Sept. 16, 1947. E. H. SWAIN 2,427,515

SHEET TEARING MACHINE

Filed May 16, 1944 14 Sheets-Sheet 1

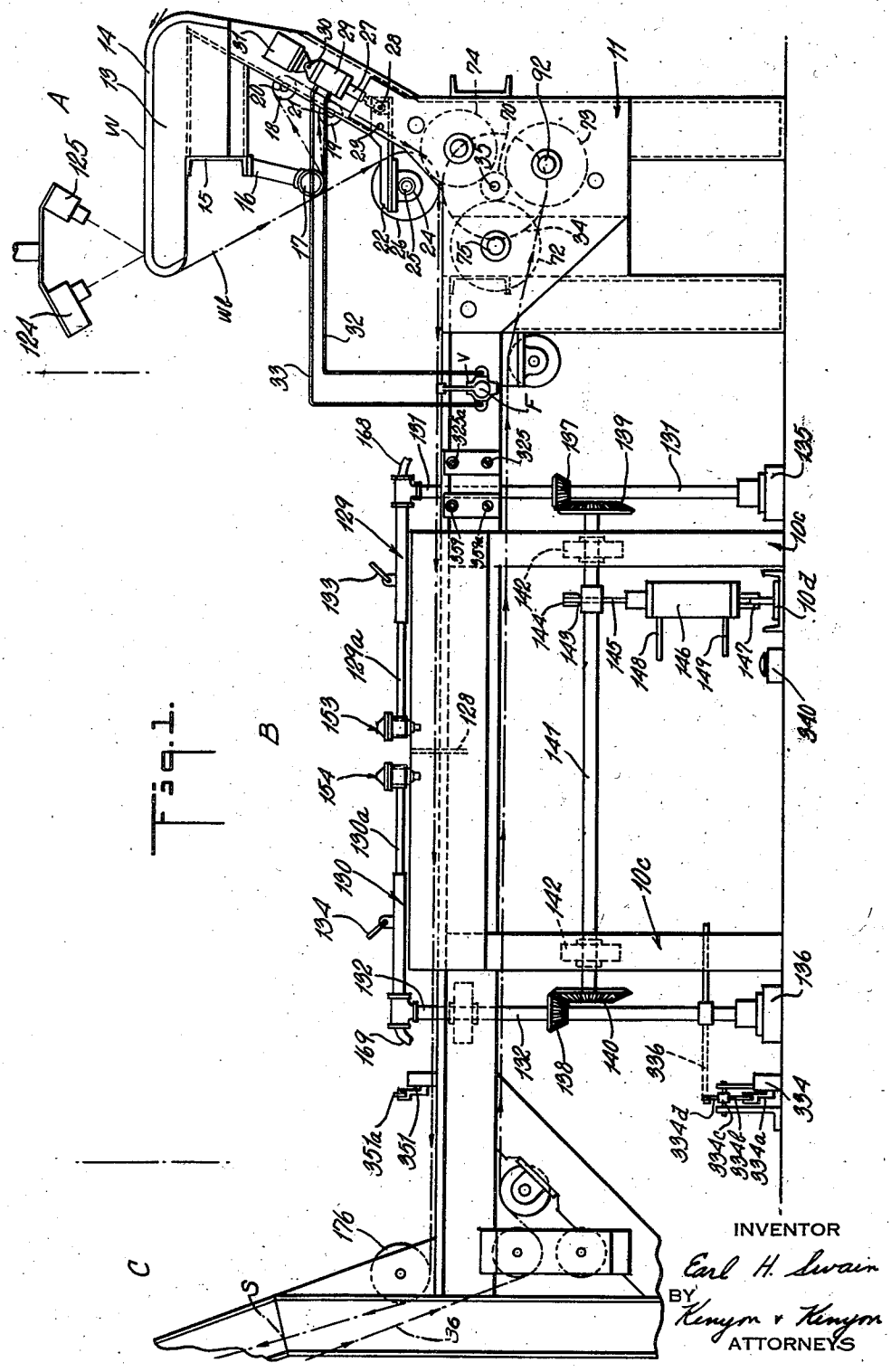

Fig. 1.

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SHEET TEARING MACHINE

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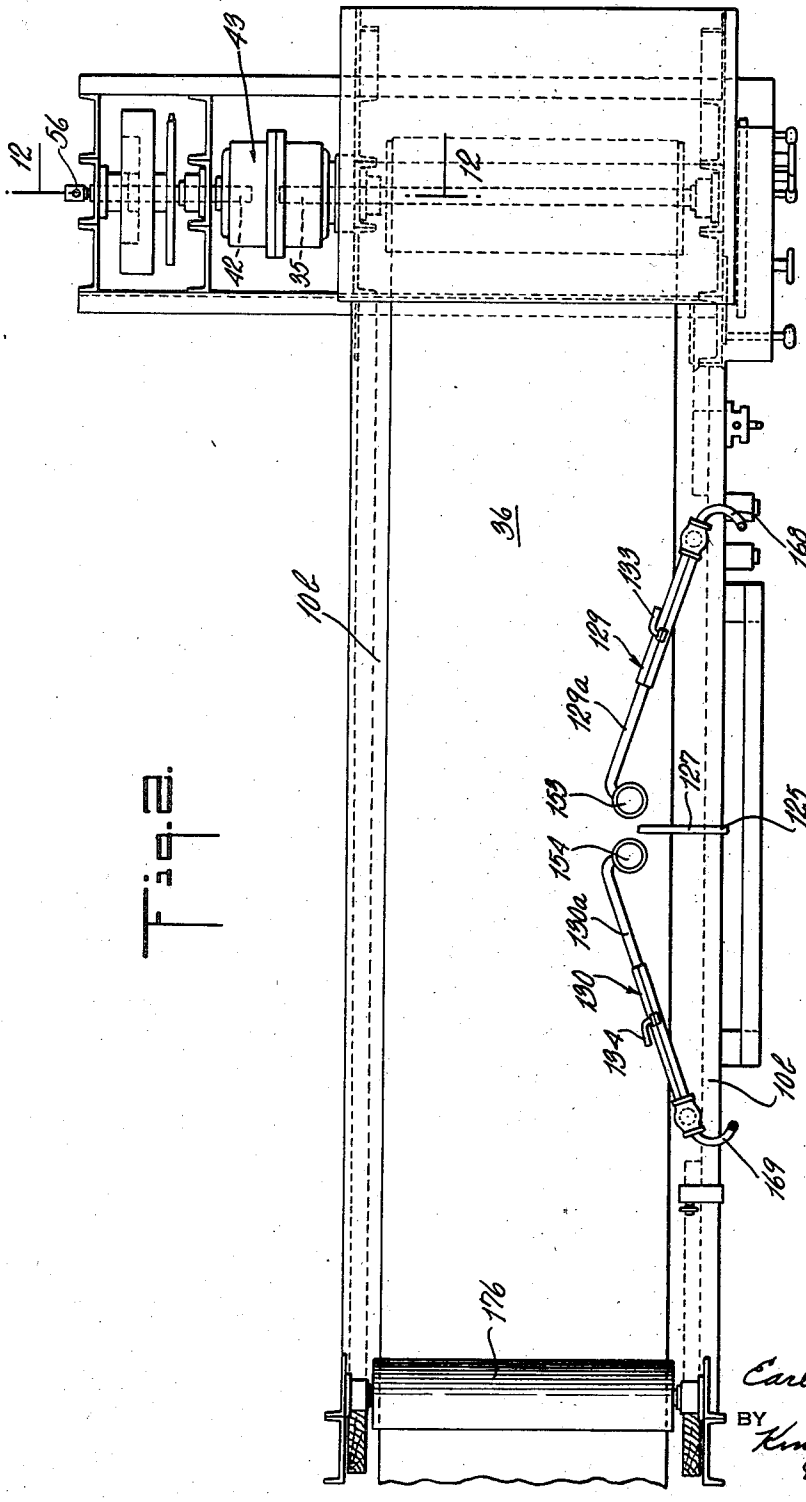

Fig. 2.

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SHEET TEARING MACHINE

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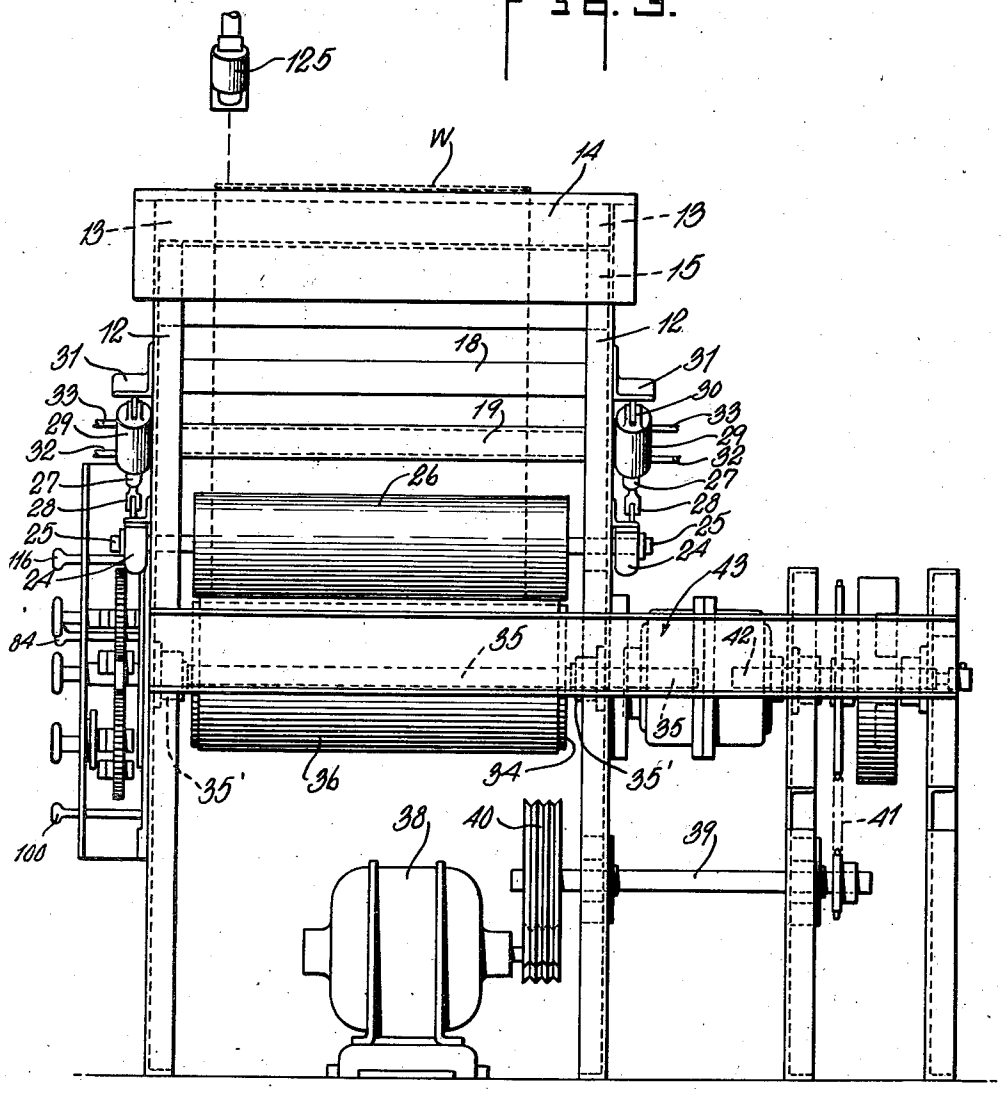
Fig. 3.



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SHEET TEARING MACHINE

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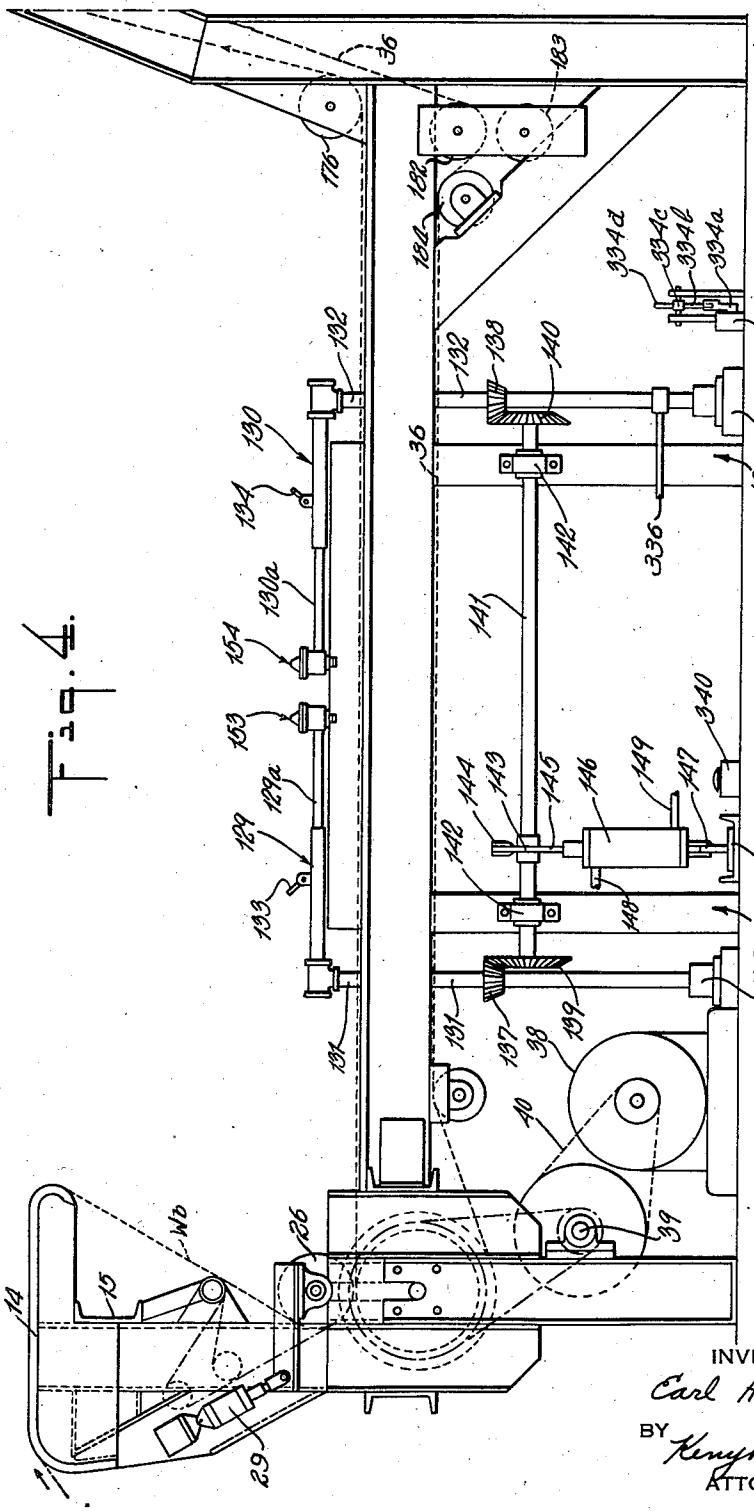

Fig. 4.

