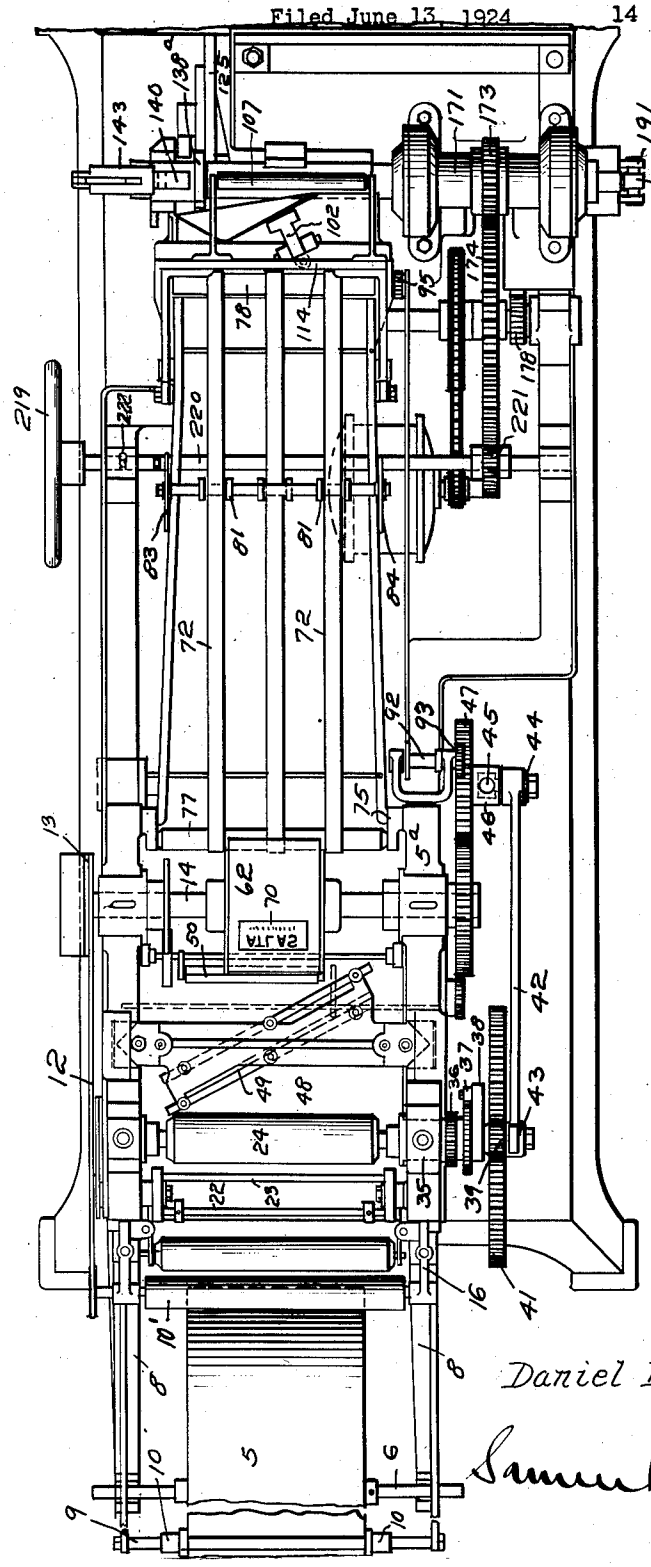


Fig. 2.

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June 2, 1925. 1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 3

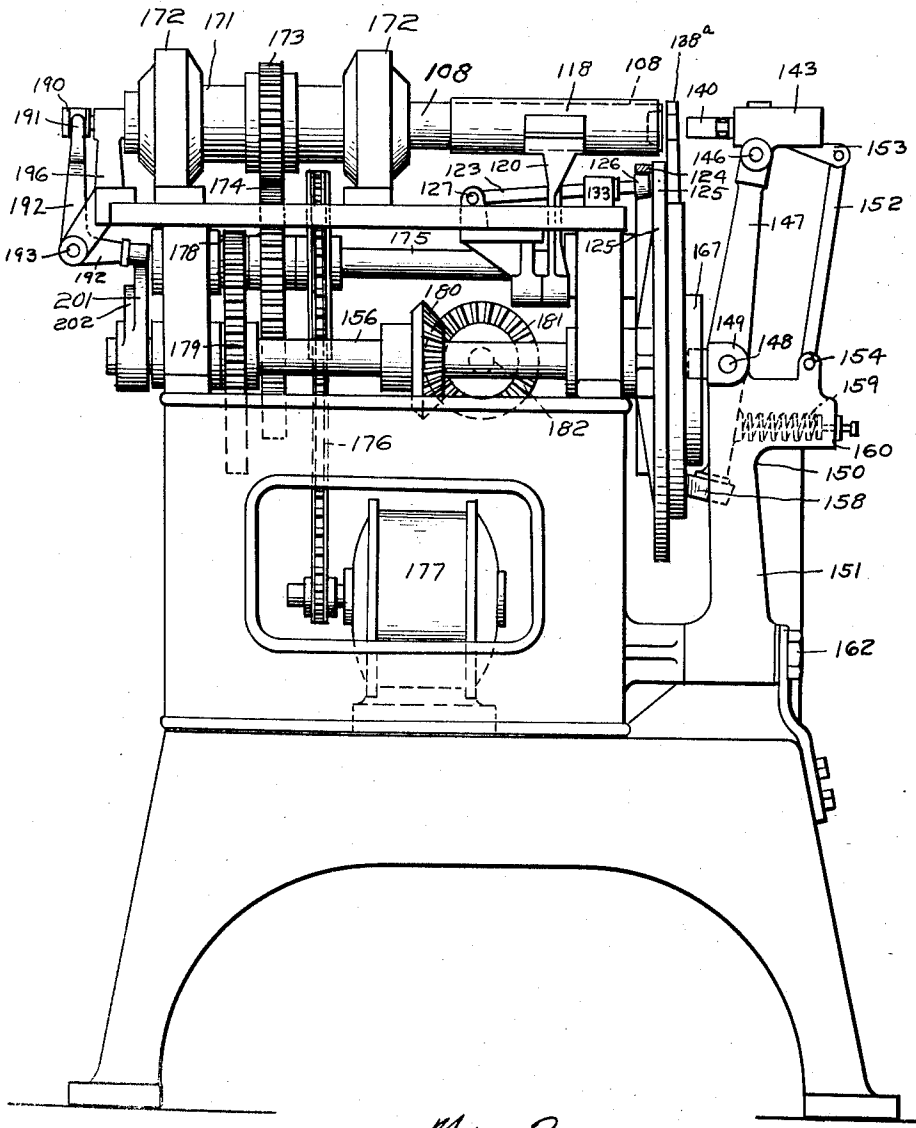


Fig. 3.

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June 2, 1925. 1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 4

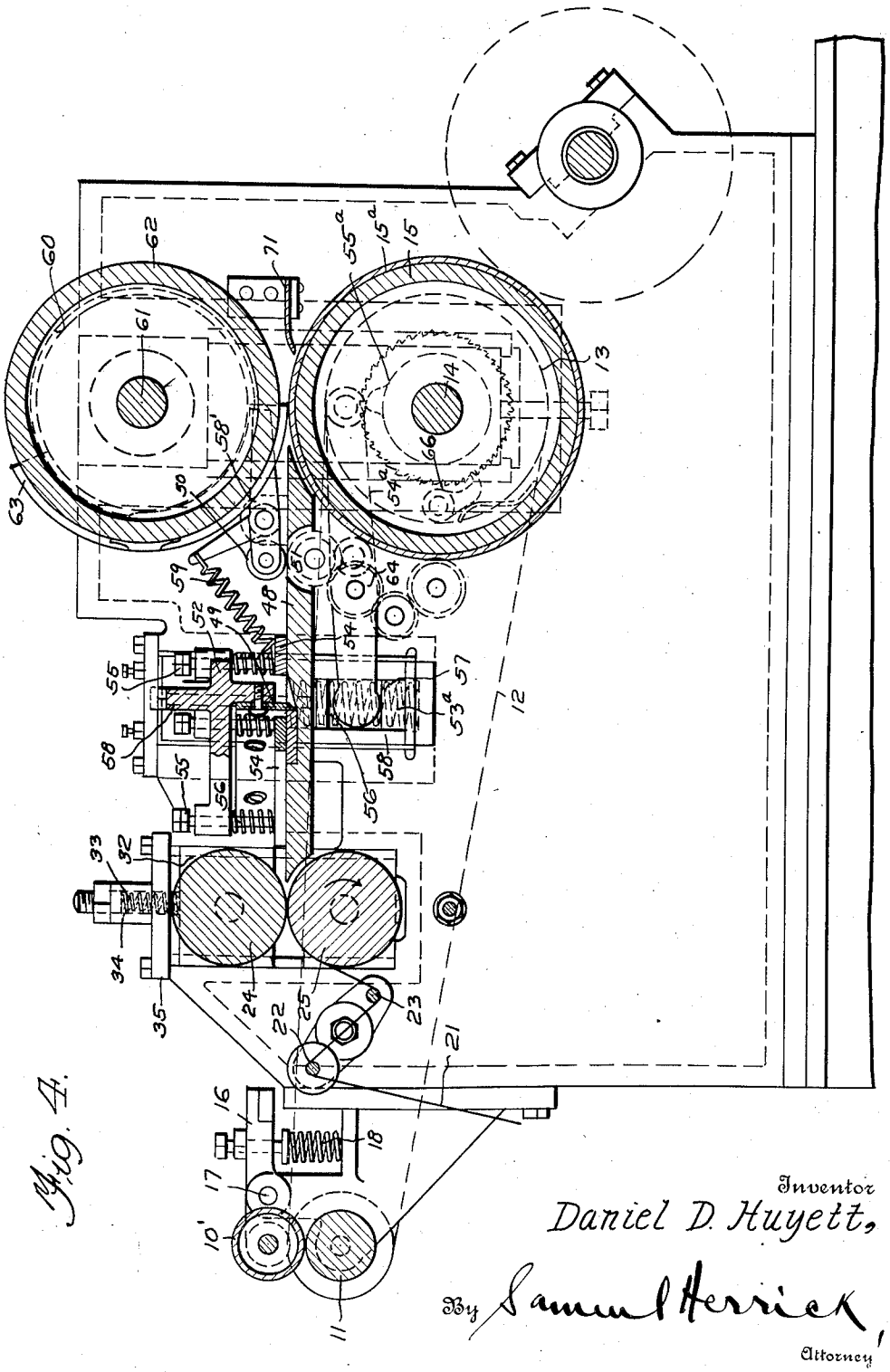


Fig. 4.

