Nov. 17, 1953 R. J. FAHEY 2,659,279

CARTON SETUP MACHINE

Filed June 12, 1948 7 Sheets-Sheet 1

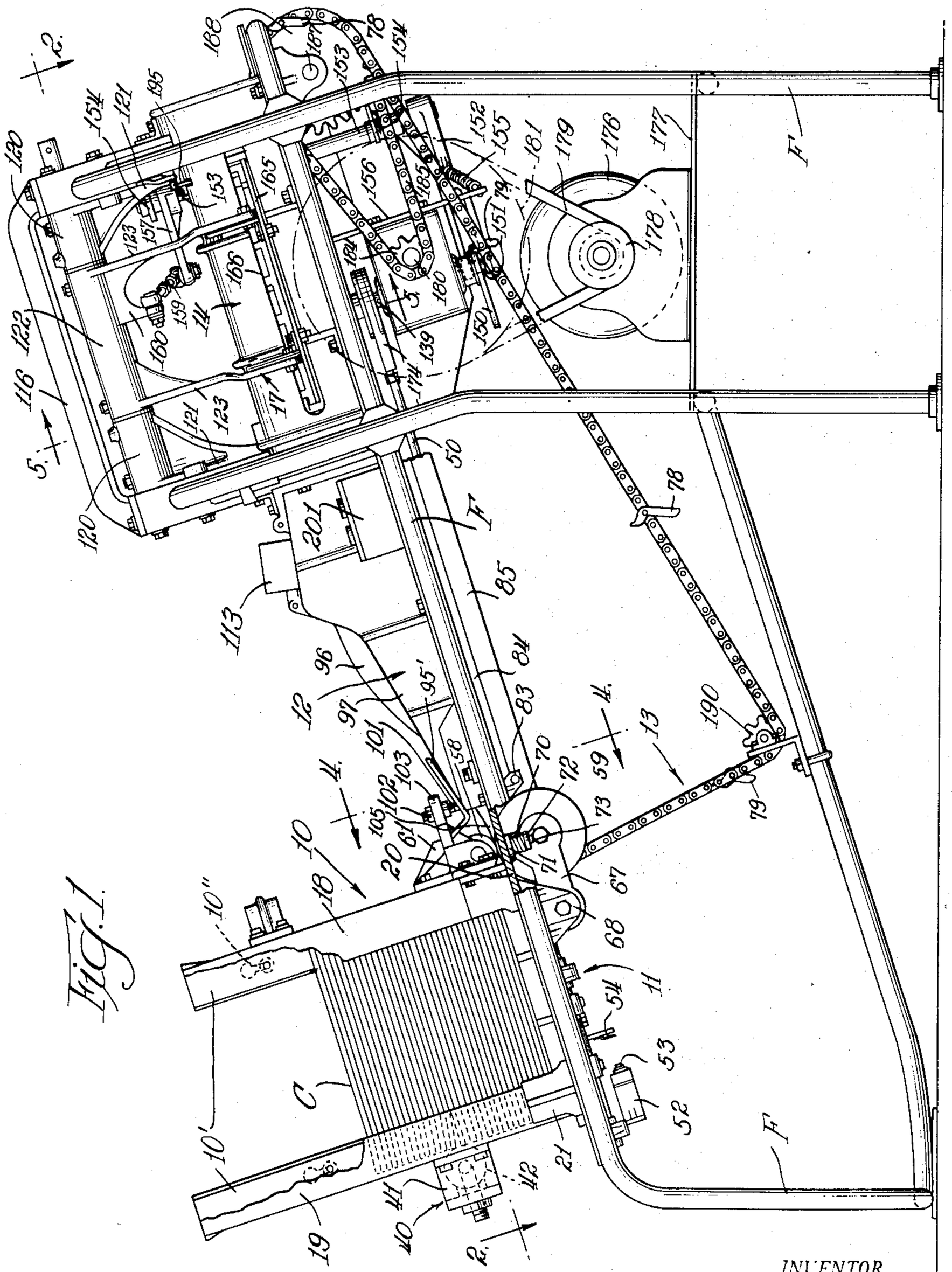

Fig. 1.

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CARTON SETUP MACHINE

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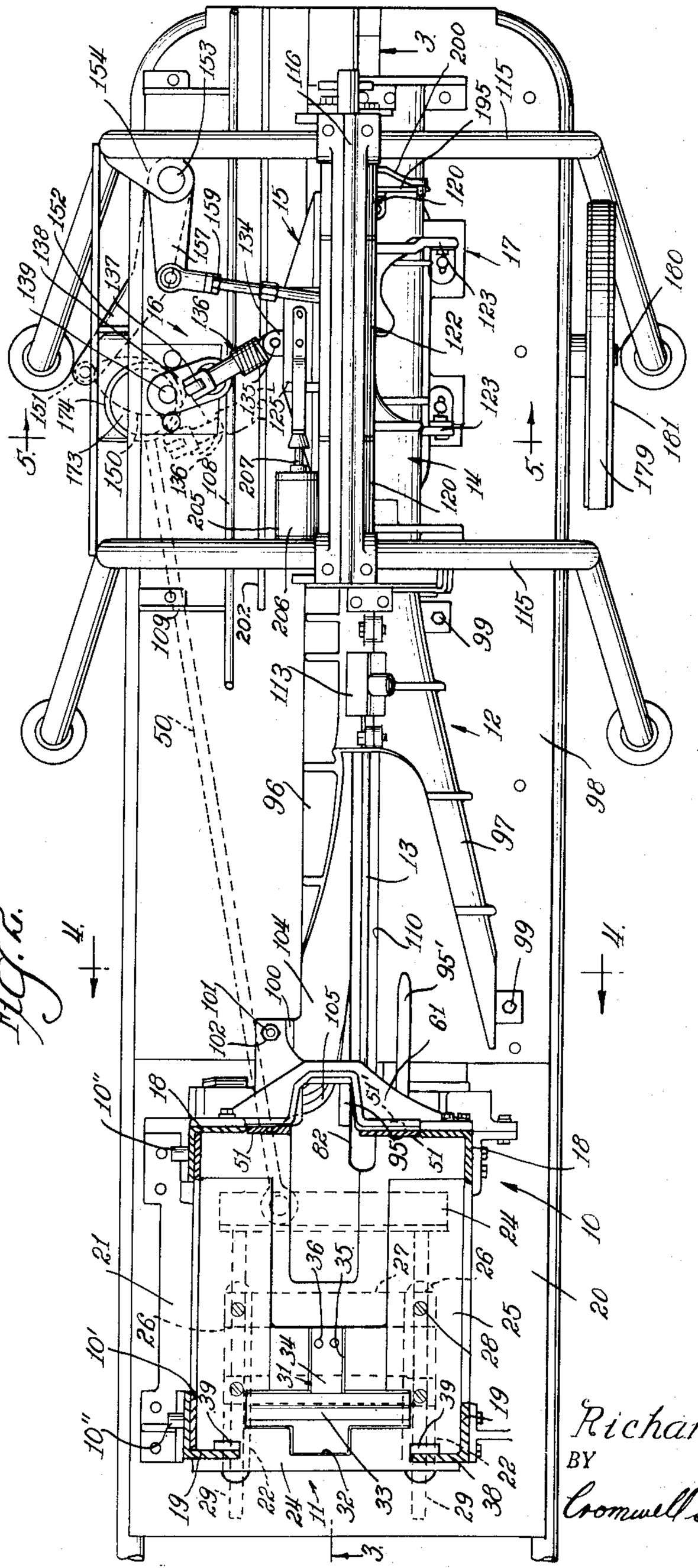

Fig. 2.

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CARTON SETUP MACHINE

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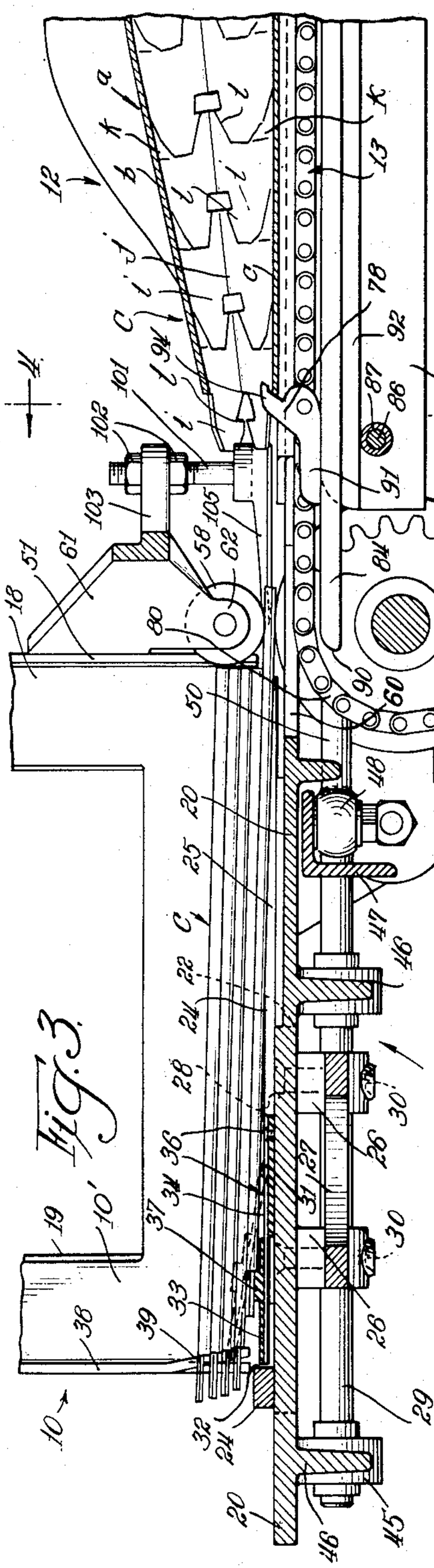

Fig. 3.

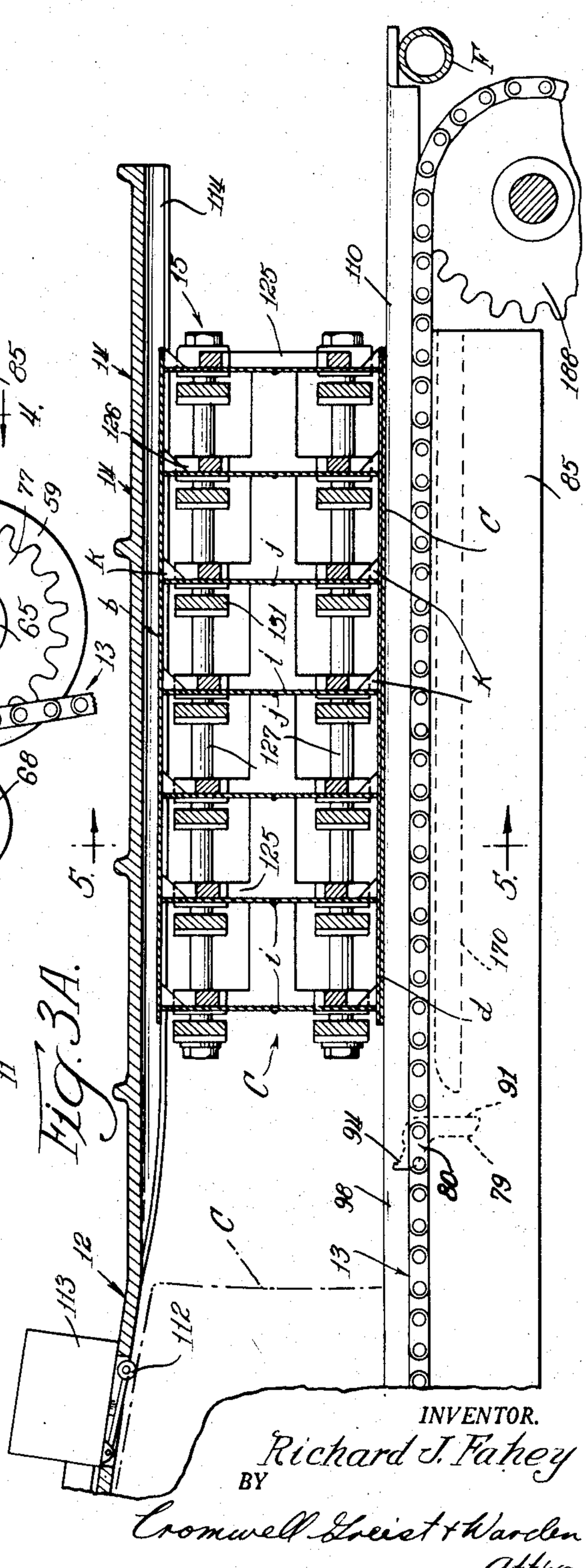

Fig. 3A.