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SHEET TEARING MACHINE

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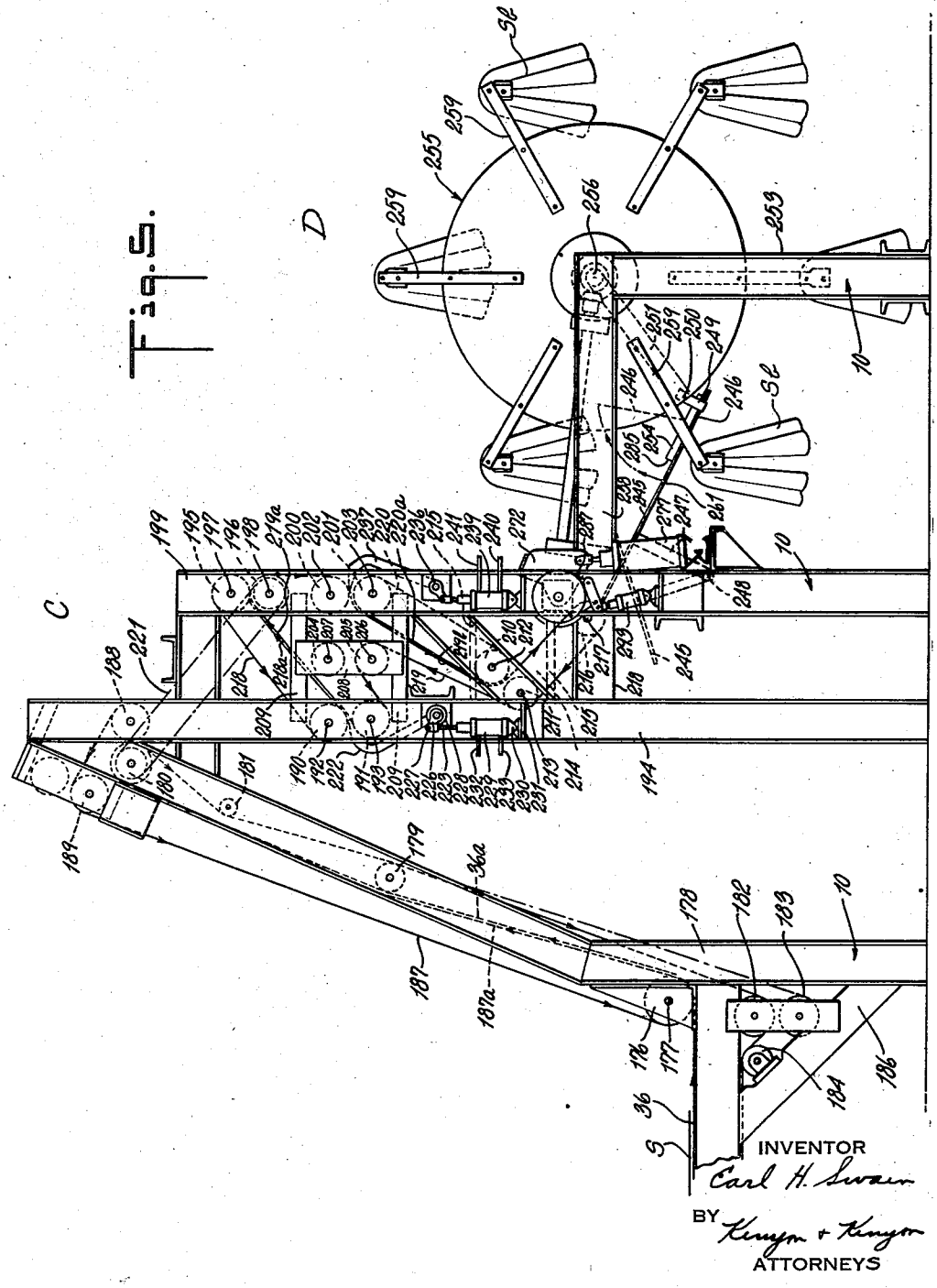
Fig. 5.



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SHEET TEARING MACHINE

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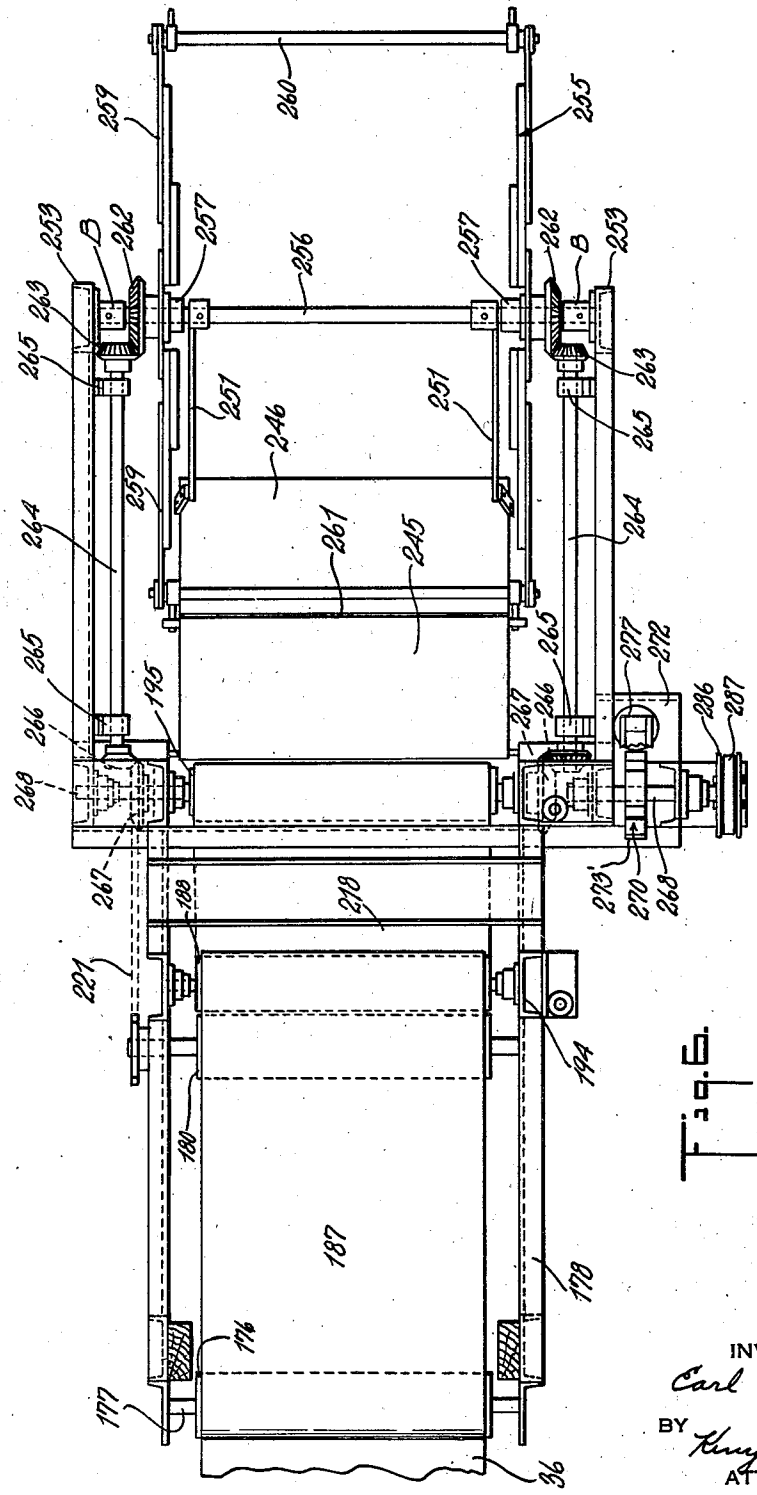

Fig. 6.

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SHEET TEARING MACHINE

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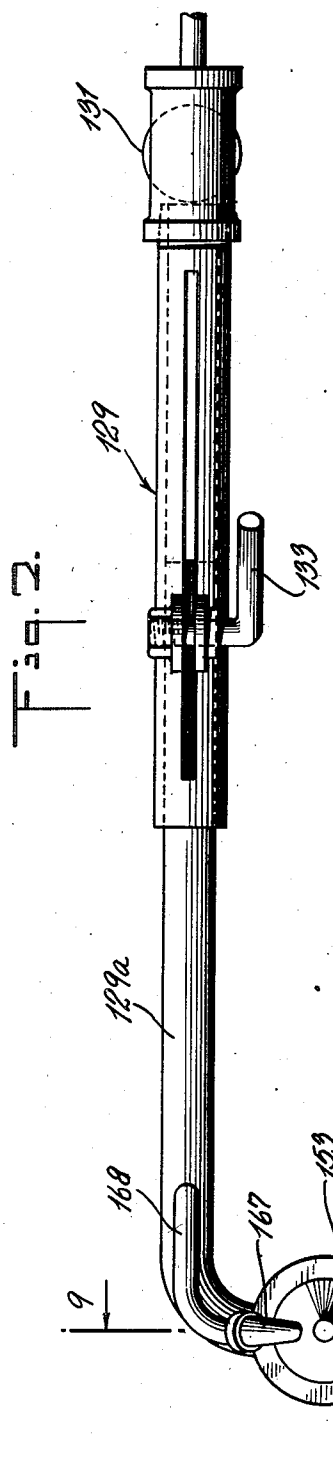

Fig. 2.

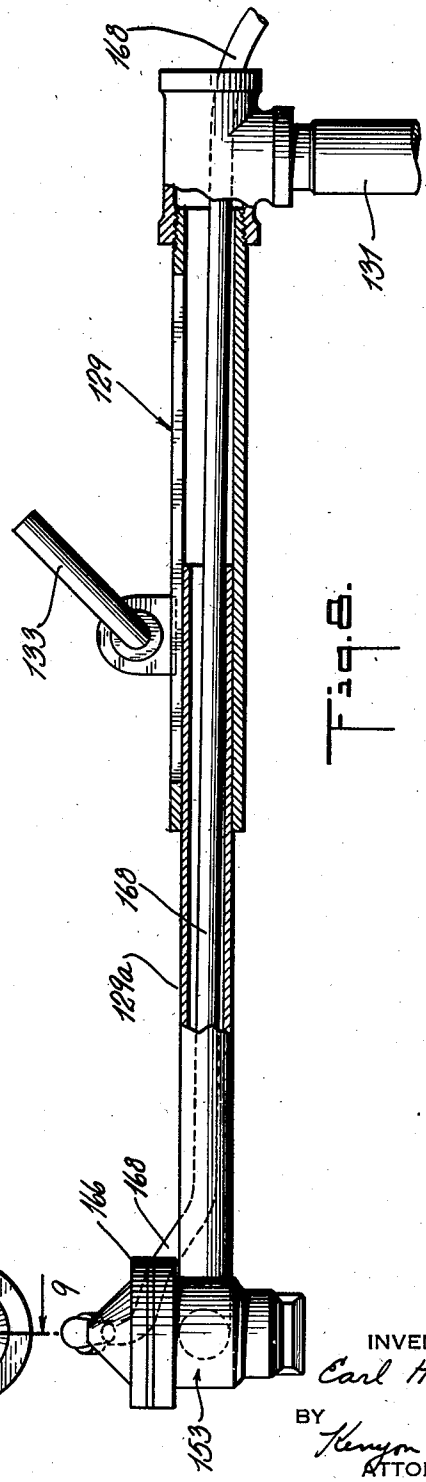

Fig. 8.

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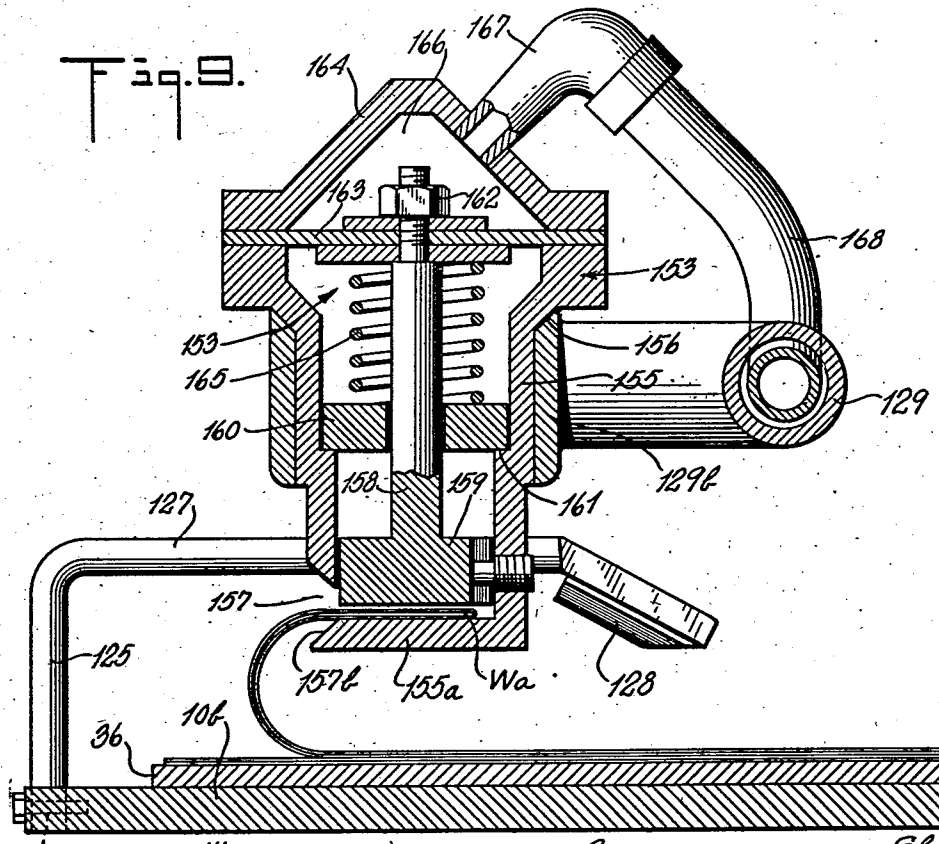
Fig. 9.



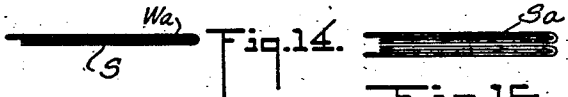


Fig. 14.

Fig. 16.

Fig. 18.

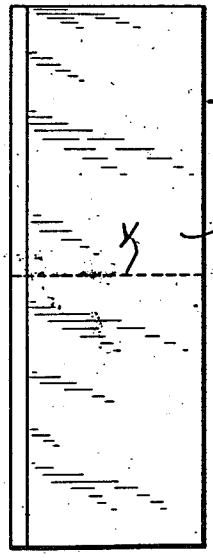


Fig. 15.

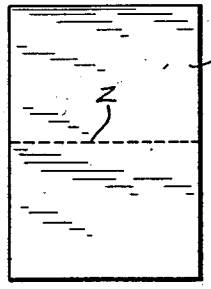


Fig. 17.

Fig. 19.

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SHEET TEARING MACHINE

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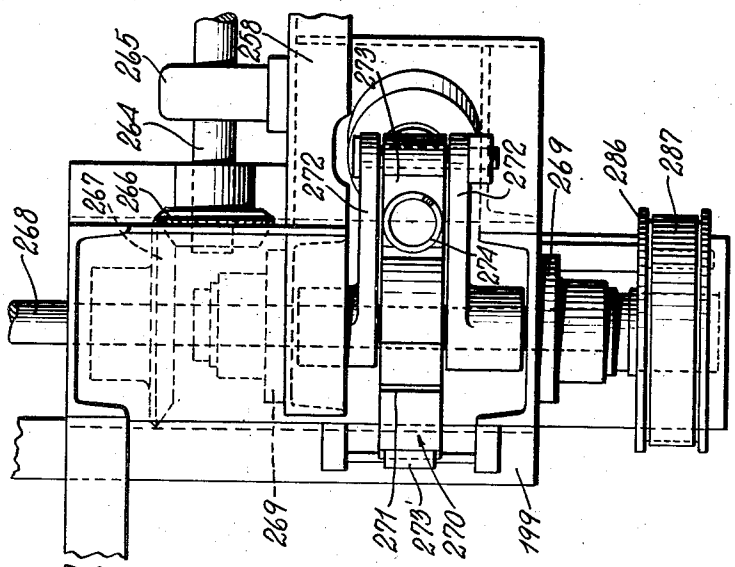

Fig. 11.

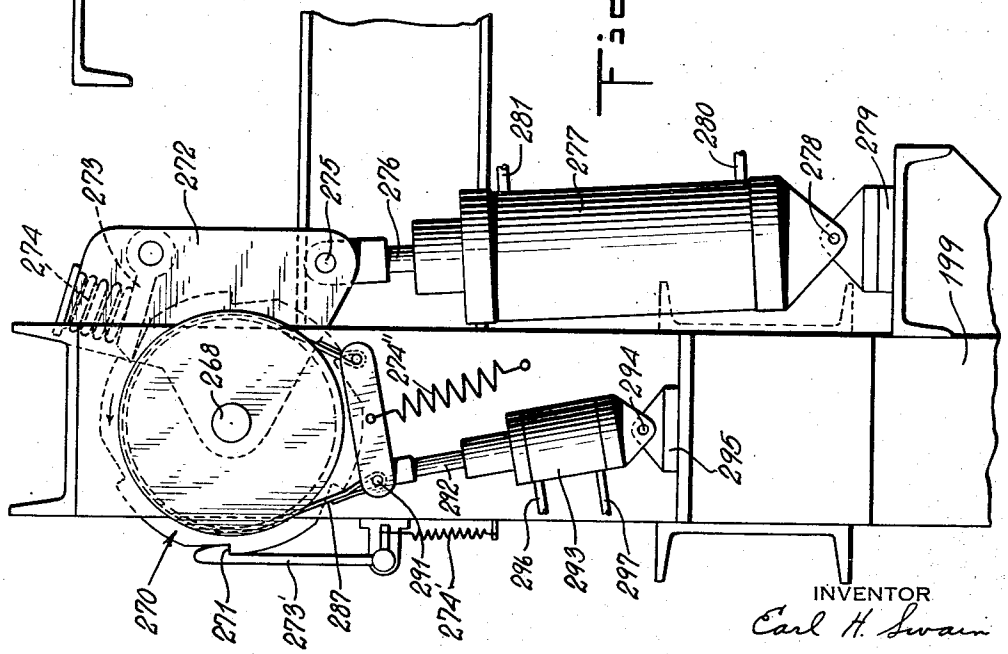

Fig. 10.