Inventor
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June 2, 1925. 1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 5

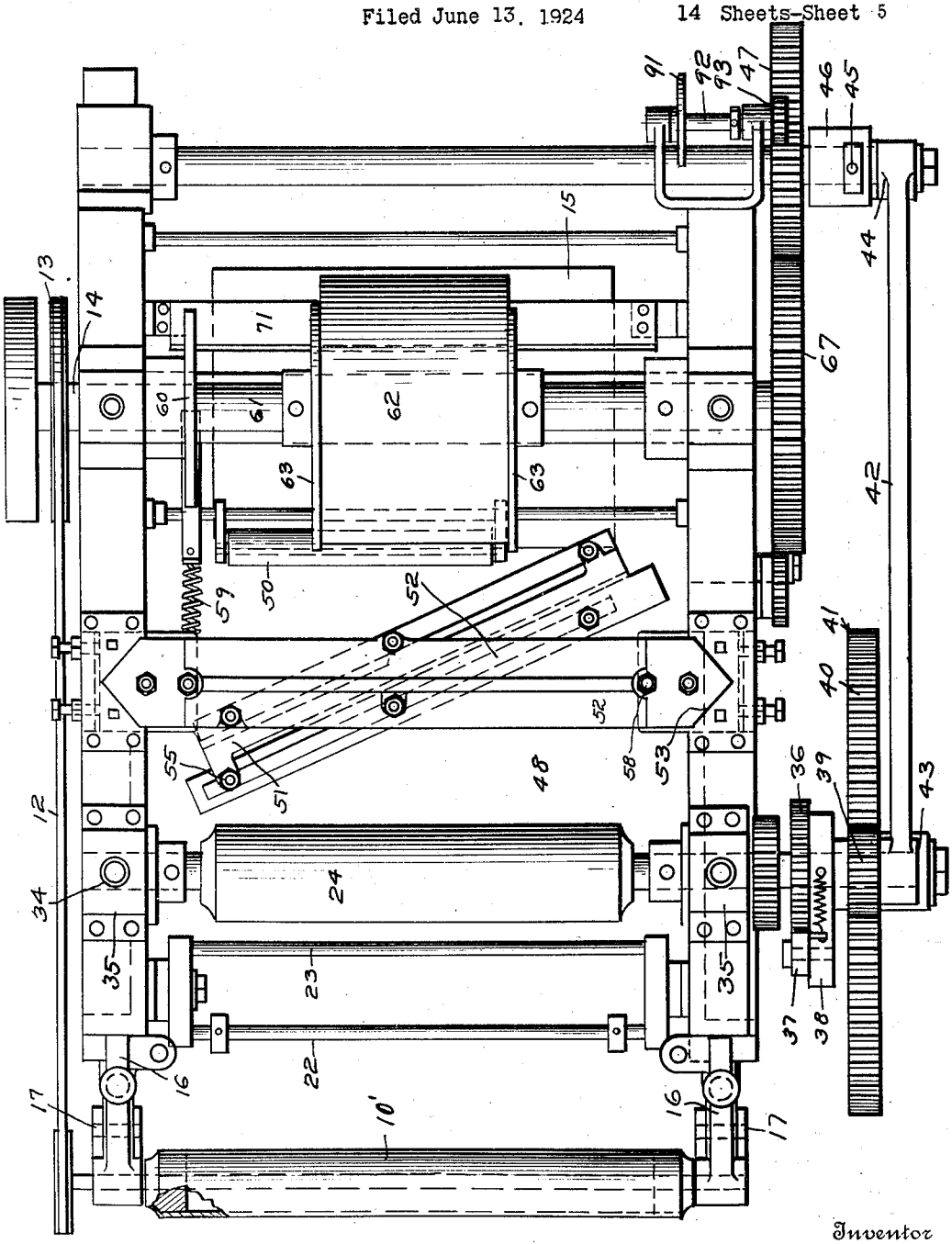


Fig. 5.

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D. D. HUYETT

PAPER SHELL MACHINE

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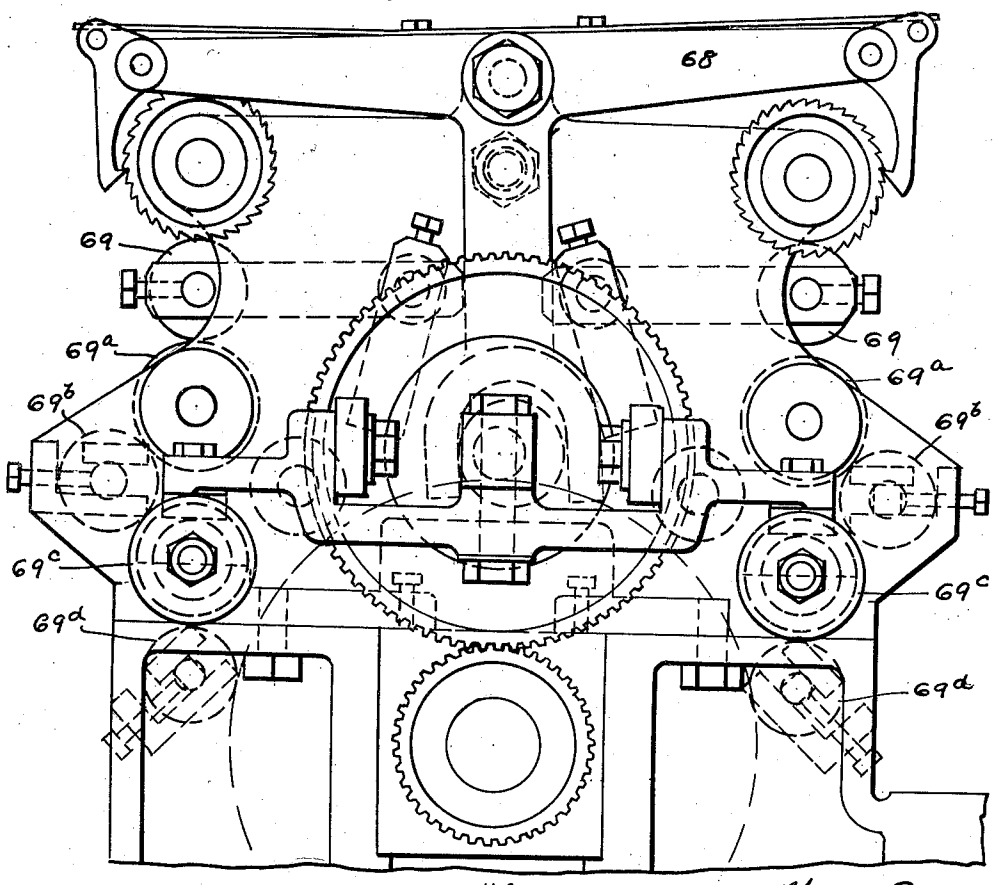


Fig. 6.

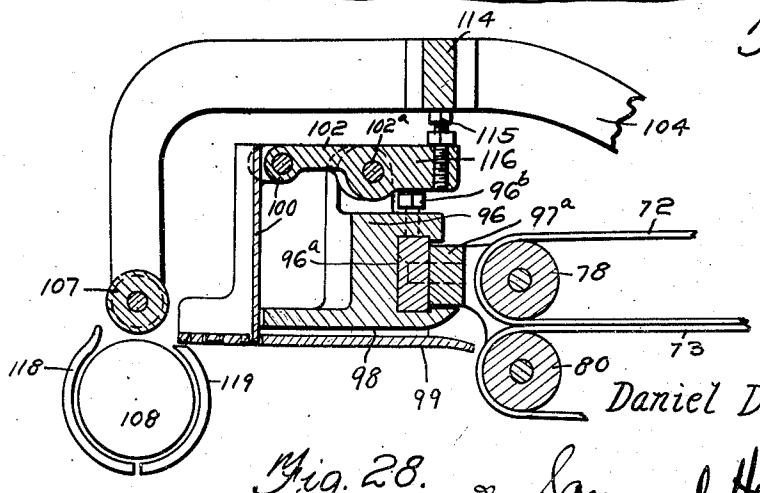


Fig. 28.

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D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924

14 Sheets-Sheet 7

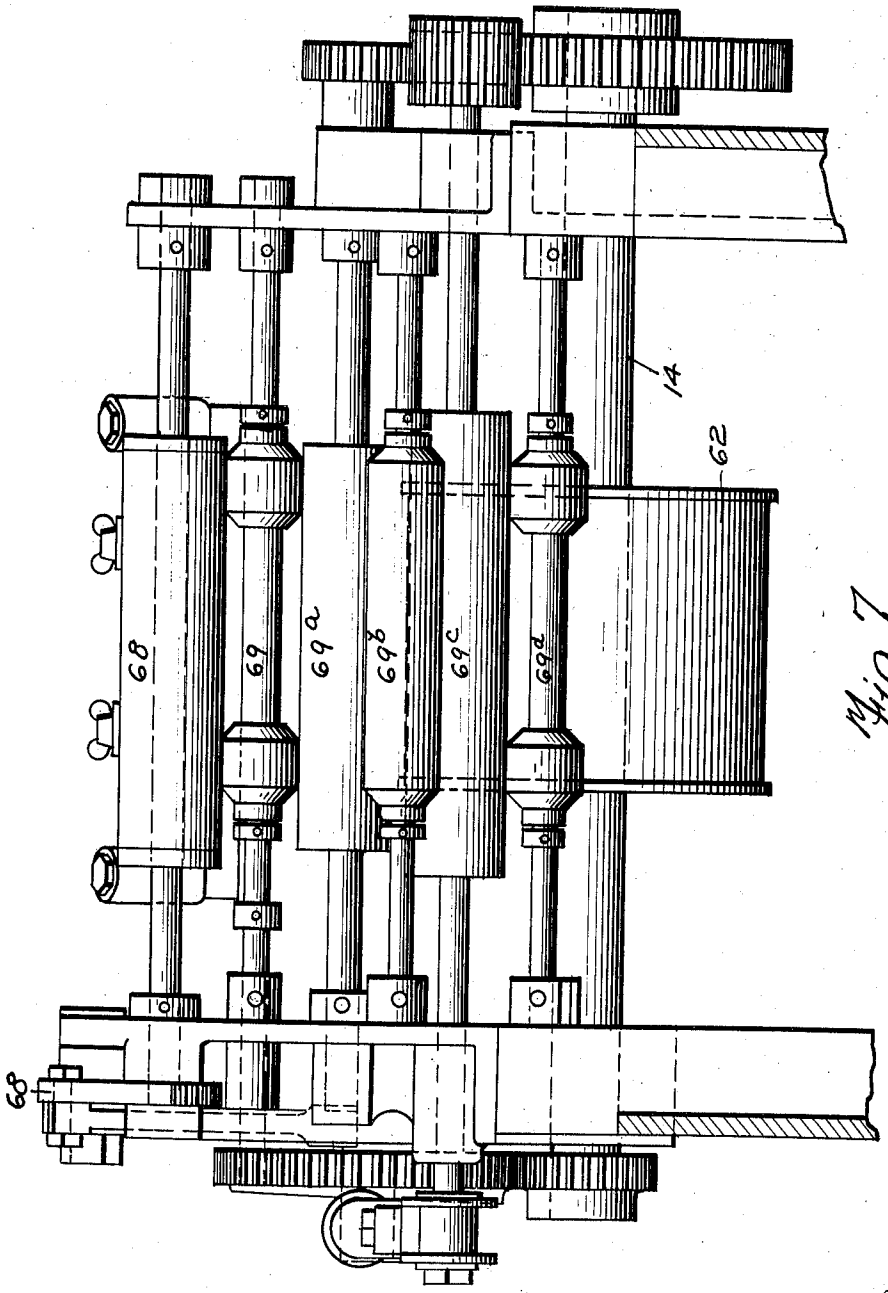


Fig. 7.