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CARTON SETUP MACHINE

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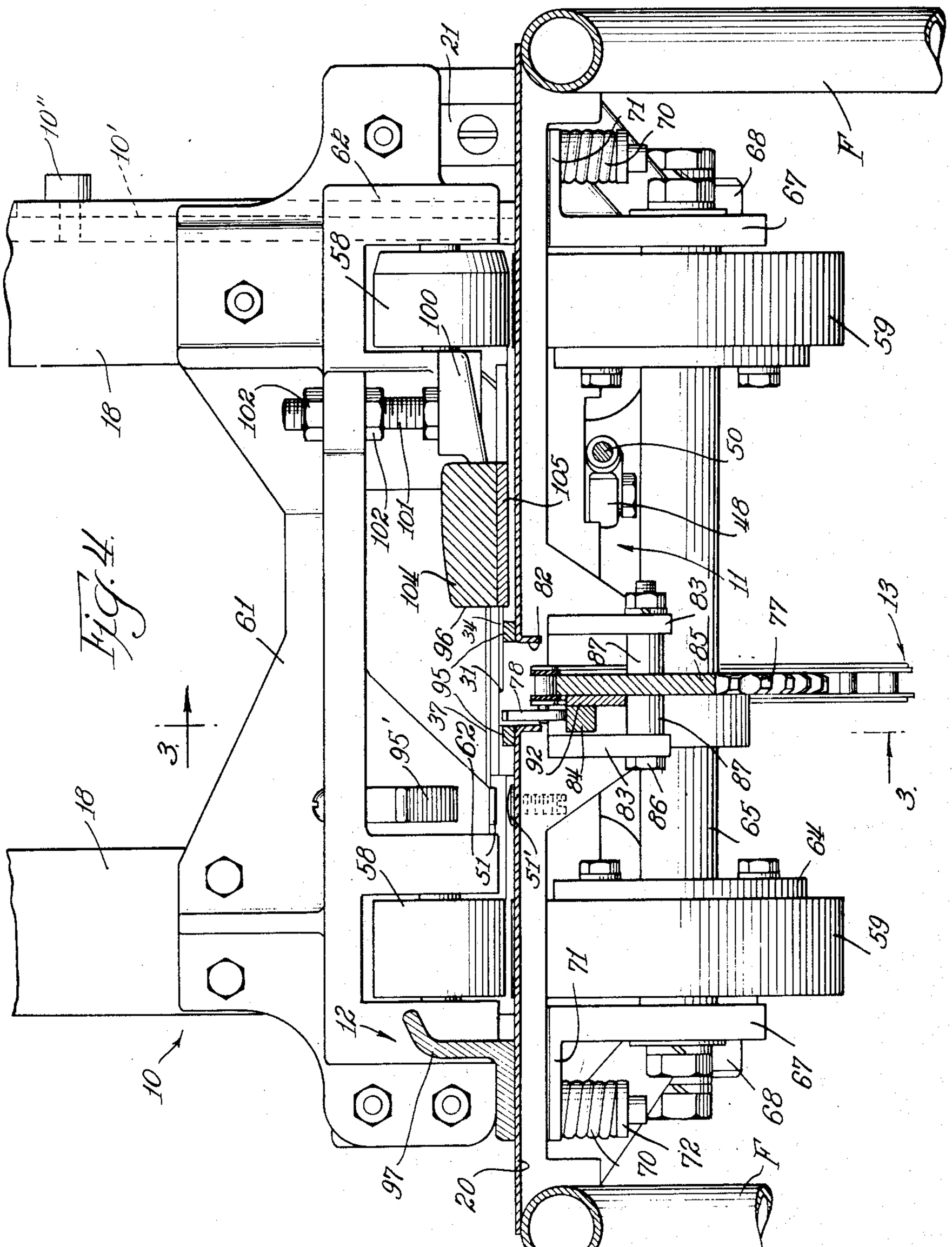

Fig. 4.

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CARTON SETUP MACHINE

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Fig. 5.

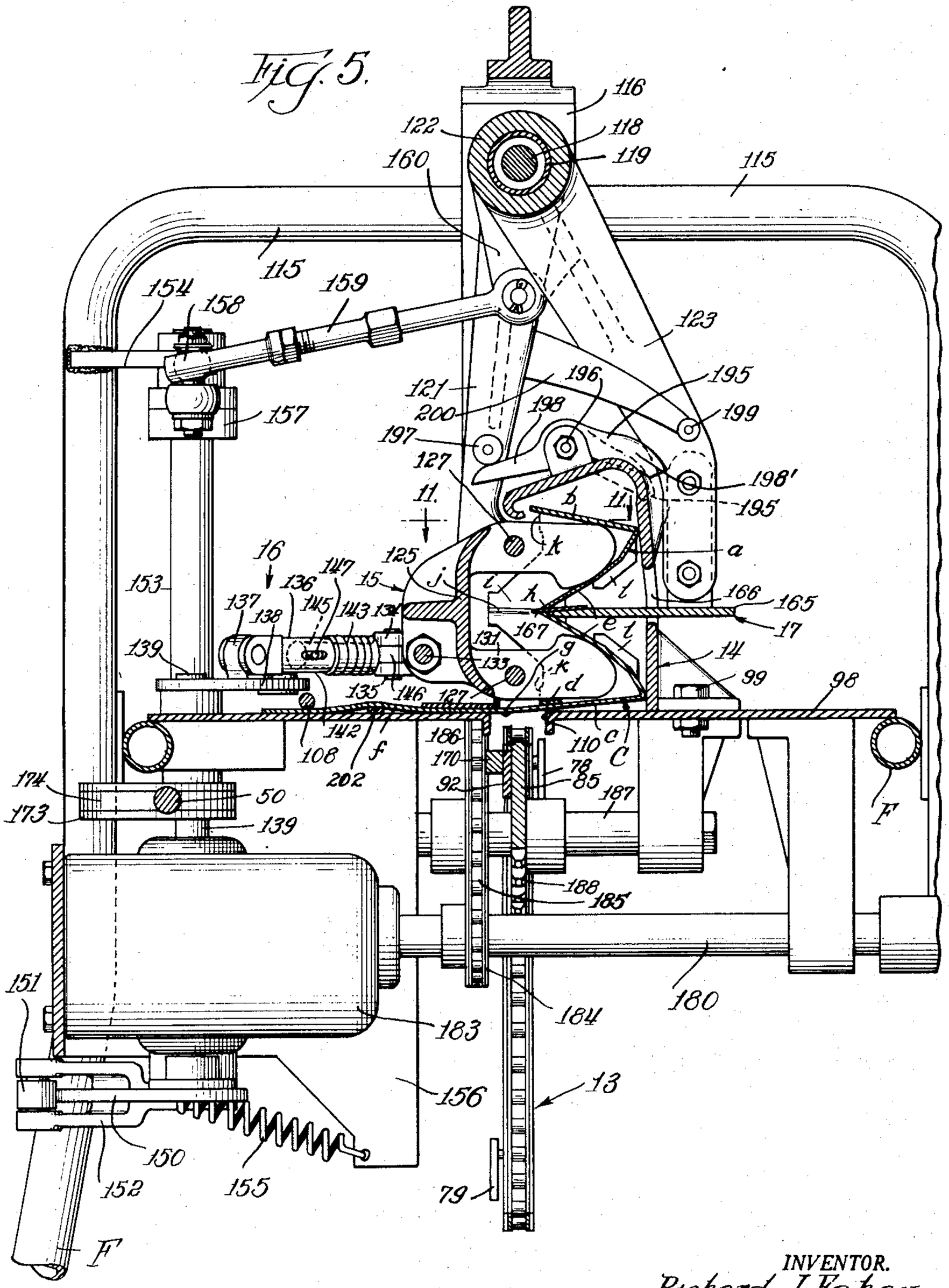

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Fig. 6.

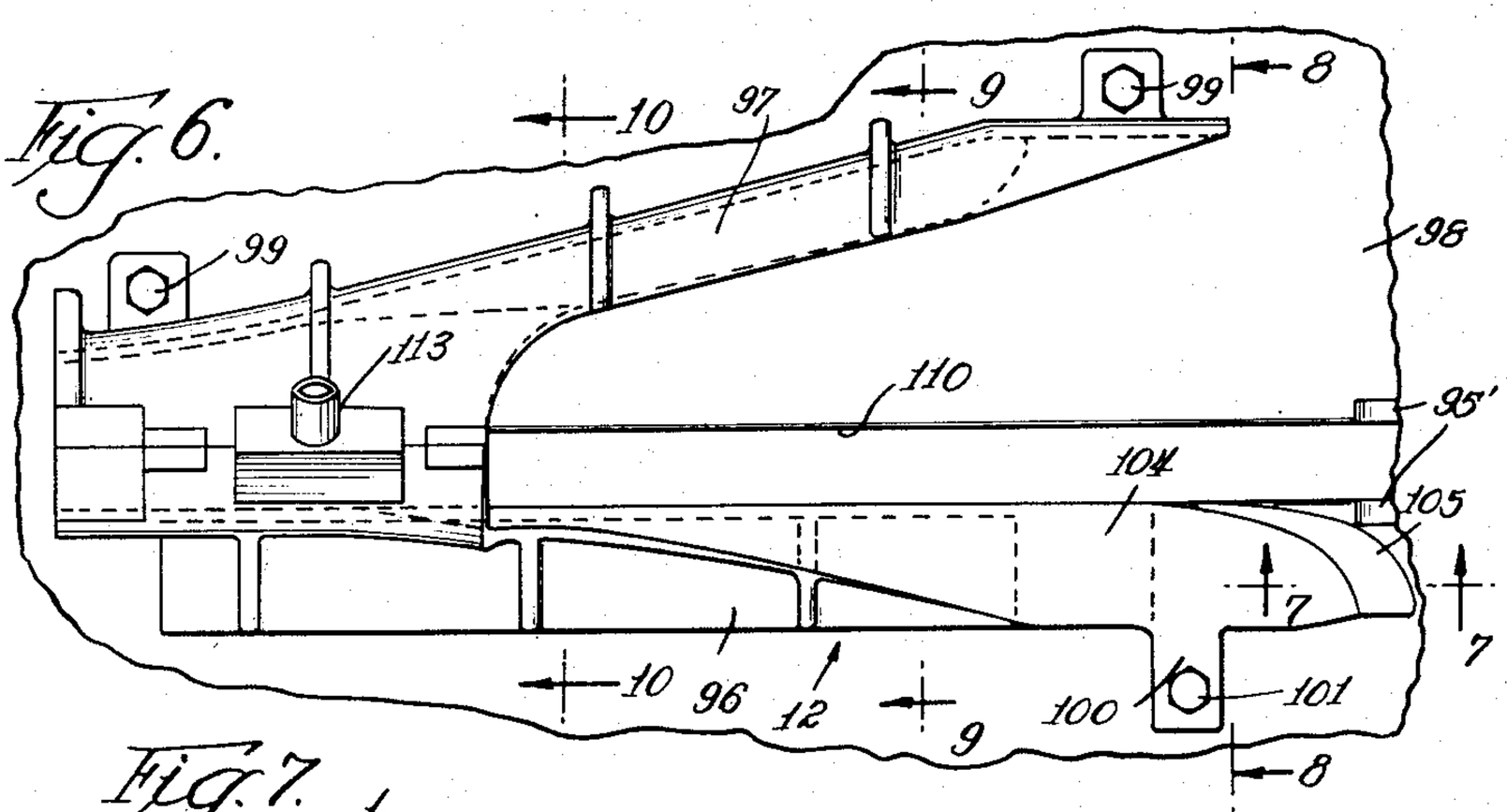


Fig. 7.

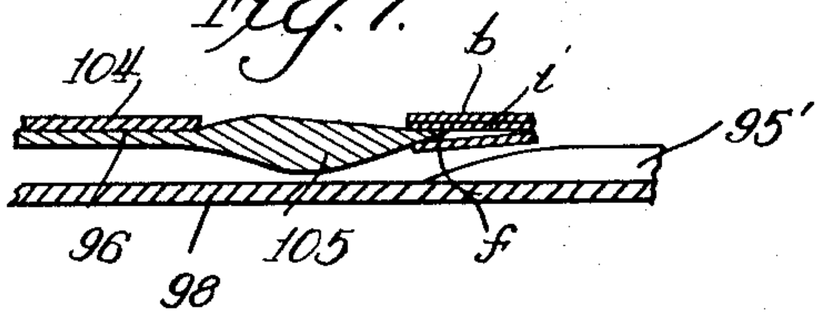
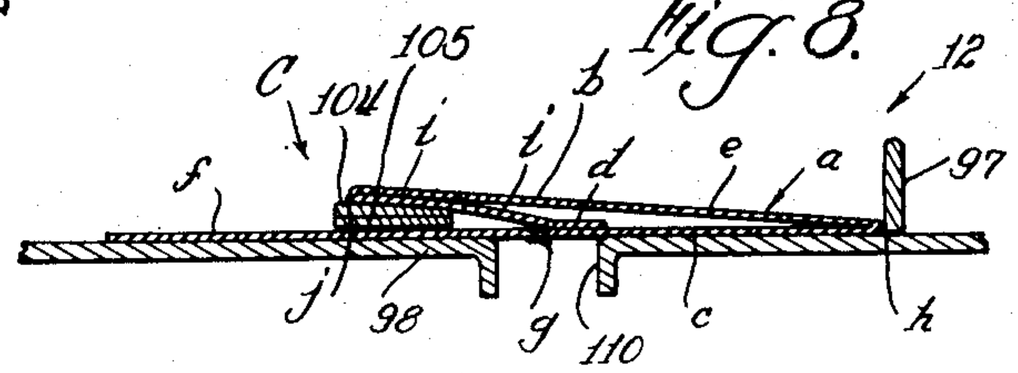


Fig. 8.