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SHEET TEARING MACHINE

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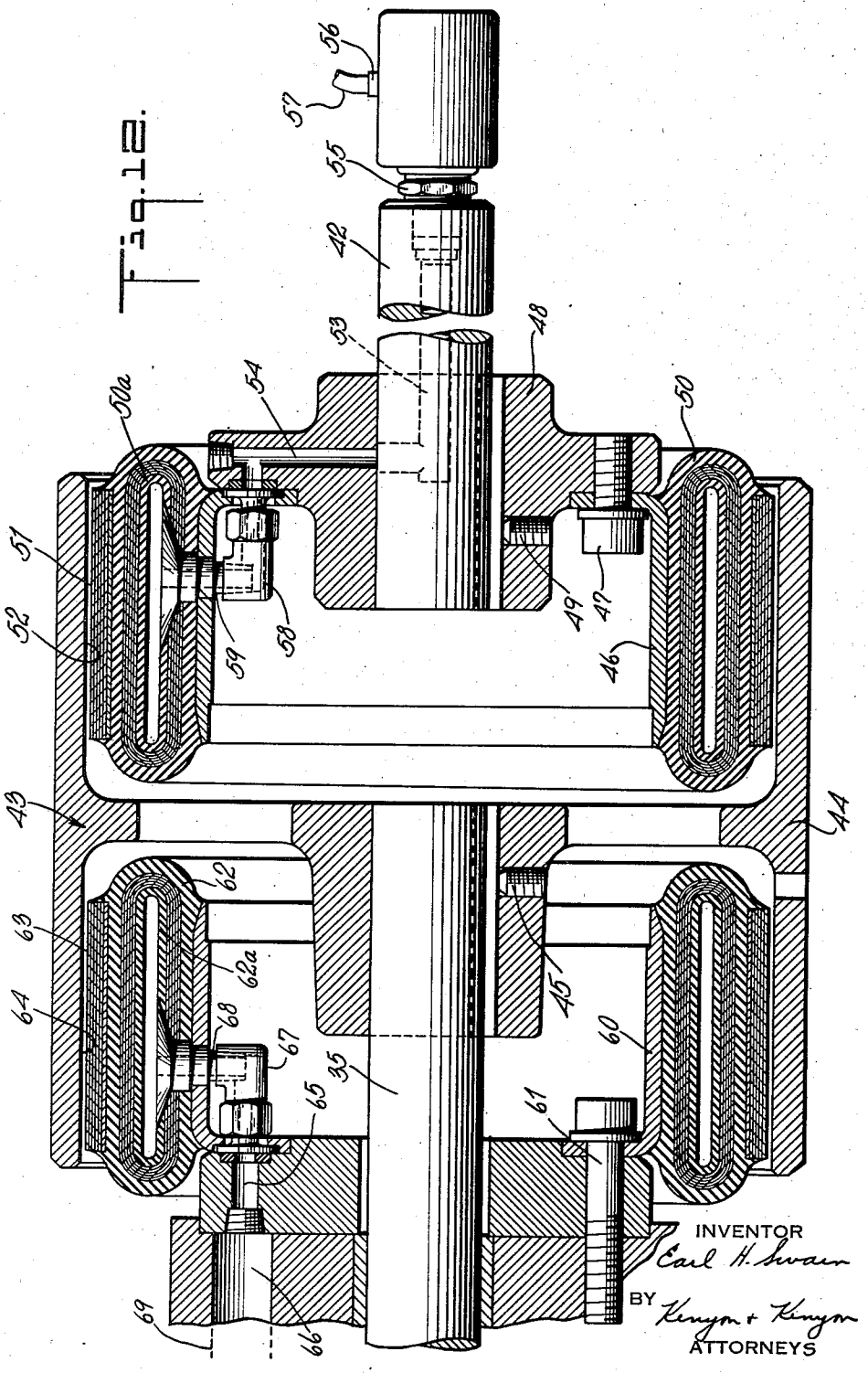
Fig. 12.



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SHEET TEARING MACHINE

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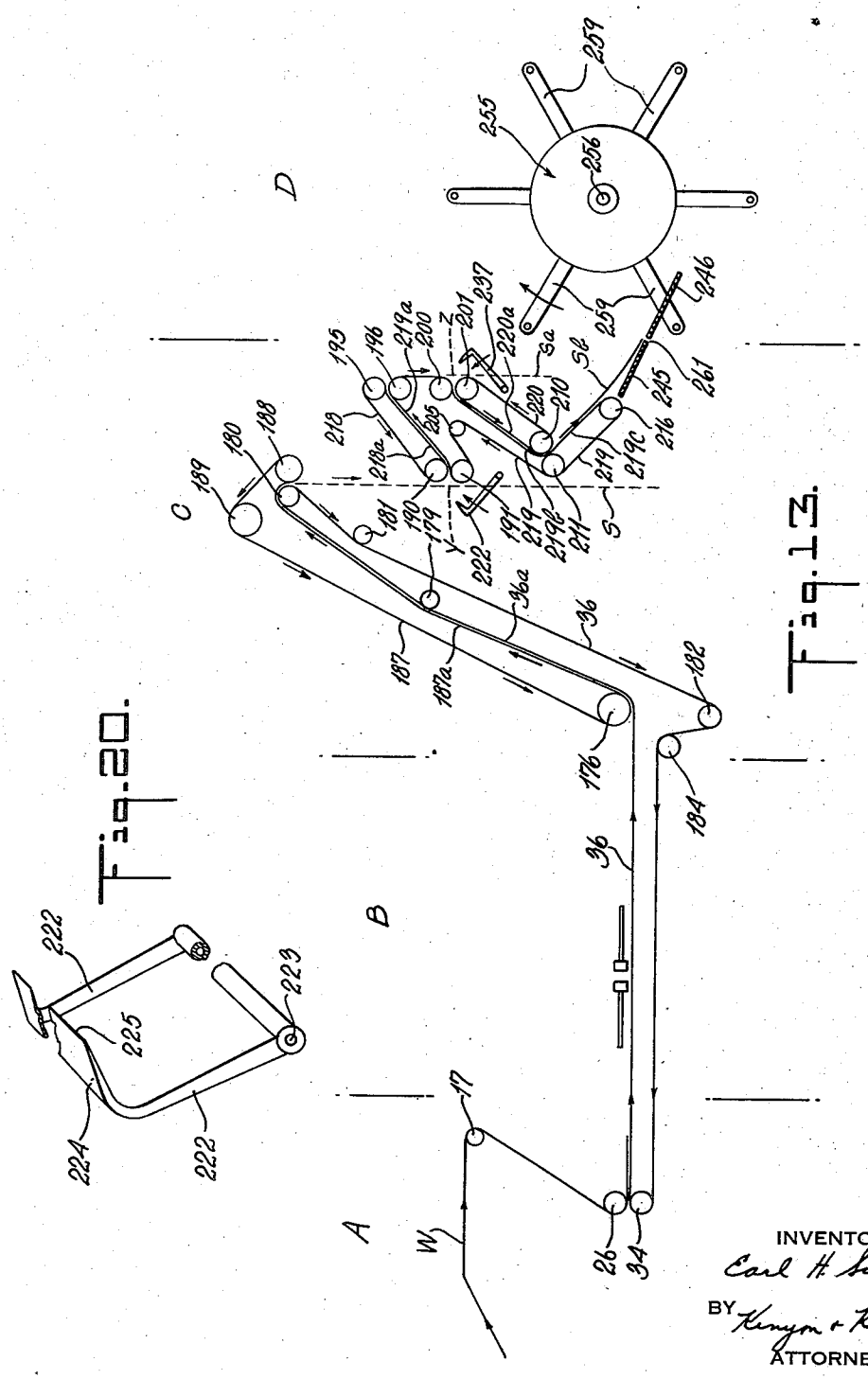

Fig. 17.

Fig. 20.

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SHEET TEARING MACHINE

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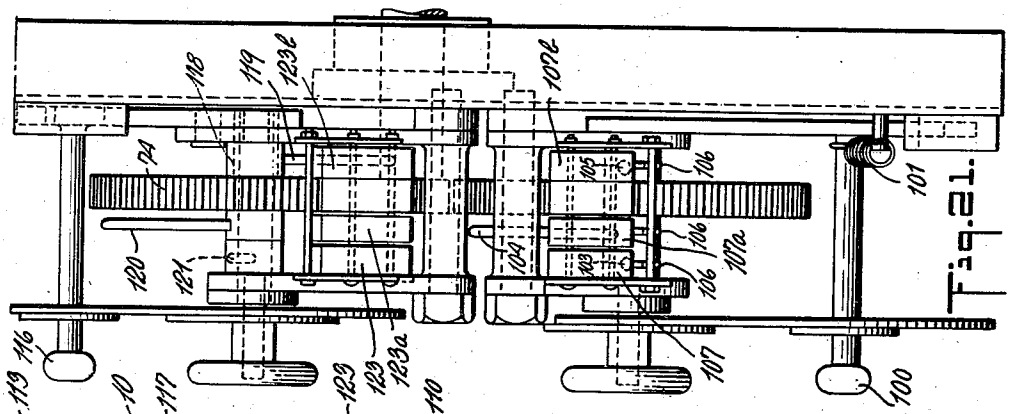

Fig. 21.

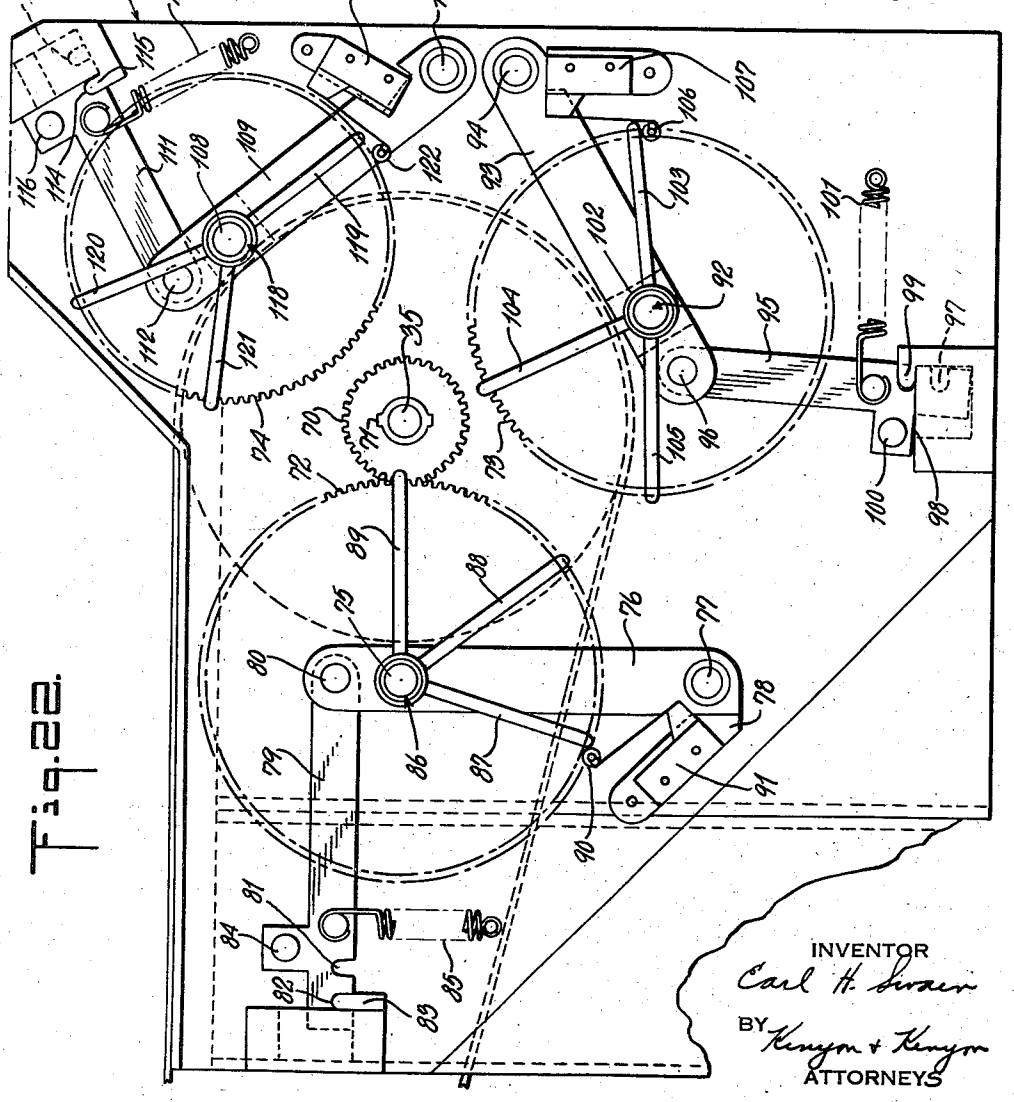

Fig. 22.

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SHEET TEARING MACHINE

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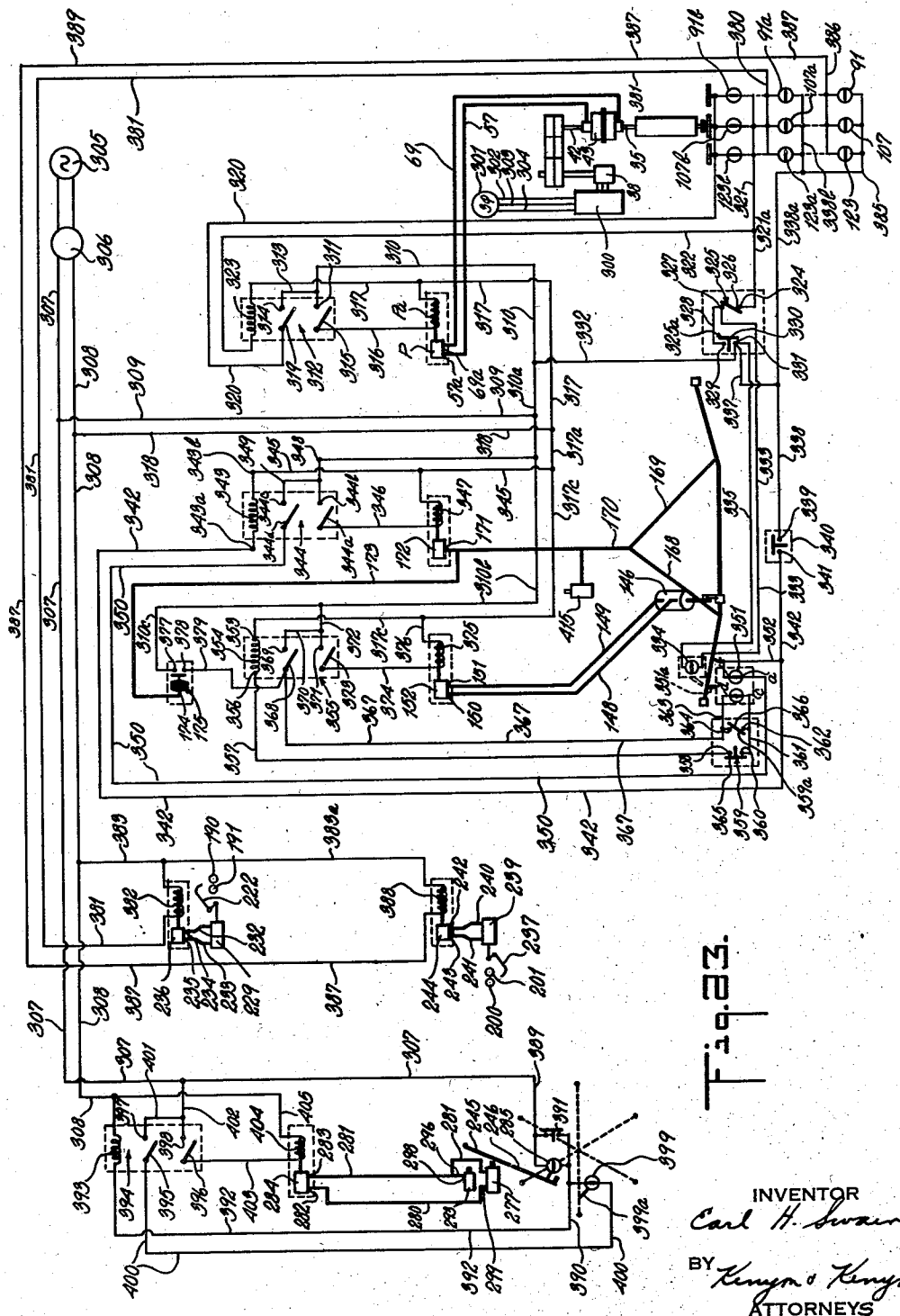

Fig. 23.