Inventor

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By Samuel Herrick,

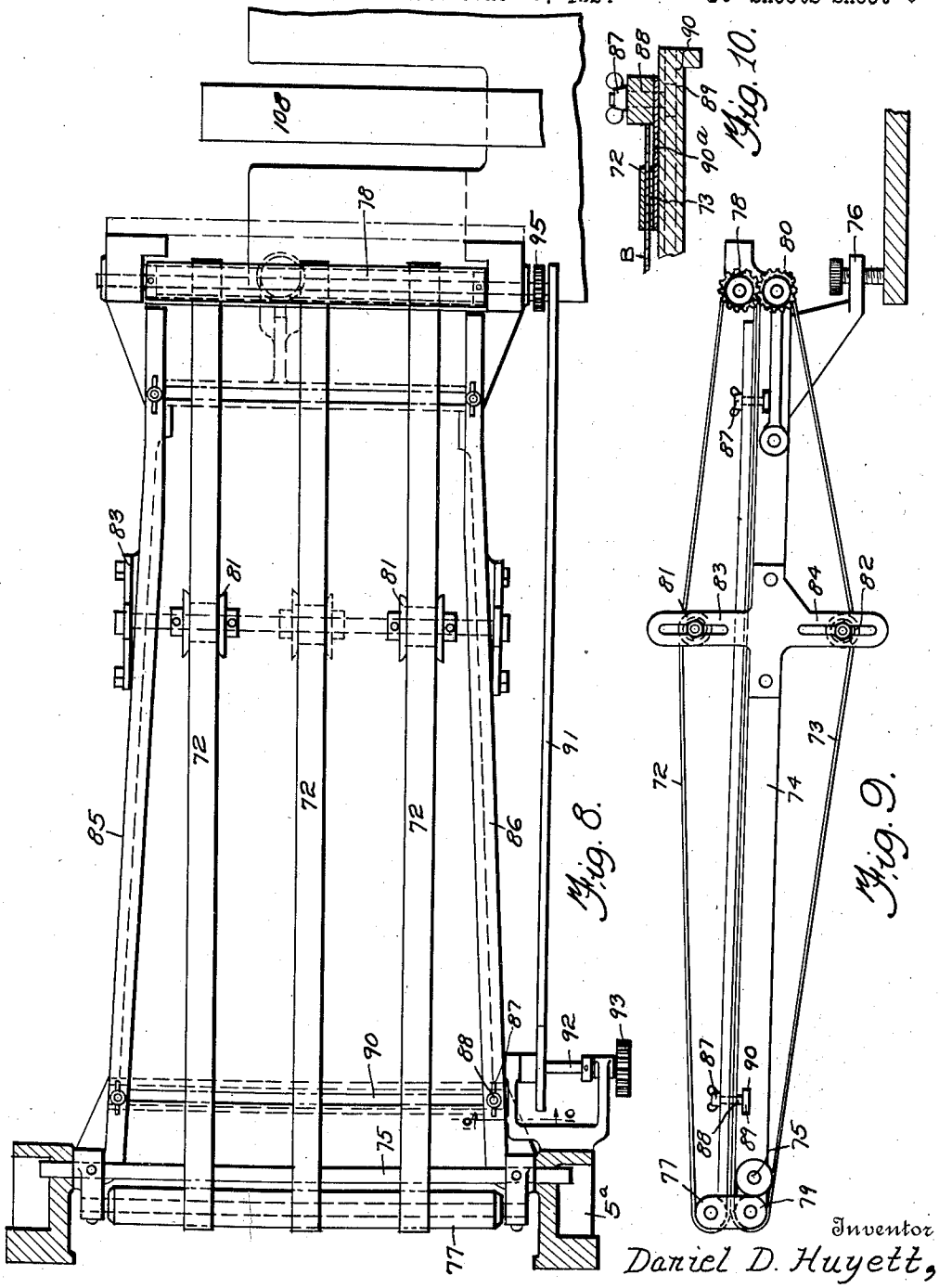
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June 2, 1925. 1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 8



Inventor
Daniel D. Huyett,
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Attorney

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1,540,336

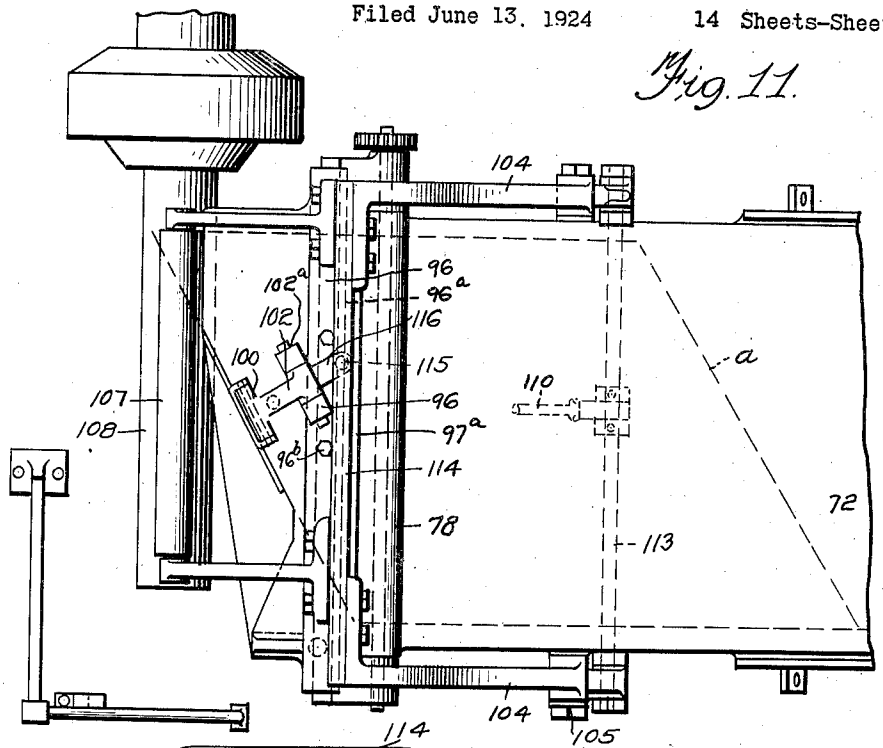
D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924

14 Sheets-Sheet 9

Fig. 11.



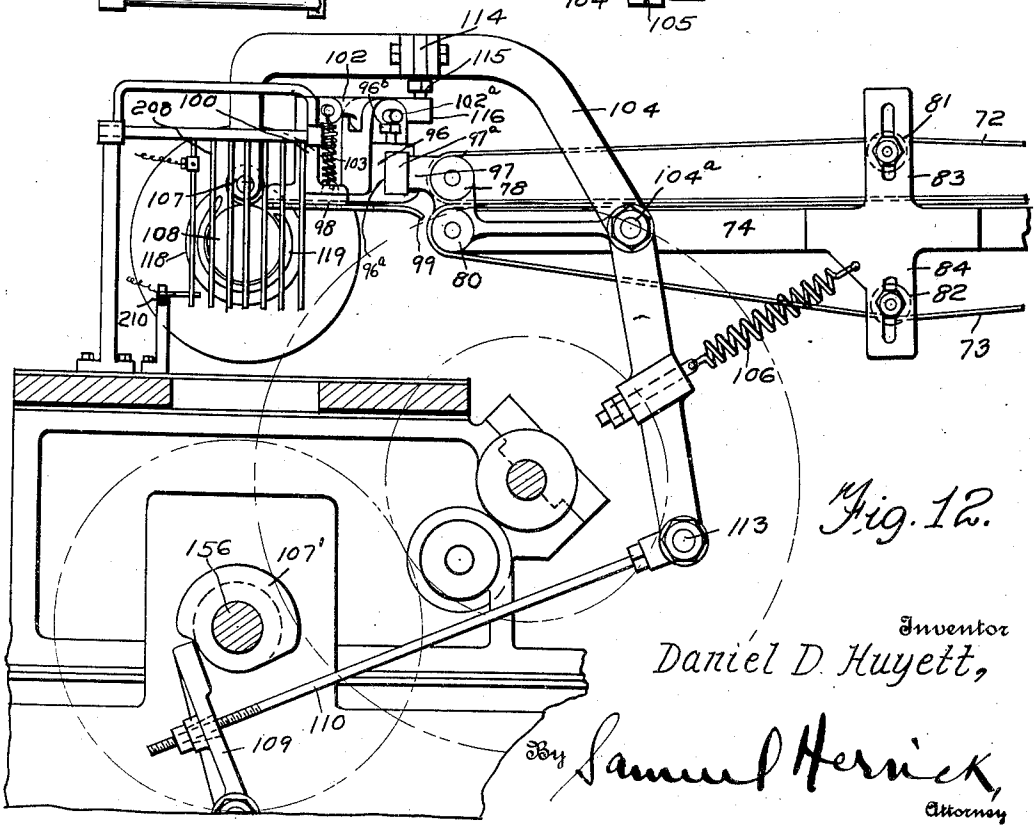


Fig. 12.

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D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 10

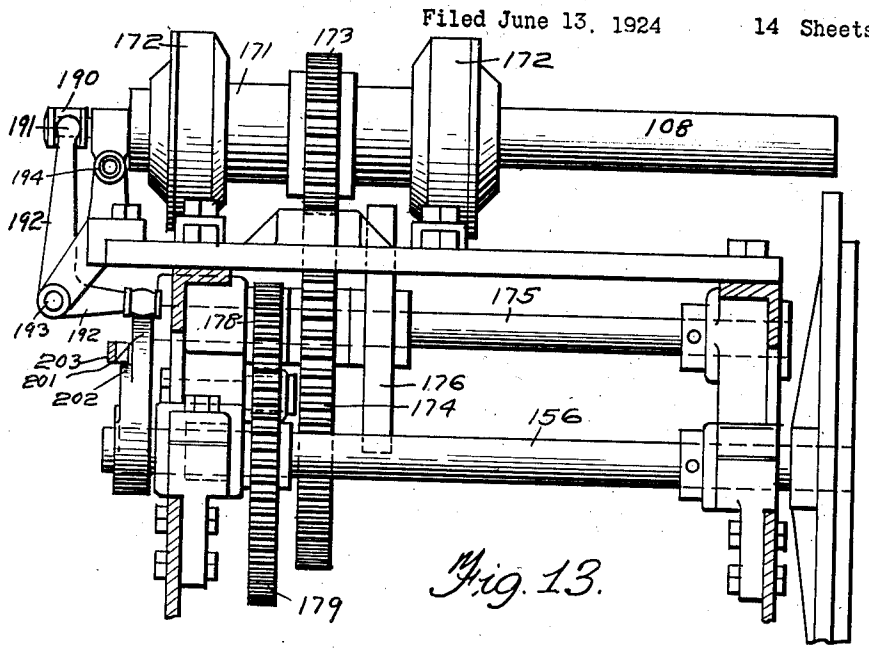


Fig. 13.

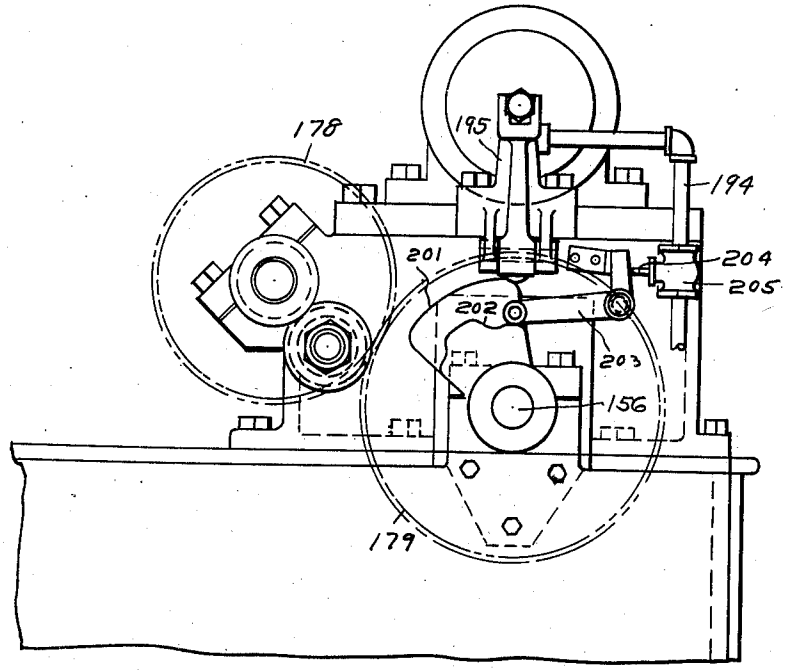


Fig. 14.