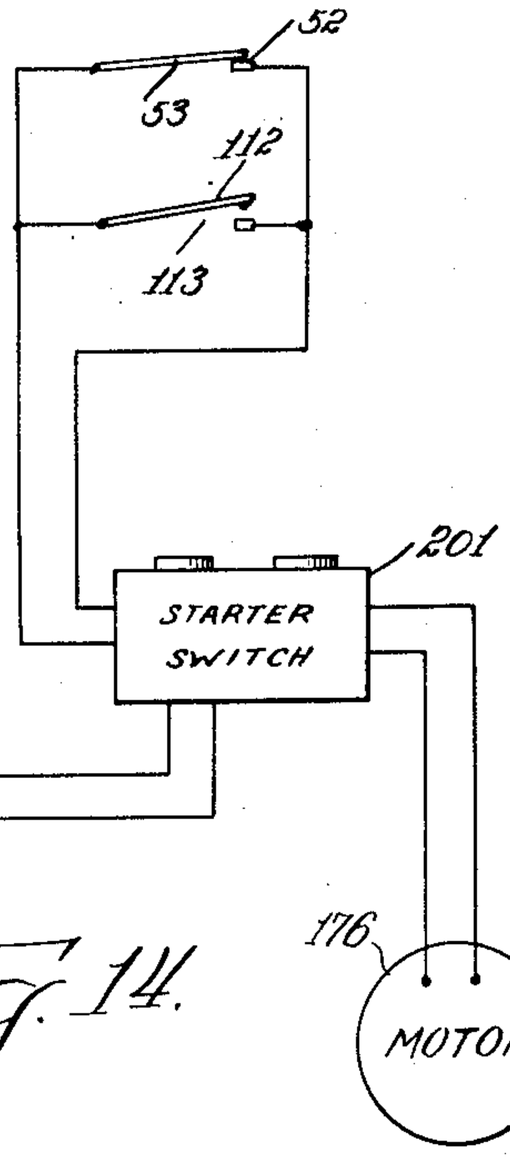


Fig. 14.

Fig. 9.

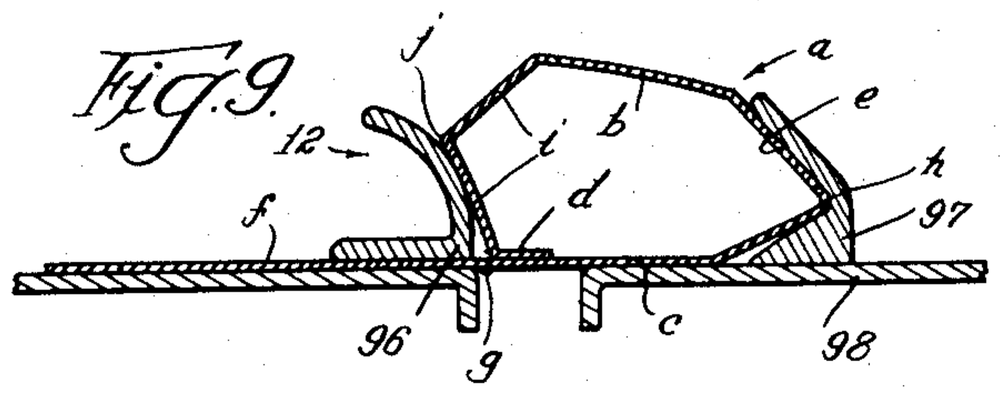
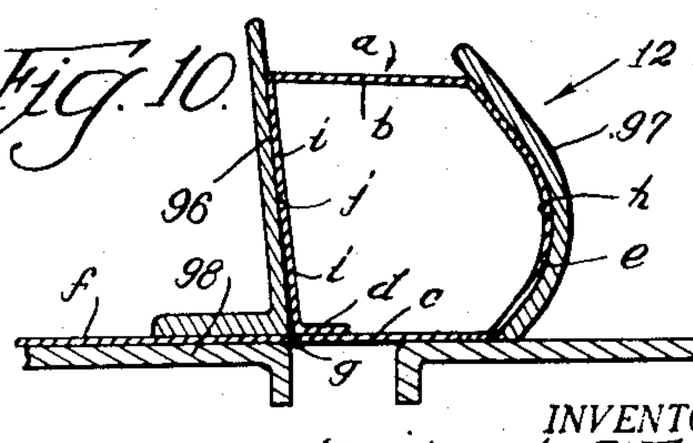


Fig. 10.



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Nov. 17, 1953 R. J. FAHEY 2,659,279

CARTON SETUP MACHINE

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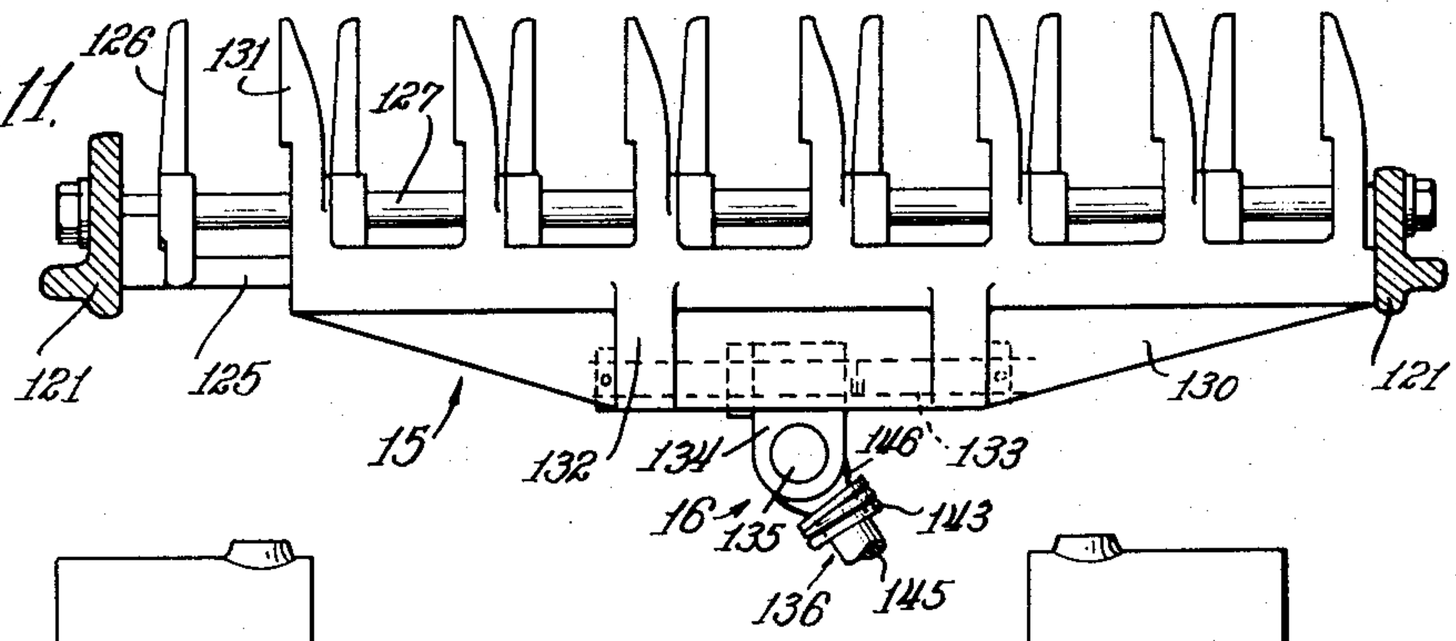
Fig. 11.



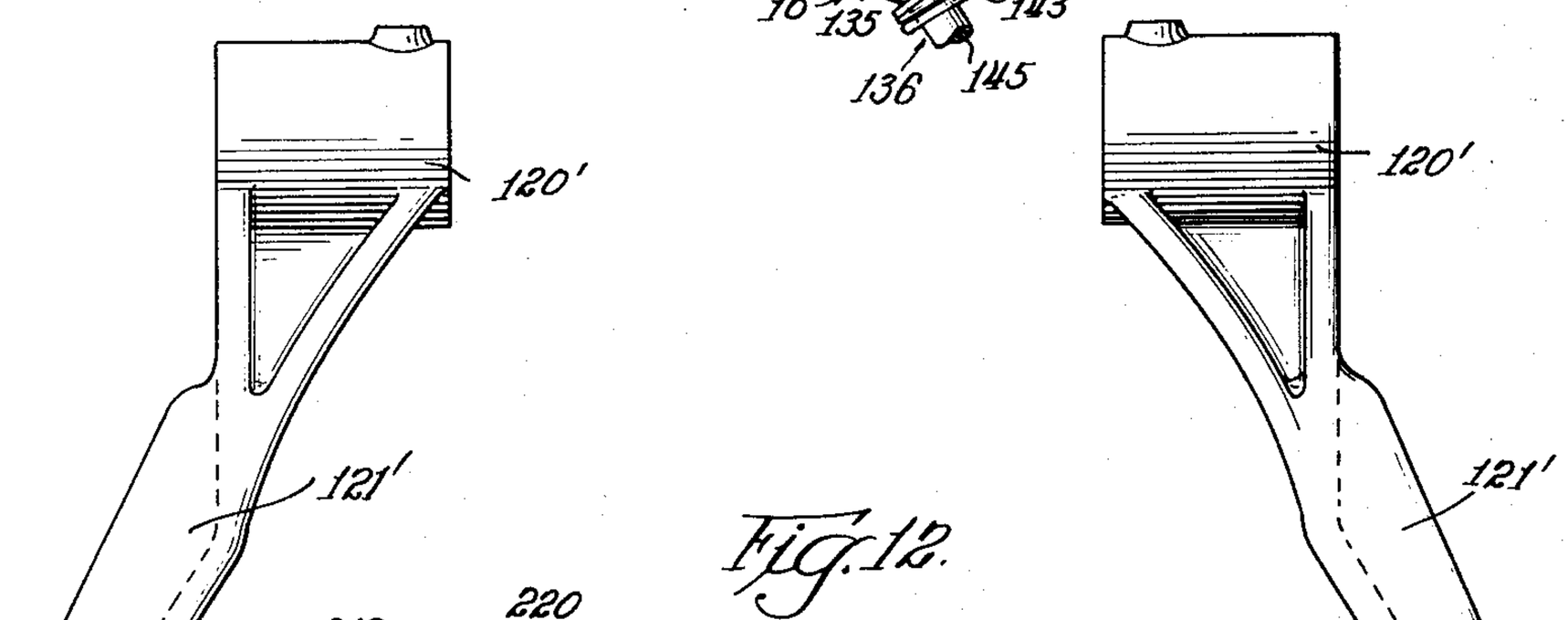


Fig. 12.

