Feb. 11, 1936. I. W. LITCHFIELD 2,030,067

BAG SEALING MACHINERY

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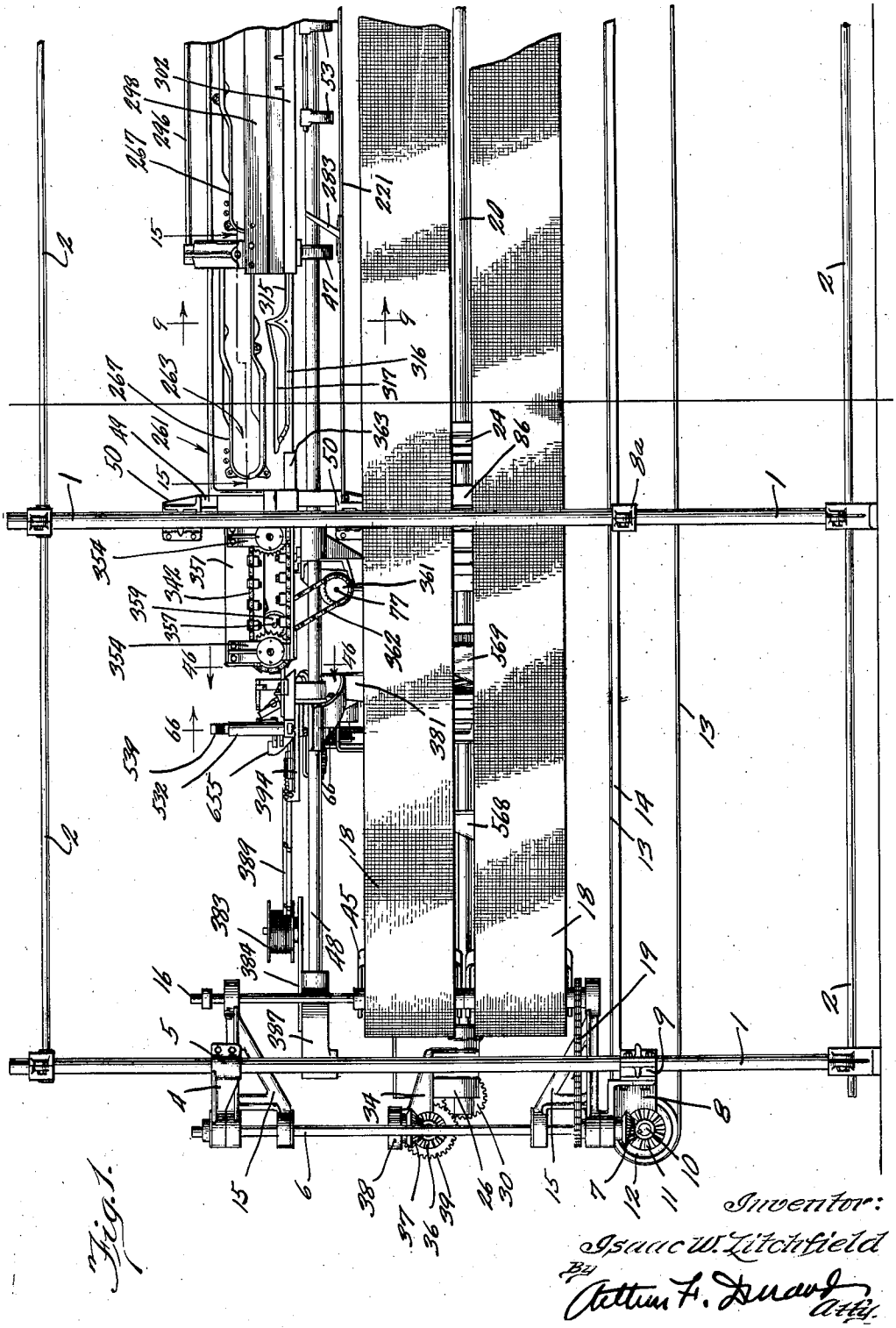


Fig. 1.

Inventor:
Isaac W. Litchfield
By Arthur F. Durand Atty.