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SHEET TEARING MACHINE

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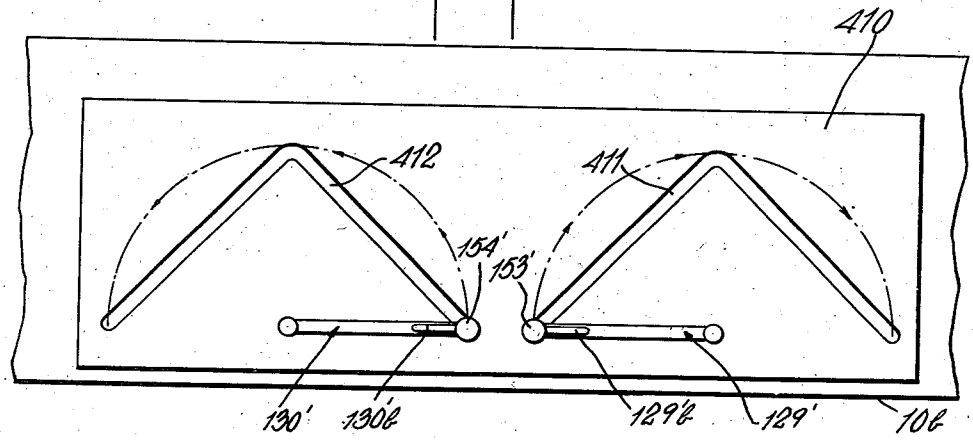
Fig. 24.



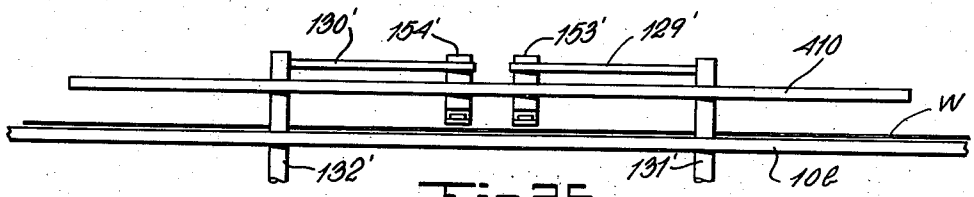


Fig. 25.

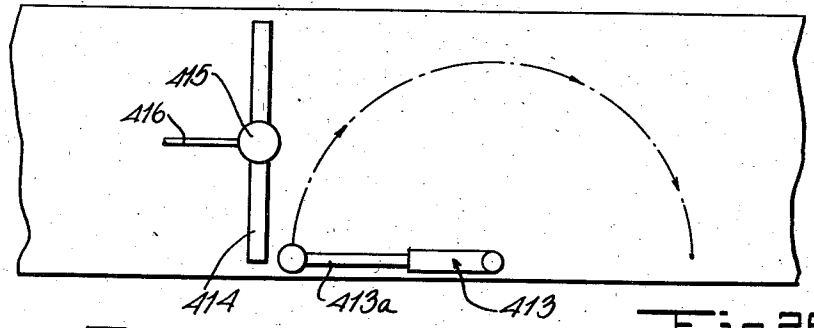


Fig. 26.

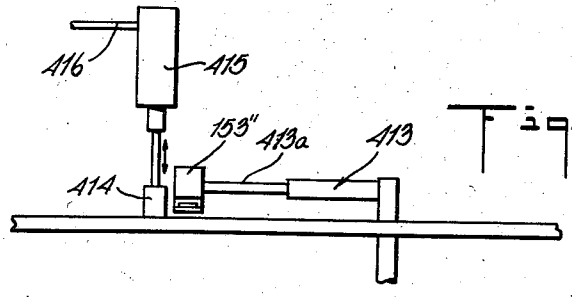


Fig. 27.

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Patented Sept. 16, 1947

2,427,515

UNITED STATES PATENT OFFICE

2,427,515

SHEET TEARING MACHINE

Earl H. Swain, New Hartford, N. Y., assignor to Utica Willowvale Bleaching Company, Utica, N. Y., a corporation of New York

Application May 16, 1944, Serial No. 535,795

25 Claims. (Cl. 164—84.5)

1

This invention relates to a machine for tearing sheetings or the like into desired lengths.

A customary procedure heretofore has been to tear manually lengths of sheeting from a longitudinally folded web after measuring off the desired length by the operator. This operation has required a person to walk forward and back alongside a table the length of a sheet for each sheet measured, torn and folded and with each tearing operation, the operator had to grip the web with both hands and nick same with knife and then tear same transversely by moving hands apart away from each other and on wider fabrics, the operator had to again grip the fabric further along the tearing line and again move hands apart to tear across the entire width of web. This has required a person of unusual strength and because of the fatiguing nature of these several operations, the procedure necessarily is a slow one and the measured lengths are subject to possible variations when measured by hand. Where large quantities of sheets are required, a great many operators are required.

A principal object of this invention is to provide a machine for automatically measuring and tearing sheetings or the like to predetermined length rapidly and accurately whereby one supervisor of such a machine can replace the numerous hand tearers heretofore required.

Another object of this invention is to provide a machine of the required character in which simple adjustment may be readily made for tearing sheetings of different desired lengths.

A further object of this invention is to provide a machine of the required character, that may be simply and conveniently operated.

The machine is designed to measure the desired length of sheet from the sheeting fed thereto, and to nick the center longitudinal fold before tearing to start the tearing point, to tear the sheet from the sheeting, to move the torn off sheets along, to fold them each twice transversely with the same folds now effected by hand operation, and to collect the folded sheets in folded piles over cross bars of a doffer mechanism at the outlet end of the machine. Provision is made in the machine so that adjustments can be made for different lengths and widths of sheets to be handled and for detection of short lengths of sheeting and seams and defects in the sheeting fed to the machine.

Still another object of the machine is to provide novel electrical circuit controls for operation of various parts of the machine.

Other objects are to provide means in the machine for feeding definite lengths of sheets between each starting and stopping of the sheeting conveyor, to provide means for braking the sheeting feed mechanism while the latter is stopped, to provide novel clamping means in conjunction with the sheet tearing means, to provide means to actuate the clamping means before the tearing means is actuated, to provide novel means for transversely folding different lengths of sheeting with the same folding means and with the same folds now applied by hand thereto, to effect automatic straightening out of the leading and trailing edges of torn off sheets after they leave the tearing means and before folding said sheets transversely, is completed, etc., to provide novel doffer mechanism for removing the sheets from the machine, and to provide controls actuated by the folded sheets for operating the doffer mechanism.

2

To the accomplishment of the foregoing and such other objects as may hereinafter appear, this invention consists in the novel construction and arrangement of parts hereinafter described and then sought to be defined in the appended claims, reference being had to the accompanying drawings forming a part hereof which show, merely for the purposes of illustrative disclosure, preferred embodiments of the invention, it being expressly understood, however, that changes may be made in practice within the scope of the claims without digressing from the inventive idea.

In the drawings, in which similar reference characters denote corresponding parts and in which section views are viewed in the directions of the respective arrows:

Fig. 1 is a front elevation of a portion of the machine including the feed-in mechanism and the tearing mechanism;

Fig. 2 is a top plan view of the portion of the machine shown in Fig. 1;

Fig. 3 is an end elevation of the machine viewed from the right of Fig. 1;

Fig. 4 is a rear elevation of the portion of the machine shown in Fig. 1;

Fig. 5 is a rear elevation of the sheet folding and sheet take-off mechanisms provided as a continuation of the right-hand portion of the machine shown in Fig. 4;

Fig. 6 is a top plan view of the mechanisms shown in Fig. 5;

Fig. 7 is an enlarged top plan view of one of the sheet tearing arms;

Fig. 8 is an enlarged elevational view partially in section of the arm of Fig. 7;

Fig. 9 is an enlarged sectional view taken along line 9—9 of Fig. 7, and illustrating the sheet gripping mechanism of one of the tearing arms;

Fig. 10 is an enlarged elevational view of feed and brake arrangement associated with the drive of the sheet take-off or doffer mechanism;

Fig. 11 is a top plan view of the structure shown in Fig. 10;

Fig. 12 is an enlarged sectional detail taken along line 12—12 of Fig. 2, illustrating details of the clutch and brake mechanism for coupling the machine to the main drive motor, and for braking it for quick stops;

Fig. 13 is a diagrammatic illustration of the sequences of operations effected in the machine;

Fig. 14 is an end view of the web of sheeting fed to the machine;

Fig. 15 is a plan view of sheeting after being torn to a prescribed length in said machine;

Fig. 16 is an end view of the sheeting of Fig. 15 after it has been given its first fold;

Fig. 17 is a plan view of the sheeting of Fig. 16;

Fig. 18 is an end view of the sheeting of Fig. 17 after it has been given its second fold;

Fig. 19 is a plan view of the sheeting of Fig. 18 as it appears when it is removed from the doffer mechanism;

Fig. 20 is an enlarged perspective view of one of the folder arms;

Fig. 21 is an enlarged end view of the web feeding mechanism for feeding predetermined lengths of sheeting to the tearing mechanism;

Fig. 22 is an enlarged front elevation illustrating somewhat diagrammatically the details of the web feeding mechanism of Fig. 21;

Fig. 23 is a diagrammatic illustration of the electrical and pneumatic control circuits of the machine;

Figs. 24 and 25 are respectively diagrammatic plan and front elevations of a modified form of tearing mechanism; and

Figs. 26 and 27 are respectively front and plan elevations of a further modification of tearing mechanism.

Referring to the drawings, and first to Figs. 1, 4 and 5, the machine embodies a web feeding and measuring section A which includes a guide frame wherein the web is received in longitudinally double, double folded condition from rolls or folded goods on platforms (not shown) and passed around appropriate measuring devices to measure off predetermined lengths, a sheet tearing section B to which the appropriately admeasured lengths of sheetings are fed and which includes a tearing table and wherein these measured lengths are torn from the sheeting successively, a sheet folding or doubling section C whereto the torn lengths of sheeting are delivered from the section B and doubled or folded transversely, and a doffer mechanism D with which the folded sheets are delivered from section C for removal from the machine.

The various sections A to D inclusive of the machine are all carried or positioned with respect to a common frame work or base 10 so that delivery of sheeting, detection of defects or seam admeasurement to desired length, tearing of admeasured lengths, folding and doffing may be carried on as a continuous operation.

The web feeding and measuring section A

In this section A, the frame 10 carries suitably a pair of oppositely located upright brackets or guide frame parts 11 each shaped to provide an upward angularly extending portion 12 and

horizontal top portions 13. A cover or guide plate 14 overlies the top portions 13 and is suitably supported thereby. The cross bar 15 extends between the portions 13 and depends therefrom. This cross bar supports a suitable bracket 16 that carries a tension bar 17 for a purpose to be presently described.

Additional spaced apart guide bars 18 and 19 are suitably supported on axes 20 and 21 extending in suitable brackets between the frame portions 12, for a purpose to be presently described. A pair of pivoted brackets 22 one carried by each of the frame portions 12 on the pivots 23 are provided. These brackets 22 each carry a journal or bearing 24 for transversely extending axle or shaft 25. A roller 26 is suitably carried on this axle or shaft.

A piston rod 27 is pivotally supported at 28 to each bracket 22 on the opposite side of the pivot 23 from that of bearings 24. Each piston rod 27 is operated by a suitable piston (not shown) within a pressure cylinder 29. The cylinders 29 are supported pivotally at 30 from suitable brackets 31 carried by the frame portions 12. With this construction, introduction of pressure fluid into the cylinders 29 through the controlled pressure feed lines 32 will cause a counterclockwise rotation of the brackets 22 about their pivots 23, while similar introduction of pressure fluid through the controlled pressure feed lines 33 will cause rotation of the said brackets in the opposite direction for a purpose to be presently described. These feed lines 32, 33 are connected to a manually operated four-way valve V of known type (Fig. 1). The latter in turn is connected by a feed line F to a pressure source (not shown).

A belt carrying drive roller 34 is supported in parallelism with and below the roller 26 on a drive shaft 35. The diameter of roller 34 is properly sized to feed proper sheet lengths when geared to the web feeding mechanism (Fig. 22), to be presently described. The latter is carried in suitable bearings 35' supported by the brackets 11. An endless web feeding belt 36 is threaded around the roller 34 and about other rollers hereinafter to be described. The shaft 35 is adapted to be driven by the motor 38 through the agency of an intermediate suitably supported shaft 39 belted at 40 to the motor and connected by a chain drive 41 or the like to a stub shaft 42 carried in suitable bearings by a portion of the frame 10 in axial alignment with shaft 35. The shafts 42 and 35 are coupled together by a clutch mechanism 43.

The clutch mechanism 43 in the embodiment shown (Fig. 12) includes an annular drum 44 pinioned at 45 to the shaft 35. A second drum 46 of smaller diameter than that of drum 44 is suitably attached at 47 to a collar 48 pinioned at 49 to the shaft 42. The drum 46 carries on its periphery an annular expansible clutch ring 50, whose outer peripheral surface 51 will frictionally engage the inner surface 52 of the drum 44 and thereby drive shaft 35 when the inner tube 50*a* of ring 50 is inflated. In unexpanded or collapsed condition the ring surface 51 lies clear of the surface 52 and in that condition shaft 35 is not driven.

The tube 50*a* is adapted to be inflated and deflated by providing communicating pneumatic passageways 53, 54 in the shaft 42 and collar 48. The passageway 53 is connected by a rotatable coupling 55 to an inlet nozzle 56 to which a hose 57 from an outlet 57*a* of a solenoid controlled

pressure valve P (Fig. 23) is connected. The passageway 54 is connected to a nozzle outlet 58 which in turn is connected directly to an inflation stem 59 extending from the tube 50*a*.

A suitable brake drum 60 is fixedly supported at 61 to the frame 10 concentrically about shaft 35. An expansible annular brake ring 62 is carried on the drum 60. The outer braking surface 63 of this ring is adapted to frictionally engage the inner surface 64 of the drum 44 when the inflatable inner tube 62*a* of the ring 62 is inflated and serves there to brake rotation of shaft 35. When this tube 62*a* is deflated, the shaft 35 is free to rotate.

Tube 62*a* is adapted to be inflated and deflated in controlled manner by providing passageways 65 and 66 for pressure fluid. Passageway 65 is connected to an outlet nozzle 67 which in turn is connected directly to an inflation stem 68 extending from the tube 62*a*. The passageway 66 is connected to a suitable hose 69 leading to an outlet 69*a* of the solenoid controlled pressure valve P (Fig. 23).

The operation of this valve P will be hereinafter described. It functions under electrical control of its solenoid to admit pressure from a source not shown into one or the other of the lines 57 and 69 and to bleed the other of these two lines whereby either the tube 50*a* or 62*a* is inflated at any given time. In this way whenever tube 50*a* is inflated thereby coupling shaft 42 to shaft 35, tube 62*a* is deflated so that no braking occurs. On the other hand whenever tube 50*a* is deflated, tube 62 is inflated so that drive shaft 42 is uncoupled from shaft 35 and the latter is effectively braked by the action of surface 63 on surface 64.