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1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924

14 Sheets-Sheet 11

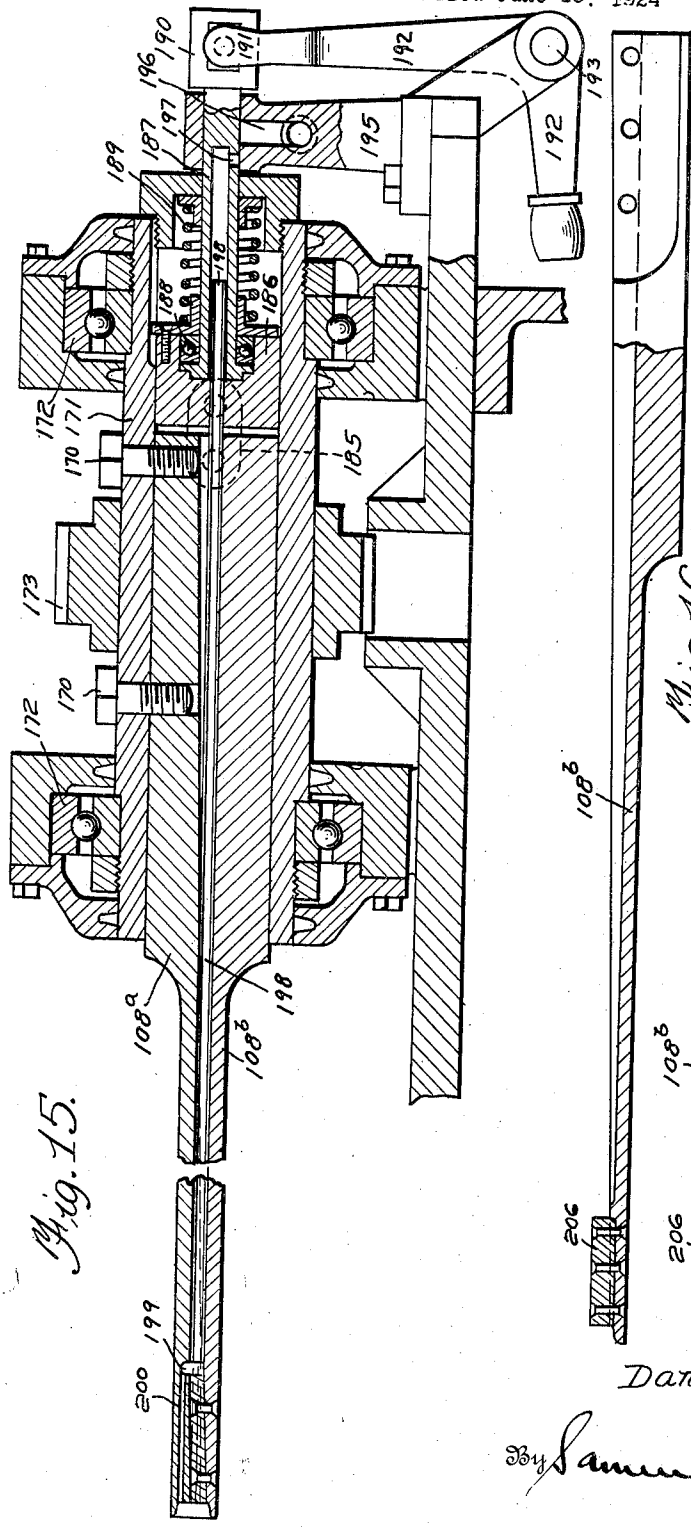


Fig. 15.

Fig. 16.

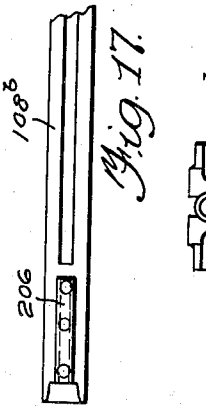


Fig. 17.



Fig. 18.



Fig. 19.

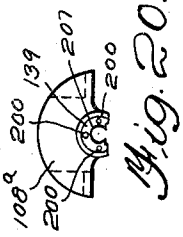


Fig. 20.

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1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924

14 Sheets-Sheet 12

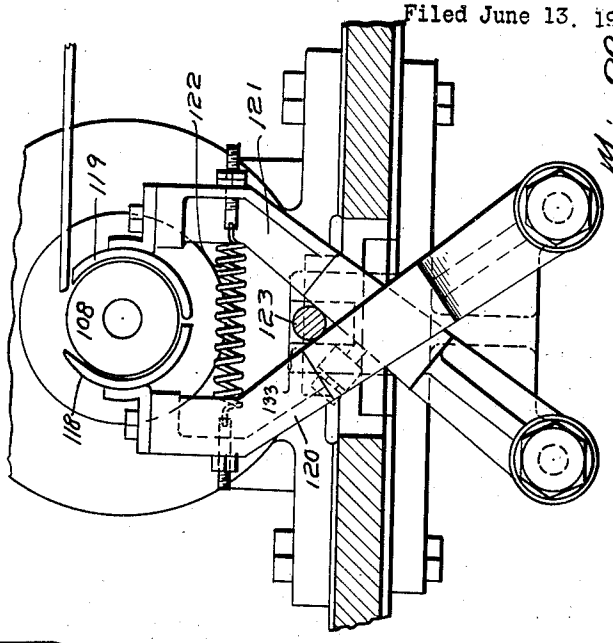


Fig. 22.

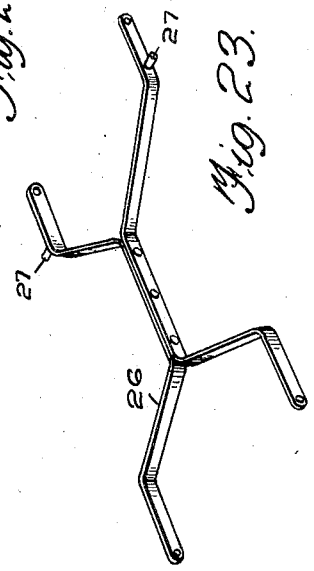


Fig. 23.

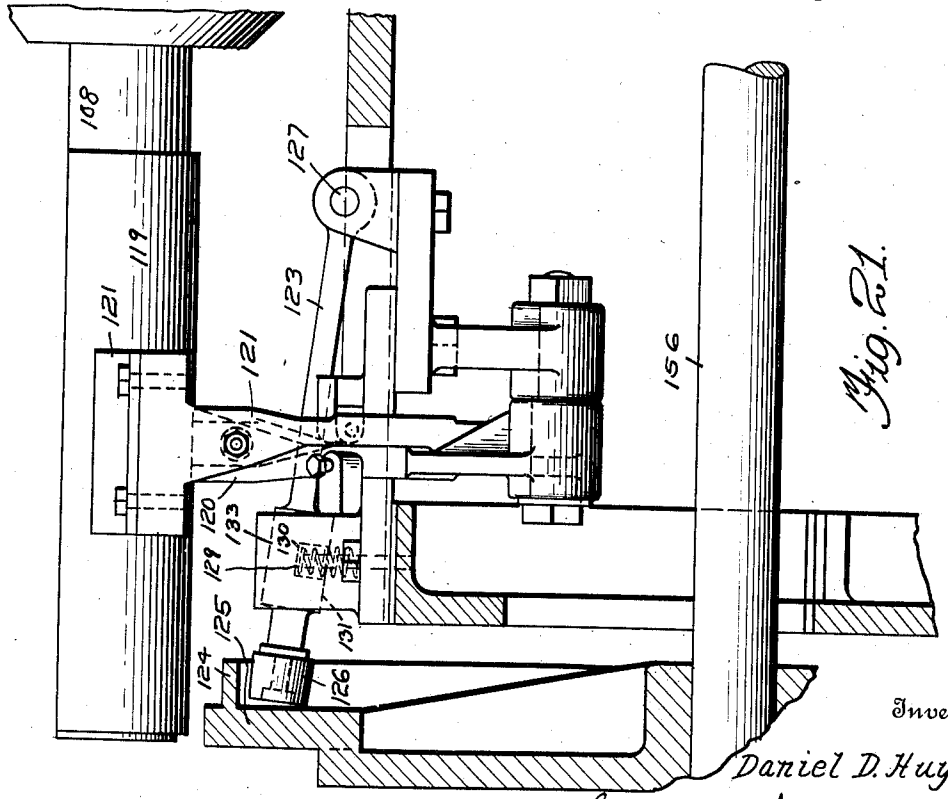


Fig. 21.

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June 2, 1925. 1,540,336

D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 13

Fig. 25.

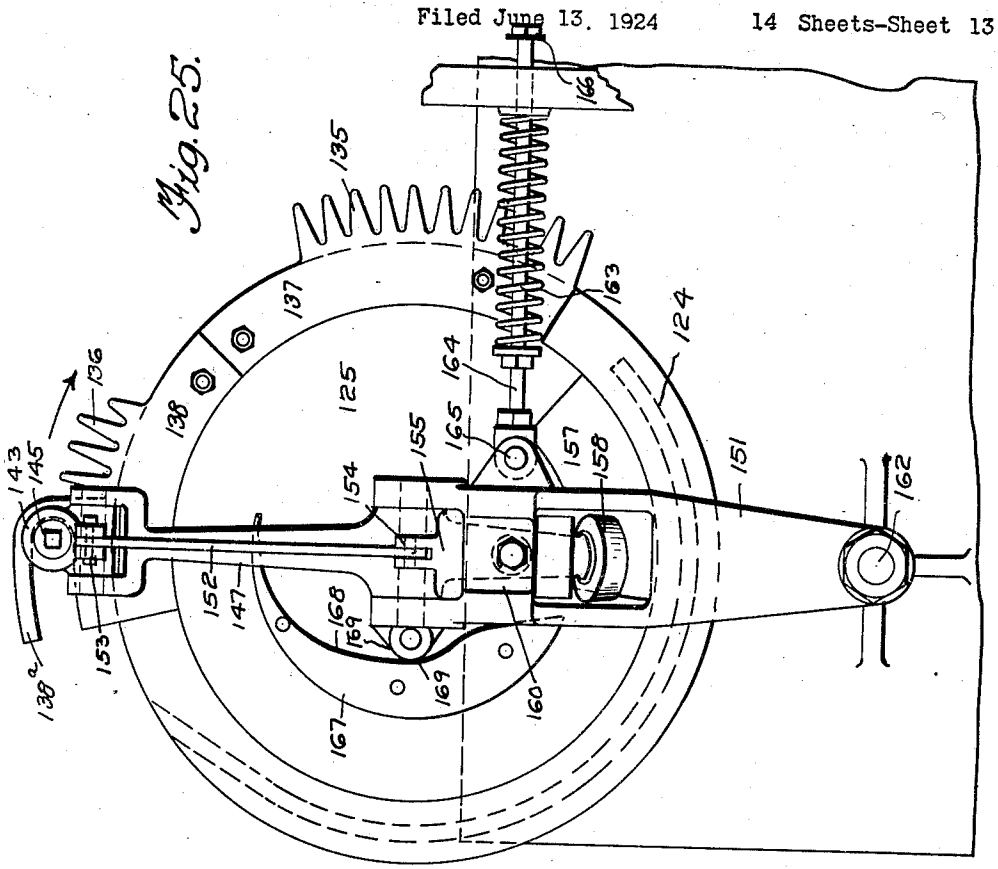
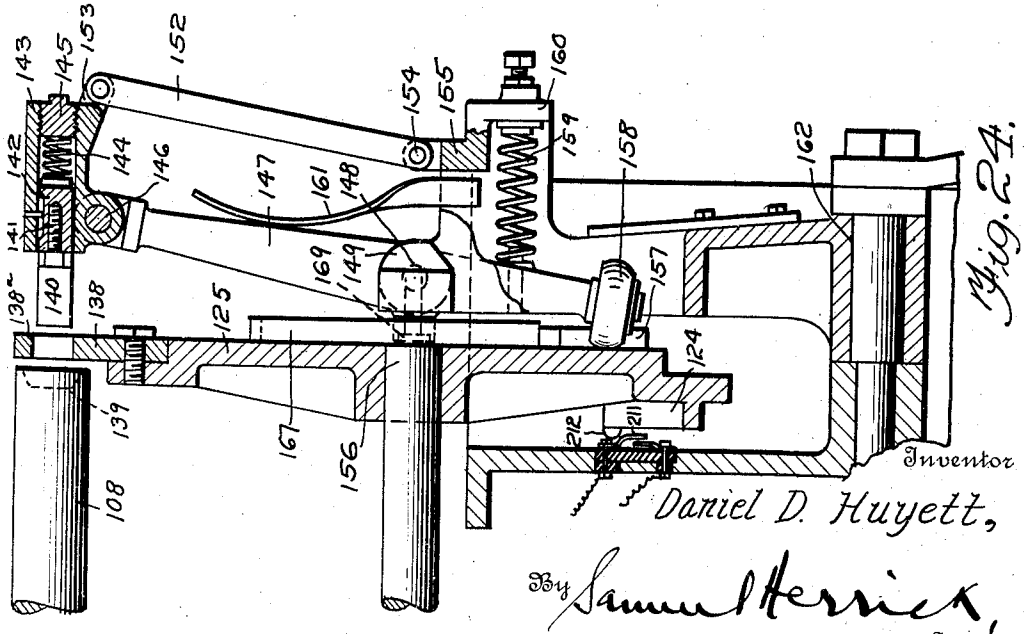