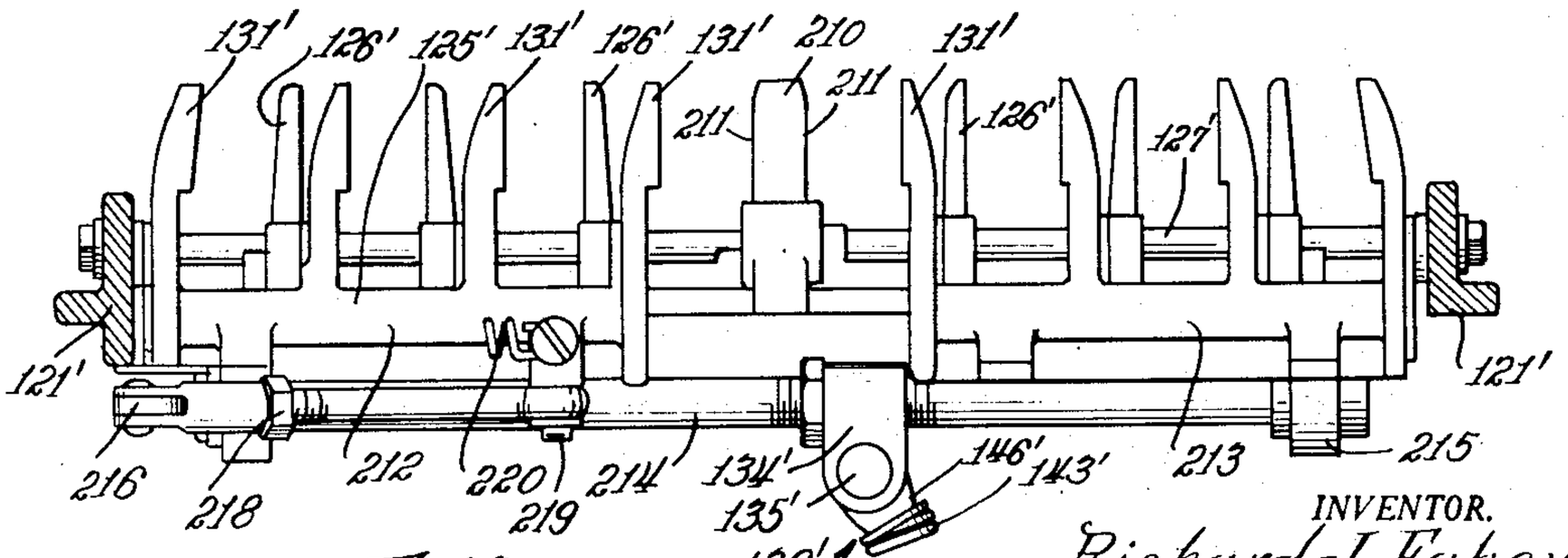


Fig. 13.

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Patented Nov. 17, 1953

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UNITED STATES PATENT OFFICE

2,659,279

CARTON SETUP MACHINE

Richard J. Fahey, Evanston, Ill., assignor to General Package Corporation, a corporation of Delaware

Application June 12, 1948, Serial No. 32,634

23 Claims. (Cl. 93—37)

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This invention relates to improvements in apparatus for automatically setting up a well known type of compartmented paperboard egg carton. These cartons, of which there are numerous types, are characterized by integral longitudinal partition means extending along a medial line thereof and by a plurality of sets of transverse partition members integrally hinged to the opposed carton side walls, which transverse partition members are swingable from their inoperative position, coplanar with one another in the non-erected or collapsed, knock-down condition of the carton, about integral hinges to an upstanding position normal to the aforesaid longitudinal partition means. The patent to Felix Troyk, Re. 18,922, of August 22, 1933, is illustrative of a carton of this type; and the present machine is especially adapted for automatically setting up such Troyk cartons. However, it will become apparent from the description to follow that the apparatus is not necessarily limited in applicability to the handling of this particular carton, but, on the contrary, will be found to be well suited for the automatic setting up of various other collapsible, compartmented paperboard cartons of the general sort referred to.

I am aware that automatic machinery has heretofore been designed by others for setting up many kinds of flexible paperboard cartons, also that numerous types of hand equipment have been evolved. However, the physical characteristics of Troyk cartons of the type referred to are such that quite thorough and comprehensive provisions must be made in an automatic set up machine therefor for the purpose of maintaining positive control of the collapsed carton as it is withdrawn from a supply and then fed through the machine. Otherwise, as is the case in certain existing machines, the set-up operation is relatively slow and unreliable, and the cartons are apt to become deformed in passing through the apparatus and to clog or jam the same as a consequence. Most machines which have been designed to date are also objectionable by reason of their high cost, due to the complexity and number of their parts, and are quite likely to get out of adjustment or otherwise become inoperative.

It is therefore an object of the present invention to provide a relatively simple, automatic, carton set-up apparatus which is reliably operable at comparatively high speed, said apparatus having provision for feeding knocked-down egg cartons from a stack thereof; for advancing the cartons in series through a continuous cycle of operation in which they are erected to a set-up

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position, while always maintaining positive control of the carbon; for preliminarily shaping the knocked-down articles to a partially erected, generally quadrilateral sectional outline during advance as aforesaid; and for completing the erection or setting up of the cartons by swinging the transverse partition members thereof to their final, operative position, in which they are interlocked with the bottom or longitudinal partition of the carton, all of which instrumentalities are characterized by their reliability of operation and their freedom from likelihood of damaging the carton while manipulating the same.

Another object of the invention is to provide a set-up machine for egg cartons having novel provisions for advancing cartons successively from a vertical stack thereof in a positive and unfailing fashion and in timed relation to the operation of further instrumentalities of the set-up machine, said feed means including a reciprocatory shuttle of novel character to insure reliable feeding engagement with the lowermost carton of a supply stack.

A further object of the invention is to provide a carton set-up machine including a forming chute to which cartons are initially fed by said feed means, which chute has a novel, specially designed opening tongue projecting rearwardly and engageable between certain parts of the flat, knocked-down carton in a fashion to insure proper commencement of the continuous carton body erecting cycle performed by the chute.

Yet another object is to provide, in association with carton supply means and chute-like body forming provisions of the type referred to above, improved means for positively engaging the cartons after they have passed out of the supply hopper from which they are fed, for advancing the same steadly and seriatim in a linear path through the body forming chute into operative transverse relation to an improved partition erecting head, for disengaging the cartons during operation of said head and for again engaging and discharging the finally erected cartons successively from the zone of said head after the erecting operation has been completed.

A still further object is to provide a novel and improved set-up or partition erecting head for a machine of the present type.

Another object is to provide, in a machine of the above sort, carton supply, advancing and erecting instrumentalities including a supply hopper and a chute through which cartons are fed, in combination with novel control means for halting the operation of the apparatus in

the event the supply of knocked-down cartons in the hopper becomes exhausted or a carton traversing the chute fails to become properly formed or erected.

Yet another object is to provide a carton set-up machine of the type described including, in combination with a chute through which the carton is advanced to initially erect the same to generally quadrilateral form, a pair of coacting oppositely oscillatory members successively engageable with the carton cross partitions and bottom during a dwell in the carton travel to cause final erection and locking of the said partition members with a longitudinal partition which is integral with said bottom.

A more specific object is to provide a positive stop engageable by the cartons toward the end of their travel through the apparatus to prevent undesired movement under the influence of said erecting means.

A still further object is to provide a carton set-up apparatus, characterized by coacting cross partition erecting members of the type referred to above, in which said members are operatively interconnected to the reciprocatory feed means for initially advancing the knock-down carton from a stacked supply thereof, thereby effecting automatic operation of the intermittent feed means in accurately timed relation to the final partition erecting phase of the set-up cycle.

Another object is to provide a set-up machine comprising one or more units transversely engageable with a carton for the purpose of completing final erection and locking in position of a plurality of integral carton cross partition elements, including a head of novel character having relatively fixed and movable members and novel means for actuating the latter to clamp said partition elements therebetween.

A more specific object of the invention is to provide a carton set-up head having relatively fixed abutment members adapted to be disposed to one side of the aforesaid carton partition elements and relative movable members shiftable as a unit toward said abutment members, whereby to clamp said elements between said members, together with means for imparting a lost motion stroke to the movable members and thereby affording a time delay in the operation thereof.

A still further specific object of the invention is to provide a carton set-up head of the type described, including reciprocatory set-up members actuable as a unit toward and from a corresponding number of fixed abutment members in which said first named members are driven by a novel lost motion, spring type actuating device and are cushioned on their spring return or partition disengaging stroke, to prevent objectionable vibration, by an air cylinder or like impact damping device.

Another object of the invention is to provide a carton set-up machine of the foregoing character having provisions operable in timed relation to the shiftable partition erecting members of the set-up head for preventing undesirable longitudinal advance of the partially formed carton while the aforesaid shiftable members are acting on the cross partitions of said carton.

A still further object is to provide an improved method of erecting collapsible, cellular, hinged partition type egg cartons, involving the progressive distending of the collapsed cartons from a flat, knocked-down condition while advancing in the direction of the length of said cartons, and subsequently deflecting the hinged cross partitions thereof from a generally coplanar relation to operative erected condition at a right angle to the walls of the carton.

The foregoing statements are indicative in a general way of the nature of the invention, but other and more specific objects will be apparent to those skilled in the art upon a full understanding of the construction and operation of the device.

Two embodiments of the invention, as regards the set-up head of the apparatus, are presented herein for purpose of exemplification, but it will be appreciated that the various features of the invention are all susceptible of incorporation in other modified forms coming equally within the scope of the appended claims.

In the drawings,

Fig. 1 is a view in side elevation, partially broken away and vertically sectioned, of a carton set-up apparatus in accordance with the present invention;

Fig. 2 is a top plan view of the apparatus illustrated in Fig. 1, being also partially broken away and sectioned along a line corresponding generally to line 2—2 of Fig. 1 to further illustrate certain details;

Figs. 3 and 3A are complementary, enlarged, fragmentary views in longitudinal section through the machine, along a line corresponding approximately to line 3—3 of Fig. 2, illustrating certain details of the apparatus and also showing some of the features of the Troyk type carton operated upon by the latter;

Fig. 4 is an enlarged view in transverse vertical section along line 4—4 of Figs. 1, 2 and 3, more clearly illustrating certain details of the carton feed apparatus and provisions for initiating formation of the body of the carton;

Fig. 5 is a view in transverse vertical section along the line 5—5 of Figs. 1, 2 and 3A, illustrating details of the final partition erecting and locking provisions of the apparatus, and also indicating certain structural features of the carton;

Fig. 6 is a plan view of the carton body forming chute of the apparatus, illustrating novel provisions of the latter for insuring unfailingly proper initiation of the carton erecting cycle by spreading of the carton body from its subjacent flat cover;

Fig. 7 is a somewhat enlarged view in longitudinal vertical cross section, along a line corresponding generally to line 7—7 of Fig. 6;

Figs. 8, 9 and 10 are, respectively, fragmentary views in vertical transverse section along lines 8—8, 9—9, and 10—10 of Fig. 6, showing successive phases of the continuous body forming operation performed by the aforementioned chute;

Fig. 11 is a plan view of the novel carton set-up head of the invention, in accordance with one embodiment of the same, as viewed from line 11—11 of Fig. 5;

Figs. 12 and 13 are, respectively, side elevational and plan views of a carton set-up head and operating provisions therefor which are of a modified character adapted for use in substitution for the set-up head illustrated in Figs. 1 through 7, in the event a carton of the divisible type is to be operated on; and

Fig. 14 is a schematic wiring diagram illustrating the electrical control circuit employed in the operation of the present apparatus.

Sufficient of the structural features of the aforesaid Troyk type carton are illustrated in

Figs. 3, 3A, 5 and 7 through 10 for the purpose of description of the present set-up machine therefor. For more specific information, reference may be made to the reissue patent identified above. Referring particularly to Figs. 3, 3A and 5, the paperboard carton, generally designated C, includes, in the substantially erected condition thereof iilustrated in Fig. 5, a receptacle or body *a*, having front and rear side walls *b*, *c*, connected by a bottom *e* of inverted V-shape, so that the carton body in cross section, as shown in Fig. 5, has the outline of a W.

Carton body *a* has a cover *f* integrally hinged to the rear wall *c* by a longitudinally extending crease line *g*. The inverted V-shaped bottom affords a longitudinal partition *h*, as referred to in the foregoing description, terminating at a longitudinal apex between two rows of egg receiving cells. These cells are further defined by the cross partitions *i*, which extend transversely of and at right angles to longitudinal partition *h* in their erected, operative condition.

In accordance with well-known carton structure these cross partitions *i* are cut from a partition panel which is adhered by a glue lap *d* to the rear wall *c* of the carton. They normally lie coplanar with one another in the flat-knocked-down condition of the egg carton, see Figs. 3 and 8. The row of partitions *i* are disposed on either side of a medial longitudinal crease line *j* paralleling the apex of the longitudinal partition *h*, being foldably superposed on one another along crease *j* in said flat condition.

Cross partitions *i* are integrally hinged to the front and rear walls *b*, *c* of the carton body *a* by certain triangular hinging gussets or webs *k*, relative to which they are adapted to be swung 90° from their original, coplanar relation into operative, normal relation to the bottom *e* and longitudinal partition *h* formed therefrom. The latter has longitudinally spaced, transverse slots therein which are adapted to receive the lower hook-like extremities or lugs *l* of the cross partition *i* whereby to lock the latter in their final erected position. Figs. 8, 9 and 10 illustrate the progressive erection of the carton by the application of opposite, compressive forces against the sides thereof as it traverses the body forming chute of the apparatus now decribed in general terms.