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BAG SEALING MACHINERY

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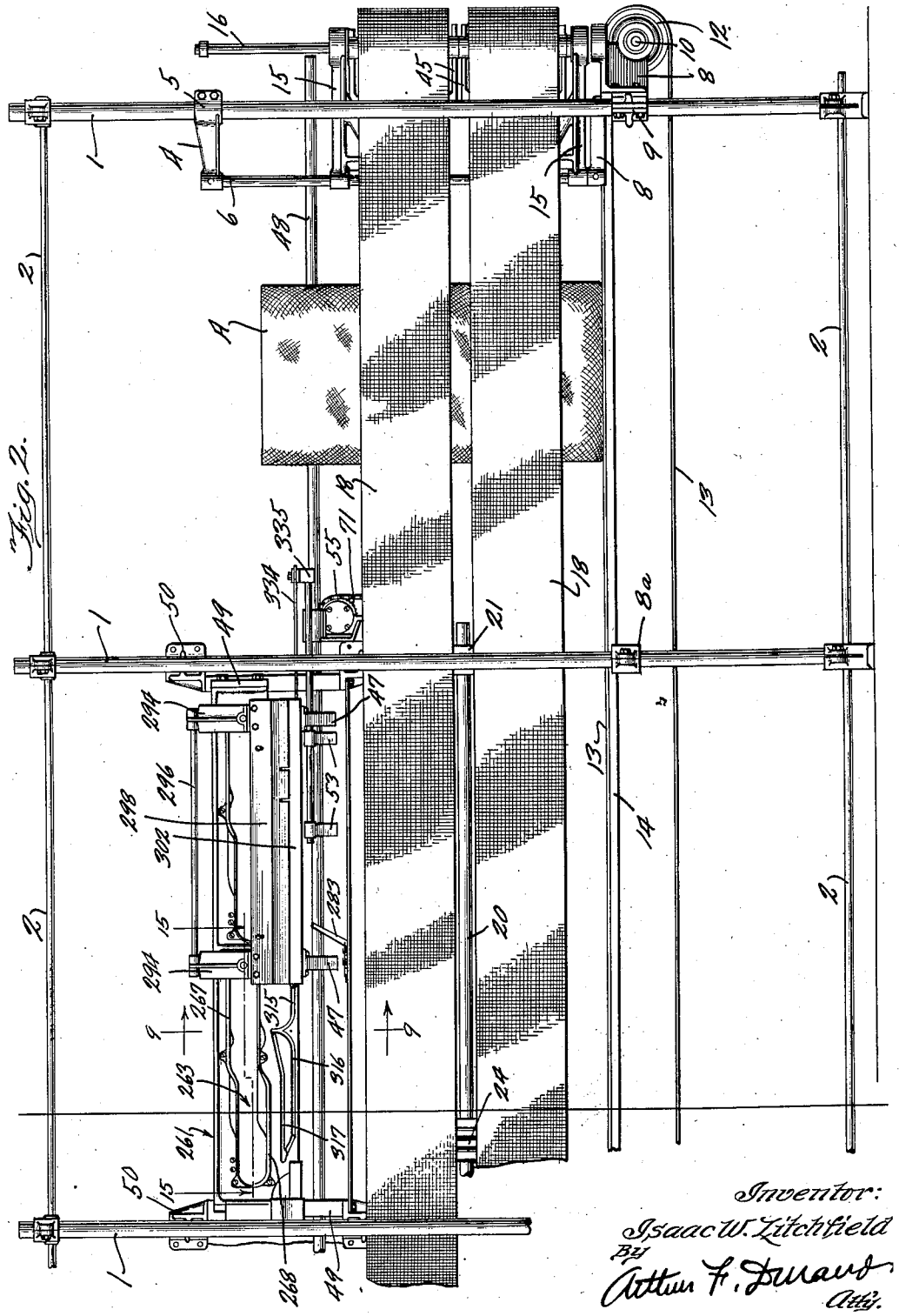


Fig. 2.

Inventor:
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BAG SEALING MACHINERY