Fig. 24.



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D. D. HUYETT

PAPER SHELL MACHINE

Filed June 13, 1924 14 Sheets-Sheet 14

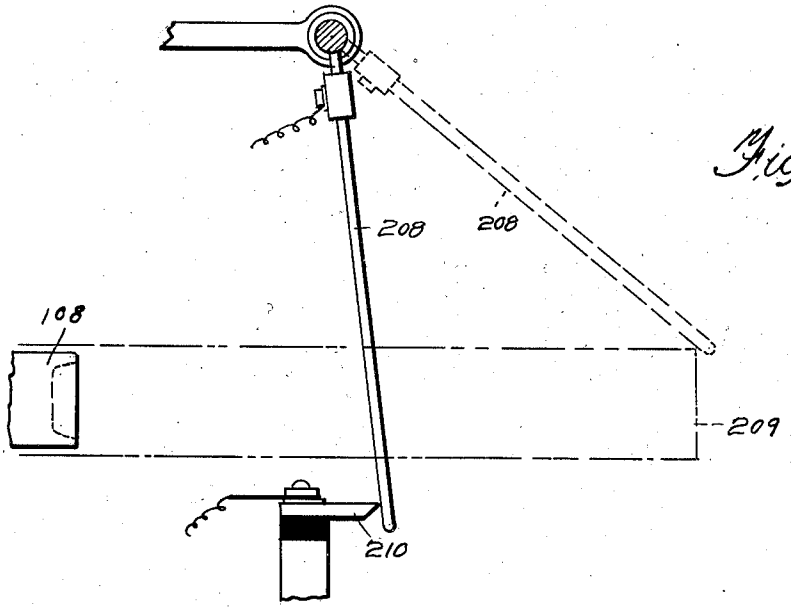


Fig. 26.

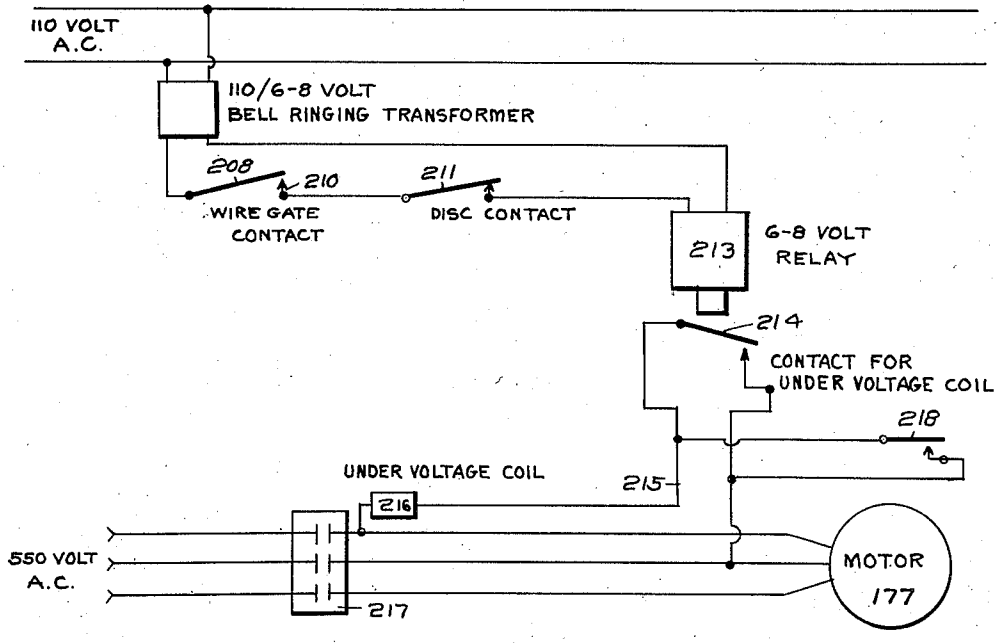


Fig. 27.

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By Samuel Herrick,
Attorney

Patented June 2, 1925. 1,540,336

UNITED STATES PATENT OFFICE.

DANIEL D. HUYETT, OF WILMINGTON, DELAWARE, ASSIGNOR TO ATLAS POWDER COMPANY, OF WILMINGTON, DELAWARE, A CORPORATION OF DELAWARE.

PAPER-SHELL MACHINE.

Application filed June 13, 1924. Serial No. 719,840.

To all whom it may concern:

Be it known that DANIEL D. HUYETT, citizen of the United States, residing at Wilmington, in the county of New Castle and State of Delaware, has invented certain new and useful Improvements in Paper-Shell Machines, of which the following is a specification.

This invention relates to a machine for making paper shells of the character commonly employed in the manufacture of dynamite sticks or cartridges.

It is a primary object of the invention to provide a machine of the character described adapted to make shells of varying lengths and varying diameters the machine being so constructed that it may be changed from the setting required for one size of shell to the setting required for another size of shell in a very short time, with very little effort and without special skill on the part of the operator.

Briefly stated the machine takes paper from a standard roll, cuts off a predetermined length thereof; prints a desired impression, in one or two colors, thereon; winds the paper upon a mandrel into tubular formation; folds one end shut, crimps the fold to make it tight and ejects the finished shell.

The length of the finished shell is determined by the width of the paper upon the roll while the diameter of the finished shell is determined by the size of the mandrel and the length of the sheet cut off from the web for each shell.

It is a further object of the invention to provide means for automatically bringing the machine to a stop if the finished shell fails to leave the mandrel at the proper time.

Further objects and advantages of the invention will be set forth in the detailed description which follows. In the accompanying drawings:

Figure 1 is a side elevation of a machine constructed in accordance with the invention with certain of the parts omitted to preserve the clearness of the drawing,

Figure 2 is a plan view of the machine with certain of the parts omitted,

Figure 3 is an end elevation of the machine with certain of the parts omitted,

Figure 4 is a longitudinal sectional view, upon an enlarged scale through the feeding, cutting and printing mechanisms with parts omitted,

Figure 5 is a plan view of the parts illustrated in Figure 4,

Figure 6 is an end elevation of certain of the parts of the printing mechanism,

Figure 7 is a side elevation of the printing mechanism,

Figure 8 is a plan view of a conveyor hereinafter described,

Figure 9 is a side view of said conveyor,

Figure 10 is a detailed sectional view through one of the sides of the conveyor upon line 10—10 of Figure 8,

Figure 11 is a plan view of the discharge end of the conveyor and the parts associated therewith including the mandrel and gate hereinafter described,

Figure 12 is a view partly in section and partly in side elevation illustrating the parts shown in Figure 11,

Figure 13 is a view looking from the rear end of the machine toward the mandrel and illustrating the mounting of the mandrel and the driving mechanism thereof together with certain of the associated parts,

Figure 14 is a view looking toward the left-hand end of the structure of Figure 13,

Figure 15 is an enlarged sectional view through the mandrel and associated parts,

Figure 16 is a view partly in section and partly in elevation of one of the halves of the mandrel,

Figure 17 is a detailed plan view of the left-hand end of the structure of Figure 16,

Figure 18 is an end elevation looking from the left in Figure 16,

Figure 19 is a detailed sectional view of the outer end of the other half of the mandrel,

Figure 20 is an end elevation of the structure illustrated in Figure 19,

Figure 21 is a view partly in section and partly in side elevation illustrating the ironers by which the paper is held in engagement with the mandrel during the winding, folding, and crimping operations,

Figure 22 is an end elevation of the mandrel, illustrating the ironers,

Figure 23 is a perspective view of a yoke located at the front end of the machine, and hereinafter described,

Figure 24 is a view partly in elevation and partly in section illustrating the punch mechanism, hereinafter described,

Figure 25 is an outer face view of said punch mechanism,

Figure 26 is a detailed view more or less diagrammatic of a contact making and breaking device constituting part of the automatic stop,

Figure 27 is a diagrammatic view illustrating the circuit employed in connection with the automatic stop, and

Figure 28 is a detailed section view through the stop or gate hereinafter described.

Like numerals designate corresponding parts throughout the figures of the drawings.

The paper from which the shells are formed is drawn from a standard cut roll 5 located at the left-hand end of the machine (Fig. 1) hereinafter referred to as the front end because it is the end from which the paper starts upon its travel. The shaft 6 upon which the paper roll 5 is mounted rests upon rollers 7, said rollers in turn being mounted in the outer end of bearing brackets 8. This permits the roll 5 to shift back and forth. The web of paper leading from the roll passes beneath a rod 9 having guide collars 10 thereon, whereby the paper is guided in a straight path to and between feed rollers 10′ and 11. The lower feed roll 11 is a driven roll said roll being driven by a sprocket chain or other suitable connection 12 from a pulley or sprocket wheel 13 upon the shaft 14 of the platen roll 15 of the printing mechanism hereinafter described. The upper roll 10′ is an idle or friction roll and is mounted in the outer ends of rock arms 16 which are pivoted, as at 17. Springs 18 tend to maintain the roll 10′ in engagement with the roll 11 and when the rolls are in this relation the paper is fed forwardly between said rolls.