The apparatus of the invention consists of the several main operating devices or sections, as follows: A supply hopper, generally designated 10, from which the lowermost, flat, knocked-down carton C is fed by a primary reciprocatory-type feed device, generally designated 11, in conjunction with certain roller feed means; a preliminary forming chute, generally designated 12, through which the carton is progressively fed by said roller feed means, and a further chain-type feeding device, generally designated 13, for progressive manipulation thereof in the fashion illustrated in Figs. 8, 9 and 10; a holding chute or frame, generally designated 14, which is in effect a continuation of the forming chute 12, and to which the preliminarily shaped carton is discharged from chute 12 for final erection of the cross partitions; an oscillatory partition erecting head, generally designated 15, which is periodically actuated by certain driving instrumentalities, generally designated 16, to bend the coplanar cross partitions *i* into the operative, right angular position thereof illustrated in Figs. 3A and 5; and an oscillatory bottom and longitudinal partition erecting and locking device,

generally designated 17, which is intermittently actuated in timed relation to the head 15 for the purpose of thrusting the bottom *e* of the preliminarily shaped carton inwardly of the carton body C, to the inverted V outline thereof shown in Fig. 5. In this position the longitudinal partition *h* of said bottom is interlocked with the cross partitions *i* which have been previously manipulated by head 15. Following operation thereon by these instrumentalities, which will presently be described in greater detail, the carton is in fully erected condition and is then discharged by chain feed device 13 from the forward side of the holding frame or chute 14. The above devices are all supported on a suitable tubular frame F, preferably in an upward and forward inclination as shown in Fig. 1.

Structural details of the supply end of the machine, including the supply hopper 10, the feed device 11 and instrumentalities associated therewith, are illustrated in Figs. 1, 2, 3 and 4 of the drawings, to which attention is now directed.

Said hopper includes pairs of forward and rearward angle iron uprights or corner members 18, 19, respectively, which are suitably sustained in rigid parallel relation to one another on a flat, apertured or slotted hopper bottom plate 20 disposed across the top of and secured to the frame F, said uprights being preferably affixed rigidly to said bottom plate by the angle type bracket provisions 21.

Referring to Figs. 2 and 3, the hopper bottom plate 20 is provided with a pair of elongated slots 22 extending in the front-to-rear direction and is also provided with further slots for the accommodation of the feeding provisions 11, 13 as hereinafter described. Plate 20 serves as a sliding support for a reciprocable carton feeding shuttle 24 of novel character which is driven in timed relation to the carton set-up head 15. The shuttle 24 has the form of a generally rectangular member, generally U-shaped in plan view, which, as illustrated in Fig. 3, tapers gradually from its rear edge forwardly and downwardly to its front margin. It is longitudinally beveled at 25 along its opposite sides (see Fig. 2) and the hopper uprights 18, 19 are appropriately slotted or relieved at their lower extremities adjacent plate 20 to permit forward and rearward reciprocatory motion of the shuttle 24 without losing lateral control of the stack of cartons C in hopper 10. Shuttle 24 has only a short reciprocatory stroke.

Hopper 10 incorporates improved means adapting it to receive either standard size cartons or an enlarged, "jumbo" size without requiring time-consuming adjustments. Said means takes the form of an upright spacing shim or plate 10' of U-shaped outline which is adapted to be disposed internally of the side webs of the hopper uprights 18, 19 on one side of the apparatus. This shim and said side webs have releasable slot and stud or bayonet-type securing provisions 10'' enabling the shim to be quickly placed in position as a partial side filler for the hopper, and to be removed just as easily and quickly, when it is desired to enlarge the hopper area to accommodate "jumbo" articles.

The slots 22 of hopper bottom plate 20 are adapted to slidably receive and guide for reciprocation the respective pairs of longitudinally spaced, upstanding guide lugs 26 of a shuttle drive bracket 27 disposed beneath the hopper bottom plate 20, said lugs projecting upwardly

through the slots 22 and being secured to shuttle 24 by the screws 28. The bracket is also bored longitudinally through the lugs 26 to receive the longitudinally extending, shuttle driving, slide rods 29, to which said bracket is rigidly secured by set screws 30. Accordingly, as said rods 29 are reciprocated in timed relation to set-up head 15, by the means hereinafter described, the bracket 27 thereon imparts a forward-to-rearward movement of short stroke to shuttle 24, which is sufficient to introduce the leading edge of the lowermost carton C within the bite of the roller feed means hereinafter described.

Provisions are incorporated in said shuttle to insure unfailing feeding engagement thereof with the rear edge of the lowermost knocked-down carton C in the stack in hopper 10, following the retractile stroke of the shuttle. To this end, the upper surface of said shuttle is longitudinally and centrally recessed at 31 and is provided with a T-shaped opening 32 rearwardly of said recess, said opening extending entirely through the shuttle in the vertical direction. A generally T-shaped carton engaging and advancing member 33 is associated with the shuttle 24. Said member is in the form of a transverse, vertically stepped bar which is secured on the rear end of an elongated leaf spring 34. The forward end of said spring is disposed in the above referred to, longitudinal upper recess 31 in shuttle 24 and is secured fixedly to the latter by screws 36.

The spring 34 normally supports the stepped carton advancing bar 33 in a somewhat elevated position relative to shuttle 24 when the hopper 10 is unloaded, as illustrated in dotted lines in Fig. 3, thus insuring that when said bar 33 is retracted rearwardly beyond the rear edge of the stack of cartons in hopper 10, the carton engaging step 37 of the bar 33 will unfailingly and positively engage behind the trailing edge of the lowermost carton in said hopper. The height of the step 37 approximates the thickness of the portion of the carton engaged thereby, so that snagging with the second carton immediately thereabove is avoided. Bar 33 slides beneath the latter in positively forwarding the lowermost article.

In order to fan the lowermost few cartons slightly forwardly in the hopper 10, thereby to further facilitate and insure positive and unfailing engagement thereof by advancing shoulder 37, it is desirable to provide cam means adjacent the bottom of the hopper. To this end the inturned flanges 38 of the rear hopper uprights 19 are vertically slitted for a slight distance and the slit portions 39 are offset forwardly. Thus, the lowermost few cartons descending by gravity in the hopper are stepped slightly and their rear edges separated somewhat in the direction of their subsequent longitudinal advance, as illustrated in Fig. 3, as they vertically approach shuttle 24.

Further to increase the reliability of feed of the flat carton C to the reciprocatory advancing device 11, it is also desirable to apply to hopper 10 some sort of restraining or load supporting device, such as is ilustrated in Fig. 1 and generally designated 40. Without going into detail as to the specific structure of this device, it may include a mounting bracket 41 journaling a roller 42, the periphery of which projects sufficiently forwardly into hopper 10 to engage the rear edge of the gravitationally supplied stack of blanks and to thus partially sustain the load in the

hopper. The weight of cartons on the carton advancing device 11 is kept uniform regardless of the fullness of the hopper, and they are dropped at a uniform rate into position for engagement at their rear by the resiliently biased carton advancing bar 33.

As illustrated in Fig. 3, the sliding rods 29 whereby shuttle 24 is reciprocated are guided in appropriate bosses 45 in a pair of longitudinally spaced, transverse reinforcing ribs 46 which depend beneath hopper bottom plate 20. These rods are coupled at their forward end by a transversely extending, angle iron type cross head 47 provided at its mid point with a universal swivel joint, generally designated 48, by which the feed device 11 is coupled to an elongated connecting rod 50 extending forwardly of the apparatus. This rod is reciprocated in timed relation to the operation of the partition set-up head 15 in a manner which will become apparent following a description of the specific actuating mechanism 16 for said head.

As illustrated in Figs. 2, 3 and 4, internal, vertical metering gates 51 are provided on the feed-out side of hopper 10, in the form of plates secured to a hopper bracket and terminating at their lower ends in predeterminedly spaced relation to the hopper bottom plate 20. A metering button 51′ is threaded in said plate for vertical adjustment relative to one of said gates, being located directly therebeneath. This button may be adjusted as desired to enable proper feed-out control by allowing for varying thicknesses of the paperboard used in the cartons.

The supply or hopper end of the machine has associated therewith means which is coordinated in the motor wiring circuit for the apparatus for interrupting the operation of the latter in the event the cartons are not being advanced properly through chute 12. The provisions for this purpose, to the extent that they are associated with hopper 10 and feed device 11, include a normally closed micro-switch 52 (Fig. 1) of standard type which is fixedly mounted beneath and adjacent the rear of hopper 10. The forwardly extending control button 53 of this switch is depressed by a depending tappet member 54 on the shuttle 24 of reciprocatory feed device 11, on the rearward stroke of the latter. When this occurs, the motor circuit for the apparatus is opened at said switch, and, in the event a carton is not progressing properly through chute 12 at the time, the entire motor circuit will be de-energized. In short, switch 52 is a circuit holding device coacting with other circuit control means, to be hereinafter described, to insure that a failure of a carton to be properly formed in chute 12 will be detected, and the apparatus halted, no later than the next succeeding return stroke of the feed device 11. If desired, tappet 54 may be resilient in character, thus affording a predetermined delay interval of engagement with control button 53, during which the circuit is broken at micro-switch 52.

Upon being fed forwardly in hopper 10 by the shuttle 24, the lowermost carton passes into the grip of pairs of opposed upper and lower feed rolls 58, 59, shown in Figs. 1, 3 and 4, the hopper bed 20 being provided with laterally spaced apertures 60 through which the lower rollers extend for driving engagement with the carton. As illustrated in Fig. 4, the set of rollers on the left-hand side is spaced somewhat more than the other set to accommodate the multiple thickness

of the carton body and bottom, and still exert uniform carton gripping action. The upper rollers **58** are carried by a cross bracket **61** provided with suitable trunnion ears **62** which freely journal said rollers. See Figs. 3 and 4. The lower rollers **59**, as shown in Fig. 4, are bolted to flanges **64** which are secured on a transverse tubular shaft **65**, with the rollers **59** in respective vertical alignment with the upper rollers **58**. Said tubular shaft **65** is rotatably journaled by suitable internal bearing provisions at its ends (not shown) on opposed, in-turned trunnions carried by a pair of supporting arms **67**, one adjacent either side of frame F, and these arms are in turn pivoted on brackets **68** depending from the hopper bed plate **20**. See Fig. 1. The rollers **59** are resiliently sustained for frictional gripping engagement with the advancing cartons. This is accomplished by means of the coil springs **70** interposed between the out-turned upper abutment ears **71** on the pivoted arms **67** and fixed abutments **72** secured to hopper bottom plate **20**. The springs **70** encircle depending pins **73** which are fixed to ears **71** and extend through abutments **72**. Suitable provisions to limit or adjust the thrust of said springs may be employed.

The tubular roller carrying shaft **65** has a sprocket **77** fixedly secured thereto, as by a set screw, around which sprocket the carton advancing chain **13** is trained at one end, the said chain at the same time serving as a source of power for positively rotating the lower feed rollers **59**. Chain **13** has sets of carton engaging dogs **78**, **79** pivoted to certain of the chain links **80**, the dogs **78** being longitudinally aligned and in equally spaced relation on one side of the chain and the dogs **79** being correspondingly aligned and spaced on the other side of the chain. However, the respective dogs **78**, **79** are staggered longitudinally for a purpose which will appear. In order to accommodate said chain and dogs as the chain passes around sprocket **77**, the hopper bottom plate **20** is slotted at **82** adjoining its forward edge, in the fashion illustrated in Figs. 2 and 4.

Said bottom plate carries a pair of laterally spaced, forked, forwardly and downwardly projecting ears **83** adjacent its forward edge which serve to support an elongated, strap-like control track **84** for governing the operation of the set of dogs **78**, as well as a similar track for the dogs **79**. The supporting provisions include, as illustrated in Fig. 4, an elongated plate **85** which is clamped between said ears **83** by the transverse bolts **86**, with spacing and clamping collars **87** interposed between opposite sides of the plate **85** and said ears. The links of chain **13** ride along the upper surface of plate **85** and the cam control track **84** for the dogs **78** is suitably secured to said plate on one side of and somewhat below chain **13**. Track **84** has the form of an elongated strip, rounded at its rear end **90** (see Fig. 3) for camming engagement with the control tail **91** of said dogs. The track is appropriately spaced from plate **85** for such engagement with the dogs by means of a spacer strip **92** interposed between the same and said plate.

In traveling over sprocket **77**, the tail **91** of dogs **78** engages the rearward track cam nose **90** to pivot the dogs clockwise and thereby bring their forward carton engaging lugs **94** into position for operative engagement with the rear edge of the lowermost carton. This carton has been advanced to the rollers **58**, **59** by the shuttle **24**, and is advanced into chute **12** by said rollers. Dogs **78** have the function of continuing the carton's travel through chute **12**, after a slight dwell upon leaving the rollers. At this stage, the forward edge of the carton has been substantially advanced by rollers **58**, **59**, and in a positive fashion, into chute **12**, as is apparent from an inspection of Figs. 1, 2 and 3. Certain parts thereof have been preliminarily spread by means associated with said chute, and in traveling forwardly the body *a* of the carton passes over the spaced, longitudinally extending riser strips **95** on the machine bed at either side of slot **82**. These act to preliminarily lift the carton body for action thereon by the chute. A fixed hold-down finger **95'**, see Fig. 1, carried by cross bracket **61** functions to maintain further control of the carton body as it passes from rolls **58**, **59**, preventing it from snapping upwardly to an extent which would jeopardize its safe passage through the forming chute. Reference should be had to Figs. 2, 4 and 6 through 10, wherein details of shape of chute **12** are illustrated.