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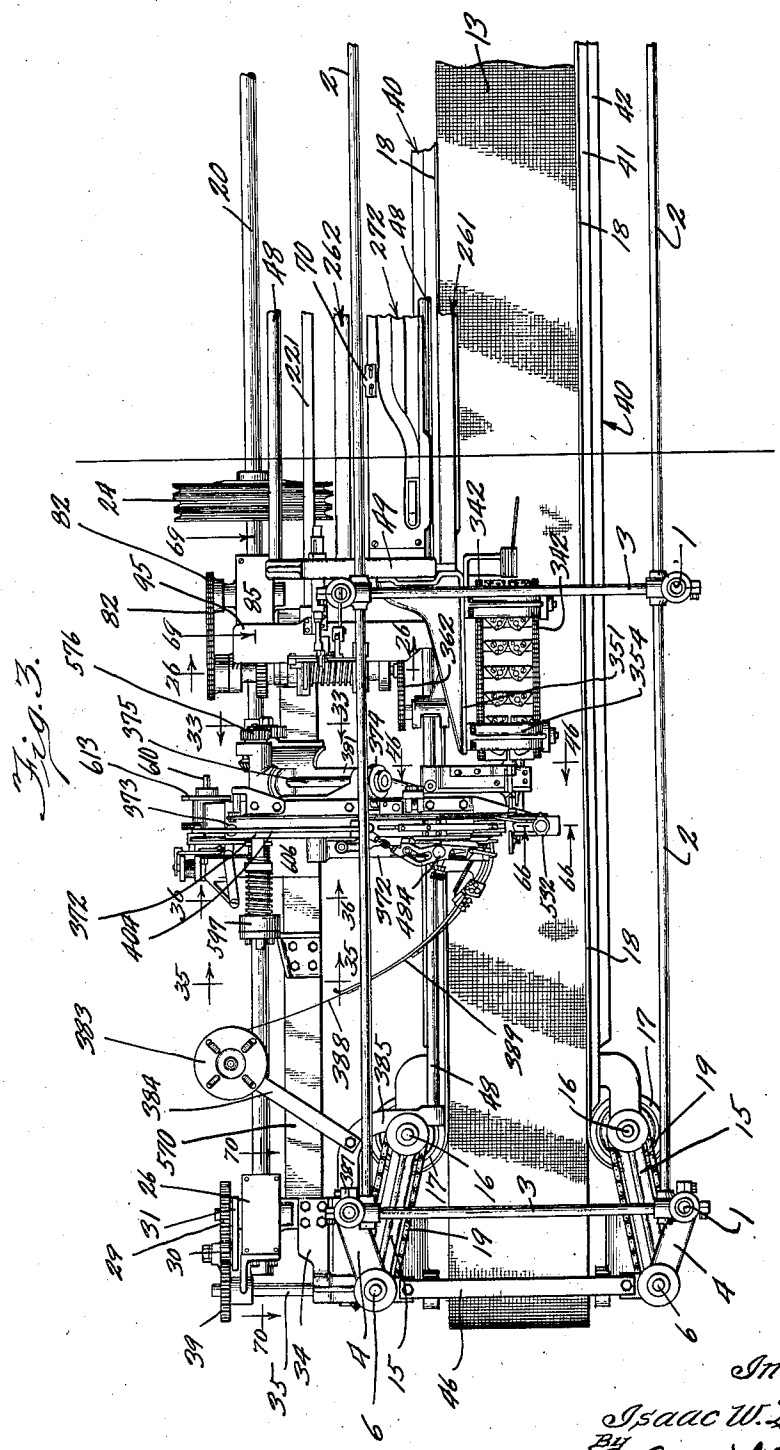


Fig. 3.

Inventor:
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BAG SEALING MACHINERY