However, since not so much paper is required to be fed forward when shells of small diameter are being made as is required when shells of large diameter are being made at each operation of the machine, it becomes necessary to vary the amount of paper fed forward in accordance with the nature of the work being done. To this end the paper web is carried from the roll 11 downwardly as at 19 (see Fig. 1) and over a roller 20, passing thence upwardly at 21. (see Fig. 4) through tension bars 22 and 23, and thence to and between feed rolls 24 and 25. The roller 20 is mounted in the outer end of a yoke 26 (see Fig. 1 and Fig. 23) which yoke is pivoted at 27 in the frame A of the machine. Links 28 connect the rear end of this yoke with the rear end of bars 29, the bars in turn being pivoted at 30 within the frame of the machine. Rods 31 are pivoted to the front ends of these bars and extend upwardly and engage the rear ends of the rock bars 16.

The feed rollers 24 and 25 have a step by step feeding movement imparted to them by a mechanism hereinafter described, and it is clear that if the paper is being taken up and fed forward by these rollers at the rate of feed of rollers 10′ and 11 there will be no over-supply of paper from the last named rollers. If, however, the paper is fed forward from the rollers 10′ and 11 at such a rate as to decrease the tension upon the web, or slacken the same then the roller 20 will be lowered, the links 28 will be lifted and the rear ends of the bars 29 will be lifted, the forward ends of the bars 29 will be depressed, the rods 31 will be drawn downwardly and the roller 10′ will be lifted out of contact with the paper web and against the tension of the springs 18. This will stop further forward feeding movement of the paper from the roll 5 until the feeding of the web between the rollers 24 and 25 restores the tension and elevates the roll 20.

The upper feed roll 24 (see Fig. 4) bears yieldingly upon the roller 25, due to the fact that it is mounted in boxes 32 which are forced downwardly under the influence of springs 33 located in extensions 34 of the caps 35. A step-by-step feeding movement is imparted to the paper web by the lower roll 25. The shaft of this lower roll carries a ratchet wheel 36 which is engaged by a pawl 37 on an arm 38. This arm 38 is loose on the shaft of the roll and has secured to it a pinion 39 which meshes with the teeth 40 of a pivoted segment 41. Swinging movement is imparted to this segment by the connecting rod 42 one end of which is pivoted to the segment at 43 and the other end which is pivoted to a block 44 adjustable by means of a screw 45 in a slotted crank 46. This slotted crank is carried by a gear wheel 47 and the position of the block 44 in the slot determines the extent of throw of the connecting rod and consequently determines the extent of the step-by-step feeding movement imparted to the web.

From the feed rollers 24 and 25 the paper passes over a bed plate 48 and beneath the knife or shear 49 and thence between the feed rollers 50 and 51. The knife is arranged diagonally with respect to the line of travel of the paper and in such manner as to make a bias cut, about 27° with the edge of the paper. Thus, both ends of the cut sheet form a spiral when the paper is wrapped into shell formation, this spiral arrangement of the ends of the paper increasing the strength and rigidity of the finished shell.

The knife 49 is supported by a vertically reciprocatory cross head 52 which is slidable in ways 53 on the frame of the machine. Strippers 54 are supported from the cross head by means of bolts 55. Springs 56 en-

circle these bolts, the arrangement being such that the strippers will be held in engagement with the web of paper, by the springs, upon initial upward movement of the knife and until the knife has been disengaged from the paper strip. Then after limited upward movement of the cross head said cross head will engage the heads of the bolts and lift the strippers out of engagement with the paper, to permit the further forward feeding movement of the paper under the influence of the feed rollers 24 and 25 and 50 and 51.

The cross head 52 is elevated by springs 53[a] disposed in suitable housings of the frame of the machine and the said cross head is pressed downwardly together with the knife 49 by rock levers 54[a], only one of which is shown. These rock levers are actuated by cams 55[a] from the shaft 14 of the platen roll 15 and their left-hand ends (see Fig. 4) engage slots 56 of heads 57 that are formed on shanks 58, and which shanks pass through the cross head. During the time that the rolls 24 and 25 are feeding, the knife and strippers are elevated and the rollers 50 and 51 are separated. Thus the rollers 24 and 25 are free to feed that particular length of paper for which the crank 46 and associated parts have been set. The feed roll 51 is a driven metal roll while the roll 50 is an idle friction roll, preferably of fibre; its function is to press the paper against the roll 51 in such manner as to cause the roll 51 to take hold of the paper and to feed it forward after the paper has been released by the knife and strippers. The roll 50 is mounted in the ends of rock arms 58[a]. A spring 59 tends to throw the roll 50 downwardly into engagement with the roll 51 but this movement is restrained by the cam 60 on the shaft 61 of the printing roll 62 which co-acts with the platen roll 15. However, the cam 60 has a cutaway portion which permits the descent of the roll 50 under the influence of the spring 59 at the proper time. The printing roll 62 is provided with feed ribs 63 which co-act with the covering 15[a] of the platen roll to feed the paper forward. It will be observed by referring to Figure 4 that the ribs 63 extend only part way around the periphery of the printing roll and it will be understood that during the feeding movement of the paper under the influence of rolls 24 and 25 the ribs 63 do not function. In other words they lie in such position that the space between the printing and platen rolls is open thus to permit of the paper passing freely therebetween. Thus the feeding of the paper to determine the length of paper that is to be cut off, and consequently to determine, in conjunction with the proper size mandrel, the diameter of the finished shell, is wholly under the influence of rolls 24 and 25 and may be absolutely controlled by adjustment of the actuating mechanism of the rolls. The roll 51 is driven by a chain of intermediate gearing 64 from a gear wheel 65 (see Fig. 1) which is mounted upon the shaft of the platen roll 15, this gear wheel 65 constituting the drive for shaft 14 of the platen roll. However the platen roll is not fixed upon the shaft 14 but is connected thereto by a pawl and ratchet 66. This pawl and ratchet connection permits slight relative movement between the platen roll and the shaft so that during the time that the type by which the printing is effected is in engagement with the paper and platen roll the feed of the platen roll may be effected by the striking of the type into the paper and the cover of the platen roll. This insures that the printing roll and the platen roll will move accurately together and prevent any smudging effect upon the printing.

I deem is unnecessary to describe in detail the construction of the printing mechanism because rotary printing mechanisms of this general character are common, in the printing art. It is sufficient to say that the shaft 61 of the printing roll is driven from the gear wheel 65 by a gear wheel 67 (see Fig. 1), 68 indicates the ink fountain, and the duct roll, 69[a], *b* and *c* ink-distributing rolls, and 69[d] the inking roll, by which the type 70, for printing, is inked. In printing cylinders of this character it is possible to locate the type at any desired point upon the printing surface of the cylinder, and, in practice, I shift the type carrying surface laterally with respect to the cylinder or shift the cylinder with respect to its shaft in accordance with the varying lengths of paper cut off, so that the printing is always a proper distance from the rear edge of the paper. The fact that the lateral shifting of the type brings about the result stated is due to the fact that the rear edge of the paper is at an angle with respect to its longitudinal line of travel and the desirability of having the printing always located a proper distance from the rear edge of the paper arises from the fact that the rear edge is of spiral formation and if the printing lay too far in advance of the rear edge it might be partially overlapped and hidden by the final wrap.

From the printing mechanism the paper passes over a guide plate 71 and between the upper and lower traveling tapes 72 and 73 of a conveyor which is best illustrated in figures 1, 8, 9 and 10. The paper travels between the lower runs of the tapes 72 and the upper runs of the tapes 73. The conveyor comprises a frame 74 the front end of which is pivoted as at 75 to a part of the frame A indicated at 5[a] and the rear end of this frame is supported upon adjusting screw 76. Thus the rear end may be raised

or lowered to properly position the conveyor and the parts carried thereby with respect to the mandrel. In other words when a large diameter mandrel is being used the frame must be elevated and when a small diameter mandrel is being used the frame must be lowered. The upper tapes 72 pass over rollers 77 and 78 and the lower tapes pass over rollers 79 and 80 and the proper tension is maintained upon the tapes by idler rolls 81 and 82 which are vertically adjustable in guides 83 and 84. Rearwardly converging rails 85 and 86 are mounted for lateral adjustment with respect to the conveyor frame by means of thumb nuts 87 and thumb screws 88 said thumb screws having T-heads 89 which are movable in transverse guide ways 90 on the conveyor frame 74.

The guide rails 85 and 86 may be adjusted laterally as stated or the tapes may be adjusted laterally by shifting the guide rollers 81 and 82 upon their shafts.

I prefer to construct these guide rails 86 as indicated in Figure 10 where 90[a] designates a thin metallic plate projecting inwardly from the guide rails integral with or soldered or welded thereto above which the tapes ride. The paper is indicated at B on this figure. The construction shown precludes the possibility of the edge of the paper working underneath the guide rails.

The drive of the conveyor is effected by means of sprocket gearing 91 from a countershaft 92 which carries a pinion 93. This pinion meshes with the teeth of the gear 47. The sprocket gearing drives to the shaft of the lower roller 80 (see Figure 9) and this shaft carries a gear which meshes with a corresponding gear 95 on the shaft of the roller 78.

From the conveyor the paper is delivered to a gate or stop mechanism which serves to straighten the paper and properly align it for engagement with the mandrel and to hold the paper until the proper moment has arrived for engagement with the mandrel.

The gate or stop mechanism is best indicated in Figures 11, 12 and 28, and by referring to these figures it will be seen that it comprises a head 96 which is carried by a projection 97 on the frame of the conveyor. The underface of the head 96 is recessed as indicated at 98 and a bottom plate 99 lies in spaced relation to the underface of the head and forms a pocket for the reception of the forward edge of the paper delivered from the conveyor. A gate 100 consisting of a T-shaped plate having fingers or lugs 101 upon its lower edge is carried by a rock lever 102. A spring 103 tends to draw the gate downwardly to a position where the fingers will pass through openings 105 formed in the plate 99. When the fingers are in this position they constitute stops against which the forward edge of the paper abuts. The continued movement of the tapes after the paper abuts these stops results in straightening the paper; causing it to align itself with the guides or stops constituted by the fingers and which lie across its path of movement. The position of the paper is indicated in dotted lines at —*a*— in Figure 11. The paper remains in this position until a predetermined point in the operation of the machine has been reached at which time the gate 100 is elevated to withdraw its fingers 101 from the path of the paper and, simultaneously therewith, a roller descends and clamps the projecting end of the paper, which overlies the mandrel, to the mandrel in such a manner as to cause the mandrel to wind the paper upon itself. This is accomplished by the movement of arms 104 which are pivoted as at 104[a] upon the conveyor frame and are bodily adjustable therewith. Springs 106 tend to move the upper portions of these arms downwardly and throw the friction roller 107 into engagement with the mandrel 108 to thereby press the paper against the mandrel and effect the winding hereinbefore mentioned. The fingers are permitted to act to accomplish the foregoing results when a cam 107′ on shaft 156 presents its lowest portion to a lever 109 which is connected by an adjustable link 110 with the lower end of the arm 104 in Figure 12, this connection being effected through the means of a cross rod 113. The downward movement of the upper portions of the arms 104 to bring the roller 107 into engagement with the mandrel elevates the gate by rocking the bar 102 on its pivot 102[a]. This is effected by a cross bar 114 which extends betwen the two arms 104 and overlies an adjustable screw 115 carried by the projecting end 116 of the rock bar 102. In order that the sheet of paper may be properly disposed with respect to the outer end of mandrel throughout all of the different widths of paper employed, the gate is rendered bodily adjustable across the path of movement of the paper by providing a sliding connection between the head 96 and the part 97 of the conveyor frame. This connection consists of a cross bar 97[a] which is engaged in a slot 96[a] of the head 96. Set screws 96[b] bind the head and gate in their varying positions of lateral adjustment. The provision of the cross bar 114 makes the arms 104 operable with respect to the gate throughout all of the positions of adjustment of the latter since the screw 115 underlies the bar at all times. When the high part of the cam 107′ acts upon the lever 109 the roller 105 is elevated the arms being moved against the tension of the springs 106. This permits the spring 103 to draw the gate downwardly and to bring its fingers into position to constitute stops for the next sheet.