The sheeting web W from which the sheets of prescribed length are to be torn is delivered from rolls of folded goods on platforms in longitudinally folded condition and passed or threaded over plate 14, under tension bar 17 and if sheeting of say 90 inch length is to be torn, around roller 26 directly between the latter and the belt 36. On the other hand, if sheets, say of 99 inch length are to be torn, the web W is passed from tension bar 17 around guide bar 19 before it is passed between roller 34 and the belt 36. If sheets say of 108 inch length are to be torn, the web W is passed from tension bar 17 around guide bar 18 before it is passed between roller 26 and the belt 36.

Whenever the clutch ring 50 is actuated to coupling position, the shaft 35 is driven and consequently the belt 36 is similarly driven. The sheeting web W, however, is not fed with the belt 36 unless the roller 26 presses it against the belt 36. Such pressing action occurs whenever the cylinders 29 have fluid pressure applied through the hoses 32.

The shaft 35 (Figs. 1, 3, 21, 22) has a gear 70 suitably keyed at 71 or otherwise fixed thereto. Any one of three gears 72, 73 or 74 is adapted to be shifted into mesh with gear 70. The gear 72 has 108 teeth about its periphery and is supported on a stub shaft 75 carried on a pivot arm 76. The arm 76 is pivoted at 77 to a fixed support carried by a portion of the frame 10. A link member 79 is pivoted at 80 to the arm 76. This link member has two notches 81, 82, either of which may be engaged with a fixed member 83 carried by a portion of the frame 10. A suitable operating knob 84 is provided for shifting either of the notches into engagement with member 83, and a suitable spring 85 is provided

to maintain such engagement. The position of notches 81 and 82 is such that when notch 82 is engaged by member 83, the gear 72 is in mesh with gear 70, whereas, if notch 81 is so engaged, the gear 72 is out of mesh with gear 70. The shaft 75 has collars 86 pinioned or otherwise fixed thereto which are provided with the respective radially extending striker arms 87, 88, 89 which are adapted on rotation of shaft 75 and its gear 72 to sweep past the respective operating rollers 90 of two suitably supported normally open selector, "micro" or limit switches 91, 91*a* and a similar normally closed switch 91*b* so as to close the first two and to open the latter 91*b* in certain positions of rotation for a purpose to be presently described. The gear 72 is adapted to be put into mesh with gear 70 when sheets of 108 inch length are to be torn.

The gear 73 which has 99 teeth about its periphery is similarly supported on a stub shaft 92 carried on a pivot arm 93. The arm 93 is pivoted at 94 to a fixed support carried by a portion of the frame 10. A link member 95 is pivoted at 96 to the arm 93. This link member 95 has two notches 97, 98 either of which may be engaged with a fixed member 99 carried by a portion of the frame 10. A suitable operating knob 100 is provided for shifting either of the notches 97, 98 into engagement with member 99, and a suitable spring 101 is provided to maintain such engagement. The position of notches 97, 98 is such that when notch 98 is engaged by the member 99, the gear 73 is out of mesh with gear 70, whereas, if notch 97 is engaged, the gear 73 is in mesh with gear 70. The shaft 92 has collars 102 pinioned or otherwise fixed thereon provided with the respective striker arms 103, 104 or 105 which are adapted on rotation of shaft 92 and its gear 73 to sweep past the respective operating rollers 106 of two suitably supported normally open selector, "micro" or limit switches 107, 107*a* and a similar normally closed switch 107*b* to close the first two and open the latter 107*b* in certain positions of rotation for a purpose to be presently described. The gear 73 is adapted to be put into mesh with gear 70 when sheets 99 inches in length are to be torn.

The gear 74 which has 90 teeth about its periphery is similarly supported on a stub shaft 108 carried on a pivot arm 109. The arm 109 is pivoted at 110 to a fixed support carried by a portion of the frame 10. A link member 111 is pivoted at 112 to the arm 109. This link member 111 has two notches 113, 114 either of which may be engaged with a fixed member 115 carried by a portion of the frame 10. A suitable operating knob 116 is provided for shifting either of the notches 113, 114 into engagement with member 115 and a suitable spring 117 is provided to maintain such engagement. The position of notches 113, 114 is such that when the notch 114 is engaged by the member 115, the gear 74 is out of mesh with gear 70, whereas, if notch 113 is so engaged, the gear 74 is in mesh with gear 70. The shaft 108 has collars 118 pinioned or otherwise fixed thereon, provided with respective radially extending striker arms 119, 120, 121 which are adapted on rotation of shaft 108 and its gear 74 to sweep past the respective operating rollers 122 of two suitably supported normally open selector, "micro" or limit switches 123, 123*a* and a similar normally closed switch 123*b* so as to close the first two and open the latter 123*b* in certain positions of rotation for a purpose to be presently described. The gear 74 is adapted to

be put into mesh with gear 70 when sheets 90 inches in length are to be torn.

The various switches 91, 91a, 91b; 107, 107a, 107b; and 123, 123a, 123b are connected in an electric control circuit shown in Fig. 23 in a manner and for a purpose hereinafter to be described. One set only of these switches is operated at any time, the set operative being that associated with the particular gear 72, 73 or 74 which is in mesh with the gear 70 so that sheets either 108 inches, 99 inches or 90 inches will be torn all as hereinafter described.

Photo-electric scanning members 124, 125 are suitably positioned to scan the web W as it moves over the guide or cover plate 14 so as to detect seams or defects in the web. These members 124, 125 are connected through an amplifier system (not shown) in a control circuit hereinafter to be described for the purpose of notifying the operator or stopping the machine when short lengths of sheetings, seams or other defects are detected, so that the short lengths or lengths of sheeting bearing such defects may be eliminated whenever they occur.

The sheet tearing section B

Referring to Figs. 1–4 inclusive and 6–9 inclusive, the frame 10 in section B has a longitudinal tearing table or guide portion 10b over the top of which the top of the web feeding belt 36 passes. An angle bar 125 (Fig. 9) is attached suitably at 126, to the top 10b. This bar 125 carries a transversely projecting arm 127. A knife 128 is suitably supported at an angle with the horizontal from the arm 127 transversely of the longitudinal direction of the portion 10b. This knife serves as will be presently described to provide a nick or starting cut in the sheeting or web W at the appropriate point thereof for tearing off a prescribed length of sheet. The knife is spaced from the upper surface of the belt 36.

Tearing arms 129 and 130 supported respectively on the rotatable shafts 131 and 132 are provided. The tearing arms have respective telescoping sections 129a and 130a, so that the effective length of each arm 129 and 130 may be adjusted as desired for different widths of sheeting to be torn. Suitable clamps 133, 134 serve to fix the adjusted sections 129a, 130a in any desired position. The supporting shafts 131, 132 extend vertically through the table top 10b near its front edge and are supported by suitable bearings (not shown) and the respective base bearings 135, 136. These shafts have the respective bevel gears 137, 138 suitably pinioned or otherwise fixed thereto and these gears in turn mesh with the respective bevel gears 139, 140 carried on a horizontally extending shaft 141. The shaft 141 is supported suitably by the bearings 142 carried by the uprights 10c of the frame 10.

A lever arm 143 is pinioned or otherwise fixed to shaft 141 and connected pivotally at 144 to the piston rod 145 of a reciprocating piston (not shown) that operates in a pressure cylinder 146. The cylinder 146 is pivotally supported at 147 from a base portion 10d of the frame. Fluid under pressure may be admitted to opposite ends of the cylinder 146 through the feed lines 148, 149, that in turn are connected at 150 and 151 to a solenoid controlled valve 152 (Fig. 23) whose solenoid is connected in an electric circuit to be hereinafter described. With this equipment, reciprocal motion of the piston rod is transmitted through gears 139, 137 and 140, 138 to shafts 131, 132 to effect substantially horizontal reciprocal rotation in opposite directions of the tearing arms 129, 130.

Pressure operated grippers 153, 154 are provided on the ends of the respective tearing arm sections 129a, 130a. Since they have identical construction, only gripper 153 illustrated in detail in Figs. 7–9 inclusive will be described. As will be noted from Figs. 2 and 7, the sections 129a, 130a curve forwardly at their outer ends, and are provided with the respective sockets or holding rings 129b, 130b which serve as supports for the respective grippers 153, 154. Gripper 153 consists of a hollow sleeve 155 that fits within the sleeve 129b. This sleeve is shouldered at 156 and rests on the top of socket 129b. The lower end of sleeve 156 extends downwardly below the socket 129b and is provided with a transversely extending open slot 157 having beveled edges 157b. A plunger rod 158 having a headed end 159 is guidedly supported within the sleeve 155 by the guide member 160, which rests upon a shoulder 161 within said sleeve. The plunger rod 158 is fastened suitably at 162 to a diaphragm 163 carried by sleeve 155 and held in place by the cover plate 164. A suitable spring 165 positioned about the plunger rod 158 between the diaphragm 163 and the member 160 serves to urge the plunger 158 upwardly so that the folded edge Wa of the web W may be inserted into slot 157. The cover plate 164 is shaped to provide a pressure compartment 166 above the diaphragm 163 to which fluid under pressure may be delivered through a suitable hose coupling 167 to which a hose 168 is attached. The hose 168 extends through the hollow sections of tearing arm 129, and is joined to a similar hose 169 that operates clamping head 154. The hoses 168, 169 are joined to a common hose 170 which in turn is connected at 171 to a solenoid controlled valve 172 (Fig. 23). The solenoid of this valve is connected in an electrical circuit to be presently described. In addition the common hose 170 is connected by a hose extension 173 to the inlet 174 of a pressure actuated or normally open electric switch 175 for a purpose to be presently described.

With this equipment, whenever pressure is supplied to the hoses 168, 169, the plungers 158 of the gripping heads 153, 154 are moved to press their heads 159 into clamping position relative to the closed bottoms 155a of the sleeves 155, thereby effectively clamping the sheeting edge Wa therein at two places located on opposite sides of the knife blade 128. Thus, when the arms 129, 130 are rotated as described hereinabove, the edge Wa is first brought into contact with the knife edge 128 to start the tearing point, and further rotation of said arms, tears the sheet transversely from selvedge to selvedge along a line started by the nick produced by the cutting edge 128. When pressure is released from the hoses 168, 169, the sheeting is released by the clamping heads 159 by action of the springs 165 so that the torn off sheet S may be advanced by the belt 36, while the sheeting W may be positioned for the next tearing off action.

The torn off sheet S is then fed further by the belt 36 to section C consisting of the folding or doubling mechanism.

The folding or doubling section C

Referring to Figs. 1, 2, 4, 5 and 13, the belt 36, carrying thereon the torn off sheet S moves forwardly on table portion 10b and under a guide roller 176 supported on a shaft 177 carried in

bearings (not shown) in the uprights 178 located on opposite sides of the frame adjacent to the end of table portion 10b. The belt 36 further passes over the guide pulley or roller 179, around the roller 180, over the guide roller 181, around either of the guide rollers 182 or 183 and over guide roller 184 all suitably supported by the frame uprights 178 or braces 186 of the frame 10 back to pulley 34 in section A of the frame. A second endless belt 187 is positioned in the section C to pass about the roller 176 over guide roller 179 in parallelism with the portion of belt 36 passing thereover, similarly partly around roller 180, thence partially around a roller 188 and partially around a roller 189 all supported from the uprights 178 in suitable bearings (not shown). The portions 36a and 187a of the two belts 36 and 187 running in parallelism carry the sheet S upwardly between them and around between the bight of the rollers 180 and 188, whence the sheet S descends vertically in free suspension (Fig. 13) to the first of the folding or doubling devices. In its descent any folds in the leading portion of the sheet S carried by the tearing action straightens out automatically. Likewise any folds in the trailing end of sheet S carried by the tearing action tend to straighten out hanging, vertically down after leaving suspending rolls 180 and 188 and after the center of sheet S has been drawn into rolls 190 and 191 at Y.

Referring to Figs. 5, 6, 13 and 20, the sheet S as it moves vertically in free suspension, passes in front of a pair of vertically superposed rolls 190, 191. These rolls are supported horizontally and suitably on axles 192, 193 carried by the uprights 194 of the frame 10. A second pair of vertically superposed rolls 195, 196 are supported horizontally and suitably on axles 197, 198 carried by uprights 199 of the frame 10. A third pair of vertically superposed rolls 200, 201 are similarly supported on the uprights 199 on axles 202, 203. Additional idler rolls 204, 205 are carried on axles 206, 207 supported suitably from frame members 208 carried on cross bars 209 that are suitably attached to the uprights 194, 199. A fourth pair of rolls 210, 211 are carried on axles 212, 213, supported suitably from frame members 214 carried on cross bars 215 that are suitably attached to the uprights 194, 199. An additional roll 216 is carried on an axle 217 supported suitably from horizontal portions 218 of the frame 10. An endless belt or band 218 is positioned around the rolls 190, 195. A second endless belt or band 219 is positioned around the rolls 191, 196, 200, 210, 216, 211 and 205. Similarly a third endless belt or band 220 is positioned around the rolls 201 and 210. The portions 218a of band 218 and 219a of band 219 extend in parallelism and in substantial contact. Similarly the portions 220a of band 220, and 219b of band 219 extend in parallelism and in substantial contact.

The roll 196 is suitably driven for example by a sprocket chain connection 221 from the roll 189. In this way the belt 219 is driven positively in the direction denoted by the arrows and the belts 218 and 220 are driven by reason of their frictional contact with the respective portions 219a and 219b of belt 219.

A first doubling member 222 is carried and pinioned on a shaft 223 that is suitably supported by the upright 194. This doubling member has substantial width extending for a major portion of the distance between the oppositely located uprights 194 of the frame 10. It is provided with two arms 222 and a laterally extending flange 224 that has a pointed edge 225. Member 222 and its flange 224 are admeasured so that a clockwise rotation of the said member 222 on its shaft 223 will cause the edge 225 to enter between the bight of the belts 218 and 219 at the rolls 190, 191. The said edge 225 before entering said bight will entrain the sheet S and start a transverse fold along center line Y of Fig. 15. The folded edge of the sheet along line Y will be pushed into the bight and gripped by the belts 218, 219 at said bight and the sheet will then be carried along from said bight by the portions 218a and 219a of said two belts. The folding member 222 is timed to effect this folding action when the said center line Y lies opposite said bight in a manner to be presently described.

The folding arms or member 222 is adapted to be reciprocally rotated on its axle or shaft 223 in any suitable manner. For example, in the embodiment shown, a lever 226 is suitably pinioned or otherwise fixed to shaft 223. The lever 226 is pivoted at 227 to a piston rod 228 of a piston (not shown) of a double acting pressure actuated cylinder 229. This cylinder in turn is pivoted at 230 to a fixed support 231 carried by the uprights 194. The pressure feed lines 232, 233 from the cylinder 229 are connected at 234, 235 to a solenoid operated valve 236.

The folded sheet Sa emerges from between the rolls 195, 196 and descends vertically in free suspension in front of the bight between rollers 200, 201 (Fig. 13). A second doubling member 237 of identical construction with the first doubling member 222, is positioned on a shaft 238 to fold the sheet Sa (Figs. 16 and 17) along the transverse center line Z and to push the fold Z into the bight between rolls 200, 201 when the fold Z lies opposite said bight and the arms 237 are given counterclockwise rotation. These arms 237 are rotated reciprocally by the suitably supported double acting cylinder 239 supported and functioning in substantially the same manner as piston 229. The pressure feed lines 240, 241 of cylinder 239 are connected at 242, 243 to the solenoid actuated valve 244 whose solenoid is connected in an electric control circuit to be presently described.

The sheet Sa introduced between the rolls 200, 201 is carried from there between the belt portions 219b, 220, to and between rolls 210, 211 and emerges from the latter as the finally folded sheet Sb (Figs. 13, 18 and 19). This sheet Sb is delivered by the portion 219c of the belt 219 to a pair of receiving plates 245, 246 arranged as an inclined slide. The plate 245 is supported on a rotatable arm 247 which in turn is pivotally supported at 248 from the upright 199, so that plate 245 may be swung from the full line position of Fig. 5 to its dotted position about pivot 248. The plate 246 is carried by a suitable support 249 which in turn is pivoted at 250 to a suitable bracket arm 251. The arm 251 in turn is suitably supported by and attached to stationary or non-revolving shaft 256 carried by the uprights 253 of the frame 10. Plate 246 may be rotated about pivot 250 to the dotted position shown. Suitable stops (not shown) normally maintain the plates 245, 246 as an inclined plane in the full line position shown in Fig. 5. The sheet Sb delivered onto the said inclined plane formed by the two plates 245, 246 are held thereon by an adjustable stop member 254 carried by the plate 246. The sheets Sb are thereafter removed from the plates 245, 246 by suitable doffer mechanism.