As illustrated in those figures, the chute **12** comprises opposed lateral sections **96**, **97**, preferably in the form of specially shaped aluminum castings which are appropriately bolted to one another and to flat operating bed **98** of the apparatus. This bed is secured to the side members of frame F. The chute section **97** is secured directly to said bed **98** by bolts **99**, but the section **96**, since it is on the side of the path of carton advance along which the carton cover *f* travels, must be supported in elevated relation to the bed **98** to afford a slight vertical clearance to accommodate said cover, thereby enabling the latter to travel under section **96** in outspread form. See Figs. 8 to 10. To this end, section **96** is provided with a laterally extending supporting boss **100** carrying an upwardly extending stud **101** which (as shown in Figs. 3 and 4) is fixedly but adjustably secured by lock nuts **102** to a forwardly extending ear **103** on the above described transverse roller journaling bracket **61**. The connection affords whatever vertical adjustment of the chute section **96** is necessary at this point.

Chute **96**, as best illustrated in Figs. 2 and 6, includes a rearwardly projecting spreading shoe **104** which has a rounded, laterally curved and rearwardly tapering knife-like carton distending tongue **105** affixed to its rear extremity. As cartons are advanced by reciprocatory feed device **11**, the tongue **105** is inserted above the laterally extending cover *f* of the carton and beneath the lower cross partition *i* of the carton, in the fashion illustrated in Figs. 7 and 8, to initially separate these portions in the vertical direction. Tongue **105** extends rearwardly toward the hopper **10** to about the center of feed rolls **58**, **59** so as to make engagement with the carton as it is forwarded by shuttle **24**. Rolls **58**, **59** then drive the carton at points spaced on either side of said tongue **105**, with the result that initial separation of the swingable portions of the carton body *a* from the cover is accomplished in a very positive and reliable manner.

Forwardly of the separating tongue **105**, sections **96**, **97** are progressively shaped internally in curvilinear and angular sectional outline, as illustrated in Figs. 8, 9 and 10. The body *a* of the carton is progressively erected by these sections to a generally quadrilateral sectional shape as it traverses the chute **12**, the sections applying opposite compressive forces to the body while guiding and restraining it during its travel. During final movement through the chute the carton is advanced by a dog **78**. This plow or chute type

of forming device is generally well known. An elongated wire cover restraining rod 108 is suitably supported by brackets 109 on the machine frame and extends parallel to the path of carton travel. It is disposed in laterally spaced relation to chute section 96 and in vertically spaced relation to the machine bed 98, for the purpose of vertically restraining the cover *f* of the carton as it traverses the apparatus. The bed 98 of the machine has a continuous elongated slot 110 aligned with chain 13 and receiving the dogs 78, 79 as they travel the length of the machine.

The carton is advanced by a dog 78 through chute 12 and delivered into the retaining section 14 of the latter, whereupon the tail 91 of said dog passes off the forward edge of the control track 84, causing the drive lug 94 of the dog to swing counterclockwise to an inoperative, dependent position, as shown in Fig. 5. The carton travel then comes to a halt pending operation of the cross partition and bottom erecting and locking devices 15, 17. However, prior to reaching this zone, the carton has passed beneath an exposed pivoted roller-type control member 112 of a normally open micro-switch 113 mounted on chute 12, see Fig. 3A.

This switch is wired into the operating circuit of the apparatus, along with micro-switch 52, in the manner illustrated in the wiring diagram of Fig. 14. In the event a carton is being properly formed in chute 12, the wall *b* thereof will engage the switch control member 112 and close the switch 113. The other switch 52 at hopper 10 insures that the motor circuit remains energized until this time, since it is of the normally closed type. Accordingly, switch 112 being closed by a properly manipulated carton, the machine will continue to operate and the hopper feed device will make its normal return and feed strokes. However, in the event a carton is not correctly formed in chute 12, the switch 113 remains open, and upon the immediately succeeding rearward return stroke of the device 11, its tappet 54, in engaging control button 53 of the microswitch 52, will open that switch. Hence, the motor circuit will be de-energized (see Fig. 14) and the apparatus comes to a halt until the cause of the trouble is corrected. This constitutes a simple but highly effective dual holding control device which avoids extensive carton damage in the rare instances of improper formation of the carton body and feed thereof to the erecting head 15 and bottom forming device 17.

Upon arrival of the formed carton body in position between the aforesaid partition and bottom erecting and locking devices 15, 17, shown in Figs. 1, 2, 3A, 5 and 11, they come into successive operation to swing the cross partitions *i* of the carton downwardly about their triangular hinges *k* into erect position and to interengage the hook-like locking lugs *l* of said cross partitions in the slots of the bottom *e* of the carton. During these operations the formed carton body *a* is held in position by the carton holding continuation 14 of section 97 of chute 12, as illustrated best in Fig. 5. This continuation member is bolted to the bed 98 and has an upper, inward overhang terminating in a re-entrant lip 114 adapted to restrain the free edge of the carton body as it is acted on by devices 15 and 17.

Head 15 and bottom set-up device 17 are pivotally supported by a pair of inverted U-shaped tubular members 115 which are a part of the frame F, and by a longitudinally extending, reinforcing rib 116 which extends between and is rigidly mounted on said cross members 115. Rib 116, as illustrated in Fig. 5, provides a mount for the opposite ends of a longitudinally extending, fixed supporting shaft 118, on which an elongated tubular sleeve 119 is appropriately mounted for oscillation; and this sleeve has affixed thereto adjacent opposite ends thereof a pair of longitudinally spaced, axially aligned hubs 120 from which integral, oscillatory supporting arms 121 for the partition erecting head 15 depend.

The sleeve 119 also has oscillatably journaled thereon the intermediate hub 122, aligned with hubs 120, from which the longitudinally spaced, integral actuating arms 123 for the bottom set-up device 17 depend. Accordingly, the sets of arms 121, 123 are independently pivoted about the fixed shaft 118 as an axis. The bottom set-up device 17, which is borne by arms 123, is actuated from the driving instrumentality 16 for head 15, in timed relation to the latter, by means of a linkage which will be described in detail in connection with the description of said head driving instrumentality 16.

Referring particularly to Fig. 11, and also to Figs. 2 and 5 for the general arrangement, the partition erecting head 15 includes a cast frame 125 to which arms 121 are connected, and said frame is provided with a plurality of pairs of integral, laterally projecting, fixed abutments 126, there being a pair of abutments for each pair of cross partitions *i* of the carton. A pair of guide rods 127 are also fixed to the frame in parallel, longitudinally extending, laterally spaced relation, these rods extending through bores in the abutments 126 adjacent the bases thereof. The rods 127 support and guide a slidable partition erecting member 130, preferably also in the form of a one-piece casting, which is provided with laterally projecting pairs of movable partition erecting fingers 131. These fingers are longitudinally bored to slide on rods 127 and are adapted to engage the cross partitions *i* of the carton and swing the same about their hinges into operative erected position, as the member 130 shifts longitudinally along frame 125. They thus force the partitions *i* positively against the respective fixed head frame abutments 126 and are adapted to hold the partitions in this position pending operation of the plate-like bottom erecting device 17.

The slidable head member 130 carries a pair of rearwardly extending lugs or flanges 132 to which a longitudinal drive rod 133 is fixed, and said rod has adjustably mounted thereon a forked connector 134. A composite, lost motion, actuating link 136 is pivoted to said connector by a pin 135, said link being a part of the head driving device 16.

Referring to Fig. 5, the link 136 is pivoted on its opposite end to a swivel member 137 to accommodate vertical swinging of the link attending oscillation of head 15. Said swivel member is pivotally articulated to a crank 138 (see also Fig. 2) which is fixed to the upper end of a vertical drive shaft 139.

An important feature of the invention resides in the lost motion operation of the link 136 on the thrust and retractile components of its crank-actuated movement, during which the partition erecting fingers 131 of member 130 are driven to the left and then returned to the right, as viewed in Fig. 11. For this purpose, link 136 has a multiple part construction, including an axially bored, forked rod 142 pivotally connected to the swivel member 137 and a coil spring 143 in com-

pressed relation to the free end of said rod. Spring 143 encircles a stem-like extension 145 on an eye 146 by which the link 136 engages head pivot pin 135, said stem being in internally telescoped, guided relation to the bore of rod 142. Thus, as the crank 138 rotates counterclockwise (as viewed in Fig. 2) and link 136 enters the head driving phase of its stroke, i. e., to the right, the crank will pass from the position shown in dotted lines in Fig. 2 to the position illustrated in solid lines, and there will be a few degrees of rotation immediately preceding its arrival at the solid line position, during which the spring 143 is compressed (the swiveled rod 142 telescoping over stem 145) without corresponding longitudinal shifting of the head erecting member 130. This is due to the fact that the increment of forward, longitudinal thrust effective through the link during the initial phase of its thrust stroke is insufficient to slide the member 130 on the guide rods 127 of frame 125. Hence, energy is stored up in the spring during this time interval, and when it has elapsed the spring expands rapidly, shifting stem 145 and member 130 to the left, as shown in Fig. 11, with a snap stroke. The time delay incident to this lost motion feature is coordinated with the inward swing of the head 15 about its pivot shaft 118 by head driving device 16, so that the partitions are positively hinged to erect condition by the fingers 131 simultaneously with the completion of the inward swing of the head. Pin and slot joint 147 limits the spring of link 136.

The oscillatory movement of the actuating arms 123 for the bottom set-up device or plates 17 is obtained as follows. Referring to Figs. 1 and 5, the vertical drive shaft 139 for crank 138 extends substantially downwardly beneath the bed 98 of the machine, and has a cam 150 affixed thereto adjacent its lower end. This cam is engaged by a roller follower 151 carried by a forked arm 152 which is secured to the lower end of a vertically extending shaft 153. Shaft 153 is appropriately journaled in brackets 154 on the frame. A coiled spring 155 anchored to a fixed motor mounting plate 156 on the frame and connected at its opposite end to arm 152 serves to maintain contact of said follower 151 with cam 150.

Referring now to Fig. 5 in connection with Figs. 1 and 2, shaft 153 has a crank arm 157 fixedly connected thereto adjacent the upper end thereof. Arm 157 is connected by a universal ball-type joint 158 to one end of an adjustable link 159, and link 159 is in turn similarly pivoted at its opposite end to a crank arm 160 integral with the intermediate hub 122 which carries the depending arms 123 on which device 17 is mounted. Thus it will be apparent that said arms are oscillated in delayed phase relation to the oscillation of the head supporting arms 121 on the opposite side of the carton.

The lower ends of arms 123 adjustably support the plate-like bottom erecting blade 165 which is adapted to enter into the chute section 14 through an elongated aperture 166 in the side of the latter. Blade 165 has longitudinally spaced knife-like elements 167 affixed to its inner edge which are engageable along the crease defining the longitudinal partition *h*, preferably entering in certain pre-formed slits of the carton bottom *e* coincident with said crease, thereby to guide the longitudinal partition *h* to its inverted V-shaped outline shown in Fig. 5 and to engage the slots in bottom *e* with the locking lugs *l* of the previously erected partitions *i* of the carton. When this is done, the arms 123 withdraw blade 165, and the operation of setting up the carton is finished.

Following this, a dog 79 comes into engagement with the rear edge of the erected carton, in the fashion illustrated in Fig. 3A, to transport said carton out of the chute section 14. This is accomplished by providing a control cam track 170 underlying the path of the dogs 79, said track being similar to the track 84 for dogs 78 and being supported by the chain guide plate 85 in the same manner that the track 84 is supported, but on the opposite side of said plate. Thus the completed cartons are discharged from the chute section 14 to an appropriate receptacle or the like.

In addition to driving the head actuating crank 138 and the set-up plate actuating cam 150, the vertical shaft 139 also serves as a source of power for reciprocating the carton feed device 11, as shown in Fig. 1. For this purpose the shaft carries an eccentrically mounted circular disk 173 immediately below the bed 98 and has a coacting yoke 174 surrounding and in peripheral sliding engagement with said disk, to which yoke the connecting rod 50 is adjustably connected. Hence, rotation of the shaft 139 imparts reciprocatory motion to said rod and to the feed device 11 in timed relation to the oscillatory movements of the arms 121, 123 on which the partition and bottom set-up and locking instrumentalities are carried.