The paper is held in close engagement with the mandrel during the winding operation by a pair of ironers 118 and 119 (see Figures 3, 21 and 22). These ironers are carried by a pair of cross levers 120 and 121 which are drawn together by a spring 122 and are forced apart at the proper time by a bar 123 which acts between them, said bar being forced downwardly by a cam 124 upon a disk 125. To this end the bar is provided with an anti-friction roller 126 upon its outer end adapted to be engaged by said cam and said bar has its other end pivoted as indicated by 127. The bar 123 is forced downwardly by the cam 124 as stated and is elevated by a spring 129 which engages in a recess 130 formed in an enlarged portion 131 of the bar, said enlarged portion being movable between guides 133.

The ironers 118 and 119 hold the paper in firm engagement with the mandrel during the time that the paper is being crimped at its ends to bring it into permanent tubular form. This crimping or folding action is effected by a series of folding fingers (see Figures 24 and 25), said fingers being designated 135 and 136. These fingers are carried by interchangeable plates 137 and 138. Only one series of the fingers may be used when a single fold is desired, while two series of fingers may be employed if a double fold is desired. The plate 138 is indicated in Figure 24 and it will be seen that these plates and the fingers carried thereby lie in such position as to, in effect, wipe across the outer end of the mandrel and fold the projecting ends of the paper in a succession of folds, one overlapping the other, and after this folding has been completed a blow is given the folded portions to crimp them into the recessed end 139 of the mandrel. This is accomplished as follows: The plate 138 has a tail 138[a] formed upon it which wipes across the crimped or folded portions of the shell after the fingers 136 leave said portion. The tail 138[a] is spaced from the body of the plate 138 to form a slot through which a pin 140 may pass and it is this pin which, passing through said slot, impinges upon the folded portions of the shells and forces them into the recess 139. The pin 140 has a shank 141 which is threaded into a head 142 slidable in a sleeve 143 and a spring 144 bears between the pin and a plug 145 threaded into the other end of the sleeve. Thus the tension of the spring may be adjusted by the plug 145 and the blow imparted to the crimped portions of the paper will be a yielding blow, the force of which will be determined by the tension of said spring.

Pin 140 and its holder 142 are free to turn in sleeve 143 so that pin will not tear the paper in case its end becomes rough due to upsetting, etc. The sleeve 143 is pivotally mounted at 146 upon the upper end of a lever 147 the lever being pivotally mounted at 148 between ears 149 constituting parts of a laterally swinging head 151 hereinafter described.

Hence the upper end of the lever 147 swings upon the arc of a circle and since it is desirable that the movement of the pin be a straight line movement, I pivot a link 152 to an ear 153 of the sleeve 143 and pivot the other end of this link at 154 to a part of the head indicated at 155.

The disk 125 by which the plates 137 and 138 are carried is mounted upon a shaft 156 and said disk carries a cam 157 upon its face which acts upon a roller 158 upon the lower end of the lever 147. The outward movement of the roller 158 and the lower portion of the lever 147 is against the tension of a spring 159 which bears between said lever and a portion of the head indicated at 160. A cushioning spring 161 aids in imparting a quick inward blow to the pin 140 and in causing a more gradual retraction of said pin. After the paper has been folded and crimped it is blown from the mandrel under the influence of compressed air and it is manifest that this action cannot take place unless the pin 140 and the associated parts are moved out of the path of movement of the shell. To this end the head 151 is pivoted for lateral swinging movement at 162. The lever 147 is carried by said head and moves bodily therewith. A compression spring 163 encircles the rod 164 which is pivoted at 165 to the head 151 and tends to move said head toward the left as shown in Figure 25. The movement of the head toward the left under the influence of the spring 163 is limited by a stop nut and washer 166 upon the rod 164. A cam 167 is carried by the disk 129 and its edge 168 acts upon a roller 169 carried by the head 151 and moves the head against the tension of the spring 163 to bring said head and the pin 140 to the position illustrated in Figures 24 and 25. However, when the cam in its rotation releases the roller 169 the spring 163 moves the pin 140 to the left in Figure 25 and out of the path of the shell to permit of the shell being blown from the mandrel as will be presently described. The stop 166 limits the movement of the head 151 and associated parts to a position where the cam will engage the roller 169 in its continued rotation to repeat the operation.

The mounting of the mandrel and the construction of said mandrel is best illustrated in Figures 15 to 20. However, it is to be understood that the invention is not to be limited to any specific type of mandrel. In the particular type of mandrel which I have shown for purposes of illustration the mandrel is made in two parts 108[a] and 108[b].

The parts are separated by a longitudinally extending oblique cut, the arrangement being such that when one part of the mandrel is longitudinally shifted with respect to the other it has the effect of reducing the diameter of the mandrel, or, in effect, collapsing the same to thereby loosen the shell upon the mandrel and permit the more ready discharge of the same from the mandrel under the influence of the compressed air.

The half 108[a] of the mandrel is secured by screws 170 to a rotating sleeve 171 which is supported by ball or other anti-friction bearings 172 and carries a spur gear 173 which meshes with a gear wheel 174 on a shaft 175. The shaft 175 is driven by sprocket gearing 176 from a motor 177. The shaft 156 is driven from the shaft 175 through the interposed gears 178 and 179. The shaft 156 carries a beveled gear 180 which meshes with the beveled gear 181 on a longitudinally extending shaft 182 and it is this shaft 182 which imparts movement to the gear 47 through the medium of beveled gearing indicated at 183 and 184 in Figure 1. The other half 108[b] of the mandrel is movable in the sleeve 171 and longitudinally with respect to the part 108[a]. This part 108[b] is connected by a link 185 with a head 186. This head is mounted to rotate with the mandrel and rotates with respect to a plunger 187 by means of a thrust bearing 188. A spring 189 tends to force the part 108[b] of the mandrel outwardly or to the left in Figure 3 which has the effect of expanding the mandrel. The stem 187 is provided with a head 190 which is pivotally connected to the forked portion 191 of the long arm of the bell crank lever 192 said lever being pivoted at 193. A compressed air supply line 194 enters the side of the casting 195 (see Figures 14 and 15), said casting having a channel 196 formed therein through which air may be supplied to the interior of the stem 187 through a port 197 when said stem is moved to the right in Figure 15 by the bell crank lever. When this action takes place the part 108[b] of the mandrel is thrown to the right and this has the effect of collapsing the mandrel. Simultaneously with the collapsing of the mandrel compressed air enters the stem 187 and passes then through a tube 198 which tube terminates at a recess 199 from which a plurality of longitudinally extending ports 200 lead to the front end of the mandrel. The movement of the bell crank lever 192 is effected by a cam 201 on the shaft 156 and at the same time that the bell crank lever is moved a second cam 202 on said shaft acts upon a bell crank lever 203 to thrust the stem 204 of a control valve 205 inwardly, said control valve being located in the air line 194. Thus there is a double control of the air which passes through the interior of the mandrel and leakage is positively prevented. By providing this secondary control the necessity of an extremely tight fit between stem 187 and its bearing in the casting 195 is obviated. Furthermore this secondary valve serves as the real timing valve and it does not open until the mandrel is fully collapsed. The primary valve constituted by port 197 and associated parts serves merely to transfer the air from 195 to 187.

To maintain proper alignment of the outer ends of the two parts of the mandrel the part 108[b] is provided with an upstanding lug 206 which is almost circular in cross section and which engages and travels in a correspondingly shaped recess 207 of the other part 108[a] of the mandrel. By referring to Figure 20 it will be seen that the mouths of the several ports 200 open at the bottom of the indentation formed in the outer end of the mandrel.

If, for any reason, the shell should fail to leave the mandrel under the influence of the blasts of the compressed air through the ports 200, the machine will be automatically brought to a stop. This is important because it is manifest that destruction of the succeeding shells would result and with possible breakage of the machine parts, if the machine continued to build the succeeding sheets of paper upon the faulty shell which had failed to leave the machine.

To bring about a stoppage of the machine if the shell fails to leave the mandrel, I mount adjacent to the end of the mandrel, a swinging wire gate or comb 208 (see Figures 12 and 26). The finished shell indicated at 209 strikes this gate and swings the gate outwardly to the dotted line position illustrated in Figure 26 and away from a contact element 210. A spring contact 211 (see Figure 24) is adapted to complete a circuit once in each revolution of the disk 125 by being engaged by a projection 212 formed upon the rear edge of the cam 124. The electrical instrumentalities by which the motor is controlled are so arranged that if a circuit is ever completed at 208 and 211 simultaneously the motor will be stopped. Thus the machine acts to periodically complete a circuit at 211 and during the time that the circuit is being completed at this point the gate is in its open position under the influence of the ejected shell. However, if the shell fails to leave the mandrel and the gate remains closed, then the circuit will be completed at 208 and 211 simultaneously and a relay 213 will be energized and affect an armature 214 which will break the circuit 215 in which is included an under-voltage coil 216 and when this under-voltage coil is de-energized it acts in a usual and well-known way upon a control switch 217 to break the main circuit through the motor 177.

For use in starting the machine or for running the machine idle a handle control 218 is furnished. It is desirable to provide means for moving the machine by hand during the time that the paper is being threaded in the machine preparatory to starting and while effecting the necessary adjustments with regard to making a change in the size of the shell to be manufactured. For this purpose I provide a hand wheel 219 which is on a shaft 220. This shaft carries a pinion 221 which may be moved into engagement with the teeth of the gear 174.

During the time that the machine is in operation this gear wheel 221 may be moved out of mesh with the gear 174 by a longitudinal movement of the shaft 220 and the hand wheel. This may be effected by withdrawing a pin 222 which normally engages in a groove in the shaft 220 to prevent longitudinal movement thereof.

It is apparent that various ways of securing the performance of the function of the several parts of the machine will readily suggest themselves to engineers skilled in the art. Therefore it is to be understood that the invention is not limited to the precise construction set forth but that it includes within its purview whatever changes fairly come within either the terms or the spirit of the appended claims.

Having described my invention, what I claim is:

1. A paper shell machine comprising, in combination, a cutting mechanism arranged to make a bias cut, a feeding mechanism in fixed relation to the cutting mechanism, a mandrel, means for imparting intermittent and variable movement to the feeding mechanism whereby sheets of paper of varying lengths and with bias cut ends, will be cut off and means for conveying said cut sheets, bias portions foremost to the mandrel whereby to form shells of varying diameters according to the length of paper cut off without shifting the position of the cutting mechanism with respect to the feeding mechanism.

2. In a shell machine the combination with a variable throw intermittent feed mechanism, of a printing mechanism, and a knife disposed between the printing mechanism and the feed mechanism, all of said mechanisms being disposed in fixed relation to each other.

3. In a paper shell machine the combination with a cutting mechanism, of a variable throw feed mechanism for feeding paper thereto comprising a pair of rollers the uppermost of which is idle and is spring pressed upon the lower roll, a variable throw crank, a swinging segment connected to said chank, a pinion with which said segment meshes, and a pawl and ratchet connection between said pinion and the lower roll.

4. A shell machine comprising a step-by-step feeding mechanism, a printing mechanism, an angularly disposed cutting mechanism between the feeding and printing mechanisms, and an auxiliary feeding mechanism between the first named feeding mechanism and the printing mechanism to carry from the knife to the printing mechanism sheets that are too short to otherwise reach the printing mechanism under the influence of the first named feeding mechanism.