The doffer mechanism D

Referring to Figs. 5, 6, 10, 11 and 13, the doffer mechanism includes a revolving creel **255** supported on an axle **256**. The axle in turn is carried in suitable brackets (B) that are supported by the uprights **253**. The uprights **253** are attached as part of the frame **10** by the girders **258**.

The radial arms **259** of the doffer creel **255** are joined by cross bars **260** which are rotatably supported between opposite pairs of said arms **259**. The arms **259** are so admeasured in length that as the creel rotates about shaft **256**, the cross bars move upwardly from under the plates **245, 246**, they pass successively and approximately through the center space **261** between the two plates, which lies under the approximate center of the folded sheet *Sb* carried on said plates **245, 246**. In so doing the cross bar drapes the folded sheet *Sb* on the plates over it and they hang thereon in self-aligning position, similar to cars of a Ferris wheel as the creel rotates as shown in Fig. 5. The plates **245, 246** tilt to their dotted line positions shown in Fig. 5 while a sheet *Sb* is being draped over a cross bar **260**.

The doffer creel **255** is adapted to be rotated step by step i. e. in successive fractional rotational movements corresponding to the angular spacing between arms **259** by mechanism controlled by the positioning of a sheet *Sb* on the plates **245, 246**. In the embodiment shown the creel **255** rotates one-sixth of a revolution at a time.

The drive mechanism for the creel **255** includes the bevel gears **262** that are fixed to the doffer arms **259** and which are rotatable about the axle **256**. These gears **262** in turn, mesh with bevel gears **263** pinioned to the respective shafts **264**. These shafts **264** are supported by suitable bearings **265** carried suitably by the girders **258**. Bevel gears **266** are pinioned or otherwise fixed to the shafts **264** and these gears **266**, in turn mesh with bevel gears **267**. The latter are pinioned or otherwise fixed to a shaft **268** (Figs. 10 and 11) which is rotatably carried in bearings **269** supported by the uprights **199**.

The shaft **268** has a toothed or ratchet wheel **270** pinioned or otherwise suitably fixed thereto. This wheel as shown (Fig. 10) has six equi-spaced teeth **271** or a number corresponding to the number of cross bars **260** of the creel. A yoke member **272** is rotatably supported on the shaft **268** about the wheel **270**. This yoke member has a pivotally supported pawl member **273** and a spring **274** for urging said pawl into engaging position with the ratchet teeth **271**. The yoke member **272** is attached pivotally at **275** to the piston rod **276** of a piston (not shown) of the double acting pressure cylinder **277**. The latter in turn is pivotally mounted at **278** to a fixed support **279** carried by the upright **199**. The pressure feed lines **280, 281** for the cylinder **277** are connected (Fig. 23) at **282, 283** to the solenoid controlled valve **284**, whose solenoid is connected in an electric circuit hereinafter to be described and which includes a limit switch **285** associated with the adjustable stop **254** on plate **246**, so that the action of pressure cylinder **277** and consequent step by step feeding of the creel **255** will be controlled by the presence or absence of a sheet *Sb* on plate **246** as will be more fully described hereafter.

A brake drum **286** (Figs. 10 and 11) is pinioned or otherwise fixed to the shaft **268**. A brake band **287** is passed about the drum **286**. This band has one end fixed at **288** to a link **289**. The other end of the band is also attached at **290** to the link **289**. The latter in turn is pivotally connected at **291** to the piston rod **292** of a piston (not shown) of a pressure cylinder **293**. The latter in turn is pivoted at **294** to a fixed support **295** carried suitably by the upright **199**. The pressure feed line **296**, for the cylinder **293** is connected (Fig. 23) at **298** to the feed lines **281** so that the piston within cylinder **293** will tend to operate in the same direction with respect to the piston in cylinder **277**. Thus while cylinder **277** is moving its piston upwardly to cause feeding movement of the pawl **273**, the piston of cylinder **293** will have air pressure on top side of piston released so as to partially release the frictional engagement of brake band **287** on the drum **286** and vice-versa. In this manner, the creel **255** is sufficiently free to rotate during feeding movement of pawl **273** and braked against rotation by tightening of brake band **287** on drum **286** while the pawl is being retracted. Both cylinders **277** and **293** are actuated simultaneously under the control of the solenoid operated valve **284** by electrical circuits later to be described.

The foregoing braking arrangement while sufficient to control the movement of the creel **255** when the cross bars **260** are accumulating bundles of draped sheets is not sufficient when sheets are removed from the delivery side of the creel **255**. When the creel **255** is ready for unloading there is approximately the same number of sheets on each cross bar **260** and the weight of sheets on the ascending and descending cross bars **260** are approximately equal so that the creel **255** is in equilibrium. When the creel **255** is first unloaded the weight on the descending cross bars **260** becomes less so that the creel **255** tends to rotate opposite to the normal direction of rotation particularly on the return or downward stroke of air piston **276** of power cylinder **277**, this is so because the brake band **287** is not fully effective due to direction of wrap around brake drum **286**, that is the brake drum **286** tends to rotate clockwise instead of counter-clockwise, and to unwind the brake band **287**. To prevent any such reverse movement of brake drum **286** a latch or pawl **273'** (Fig. 10) with a pivot suitably attached to frame **10** and a spring **274'** are provided for urging said pawl into engaging position with ratchet teeth **271**. This prevents any reverse movement of ratchet wheel **270** or any reverse movement of creel **255**. As the unloading of sheets from the creel **255** proceeds the weight on the descending cross bars **260** becomes greater than the weight on the ascending cross bars **260**. This unbalanced load condition would cause the creel **255** to travel beyond its usual one sixth revolution unless some constant braking effort is applied to brake drum **286** to off-set this unbalanced weight in creel **255**. With only an air cylinder **293** for braking purposes there is an interval of time at the actuating stroke of power piston **276** of power cylinder **277** when there is no braking effort effected by braking cylinder **293** on the brake drum **286**. To obtain the necessary braking required in this cycle of operation an adjustable tension spring **274''** is provided which exerts a constant pull on brake link **289** exerting a pull on brake band **287** and sufficient braking effort on brake drum **286** so that doffer creel **255** will not move independently of power actuated stroke of power cylinder **277**. Power cylinder **277** is of sufficient size to rotate creel **255** against constant braking resistance effected

by spring 274". After the end of the actuating stroke of power cylinder 277 and the beginning of the return or downward stroke of power cylinder 277 pressure is simultaneously applied to the top side of piston in cylinder 293 which applies an additional braking effort to the brake drum 286 to assist in effecting quick braking and proper positioning of doffer creel 255. It is possible, of course, to substitute for the pressure cylinders 277, 293 a geared motor drive to drive the doffer creel 255. Such substitution is contemplated.

As the sheets Sb removed by the cross bars 260 are suspended thereon in Ferris wheel fashion, it is possible to permit a plurality of sheets to accumulate on each cross bar 260 in a number of complete revolutions of the creel 255 before any are removed from any cross bar.

The control circuits for the machine

Referring particularly to Fig. 23, the various control circuits are shown diagrammatically therein in conjunction with the various parts of the machine.

The main drive motor 38 is connected, for example, through a suitable starting box 300 of known type to a three phase power source 301 of say 60 cycle, 440 volts A. C. by suitable power lines 302, 303, 304.

The power source 305 for operating the various electrical controls may, for example, be single phase, 60 cycle 110 volts A. C., controlled by a conventional rotary snap switch 306 or the like. The power lines or conductors 307, 308 are tapped at appropriate points as will now be described.

The line or conductor 307 is connected by a conductor 309 to a conductor 310. The latter is connected to one pole 311 of a double pole, single throw normally open solenoid operated switch 312, and by a branch conduit 313 to the second pole 314 of this switch 312. The movable blade 315 of the first pole 311 is connected by a conduit 316 to one terminal of the solenoid Pa of the valve P. The other terminal of the solenoid Pa is connected to a conduit 317 which in turn is connected by return conduit 318 to the power conduit 308. The second blade 319 of the switch 312 is connected by a conduit 320, to one pole of each of the three normally-closed selector "micro" or limit switches 91b, 107b and 123b. The second pole of each of these three switches is connected to conduits 321, 322. The latter conduit is connected to one terminal of the solenoid 323 of the switch 312, and the other terminal of said solenoid is connected to the conduit 317 which is connected by conduit 318 to power line 308. The three switches 91b, 107b and 123b are opened once during each revolution of the respective gears 72, 73 or 74 by the respective arm or striker 87, 103 or 119 moving with the particular one of the gears 72, 73 or 74 in operation. Thus in normal operation, the machine clutch 43 is coupled to advance the sheeting W a single sheet length at a time and to stop after such an advance.

The conduit 321 is continued at 321a and connected to one pole 324 of a snap switch 325. The bridging blade or member 326 of this switch is normally in contact with the pole 324 and a second pole 327. This second pole 327 is connected by a bridging conduit 328 to a pole 329 of a normally open button switch 325a. The latter has a bridging blade or member 330 that is normally out of contact with the pole 329 and another pole 331. The pole 331 of the button switch 325a is connected by a conduit 332 to the conduit 310 and thence through conduit 309 to power line 307. The snap switch 325 and button switch 325a are conveniently positioned at the front of the machine (Fig. 1) for convenient operation by the operator and serve a purpose to be presently described.

The second pole 327 of snap switch 325 is also connected by a conduit 333 to one pole of a normally open limit or "micro" or limit switch 334, and the other pole of this switch 334 is connected by a conduit 335 to the fourth pole 331. This "micro" or limit switch 334 is positioned to be closed briefly on the return stroke of the tearing arms 129, 130.

This switch 334 is fixed as shown in Fig. 1 to the machine base. Its operating lever 334a is pivotally connected to arm 334b of a pivoted lever 334c. Another arm 334d of the latter lever 334c is arranged in the path of travel of a striker arm 336 that is pinioned or otherwise fixed to the tearing arm support shaft 132. The striker arm 336 is so positioned that it engages lever arm 334c to close switch 334 momentarily only when the tearing arm 129, 130 are returned toward original position after a tearing stroke.

When the switch 334 is closed a circuit including it, the conduits 335, 332, 310, 309, 307 and the conduits 333, 328, switch 325, conduits 321a, 322, the solenoid 323, the conduits 317, 318 and 308, the switch 312, and the solenoid Pa is established whereby the valve P is actuated to open the pressure line 57 to pressure and to inflate clutch tube 50a thereby to drive shaft 35 from shaft 42. At the same time pressure line 69 is opened to bleed, deflating brake tube 62a and releasing the breaking surface 63 from drum surface 64 (Fig. 12). Thus the feed of the conveyor belt 36 may be started by the return stroke of the tearing arms.

The pole 331 of the button switch 325a is also connected by a conduit 337 to a conduit 338. The latter is connected to one pole 339 of a two pole-foot-operated starting button or switch 340 or the like. This switch 340, conveniently initiates the sequential operation of all the control circuits as will be presently described. The second pole 341 of the starting switch 340 is connected by a conduit 342 to one terminal 343a of a solenoid 343. The latter when energized serves to operate and close a double pole, single-throw, solenoid-operated switch 344. The other terminal 343b of the solenoid is connected by a conduit 345 to an extension 317a of the conduit 317 and through said extension 317a to the conduit 318 connected to the power line 308. Thus, whenever main switch 340 is closed, a circuit is established including the main line 307, the conduits 309, 310, 332, 337, 338, the switch 340, the conduit 342, the solenoid 343, the conduits 345, 317a, 318 and the other power line 308. This energizes the solenoid 343 and closes switch 344. The blade 344a of the latter switch is connected by a conduit 346 to a terminal of the controlling solenoid 347 of the valve 172 that controls the pressure line 170 to the clamping heads 153, 154. The other terminal of the solenoid 347 is connected to the conduit 345 and from there through conduits 317a and 318 to the main power line 308. The fixed pole 344b with which blade 344a may be engaged, is connected by a conduit 348 to an extension 310a of the conduit 310 and from there through conduit 309 to the other main power line 307. Thus whenever switch 344 is closed by energization of its solenoid 343, a circuit is es-

tablished including the main line 307, the conduits 309, 310a, 348, the switch pole 344b, the blade 344a, the conduit 346, the solenoid 347, the conduits 345, 317a, 318 and the other main power line 308. This opens valve 172 and admits pressure to the pressure feed line 170 and closes the clamping heads 153, 154.

The second fixed pole 344c of the switch 344 is connected by a conduit 349 to the conduit 348. The second blade 344d that is adapted to engage pole 344c when the solenoid 343 is energized is connected by a conduit 350 to one pole a of a normally closed "micro" or limit switch 351 another of whose poles b is connected by a conduit 352 to the conduit 342. Thus whenever the main switch 340 is closed a circuit is established including the main power line 307, the conduits 309, 310, 332, 337, 338, the main switch 340, the conduits 342, 352, the "micro" or limit switch 351, the conduit 350, the blade 344d, the pole 344c, the conduits 349, 348, 310a and 309 back to the same power line 307. Since the conduit 349 is connected to conduit 348, the status of main switch 340 is immaterial once it has been closed as long as poles a, b of the "micro" switch 351 are closed as a holding circuit for the solenoid has been established including the power line 308, conduits 318, 317a, solenoid 343, conduits 342, 352, poles a and b, of switch 351, conduits 350, blade 344d, pole 344c, conduits 349, 348, 310a, 309 and the second power line 307. As soon as the limit or "micro" switch 351 is opened, the holding circuit just described is broken at the said poles a and b of switch 351, and as a result solenoid 343 is deenergized opening switch blades 344d and 344a and breaking the circuit to the solenoid 347 of valve 172, thereby opening the clamps 153, 154.

To effect opening of the normally-closed limit or "micro" switch 351, the latter is positioned on the table 106 (Fig. 1) so that the tearing arm 130 will strike its operating lever 351a when the said arm has completed its tearing stroke, and before it has begun its return movement.

The conduit 317a is extended at 317c and connected to one terminal 353 of a solenoid 354 of a double pole single throw solenoid operated switch 355. The other terminal 356 of this solenoid 354 is connected by a conduit 357, to one pole 358 of a normally closed button switch 359. A second pole 360 of this button switch 359 is connected by a conduit 361 to a pole 362 of a snap switch 359a and to pole c of the limit or "micro" switch 351. The fourth pole d which is normally in closed circuit with pole c of the limit or "micro" switch 351 is connected by a conduit 363 to a second pole 364 of the snap switch 359a. The bridging blades 365, 366 of the button switch 359 and snap switch 359a respectively may bridge the poles 358, 360 and 362, 364. The button switch 359 and snap switch 359a are mounted for convenient operation by the operator at the front of the machine (Fig. 1).

The conduit 363 from pole 364 of snap switch 359a is connected to a conduit 367 which is connected to one of the movable blades 368 of the solenoid-operated switch 355. The pole 369 of switch 355 with which blade 368 may be engaged is connected by a conduit 370 with the second fixed pole 371 of the switch 355 and by a conduit 372 to an extension 310b of the conduit 310a. The second movable blade 373 of the switch 355 is connected by a conduit 374 to one terminal of the solenoid 375 that controls operation of the tearing-arm control valve 152. The other terminal of the solenoid 375 is connected by the conduit 376 to the conduit 317c.