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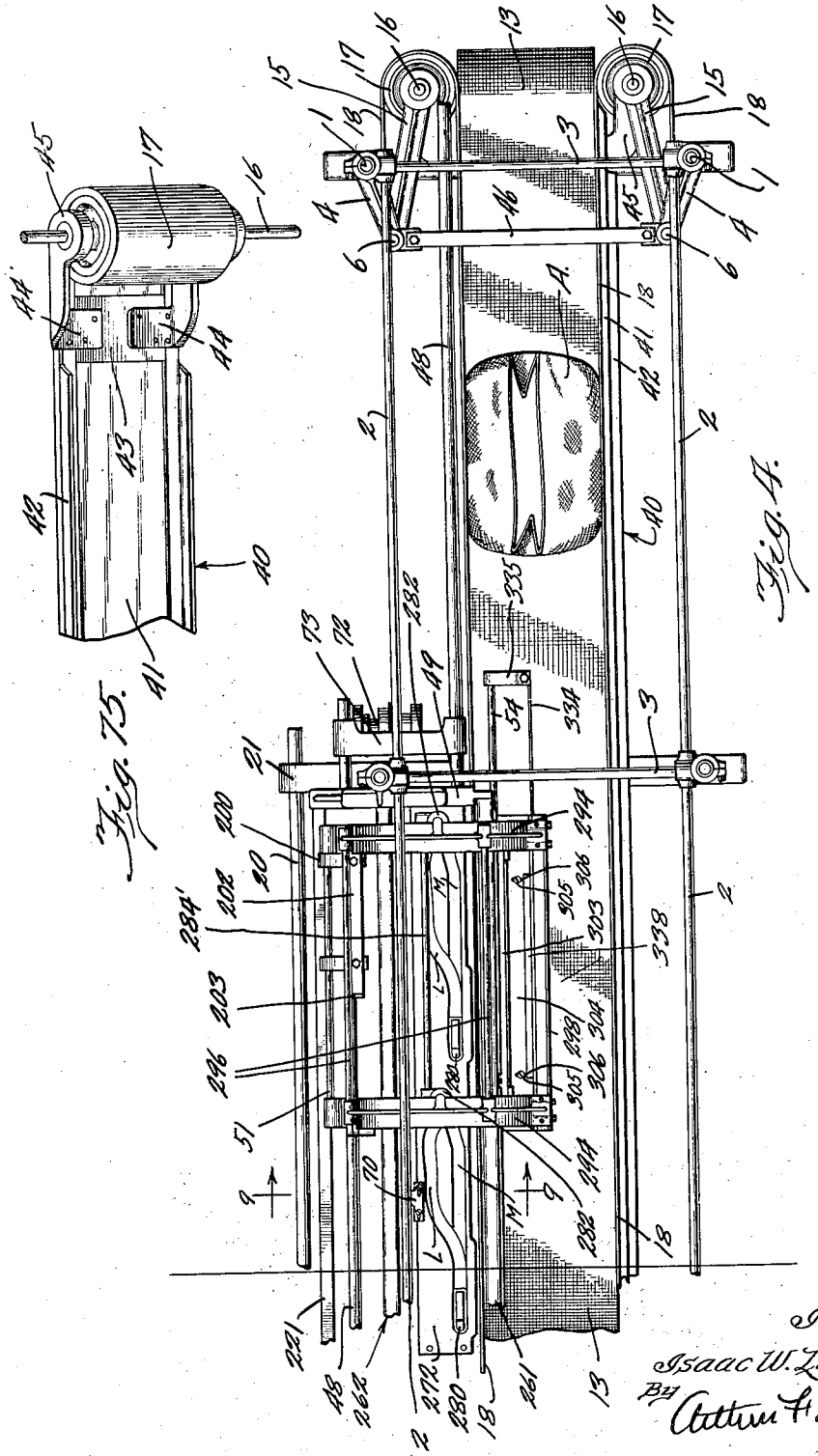


Fig. 4.

Fig. 15.