The drive for the various instrumentalities described above, and transmitted through shaft 139 as above described, is initially derived from a suitable electric motor 176 mounted on a platform 177 carried by the machine frame F beneath the bed 98. Said motor has a pulley 178 on its shaft driving a V belt 179 (see Fig. 1) and thereby rotating the transverse main drive shaft 180 at a somewhat reduced speed through a larger pulley 181 on said shaft, about which said belt is trained. Shaft 180 is connected through a standard reduction gearing 183 appropriately mounted on the frame, as by the fixed depending plate 156 or other mounting provision, and vertical drive shaft 139 is driven from said gearing at appropriately reduced speed.

The carton advancing chain 13 is driven as follows. Main drive shaft 180 has a small drive sprocket 184 secured thereon and a flexible power chain 185 is trained around this sprocket. Chain 185 drivingly engages a larger sprocket 186 on a chain driving shaft 187 which is appropriately journaled on the machine frame adjacent the forward end of the chute section 14. A chain driving sprocket 188 is secured on shaft 187 in laterally spaced relation to the power chain 185 (see Fig. 5) and in longitudinal alignment with the rear chain sprocket 77, and the carton advancing chain 13 is trained thereover. A third idler sprocket 190 for chain 13 is adjustably supported on the frame at a rearward point (see Fig. 1), the mounting means therefor having clearance space to permit the passage of the carton advancing dogs 78, 79 around said sprocket 190.

It is evident that the engagement of the partition set-up head 15 with the carton partitions *i* to swing the same inwardly is attended by the imposition of a substantial longitudinal force on the carton as a whole. This would normally tend to shift the carton forwardly in an undesired manner. Likewise, it is desirable to provide pos-

itive carton stop means to insure that each formed carton body *a* is unfailingly fed longitudinally into the holding member 14 a predetermined distance, and no more. Otherwise, the operation of head 15 and device 17 will be faulty. Hence, in the use of the type of head illustrated in Fig. 11, it is advisable to provide some form of means in association with the partition set-up instrumentalities for positively restraining the carton body against such movement. Various devices may be employed for this purpose, one of which, of an escapement type, is best illustrated in Fig. 5. It includes a carton stop or detent element 195 in the form of a dog intermediately pivoted at 196 on the top of the chute holding section 14, adjacent the discharge end thereof, see Fig. 1. Said section has a slot through which element 195 is adapted to swing clockwise to a position to engage and halt the forward edge of a carton in the chute, i. e., in the dotted line position of Fig. 5. In this lowered position the carton abuts longitudinally of the element 195 and is positively restrained from undesired forward shifting under the aforementioned longitudinal thrust by the head 15. To time the movement of the element 195, the head supporting arm 121 has a cam roller 197 thereon which is engageable with an adjacent cam surface 198 on element 195 to urge the latter to the inoperative solid line position of Fig. 5. This is the position of element 195 when the set-up head 15 is inserted fully into the carton body, with the cross partitions *i* gripped between its abutments 126 and movable fingers 131. Following operation of the bottom set-up plate 165 of device 17, the head 15 commences to retract, whereupon the chain feed dog 79 discharges the completed carton from the chute, just as soon as there is sufficient lateral clearance past the head. At the end of its retractile movement the arm 121 functions to reposition the stop element 195 in chute 14. This is effected by the engagement of a second cam roller 199, carried by a lateral extension 200 of arm 121, with a second cam surface 198' on element 195. Thus the element 195 is returned to position to engage the leading edge of a carton forwarded into chute section 14 and to positively restrain further advance until the erecting means have acted.

In order to counteract any tendency of the carton body *a* to follow the erecting head 15 laterally, as the latter retracts outwardly from the chute extension 14, it is advantageous to provide a longitudinal cover biasing strip 202 (see Figs. 2 and 5) which extends along the machine bed 98 in parallel relation to the path of carton travel. This strip is positioned between the cover restraining rod 108 and the chain slot 110 in the bed. The carton cover *f* overlies and frictionally engages said strip as the carton is being operated on by head 15, resisting lateral movement of the carton body *a* as the head is withdrawn and, in fact, spring biasing the body somewhat to hold it against the inner side of chute extension 14.

In the operation of the apparatus, upon actuation of a standard master stop-go control switch 201 wired in the motor circuit in the manner shown in Fig. 14, the various instrumentalities are driven in timed relation. The shuttle 24 of the reciprocatory feed device 11 is actuated by connecting rod 50 from vertical drive shaft 139 and advances in engagement with the rear edge of the lowermost carton C in hopper 10 to initially forward the same from said hopper into the bite of rolls 58, 59. The advancing carton, upon exiting from the hopper, first encounters the rearwardly extending spreading tongue 105 on shoe 104 of the section 96 of chute 12, which is operative to lift the cross partitions *i* of the carton somewhat and separate the stem from the carton cover *f*, the latter passing beneath said tongue. After a predetermined advance by the device 11, the latter reverses its stroke under the control of the eccentric operated connecting rod 50, and returns rearwardly a full stroke beneath the carton stack, whereupon the spring biased, stepped feed bar 33 on shuttle 24 of said device 11 springs upwardly into engagement behind the rear edge of the next carton.

In the meantime, the rollers 58, 59 fully remove the first mentioned carton and insert the same into chute 12. Next a dog 78 on one side of the continuously traveling chain 13 passes around sprocket 77 and through the slot 82 in the bed 23 of the hopper, and comes into engagement with the rear edge of said carton, being positioned for this engagement by cam-elevation of its tail 91 by the elongated control track 84. The carton is then moved continuously through chute 12 by chain 13, being shaped to generally quadrilateral outline by the coacting lateral sections 96, 97 of said chute. The cover *f* of the carton is vertically restrained by the longitudinal rod 108 during this travel.

While traversing the chute 12 the upper portion of carton body *b* normally rides beneath and engages the control member 112 of the normally open micro-switch 113 to hold the motor circuit closed, but if the carton is not being properly erected in the chute, this engagement fails to take place, the switch 113 is opened, and the other switch 52 is opened on the next back-stroke of shuttle 24 to interrupt the motor circuit.

The erected carton is delivered by the chain dog 78 to the holding section 14 of the chute into forward abutment with the detent element 195 and the dog 78 disengages the rear edge of the carton, due to its tail 91 riding off the forward edge of the fixed control track 84.

The partition erecting head 15 now comes into operation. Its fixed abutments 126 are projected into the carton interior on the forward side of the respective partitions *i*, the head being swung on the suspending arms 121 by the crank 138 and link 136 of lost motion driving device 16 while this takes place. During this phase the coil spring 143 of the head actuating link 136 is being compressed, without relative movement of the movable fingers 131 of the head until a certain point is reached in the rotation of crank 138. At this time the energy stored in spring 143 suffices to snap the head member 130 forwardly. This causes the partitions *i*, which have been but partially pivoted about their integral hinges by the engagement of the forward side of the head abutments 126 therewith, to be snapped rapidly forwardly into final position normal to the axis of the carton. They are held positively in this position between the abutments 126 and fingers 131 until the bottom set-up blade 165 of the device 17 is swung inwardly to the position shown in Fig. 5, thereby thrusting the bottom *e* and longitudinal partition *h* thereof into locked relation to the hook elements *l* of the cross partitions *i*.

The spring 143 maintains the aforesaid positive clamped engagement of said partitions between the head abutments and fingers even though the actuating link 136 for head 15 has commenced its retractile stroke. This time de-

lay feature arising from the lost motion characteristic of the link 136 thus insures holding of partitions *i* until the device 17 has functioned, and it is an important feature of the invention.

Following the completion of erection and locking of the carton partition, the head 15 and device 17 retract outwardly and upwardly and the detent element 195 is withdrawn from the carton path. A carton feed dog 79 on the opposite side of chain 13 from the dogs 78 now comes into operative relation to the rear edge of the carton, due to camming engagement of its tail 91 with the control strip 170, and the carton is discharged forwardly by said dog from the holding section 14 of the chute.

It may be found desirable, for the purpose of damping vibration incident to the snap operation of the set-up head member 130, to provide means for slowing down its movement, particularly on its return stroke. For this purpose there is provided the dash pot device 205 shown in Fig. 2. This is simply a fixed air cylinder 206, appropriately mounted on the frame 125 of set-up head 15, and a plunger therein connected by a rod 207 with the reciprocatory partition set-up member 130. Such device cushions the return stroke of said member during a phase when no special speed of operation is required, to thereby prevent objectionable vibration.

Figs. 12 and 13 illustrate a modified embodiment of a partition set-up head which specially adapts the apparatus for operation on cartons of the divisible type, i. e., perforated for subdivision into two equal halves. Cartons of this type are characterized by sets of like cross partition members on opposite sides of a central transverse division line, which sets swing in opposite directions about the respective integral partition hinges. It is accordingly necessary to provide a set-up head of the sort shown in Figs. 12 and 13, having sets of movable fingers which shift in opposite directions toward coacting fixed abutments. Many of the details of this head are practically identical to parts of the head illustrated in Fig. 11, hence, in the interest of simplicity, will be referred to by corresponding reference numerals, primed.

It will be noted that the fixed frame 125' has a central abutment member 210 provided with opposed faces 211 adapted to coact with adjacent set-up fingers 131' on the oppositely movable slide members 212, 213. The latter are slidably guided on the elongated rods 127' fixedly carried by frame 125'. The actuating link 136' for this head is pivoted in an adjustable manner on the elongated rod 214 to which the head member 213 is secured, as by an integral boss 215; and the forward end of said rod serves as a tappet which engages one end of a reversing lever 216 pivoted at 217 on the head frame 125'. The opposite end of lever 216 is pivotally coupled to an adjustable link 218, and said link is in turn pivoted at 219 to the head set-up member 212. Accordingly, upon the lost motion, spring-urged reciprocation of rod 214 the members 212, 213 will be simultaneously shifted in opposite directions for coaction of their movable fingers 131' with the fixed abutments 126' in erecting the oppositely swingable partitions of the divisible type carton. A tension spring 220 connected between member 212 and a fixed anchor, as the supporting arm 121', assists in the return stroke of members 212, 213.

In all other respects, the operation of a machine in which this form of head is incorporated is the same as that described in detail above. However, it will be observed that the thrust imparted to the carton by the oppositely movable fingers 131' of the head is self-compensating so that it is unnecessary to employ a detent device such as is represented by the element 195 of the first embodiment.

I claim:

1. In a machine of the type described, a supply device for flat knock-down cartons to be erected, a feed mechanism for advancing a carton from said supply device in a forward direction, and a forming device through which said carton is advanced by said feed mechanism, said forming device including a forming chute having longitudinally extending portions slidably engaged by said carton as the latter advances therethrough to shape the same in generally rectangular cross sectional outline, and a separating extension projecting rearwardly and terminating immediately adjacent said carton supply device, said element being engageable between superposed layers of said carton immediately upon issuance thereof from said supply device to separate said layers from one another.

2. In a machine of the type described, a supply device for flat knock-down cartons to be erected, a feed mechanism for advancing a carton from said supply device in a forward direction, and a forming device through which said carton is advanced by said feed mechanism, said forming device including a forming chute having longitudinally extending portions slidably engaged by said carton as the latter advances therethrough to shape the same in generally rectangular cross sectional outline, and a separating extension projecting rearwardly and terminating immediately adjacent said carton supply device in a laterally curved and gradually beveled tongue insertable between superposed layers of said carton immediately upon issuance thereof from said supply device to separate said layers from one another.

3. In a machine of the type described, a supply device for flat knock-down cartons to be erected, a reciprocatory feed device to advance a carton from said supply device in a forward direction, a carton forming device toward which said carton is advanced by said feed device, said forming device including a forming chute having longitudinally extending portions slidably engaged by said carton as the latter advances therethorugh to shape the same in generally rectangular cross sectional outline, and a separating tongue projecting rearwardly and terminating immediately adjacent said carton supply device for engagement between superposed layers of said carton incident with issuance thereof from said carton supply device, and a further carton advancing mechanism engageable with the rear edge of the carton so engaged by said tongue to continue the advance of said carton through said forming device following the return stroke of said reciprocatory feed device.

4. In a machine of the type described, a supply device for flat knock-down cartons to be erected, a reciprocatory feed device to advance a carton from said supply device in a forward direction, a carton forming device toward which said carton is advanced by said feed device, said forming device including a forming chute having longitudinally extending portions slidably engaged by said carton as the latter advances therethrough to shape the same in generally rectangular cross sectional outline, and

a separating tongue projecting rearwardly and terminating immediately adjacent said carton supply device for engagement between superposed layers of said carton incident with issuance thereof from said carton supply device, and a continuous chain-type carton advancing mechanism engageable with the rear edge of the carton so engaged by said tongue to continue the advance of said carton through said forming device following the return stroke of said reciprocatory feed device.