The conduit 310b is extended as conduit 310c, and the latter is connected to one pole 377 of the pressure actuated switch 175. The second pole 378 of this switch 175 is connected by a conduit 379 to the first blade 368 of the switch 355. The normally open switch 175 closes as soon as pressure appears in line 170 with the opening of clamp controlling valve 172. When this occurs and the button of push button switch 359 is in closed position, the engagement of blade 365 with poles 358, 360 established a circuit from power line 308 through conduits 318, 317a, 317c, solenoid 354, conduit 357, poles 358, 360, blade 365, conduit 361, poles c and d of limit or "micro" switch 351, conduits 363, 367, 379, switch poles 378, 377, conduits 310c, 310b, 310a, and 309 to the other power line 307. This energizes the solenoid 354 and closes the switch 355. This it will be noted, can occur only if the pressure switch 175 is closed. The latter is closed only while there is pressure in the pressure line 170 to clamping heads 153, 154 so that that condition is one precedent to the closure of switch 355. The closure of the latter switch establishes a holding circuit for the solenoid 354 which includes the power line 308, conduits 318, 317a, 317c, solenoid 354, conduits 357, poles 358, 360 and blade 365, conduit 361, poles c and d of switch 351, conduits 363, 367, blade 368, pole 369, conduits 370, 372, 310b, 310a, 309 and the other main line 307. This holding circuit can be broken at any time desired by the operator pressing push button switch 359 to move the blade 365 away from poles 358, 360. At the same time, the second blade 373 of the switch 355 then closes a circuit including the power line 308, conduits 318, 317a, 317c, solenoid 375 of the tearing arm control valve 152, conduit 374, blade 373, pole 371, conduits 372, 310b, 310a, 309 and the other power line 307. This energizes the solenoid 375 and operates tearing arm control valve 152 to open pressure line 149 to pressure and pressure line 148 to exhaust, thereby causing the piston in tearing arm cylinder 146 to move and impart tearing motion to the tearing arms 129, 130. When these arms complete their tearing stroke, the arm 130 strikes the operating arm 351a of the "micro" or limit switch 351 breaking the circuit through the poles c and d thereof and at the same time breaking the circuit between the poles a and b thereof, so that solenoids 354 and 343 of the switches 355 and 344 are simultaneously deenergized, opening said switches, and thereby deenergizes solenoids 347 of the clamp control valve 172. This cuts off pressure to clamping pressure lines 170, and pressure line 173 of switch 175. The opening of switch 355 deenergizes solenoid 375 and thereby opens pressure line 149 of the tearing arm cylinder 146 to exhaust and open its pressure line 148 to pressure, whereby the tearing arms 129, 130 are moved in retraction to their starting positions. The clamps 153, 154 open before return strokes of the arms 129, 130 begin.

If it is desired to maintain the tearing arms 129, 130 in the position they attain at the ends of the tearing strokes, the snap switch 359a is closed moving its blade 366 into contact with the poles 362, 364 of said switch 359a to bridge or short circuit the poles c, d of switch 351, and push button blade 365 is left as shown in Fig. 23 in contact with poles 358, 360. As a result, the separation of contacts c, d which occurs when the tearing arm 130 reaches the end of its tear-

ing stroke, has no effect because the circuit that would normally be opened by such action remains closed through the poles 362, 364 and blade 366 of the snap switch 359a. The tearing arms 129, 130 thus remain in the position they attain at the end of their tearing strokes until the operator pushes the button of the push button switch 359 to move the bridging member or blade 365 away from the poles 358, 360.

The operations of the two folding arms 222, 237 are timed and determined respectively by the two sets of selector, "micro" or limit switches 91a, 107a, 123a, and 91, 107, 123. Each of these switches is in normally open circuit. One terminal of each of the three switches 91a, 107a, 123a is connected by a conduit 380 to a conduit 381. The latter is connected to one terminal of the solenoid 382 of the first folder arm controlling valve 236. The other terminal of said solenoid 382 is connected to a conduit 383 which in turn is connected to the power line 308. The other poles of the three switches 91a, 107a, 123a are connected by a conduit 338b to an extension 338a of the conduit 338. The three switches 91a, 107a, 123a are adapted to be closed selectively by the respective striker arms 88, 104 or 120 that move with the respective gears 72, 73 and 74. If, for example, gear 72 is in mesh with gear 70, the striker arm 88 rotates with gear 72, and once during each revolution whenever a fold line Y of sheet S lies opposite the bight between the rollers 190, 191 closes the switch 91a. The striker arm 88 is positioned to secure this effect for 108 inch length sheets S. Similarly the striker arms 104 and 120 are positioned respectively to secure this with sheets respectively of 99 inch and 90 inch length. The other gears 73, 74 are stationary not being coupled to gear 70, and in consequence their striker arms 119, 104 are stationary at this time and do not operate on their respective switches 107a or 123a. Similar action takes place for each of the latter two switches, when the respective gears 73 or 74 are coupled to the gear 70. The selective closure of any one of the three switches 90a, 107a or 123a establishes a circuit including the main line 308, conduit 383, solenoid 382, conduits 381, 380, one of the three switches 90a, 107a or 123a, conduits 338b, 338a, 337, 332, 310, 309 and the other power line 307. This closed circuit energizes the solenoid 382 and operates valve 236 to open pressure line 232 to pressure and pressure line 233 to exhaust so that the piston of cylinder 229 actuates the first folding arm 222 in its folding stroke. As soon as the said last-named circuit is opened at the said one of the three switches 91a, 107a or 123a, the solenoid 382 is deenergized causing valve 236 to move in opposite direction, opening pressure line 232 to exhaust and pressure line 233 to pressure thereby actuating the position of cylinder 229 to retract the first folding arm 222.

The operation of the second folding arm 237 is controlled similarly by the respective switches 91, 107 and 123 and the respective striker arms 89, 105 and 121. One terminal of each of the three switches 91, 107 and 123 is connected by the conduit 385 to an extension 338b of the conduit 338a. The other terminal of each of these three switches 91, 107, 123 is connected by a conduit 386 to a conduit 387. The latter is connected to one terminal of the solenoid 388 of the second folder arm controlling valve 244. The other terminal of said solenoid 388 is connected to an extension 383a of conduit 383 which latter in turn is connected to the power line 308. The three switches 91, 107 and 123 are adapted to be closed selectively by the respective striker arms 89, 105 or 121 that move with the respective gears 72, 73 and 74. If, for example, gear 72 is in mesh with gear 70, the striker arm 89 rotates with gear 72, and once during each revolution whenever a fold line Z of the sheet Sa lies opposite the bight between the rollers 200, 201. The striker arm 89 is positioned to secure this effect for 108 inch length sheets S. Similarly the striker arms 105 and 121 are positioned respectively to secure this effect with sheets respectively of 99 inch and 90 inch lengths. The selective closure of any one of the three switches 91, 107 or 123 which occurs later in point of time than that of the switches 91a, 107a or 123a, establishes a circuit including the main line 308, conduits 383, 383a, solenoid 388, conduits 387, one of the three switches 91, 107 or 123, conduits 385, 338b, 338a, 337, 332, 310, 309 and the other power line 307. This closed circuit energizes the solenoid 388 and operates valve 244 to open pressure line 241 to pressure and pressure line 240 to exhaust so that the piston of cylinder 239 actuates the second folding arm 237 in its folding stroke. As soon as said last-named circuit is opened at the said one of the three switches 91, 107 or 123, the solenoid 388 is deenergized causing valve 244 to move in opposite direction, opening line 241 to exhaust and pressure line 240 to pressure, thereby actuating the piston of cylinder 239 to retract the second folding arm 237.

The step by step rotation of the doffer creel 255 is also controlled automatically to rotate the latter, in the embodiment shown, one sixth of a revolution at a time and to brake rotation after each movement. To this end one pole of the normally-open limit or "micro" switch 285 which is carried on the plate 246 (Figs. 5 and 23) is connected by a conduit 389 to the power line 307. The other pole of the switch 285 is connected to a conduit 390. A normally open push button switch 391 is connected across the conduits 389, 390 with its poles in parallel with the two poles of the switch 285. The conduit 390 is connected to a conduit 392 which in turn is connected to one terminal of a solenoid 393 of a solenoid operated double pole angle throw switch 394. The other terminal of the solenoid 393 is connected to the power line 308. Thus whenever the switch 285 is closed by a sheet Sb on plate 246, or by manual closing of push button switch 391, a circuit is established including the power line 307, conduit 389, either switch 285 or 391, conduits 390, 392, solenoid 393 and the other power line 308. This energizes the solenoid 393 and moves the blades 395, 396 of the switch 394 into contact with the respective fixed poles 397, 398.

The conduit 390 is connected also to a pole of a normally closed limit or "micro" switch 399. The latter switch is suitably carried with respect to the creel 255 as to be opened once during each one-sixth revolution of the latter, its operating member 399a being moved for example by each succeeding creel arm 259. The second pole of the said switch 399 is connected by a conduit 400 to the first blade 395 of the switch 394. The pole 397 of the switch 394 is connected by a conduit 401 to the pole 398 of said switch 394 and by a conduit 402 to the power line 307. The second blade 396 of the switch 394 is connected by a conduit 403 to the solenoid 404 of the doffer operating valve 264. The other terminal of said

solenoid 404 is connected by a conduit 405 to the power line 308.

Thus, whenever the switch 394 is closed by energization of its solenoid 393 as described above, a holding circuit is established for the solenoid 393 including the power line 308, the solenoid 393, conduits 392, 390, switch 399, conduit 400, blade 395, pole 397, conduits 401, 402 and power line 308, which is broken by the opening of switch 399 on movement of the creel 255 as described above one-sixth of a revolution. Simultaneously with the establishment of said last-named holding circuit, another circuit is established including the power line 308, conduit 405, solenoid 404, conduit 403, blade 396, pole 398, conduit 402 and power line 307. This causes energization of the solenoid 404 which then operates the valve 284 to simultaneously open the pressure feed lines 281, 296 to exhaust and pressure feed lines 280, 297 to pressure to actuate the pistons of the respective cylinders 277, 293 so that the piston 276 is moved to cause a feeding rotation of the ratchet wheel 270 and simultaneously to move the piston 292 so that the brake band 287 releases the brake drum 286, thus permitting the rotation of creel 255 one sixth of a revolution. When the creel 255 has so moved the sheet Sb on the plates 245, 246 is draped over a bar 260, thereby opening the switch 285. The holding circuit described through the switch 399 however remains closed so that the switch 394 is kept closed until one of the arms 259 of the creel strikes the operating arm 399*a* of the switch 399 to open the latter. This breaks the described holding circuit through solenoid 393 and opens switch 394. This deenergizes solenoid 404 of the valve 284 and opens pressure feed lines 281, 296 to pressure and pressure feed lines 280, 297 to exhaust thus reversing movement of the pistons of cylinders 277, 293, causing the brake 287 to be applied to drum 286 and the pawl 273 to be returned to its initial position ready for the next feeding stroke of piston 276.

It is obvious that the circuits described which include the switches 285, 391, 394 and 399 could be used as well to control a feed motor for the geared drive that is contemplated as a substitute for the described pressure cylinder drive of the doffer creel 255.

It will be understood that while specific circuits and controls have been described to effect the desired sequential operation of the various parts of the machine, other circuits and controls could be utilized for effecting equivalent operation.

Modified tearing mechanism

A modified form of tearing arms is shown in Figs. 24 and 25.

In these figures a cam plate 410 is positioned suitably above the tearing arms 129'; 130'. This plate has the pair of inverted V-shaped cam slots or grooves 411, 412 in which the clamping heads 153', 154' constructed identically as clamping heads 153, 154 are guided during the tearing and return stroke of said tearing arms 129', 130'. The latter are operated identically as the arms 129, 130. The extension 129'*a* and 130'*a* thereof have the slots 129'*b* and 130'*b* in which the heads 153', 154' may move during their movement in the cam slots 411, 412. The advantage of the cam guides is that in some cases, it is better to guide the heads 153', 154' during tearing to get a more effective tearing action on the sheets and sheeting.

A further modified form of tearing construction is shown in Figs. 27 and 28. In this construction a single tearing arm 413 replaces the two tearing arms 129, 130 of the principal modification. This arm 413 has an adjustable portion 413*a* adjustable in the same way as the portions 129*a* or 130*a*. A single tearing head 153'' identical in construction with the tearing head 153 is suitably attached to the portion 413*a* and is operated in identical way. Likewise the tearing arm 413 is reciprocally rotated in identically the same way from the pressure cylinder 146 as the tearing arms 129, 130. A suitable clamping or cross bar 414 is positioned parallelly with the knife 128 above the top of the tearing table. This bar is movable reciprocally toward and away from the table top in clamping and release strokes. A suitable pressure cylinder 415 whose pressure line 416 may be connected to the pressure line 170 serves to move the bar 414 in clamping stroke simultaneously with the operation of clamping head 153'' to clamping position. Thereafter, rotation of tearing arm 413 tears off the sheet from the sheeting W. This form of tearing mechanism may be more advantageous with some widths of sheets.

General operation of the machine

To operate the machine, the operator first determines whether sheets 108 inches, 99 inches or 90 inches in length are to be torn. He then places the appropriate gear 72, 73 or 74 into mesh with gear 70 and uncouples the other two of these gears from gear 70. Then the valve V is moved manually so that cylinders 29 pivot the roller 26 to a position away from the roller 34 and belt 36. Then the web W is passed over guide plate 14 under bar 17 and for 90 inch sheets directly around roller 26, or for 99 inch sheets around bar 19 and then under roller 26, or for 108 inch sheets around bar 18 and then under roller 26. Thereafter the valve V is moved manually to bring the roller 26 into pressure engagement with belt 36 and roller 35 (the position shown in Figs. 1 and 3).

Thereafter the movable sections 129, 130*a*, 129'*a*, 130'*a* are adjusted for tearing arm lengths appropriate to the particular width of sheeting to be torn and the clamps 133, 134 tightened. The sheeting W is then further pulled along manually under roller 26 and over belt 34 until its leading end lies ahead of blade 128 the length of the first sheet to be torn from the web W. Its folded edge W*a* (Fig. 9) is positioned in the slots 157 of the clamping heads 153, 154, 153', 154' of the tearing arms 129, 130, 129', 130' or 413.

The motor 38 is then started through its starting box 300 (Fig. 23) but the clutch 43 is left uncoupled so that shaft 42 as yet delivers no power to the machine, whose drive shaft 35 remains braked by brake band 63 (Fig. 12). The machine is now in condition to be operated through a complete cycle.

This cycle is now initiated by momentarily depressing the foot operated main switch 340. When this is done, the first effect is to close the previously described circuit that includes the normally closed poles *a*, *b* of "micro" switch 351 whereby the tearing arm head clamps 153, 154, or 153' or 153'' are closed to securely grip the sheeting and if clamp 153'' is used to move clamping bar 414 to clamping position. As soon as this occurs, solenoid actuated switch 344 closes, closing pressure actuated switch 175 and

thereby closing the circuits including solenoid actuated switch 355 and the poles *c*, *d* of "micro" switch 351. This actuates valve 152 as described to supply tearing arm stroke pressure in cylinder 168 and rotate the tearing arms 129, 130 or 129', 130' or 413 in their tearing strokes. In such motion the arms 129, 130 or 129', 130' or 413 move the sheet edge W*a* for nicking by the knife blade 128 as described. Upon completion of the tearing stroke of arms 129, 130 or 129', 130' or 413 the circuits including the poles *a*, *b* and *c*, *d* of the limit switch 351 are opened by the striking of tearing arm 130 or 130' or 413 against operating arm 351*a*. This removes pressure feed at valve 172 to the clamping heads 153, 154 or 153', 154' or 153'' and cylinder 416 through line 170, opening the clamps and lifting bar 414 if the latter is used opens pressure switch 175, however limit switch 351 poles *c* and *d* open holding the circuit on switch 355 and reverses pressure feed valve 152 to cylinder 168 before pressure switch 175 opens in the same holding circuit and thereby reverses pressure feed at valve 152 to the cylinder 168 thereby moving tearing arms 129, 130, or 129', 130' or 413, in their return strokes. When the arm 130 or 130' or 413 begins the return stroke, it strikes operating arm 334*a* of the "micro" switch 334 closing the described circuits associated with that switch whereby the valve P is actuated to inflate the clutch tube 59*a* and deflate the brake tube 62*a*. This couples shaft 35 to the motor driven shaft 42 and starts movement of the conveyor belt 36 and the feed of a new length of sheet on the tearing table 10B. As soon as this occurs, that one of the striker arms 87, 103 or 119 moving with the respective gear 72, 73, or 74 which happens to be coupled with gear 70, rotates with its gear in engagement with the respective of the selector "micro" switches 91*b*, 107*b* or 123*b* permitting the appropriate one of these three switches to open after the feed of the conveyor belt has continued for a full revolution of the respective gear 72, 73 or 74 coupled with gear 70. This has advanced the sheeting W the length of a second sheet to be torn on the tearing table 10B, and has caused valve P to move in reverse or uncoupling direction to uncouple shaft 42 from shaft 35 and to inflate brake tube 62*a* and stop feed of the conveyor belt 36.

During this described movement of the conveyor belt 36, it advances the torn off sheet S toward the folding or doubling section C of the machine.