Inventor:
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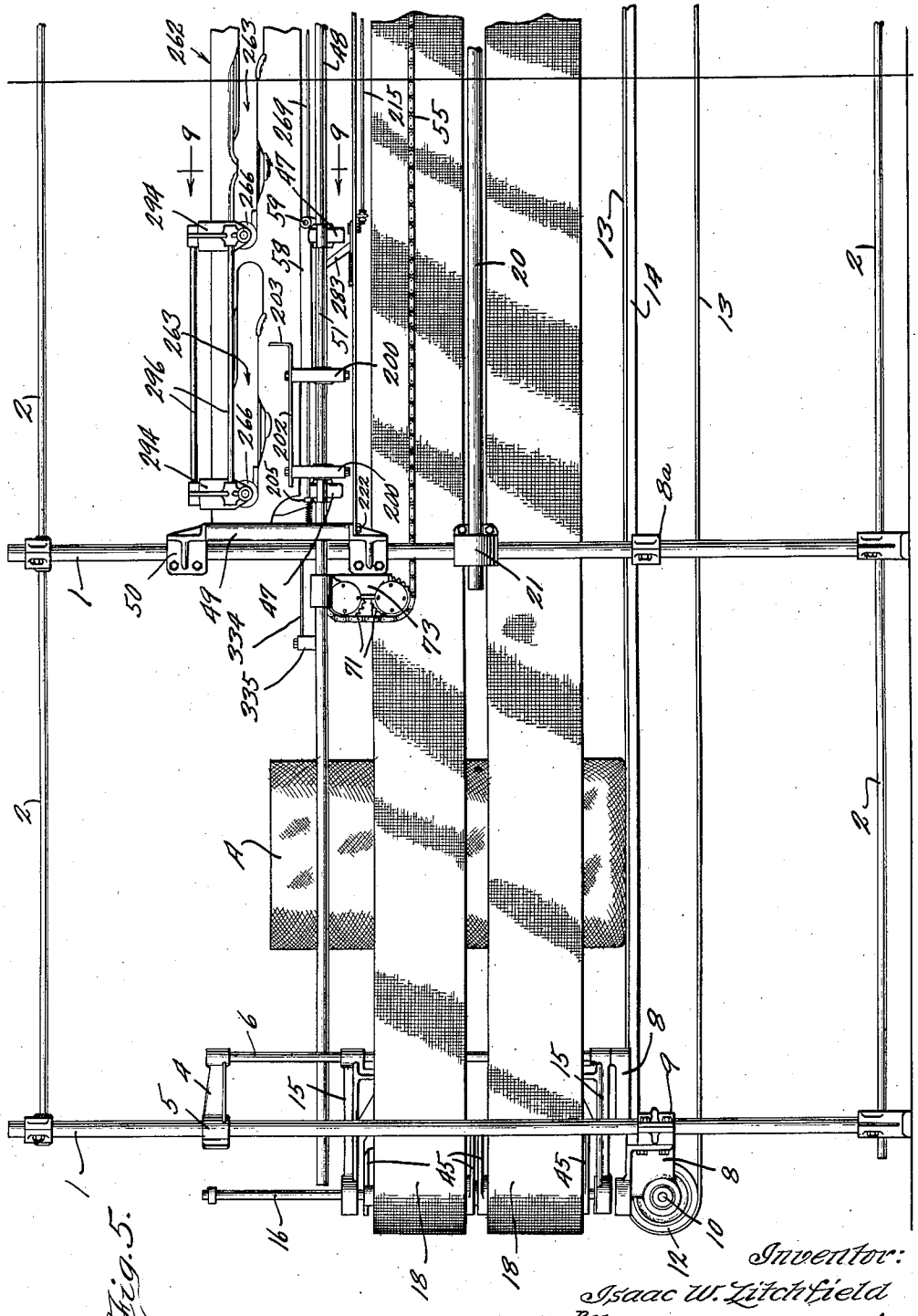


Fig. 5.

Inventor:
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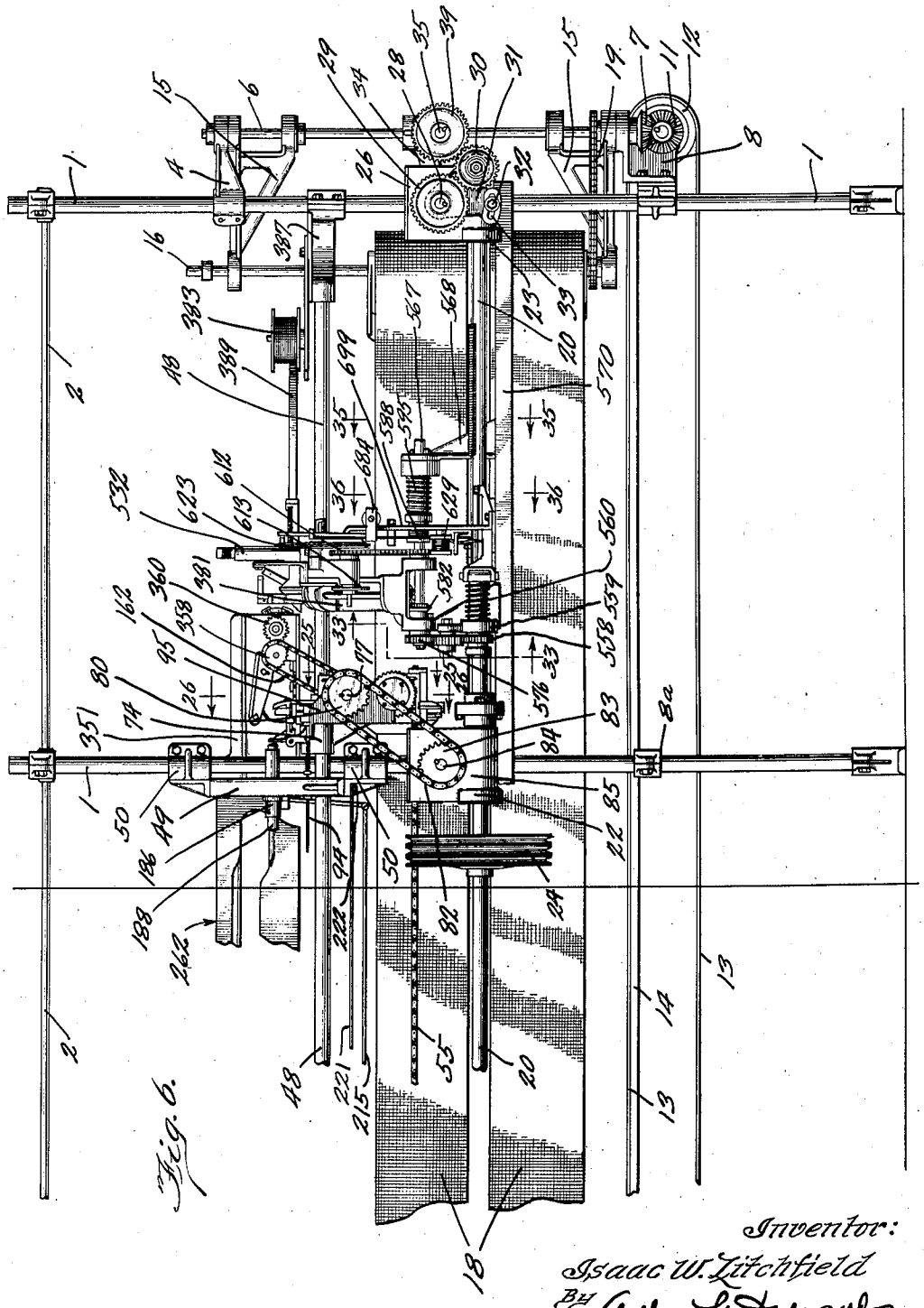