5. In a machine of the type described, a supply hopper for a stack of flat knock-down cartons, a feed device reciprocable beneath said hopper for advancing the lowermost carton of said stack in a forward direction, a carton body forming device toward which said carton is advanced forwardly by said feed device, and a continuous carton advancing mechanism operable on a carton to continue the advance of said carton through said machine, said mechanism including an endless flexible device provided with two sets of carton engaging elements, one set on either side thereof, the elements of the respective sets alternating in longitudinal spacing along said device, and means to periodically shift the elements of said respective sets relative to said flexible device for operative engagement and disengagement with a carton.

6. In a machine of the type described, a supply hopper for a stack of flat knock-down cartons, a feed device reciprocable beneath said hopper for advancing the lowermost carton of said stack in a forward direction, a carton body forming device toward which said carton is advanced forwardly by said feed device, said forming device including a separating tongue projecting rearwardly toward and terminating adjacent said hopper, said tongue being engageable between layers of said carton to separate the same, and a continuous carton advancing mechanism operable on a carton so engaged by said tongue to continue the advance of said carton through said machine, said mechanism including an endless flexible device provided with two sets of carton engaging elements, one set on either side thereof, and means to periodically shift the elements of said respective sets relative to said flexible device for operative engagement and disengagement with a carton.

7. A container erecting machine of the type described, comprising a means to supply flat knocked-down containers, a feed mechanism including a reciprocatory device, said mechanism being operative to advance a container from said supply means, an erecting device through which a container is advanced by said feed mechanism progressively to shape the container, a switch engageable by said reciprocatory feed device, a further switch engageable by an advancing container, and an operating circuit for said machine controlled by said switches.

8. A container erecting machine of the type described, comprising a means to supply flat knocked-down containers, a feed mechanism including a reciprocatory device, said mechanism being operative to advance a container from said supply means, an erecting device through which a container is advanced by said feed mechanism progressively to shape the container, a switch mounted adjacent said supply means and engageable by said reciprocatory feed device on a retractile stroke thereof, a further switch associated with said erecting device and engageable by an advancing container, and an operating circuit for said machine controlled by said switches to interrupt operation of the machine in the event said supply means is empty or a container is not properly shaped by said erecting device.

9. A container erecting machine of the type described, comprising a means to supply flat knocked-down containers, a feed mechanism including a reciprocatory device, said mechanism being operative to advance a container from said supply means, an erecting device through which a container is advanced by said feed mechanism to progressively shape the container, a normally closed switch mounted adjacent said supply means and engageable by said reciprocatory feed device on a retractile stroke thereof, a further, normally open switch associated with said erecting device and engageable by an advancing container, and an operating circuit for said machine controlled by said switches to interrupt operation of the machine in the event said supply means is empty or a container is not properly shaped by said erecting device.

10. A carton erecting machine of the type described, comprising a supply hopper for a stack of flat knocked-down cartons, a feed mechanism including a reciprocatory device operative to advance the lowermost carton from said stack, a progressive body forming device comprising a hollow chute engageable with a carton advanced by said feed mechanism to preliminarily shape the same, a normally closed switch mounted adjacent said hopper and having a control element engageable by said reciprocatory feed device on a retractile stroke thereof to open said switch, a normally open switch having a control element extending into said forming chute and engageable by a carton advancing therethrough to close said last named switch, and an operating circuit for said machine controlled by said switches for de-energization under certain circumstances.

11. In apparatus of the class described, means for advancing a flat, knocked-down carton of the swingable partition type, means to preliminarily shape the body of said carton during the advance thereof, and a partition erecting instrumentality in receiving relation to said last named means, comprising a partition set-up head, means mounting said head for transverse movement relative to the path of carton advance, said head having a plurality of longitudinally movable partition erecting elements engageable with the partitions of said carton upon said transverse movement of said head, and an actuating device for said head comprising a driving member, a resilient linkage connecting said driving member and head to shift the latter transversely of the path of carton advance and into engagement with the carton, and means operatively connecting said linkage with certain of said longitudinally movable head elements to impart delayed longitudinal movement thereto at an angle to the transverse movement of the head.

12. In apparatus of the class described, means for advancing a flat knocked-down carton of the swingable partition type, means to preliminarily shape the body of said carton during the advance thereof, and a partition erecting instrumentality in receiving relation to said last named means, comprising a partition set-up head, means mounting said head for transverse movement relative to the path of carton advance, said head having a plurality of longitudinally movable partition

erecting elements engageable with the partitions of said carton upon said transverse movement of said head, and an actuating device for said head comprising a driving member and a resilient, lost motion connection between said driving member and certain of said head elements to impart delayed longitudinal movement thereto at an angle to the transverse movement of the head, said connection comprising a rotary crank, a longitudinally expansible connecting rod pivoted on said crank and in pivotal driving relation to said head elements and means exerting resilient expanding action on said rod.

13. In apparatus of the class described, means for intermittently advancing longitudinally a partially erected partition-type carton, and a partition erecting instrumentality operative to erect partitions of said carton during a dwell in its advance, comprising a partition set-up head, means pivotally mounting said head for swinging movement transversely of the path of carton advance, said head having a plurality of partition erecting fingers mounted thereon for longitudinal movement as a unit and engageable with the partitions of said carton upon transverse movement of said head to erect said partitions, a further forming element pivotally mounted for swinging movement transversely of the carton advance and in opposition to said head to interlock said erected partitions with the carton body, and means to drivingly interconnect said head and element for synchronized swinging movement thereof.

14. In a machine for erecting elongated partition-type cartons, a partition erecting head movable transversely of the length of said cartons, said head including a plurality of fixed abutments and a plurality of partition erecting fingers movable relative to said abutments to engage the partitions of the carton therebetween and thereby erect said partitions, means mounting said fingers for longitudinal sliding movement relative to said abutments in a direction paralleling the length of the carton, means including a resilient lost motion linkage actuating said fingers for said movement, and means actuating said head through said linkage to transversely engage the head with the carton for operation of said fingers on said partitions.

15. In a machine for erecting elongated partition-type cartons, a partition erecting head movable transversely of the length of said cartons, said head including a plurality of fixed abutments and a plurality of rigidly coupled, partition erecting fingers movable relative to said abutments to engage the partitions of the carton therebetween and thereby erect said partitions, means mounting said fingers for longitudinal sliding movement as a unit relative to said abutments in a direction paralleling the length of the carton, means including a resilient lost motion linkage actuating said fingers for said movement, and means actuating said head through said linkage to transversely engage the head with the carton for operation of said fingers on said partitions.

16. In a machine for erecting elongated partition-type cartons, a partition erecting head movable transversely of the length of said cartons, said head including a plurality of fixed abutments and a plurality of sets of partition erecting fingers, the fingers of each set being engageable with certain of the partitions of the carton to erect the same against said abutments, means mounting said respective sets of fingers for opposite, longitudinal, sliding movements relative to said abutments in directions paralleling the length of the carton, means including a resilient lost motion linkage simultaneously actuating said sets for said movements, and means actuating said head through said linkage to transversely engage the head with the carton for operation of said fingers on said partitions.

17. In a machine for erecting elongated partition-type cartons, a partition erecting head movable transversely of the length of said cartons, said head including a plurality of fixed abutments and a plurality of sets of partition erecting fingers, the fingers of each set being rigidly coupled to one another and being engageable with certain of the partitions of the carton to erect the same against said abutments, means mounting said respective sets of fingers for opposite, longitudinal, sliding movements relative to said abutments in directions paralleling the length of the carton, means including a resilient lost motion linkage simultaneously actuating said sets for said movements, and means actuating said head through said linkage to transversely engage the head with the carton for operation of said fingers on said partitions.

18. In a machine for erecting elongated partition-type cartons, a partition erecting head movable transversely of the length of said cartons, said head including a plurality of fixed abutments and a plurality of partition erecting fingers engageable with the partitions of the carton to erect the same against said abutments, means mounting said fingers for longitudinal sliding movement relative to said abutments in a direction paralleling the length of the carton, means including a resilient lost motion linkage for intermittently actuating said fingers for said movement, means acting through said linkage to shift the head transversely into engagement with said carton for operation of said fingers, and means actuated in timed relation to operation of said finger actuating means to prevent longitudinal movement of the carton under force imparted thereto by movement of said fingers.

19. Apparatus for erecting a collapsed, cellular, hinged cross partition type egg carton, characterized by a tubular body having integrally hinged side wall, bottom and coplanar cross partition-bearing panels, comprising means for advancing the egg carton endwise of said panels, means for progressively distending the tubular carton body to generally rectangular outline while so advancing, including a channel laterally restricted on both sides of the path through which the carton is forwarded by said advancing means, said channel engaging and exerting transverse compressive force on opposed integral hinges of the carton body panels, and means for deflecting the cross partitions of said partition-bearing panel about the respective hinges thereof from coplanar relation to a spaced, parallel, erected condition.

20. Apparatus for erecting a collapsed, cellular, hinged cross partition type egg carton, characterized by a tubular body having integrally hinged side wall, bottom and coplanar cross partition-bearing panels, comprising means for advancing the egg carton endwise of said panel, means for progressively distending the tubular carton body to generally rectangular outline while so advancing, including a channel laterally restricted on both sides of the path through which the carton is forwarded by said advancing means, said channel engaging and exerting transverse compres-

sive force on opposed integral hinges of the carton body panel, means to halt the advance of the carton, and means acting while the carton is halted to deflect the cross partitions of the partition-bearing panel about the respective hinges thereof from coplanar relation to a spaced, parallel, erected condition, said last named means engaging said partitions in a direction transverse the direction of carton advance.

21. Apparatus for erecting a collapsed, cellular, hinged cross partition type egg carton, characterized by a tubular body having integrally hinged side wall, bottom and coplanar cross partition-bearing panels, comprising means for advancing the egg carton endwise of said panels, means for progressively distending the tubular carton body to generally rectangular outline while so advancing, including a channel laterally restricted on both sides of the path through which the carton is forwarded by said advancing means, said channel engaging and exerting transverse compressive force on opposed integral hinges of the carton body panels, means for deflecting the cross partitions of said partition-bearing panel about the respective hinges thereof from coplanar relation to a spaced, parallel, erected condition, and control means associated with said channel and operatively connected to said carton advance means, said control means being operated in response to the presence or absence of a carton in said channel to govern actuation of said carton advance means.

22. Apparatus for erecting a collapsed, cellular, hinged cross partition type egg carton, characterized by a tubular body having integrally hinged side wall, bottom and coplanar cross partition-bearing panels, comprising means for advancing the egg carton endwise of said panel, means for progressively distending the tubular carton body to generally rectangular outline while so advancing, including a channel laterally restricted on both sides of the path through which the carton is forwarded by said advancing means, said channel engaging and exerting transverse compressive force on opposed integral hinges of the carton body panel, means to halt the advance of the carton, means acting while the carton is halted to deflect the cross partitions of the partition-bearing panel about the respective hinges thereof from coplanar relation to a spaced, parallel, erected condition, said last named means engaging said partitions in a direction transverse the direction of carton advance, and control means

associated with said channel and operatively connected to said carton advance means, said control means being operated in response to the presence or absence of a carton in said channel to govern actuation of said carton advance means.

23. Apparatus for erecting a collapsed, cellular, hinged cross partition type egg carton, characterized by a tubular body having integrally hinged side wall, bottom and coplanar cross partition-bearing panels, comprising a carton supply device, means for advancing egg cartons from said supply hopper in a direction endwise of said panels, means for progressively distending the tubular carton bodies to generally rectangular outline while so advancing, including a channel laterally restricted on both sides of the path through which the cartons are forwarded by said advancing means, said channel engaging and exerting transverse compressive force on opposed integral hinges of the carton body, means for deflecting the cross partitions of said partition-bearing panel about the respective hinges thereof from coplanar relation to a spaced, parallel, erected condition, means for engaging said cross partitions with said bottom panel, and control means for said carton advance means, comprising control elements associated with said channel and with said supply device, and means operatively connecting said control elements to said carton advance means for actuating the latter in accordance with the presence or absence of cartons in said channel and supply device.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
890,464	Staude	June 9, 1908
1,333,772	Payne	Mar. 16, 1920
1,637,560	Krapf	Aug. 2, 1927
1,960,238	Benoit	May 29, 1934
1,994,241	Burger	Mar. 12, 1935
2,018,396	Burger	Oct. 22, 1935
2,057,082	Burger	Oct. 13, 1936
2,224,426	Cullen et al.	Dec. 10, 1940
2,224,510	Coyle	Dec. 10, 1940
2,261,625	Jones	Nov. 4, 1941
2,294,255	Van Uum	Aug. 25, 1942
2,336,507	Shields	Dec. 14, 1943
2,429,536	Von Sydow	Oct. 21, 1947
2,517,449	Shields	Aug. 1, 1950
2,585,201	Wetzler	Feb. 12, 1952