At the completion of the cycle just described that is effected by the depressing of the foot-operated switch 340, the operator may find it necessary to rearrange the torn end of sheeting W. Also he will have to reinsert the edge W*a* thereof between the slots 157 of the clamping heads 153, 154 or 153', 154' or 153''. When this has been done, he again depresses the foot operated button 340 to repeat the cycle of operations just described.

When the first of the torn off sheets S has been moved by conveyor belt 36 to section C of the machine and by the said belt 36 and belt 187 between rolls 180 and 188, so that said sheet hangs suspended from the latter as shown in Fig. 13 with its folding line Y approximately opposite the bight between the first folding rolls 190, 191, the striker arm 88, 104 or 120 depending upon which gear 72, 73 or 74 is coupled to gear 70, moves into position to close that one of

the three normally open selector, "micro" or limit switches 91*a*, 107*a* or 123*a* momentarily to close the described circuit associated with these switches. This operates valve 236 to actuate cylinder 229 and move its piston to actuate the first folding arm 222 in its folding stroke. The said one of said switches 91*a*, 107*a* or 123*a* opens as soon as the respective striker arms 88, 104 or 120 has passed the control roller of the one of these three switches in operation, thereby breaking the described circuit therethrough and causing a return stroke of the folding arm 222.

Subsequently, when the folded sheet S*a* has passed between the folding rollers 190, 191 and has been delivered by the belt position 218*a*, 219*a* between rollers 195, 196 and hangs suspended as shown in Fig. 13 with its folding line Z approximately opposite the bight between the second folding rolls 200, 201, the striker arms 89, 105 or 121 depending upon which gear 72, 73 or 74 is coupled to gear 70, moves into position to close that one of the three normally open, selector, "micro" or limit switches 91, 107 or 123 momentarily to close the described circuit associated with these switches. This operates valve 244 to actuate cylinder 239 and move its piston to actuate the second folding arm 237 in its folding stroke. The said one of the three switches 91, 107 or 123 opens as soon as the respective striker arm 89, 105, or 121 has passed the control roller of that one of these three switches in operation, thereby breaking the described circuit therethrough and causing a return stroke of the folding arm 237. This same sequence of operations occurs with each sheet as it reaches the aforedescribed positions of the said first sheet S. After the machine has been operated for a long enough period for said first sheet to have reached its said described positions they occur each time the conveyor belt 36 has been set in motion as described by the depression of foot-operated switch 340.

When the first finally or doubly folded sheet S*b* is delivered from the second folding rolls 220, 221 by belt portions 220*a*, 219*b* around roll 210, and belt portion 219*c* to the inclined plane of plates 245, 246, the said sheet S*b* operates the limit or "micro" switch 285 associated with plate 246 to close said switch 285. This closes the described circuits associated with said switch 285 and thereby operates the pressure valve 284 to actuate the brake cylinder 293 to its release position and the doffer creel advance cylinder 277 to its feeding position, thereby rotating the creel 255 so that one of its cross bars 260 moves up from under the pivoted plates 245, 246 and has the sheet S*b* draped thereover. When the creel 255 has moved in this way through one sixth of a revolution, one of its arms 259 operates the normally closed "micro" or limit switch 399 by engagement with its operating arm 399*a* to open the circuit including said switch and thereby cause the piston of the brake cylinder 293 to move into braking position tightening brake band 287 on drum 286 and also to move the piston of creel feed cylinder 277 in its retractive or non-feeding stroke to original position. This locks the creel 255 against back-lash or unwanted forward rotation and thereby permits the accumulation on the cross bars 260 thereof of any desired number of draped sheets S*b*. The latter thereafter can be removed at will from the said cross bars 260. After the first sheet has reached the inclined plane of plates 245, 246, the described operation of the doffer creel 255 occurs each time the con-

veyor belt feed 36 is started by depression of the foot operated switch 340, because each such depression results in the delivery of a folded sheet Sb to said inclined plane of said plates 245, 246.

The operator may interrupt the operations of various parts of the machine at any time for desired purposes through the snap switch 325, push button switch 325a, snap switch 359a, push button switch 365 and push button switch 391. If the operator desires to prevent starting of the conveyor 36 by the return stroke of the tearing arms but to continue operation of the gripping heads 153, 154 and arms 129, 130 he opens the normally closed snap switch 325. This prevents completion of the described circuit closed by a closure of the "micro" switch 334 affected on the return stroke of the tearing arm 130. He then can depress foot operated switch 340 to initiate the tearing arm clamping action and tearing strokes without any advance of the conveyor 36.

If he desires to permit an advance of the conveyor belt 36 one sheet length without any further operation of the tearing arms or their clamps, he closes the snap switch 325 and pushes the push button switch 325a to close the latter, thus short-circuiting the normally open switch 334 and completing a circuit including switch 325a, the conduits 332, 310, 309, power line 307 and the conduits 328, switch 325, conduits 321a, 322, the solenoid 323, conduits 317, 318 and power line 308, the switch 312, and the solenoid Pa to energize the latter whereby the valve P is actuated to throw in the clutch 51 and release the brake 63. Since the tearing arms will not again move until the foot-operated switch 340 is again depressed, it is possible to advance the sheeting full sheet length without operation of the tearing arms by pushing push button switch 325a momentarily to closed position. In normal cyclic operation the snap switch 325 is closed and push button switch 325a is open.

Similarly the operator may initiate operation of the doffer creel 355 at any time by closing push button switch 391. This completes the circuit normally completed by the presence of a sheet Sb on the plate 246 to start the described operation of said creel.

The portion Wb of the sheeting W extending between the guide plate 14 and bar 17 is always visible so that if 108 inch length sheets are being torn and a seam or defect is detected by the scanning elements 124, 125 which notifies the operator of such a condition, he permits the seam or defect to move between the guide plate 14 and bar 17. He can then determine at a glance if a 90 inch or 99 inch length of sheet can be salvaged, or if 99 inch sheeting is being torn whether a 90 inch length can be salvaged, and if so, make appropriate adjustments in the machine for tearing out the defective portion and salvaging the shorter length sheeting or by appropriate operation of the switches 325, 325a and the appropriate adjustment of the gears 72, 73 or 74 as the case may be.

The detectors 124, 125 are positioned so that light to them from a source (not shown) may be intercepted by suitable colored stickers applied previously over the seam or defect to operate a signal device (visual or aural) for a predetermined period in known manner.

A machine, therefore, has been described with which it is possible to tear predetermined lengths of sheets from sheeting and to fold the torn off sheets with a pair of transverse folds, the folded sheets being thereafter removable at will from doffer mechanism associated with the machine.

While a specific embodiment has been shown and described, modification in structural detail is possible and is contemplated within the scope of the claims. There is no intention of limitation to the exact details shown and described.

What is claimed is:

1. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting and horizontally oscillatable, swinging arms for tearing sheets of predetermined length from said cloth or sheeting, vertical pivots for said arms, and means for swinging said arms in opposite directions about said vertical pivots to tear said sheets in a substantially horizontal plane.

2. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, and horizontally oscillatable, swinging arms for tearing sheets of predetermined length from said cloth or sheeting, and gripping means in conjunction with said arms, vertical pivots for said arms, and means for swinging said arms about said vertical pivots in opposite directions to tear said sheets in a substantially horizontal plane.

3. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, horizontal, oscillatable, swinging arms for tearing sheets of predetermined length from said cloth or sheeting, and means for the removal of and elevated delivery of torn sheets from the tearing means to folding equipment.

4. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, horizontal, oscillatable swinging arms for tearing sheets of predetermined length from said cloth or sheeting, gripping means in conjunction with said arms, and means for the elevated delivery of torn sheets to folding equipment.

5. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, fluid-pressure-actuated means for tearing sheets of predetermined length from said cloth or sheeting, fluid-pressure-actuated gripping means in conjunction with said tearing means, and electrically controlled, fluid-pressure-valve means for controlling operation of said tearing means, clamping means and feeding means.

6. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, fluid-pressure-actuated means for tearing sheets of predetermined length from said cloth or sheeting, electrically controlled, fluid-pressure valve means and electrical circuits including switches controlled by said tearing means to actuate said feeding means sequentially.

7. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, fluid-pressure-actuated means for tearing sheets of predetermined length from said cloth or sheeting, electrically controlled, fluid-pressure valves for control of said tearing means and said feeding means sequentially, electrical circuits for said valves, and electrical switches in said circuits for controlling operation of said valves independently so that said feeding means and said tearing means may be independently operated to permit removal of defective lengths of cloth or sheeting appearing during operation of the machine.

8. A machine of the character described, comprising feeding means including moving belts for feeding predetermined lengths of cloth or sheeting, pressure-actuated means for tearing sheets of predetermined length from said cloth or sheeting, gripping means in conjunction with said tearing means, electrical circuits including switches controlled by said tearing means to actuate said feeding means sequentially, and electrical circuits including a switch controlled by said feeding means to stop movement of said belts after a predetermined length of said cloth or sheeting has been fed to said tearing means.

9. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, means for detecting defects and seams in said cloth or sheeting, means controlled by said detecting means for notifying an operator of said machine of the presence of said defects and seams, and means for tearing sheets of predetermined length from said cloth or sheeting.

10. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, photo-electric means for detecting defects and seams in said cloth or sheeting, means controlled by said detecting means for notifying an operator of said machine of the presence of said defects and seams, and means for tearing sheets of predetermined length from said cloth or sheeting.

11. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, photo-electric means for detecting defects and seams in said cloth or sheeting, means controlled by said detecting means for notifying an operator of said machine of the presence of said defects and seams, means for adjusting said machine to change the predetermined length of cloth or sheeting fed, means for tearing sheets of predetermined length from said cloth or sheeting, and gripping means in conjunction with said tearing means for gripping the sheeting or cloth while it is torn by said tearing means.

12. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, including a belt conveyor, a motor, a clutch, a brake, movable members and electrical circuits including a switch operated by said movable members to advance said sheeting one predetermined length at a time and thereafter to release said clutch and to apply said brake, horizontally oscillatable arms for tearing sheets of predetermined length from said cloth or sheeting, and gripping means in conjunction with said tearing arms for gripping the sheeting or cloth while it is being torn by said arms.

13. A machine of the character described, comprising means for feeding predetermined lengths of cloths or sheeting including a belt conveyor, a motor, a pressure operated clutch, a pressure operated brake, a pressure operated roll in conjunction with said belt, movable members and electrical circuits including switches operated by said movable members to advance said sheeting one predetermined length at a time and thereafter to release said clutch and to apply said brake, and horizontally swingable arms for tearing sheets of predetermined length from said cloth or sheeting.

14. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, including a belt conveyor, a motor, a pressure operated clutch, a pressure operated brake, a pressure operated roll in conjunction with said belt, movable members and electrical circuits including switches operated by said movable members to advance said sheeting one predetermined length at a time and thereafter to release said clutch and to apply said brake, means to control movement of said roll toward and away from said belt at will whereby said cloth or sheeting may be moved independently of said feeding means in one position of said roll, pressure-actuated means for tearing sheets of predetermined length from said cloth or sheeting, and gripping means in conjunction with said tearing means.

15. An apparatus of the character described comprising in combination driven rollers and conveying belts for drawing a longitudinally double double folded web of fabric from a source of supply, a guide frame and tearing table, means for intermittently actuating said rollers and belts to draw said web over said guide frame in measured lengths to said table, means for detection of defect markers on said web so that defects can be drawn to tearing portions on said table and torn out, and means for clamping the measured lengths of web fed by said apparatus.

16. An apparatus of the character described comprising in combination, horizontal oscillating swinging arms, clamping members on said arms to grip double double folded fabric to be torn along a longitudinal center fold, a knife so located with respect to said swinging arms that the swinging of said arms effects a nicking of said center fold automatically to start tearing of said fabric when said arms begin their swinging operation to tear the full width of said fabric, means for adjusting the lengths of said tearing arms for different widths of said fabric, and means for swinging said arms to effect tearing of said fabric from selvedge to selvedge.

17. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, vertically pivoted, horizontally swingable arms for tearing sheets of predetermined length from said cloth or sheeting, fluid-pressure-actuated gripping means in conjunction with said tearing arms and means to guide said gripping means while effecting tearing of said sheets.

18. A machine of the character described, comprising means for feeding predetermined lengths of cloth or sheeting, and fluid-pressure-actuated means for tearing sheets of predetermined length from said cloth or sheeting including a single tearing arm for tearing sheets of predetermined length, fluid-pressure-actuated gripping means on said arm for gripping said sheets on one side of the tearing line, and fluid-pressure-actuated gripping means for gripping said sheets on the opposite side of said tearing line.

19. An apparatus of the character described comprising in combination driven rollers and conveying belts for drawing a longitudinally double double folded web of fabric from a source of supply, a guide frame and tearing table, means for intermittently actuating said rollers and belts to draw said web over said guide frame in measured lengths to said table, means for detection of defect markers on said web so that defects can be drawn to tearing portions on said table and torn out, means for clamping the measured lengths of web fed by said apparatus, and means for adjusting said apparatus for changed measured lengths of said web.

20. An apparatus of the character described comprising in combination driven rollers and

conveying belts for drawing a longitudinally double double folded web of fabric from a source of supply, a guide frame and tearing table, means for intermittently actuating said rollers and belts to draw said web over said guide frame in measured lengths to said table, means for detection of defect markers on said web so that defects can be drawn to tearing portions on said table and torn out, means for clamping the measured lengths of web fed by said apparatus, and means including rollers and belts continued beyond said tearing table for intermittently feeding measured torn lengths of said web through folding apparatus and for feeding of measured folded webs to hinged trays.

21. An apparatus of the character described comprising in combination driven rollers and conveying belts for drawing a longitudinally double double folded web of fabric from a source of supply, a guide frame and tearing table, means for intermittently actuating said rollers and belts to draw said web over said guide frame in measured lengths to said table, means for detection of defect markers on said web so that defects can be drawn to tearing portions on said table and torn out, means for clamping the measured lengths of web fed by said apparatus, and means for feeding said web over said guide frame and on to said tearing table so that the full length of sheet in advance of the tearing point is visible to enable the operator to determine the location of defects therein.

22. An apparatus of the character described comprising in combination driven rollers and conveying belts for drawing a multiplicity of plies of unfolded webs of fabric and a multiplicity of plies of double folded fabric from a source of supply, a guide frame and tearing table, means for intermittently actuating said rollers and belts to draw said plies over said guide frame in measured lengths to said table, means for detection of defect markers on said plies so that defects can be drawn to tearing portions on said table and torn out, and means for clamping the measured lengths of plies fed by said apparatus.

23. An apparatus of the character described comprising in combination, horizontal oscillating swinging arms, clamping members on said arms to grip the selvedge edge of a single web of unfolded fabric and also to grip the selvedge edges of a multiplicity of plies of unfolded fabric webs to be torn along selvedge edge and edges,

a knife so located in respect to said swinging arms that the swinging of said arms effects a nicking of said selvedge edge and edges to start tearing when said arms start swinging operation to tear full width of fabric, and means for adjusting the lengths of said tearing arms for different widths of fabric.

24. An apparatus of the character described comprising in combination, horizontal oscillating swinging arms, clamping members on said arms to grip double longitudinally folded fabric to be torn along a longitudinal center fold, a knife so located in respect to said swinging arms that the swinging of said arms effects a nicking of said center fold automatically to start tearing when said arms start swinging operation to tear full width of fabric, means for adjusting the lengths of said tearing arms for different widths of fabric, and means of swinging said arms to effect tearing of said fabric from selvedge to selvedge.

25. An apparatus of the character described comprising in combination, horizontal oscillating swinging arms, clamping members on said arms to grip a multiplicity of plies of double longitudinally folded fabric webs to be torn along longitudinal center folds, a knife so located in respect to said swinging arms that the swinging of said arms effects a nicking of said center folds automatically to start tearing when said arms start swinging operation to tear full width of fabric webs, means for adjusting the lengths of said tearing arms for different widths of fabric, and means for swinging said arms to effect tearing of said fabric webs from selvedge to selvedge.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,330,903	McDearmid	Oct. 5, 1943
2,346,194	Sjostrom	Apr. 11, 1944
2,111,770	Griesinger	Mar. 22, 1938
358,174	Tetley	Feb. 22, 1887
2,145,592	Folger	Jan. 31, 1939
1,407,636	Clift	Feb. 21, 1922
1,607,407	Mayer	Nov. 16, 1926
1,766,789	Mayer	June 24, 1930