Fig. 6.

Inventor:
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BAG SEALING MACHINERY

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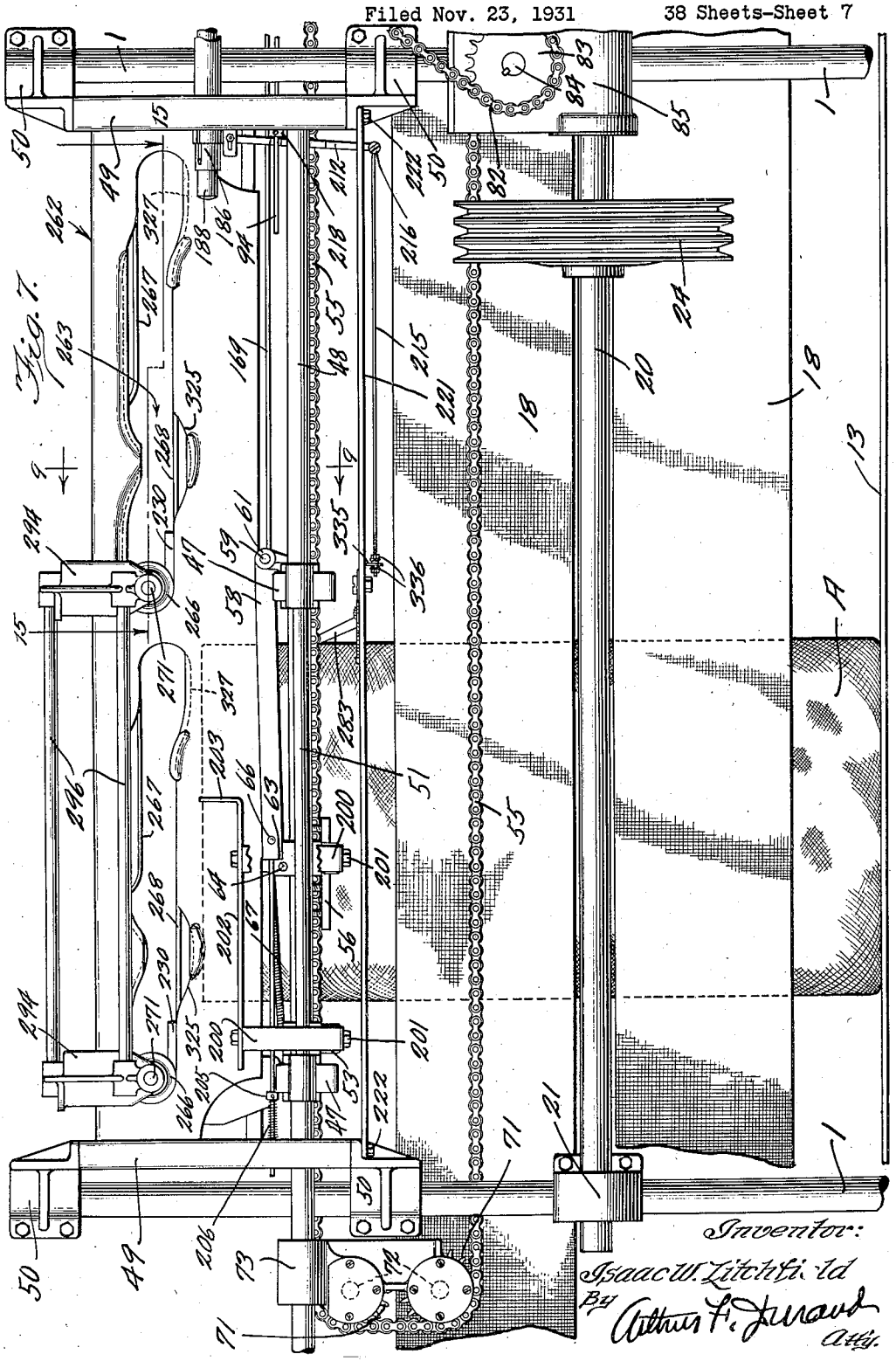