5. In a shell machine the combination with means for supporting a paper roll, of a step-by-step feed mechanism for imparting feeding movement to the paper drawn from said roll, a knife disposed obliquely across the path of the travel of the paper web, a mandrel, a conveyor for conveying the paper cut from the web to said mandrel, a gate disposed adjacent the mandrel for temporarily retaining the cut sheet, means for clamping the projecting portions of the angularly cut sheet to the mandrel to cause the same to be wound thereon, and means for simultaneously opening the gate.

6. A machine of the character described, comprising a step-by-step feeding mechanism, a knife disposed obliquely across the path of travel of the paper from which the shells are made, a printing mechanism located beyond the knife, a mandrel, and a conveyor between the printing mechanism and the mandrel, that end of the conveyor adjacent the mandrel being vertically adjustable.

7. A machine such as recited in claim 6 in combination with a gate carried by and bodily adjustable with the conveyor and disposed adjacent the mandrel and serving to temporarily stop the cut sheet.

8. A machine of the character described comprising means for supporting a paper roll, means for imparting step-by-step movement to the paper drawn from said roll, a knife disposed obliquely to the line of travel of the paper, a conveyor comprising opposed traveling tapes, a mandrel disposed adjacent to the discharge end of said conveyor, a gate by which the cut sheets are temporarily stopped with their projecting end overlying the mandrel, a pressure element for pressing the said projecting ends of the sheets into engagement with the mandrel causing the sheets to be wound upon the mandrel, a movable member by which said pressure element is carried, and means actuated by said movable member for opening the gate.

9. A machine of the character described comprising, in combination, means for supporting a roll of paper, means for imparting step-by-step movement to said paper in varying degrees, an obliquely disposed knife adapted to cut off the amount of paper fed past said knife by the feeding mechanism,

a conveyor comprising opposed traveling tapes, a mandrel to which the paper is delivered by said tapes, and an obliquely disposed gate against which the front end of the obliquely cut sheet abuts and by which the paper is temporarily stopped the action of the tapes serving to straighten the paper during such temporary stoppage.

10. A machine such as recited in claim 9 in combination with a printing mechanism disposed between the knife and the conveyor.

11. A machine of the character described comprising means for supporting a paper roll, a variable throw step-by-step feeding mechanism for feeding a web of paper from said roll, a knife disposed obliquely to the line of travel of the web of paper, a mandrel, conveying means for conveying the paper sheet to said mandrel, means for bringing the paper sheets into engagement with the mandrel to cause them to be wound thereon, a folding mechanism for folding the ends of the sheets to bring same to a tubular form, and means for discharging jets of compressed air against the folded ends of the shells to eject the same from the mandrel.

12. In a machine of the character described the combination with a rotating mandrel, of means for winding a sheet of paper thereon to bring the same to tubular form, folding means for folding the sheet ends to bring the same to a cup like form, and yieldable means for imparting a cushioned blow to said folded ends to cause them to retain their folded shape.

13. A structure as recited in claim 12, in combination with means for transversely removing the blow imparting means from alignment with the mandrel and for thereafter discharging the shell from the mandrel under the influence of compressed air.

14. A machine of the character described comprising a rotative mandrel, means for causing a sheet of paper to be wound thereon with one end of the paper projecting therefrom, folding means movable across the mandrel for folding the projecting portion of the sheet to bring the same to cup like formation, a pin movable axially with respect to the mandrel for imparting a blow to the cup end of the shell, means for bodily swinging said pin transversely of and out of alignment with the mandrel, and means for subsequently blowing the shell from the mandrel under the influence of compressed air.

15. In a shell making machine the combination with a rotative mandrel made in two parts and separated upon an oblique line, said mandrel having compressed air conduits formed therein which open at the outer end of the mandrel, of means for moving one part of the mandrel with respect to the other and simultaneously admitting compressed air to the mandrel the movement of one part of the mandrel with respect to the other collapsing the same for releasing the shell thereon and the compressed air acting to discharge the shell from the mandrel.

16. In a machine of the character described the combination with a collapsible mandrel having compressed air conduits therein which open at the outer end of the mandrel, and means for collasping the mandrel and simultaneously therewith admitting compressed air to the interior of the mandrel.

17. In a machine of the character described the combination with a rotative mandrel, of a disk rotating transversely to the axis of the mandrel, folding fingers carried by the disk and acting across the end of the mandrel, a head mounted to swing across the face of said disk, a lever pivoted intermediate its ends on said head, a pin movable axially with respect to the mandrel and pivoted upon one end of said lever, and a cam upon the disk acting against the other end of said lever to thrust the pin toward the mandrel to crimp the folded end of the shell.

18. A structure as recited in claim 17 in combination with means for maintaining the pin in axial alignment with the mandrel throughout the swinging movement of said lever.

19. A structure as recited in claim 17 wherein said pin is yieldingly and rotatively mounted with respect to said lever.

20. A structure as recited in claim 17 in combination with means for moving said head laterally with respect to the mandrel to carry the pin out of alignment with the mandrel after the crimping of the end of the shell has been completed to thereby permit the endwise removal of the shell from the mandrel.

21. A structure as recited in claim 17 in combination with spring means tending to swing said head to carry the pin out of alignment with the mandrel and a cam carried by the disk and acting upon said head to move said pin into alignment with the mandrel.

22. In a shell forming machine, the combination with a rotative mandrel, of means for securing cut sheets thereto in such manner that portions of the sheets project beyond the ends of the mandrel, means for folding the projecting portion of the sheet to form a closed end, means for discharging jets of compressed air through the mandrel against the closed ends to thereby eject the shells from the mandrel and means for collapsing the mandrel prior to the discharge of the compressed air against the closed end of the shell.

23. In a shell forming machine, a mandrel

comprising two similar parts which are substantially semi-circular and which are separated longitudinally upon an oblique line, said parts complementally constituting the surface of the mandrel, means for moving one of the said parts longitudinally with respect to the other, to thereby collapse the mandrel, a conduit for compressed air lying complementally within the two parts of the mandrel and extending longitudinally thereof, and means for automatically admitting compressed air to said conduit after the movement of the two parts of the mandrel with respect to each other to collapse the same.

24. A structure as recited in claim 23 in combination with an air conveying tube extending axially through the mandrel and along the line of division between the parts of the mandrel.

25. In a shell forming machine, a mandrel having an air discharge conduit formed therein, a stem with respect to which said mandrel rotates said stem having an air passage formed therein, means for moving said stem axially and a source of air under pressure into communication with which said stem is brought upon such axial movement.

26. In a shell forming machine, a mandrel formed in two parts separated along an oblique line, a member carried by one of said parts and guided in the other of said parts at the other end of the mandrel, and a line of air discharge ports formed in the mandrel outwardly of said member.

27. A structure as recited in claim 26 in combination with a tube extending through the mandrel along the line of division between the parts of the mandrel and serving to conduct air to said line of ports.

28. In a shell forming machine, a mandrel made in two parts separated along an oblique line so that movement of one part with respect to the other has the effect of collapsing the mandrel, a link connected to the movable part, a head to which said link is connected, a stem with respect to which the mandrel and head rotate, spring means for moving the head and movable parts of the mandrel in one direction, means for moving the head against the tension of its spring in the other direction, air conduits formed in the stem and mandrel, and a source of compressed air into communication with which the conduit of the stem is brought when said head is moved against the tension of the spring.

29. A structure as recited in claim 28 in combination with a rotatably mounted sleeve in which the two parts of the mandrel and the head are mounted for sliding movement, and a gear upon the exterior of said sleeve for driving the whole.

30. In a shell forming machine, the combination with a mandrel having air conduits formed therein, said mandrel being made in two parts, connections for actuating one of the parts with respect to the other comprising a bell crank lever, an air conduit adapted to be brought into communication with the interior of the mandrel upon movement of said bell crank lever, a control valve for the air conduit, a rotative shaft, and a pair of cams on said shaft one of which acts upon said valve and the other of which acts upon the bell crank lever.

31. In a shell making machine, the combination with a rotative mandrel, of a pair of semi-circular ironers adapted to embrace the mandrel during the winding of the shell thereon, spring means tending to draw said ironers against the mandrel, and mechanical means acting against the said spring means to separate the ironers from the mandrel to permit the finished shell to be ejected.

32. In a shell making machine, the combination of a pair of crossed and pivoted levers, spring means engaging the upper portions of said levers and tending to draw them together, semi-circular ironers carried by the upper portions of said levers, and a mandrel with which said ironers co-act.

33. A structure as recited in claim 32 in combination with a pivoted bar lying between said crossed levers and adapted to force them apart against the tension of said spring means when said bar is forced downwardly, and a cam acting against the free end of said bar and forcing the same downwardly to move the ironers away from the mandrel.

34. The combination with a shell forming machine comprising a mandrel, of means for ejecting the finished shell from the mandrel, a member lying in front of the end of the mandrel to which movement is imparted by the shell as it is being ejected, and means for stopping the operation of the machine if said member fails to move.

35. A shell forming machine comprising a rotative mandrel, means for ejecting a finished shell therefrom, a movable element lying in front of said mandrel and moved by the shell in its passage from the mandrel, an electric circuit controlled by the movement of said member, and means controlled by said circuit for bringing the machine to a stop if the shell fails to leave the mandrel and operate the member.

36. In a shell forming machine, the combination with a rotative member, of means for ejecting the finished shells therefrom, a pivoted element lying in front of said mandrel adapted to be swung upon its pivot by the action of the shell in leaving the mandrel, an electric circuit in which said member is included, and means for interrupting the operation of the machine if the said

member fails to move under the influence of the shells.

37. In a shell forming machine, the combination with a rotative mandrel, of means for ejecting a finished shell therefrom, an electric motor for driving the machine, and circuit controlling means for the said motor comprising two switches one of which is closed periodically during the operation of the machine, the other of which is opened periodically by the passage of the shells from the mandrel, said circuit controlling means including elements for interrupting the circuit to the motor bringing the machine to a stop if both of said switches are thrown in simultaneously.

38. In a shell forming machine, the combination with a rotative mandrel, of a pivoted gate adjacent the end thereof, and adapted to be swung upon its pivot by the passage of the shells from the mandrel, an electric circuit in which said gate is included said gate acting to break the circuit when swung upon its pivot, a second circuit breaking element included in the same circuit and moved periodically to a closed position during each cycle of operation of the machine, a circuit in which the motor is included, and means controlled by the first named circuit for interrupting the motor circuit and bringing the machine to a stop if the gate fails to move and break its circuit at the time that the machine operated circuit closing element is closed.

39. The hereindescribed combination comprising a rotative mandrel, ironers associated with said mandrel, a feed roll disposed above the mandrel, and means for feeding biased cut sheets to the mandrel in such position that the end thereof overlies the mandrel in position to be clamped to the mandrel by the feed roll.

40. The hereindescribed combination of parts comprising a rotative mandrel, a folding mechanism associated therewith a crimping mechanism acting against the folded ends of the sheets and means for adjusting the intensity of the crimping blow.

41. The herein described combination of parts, comprising a rotative mandrel, a folding mechanism associated therewith, a crimping mechanism acting against the folded end of the sheet to deliver a crimping blow and comprising a spring pressed pin, and means for adjusting the tension of the spring of said pin.

In testimony whereof he affixes his signature in the presence of two witnesses.

DANIEL D. HUYETT.

Witnesses:
P. W. PARVIS,
A. L. SWEARER.