Fig. 7.

Inventor:
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BAG SEALING MACHINERY

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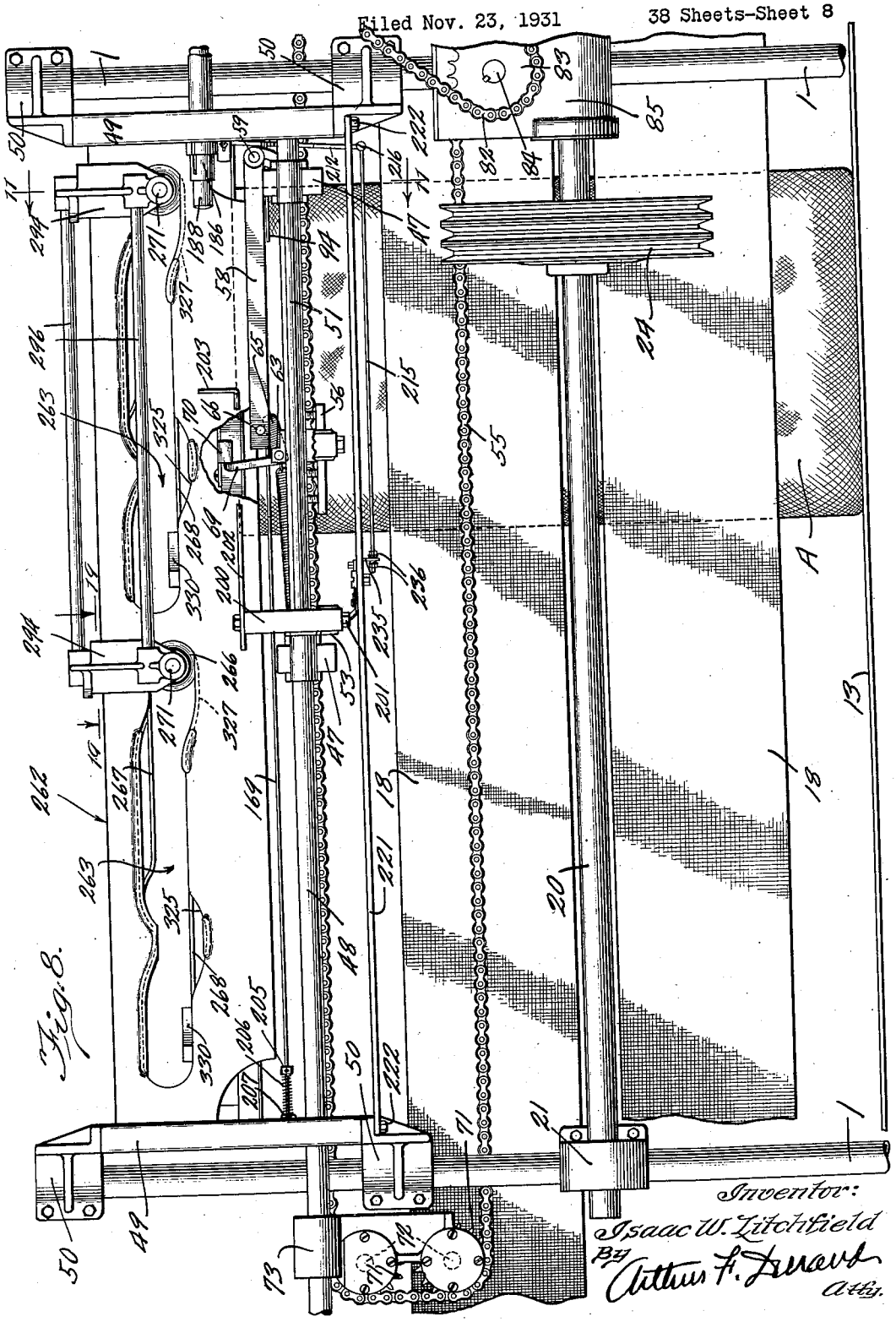


Fig. 8.

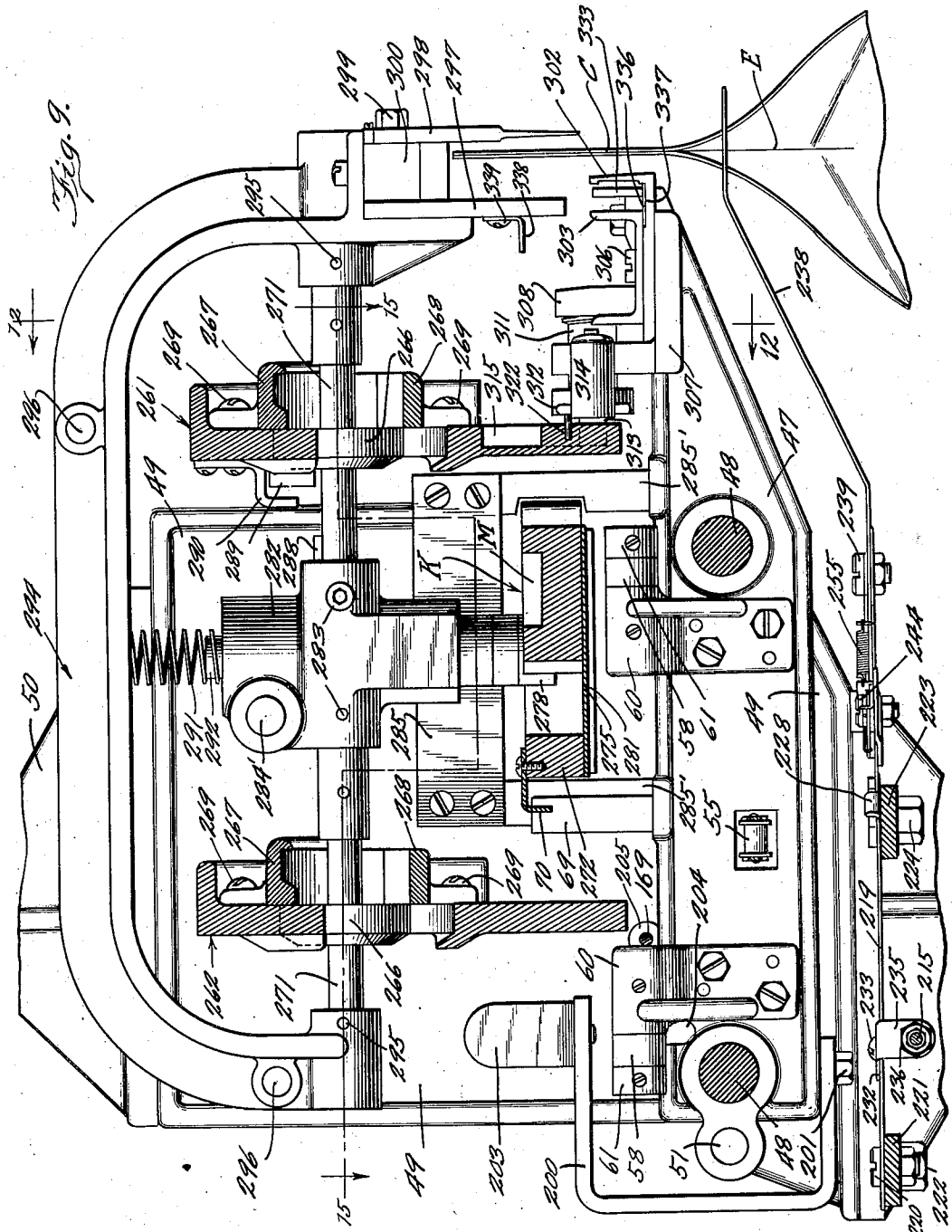
Inventor:
Isaac W. Litchfield
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BAG SEALING MACHINERY

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Fig. 9.



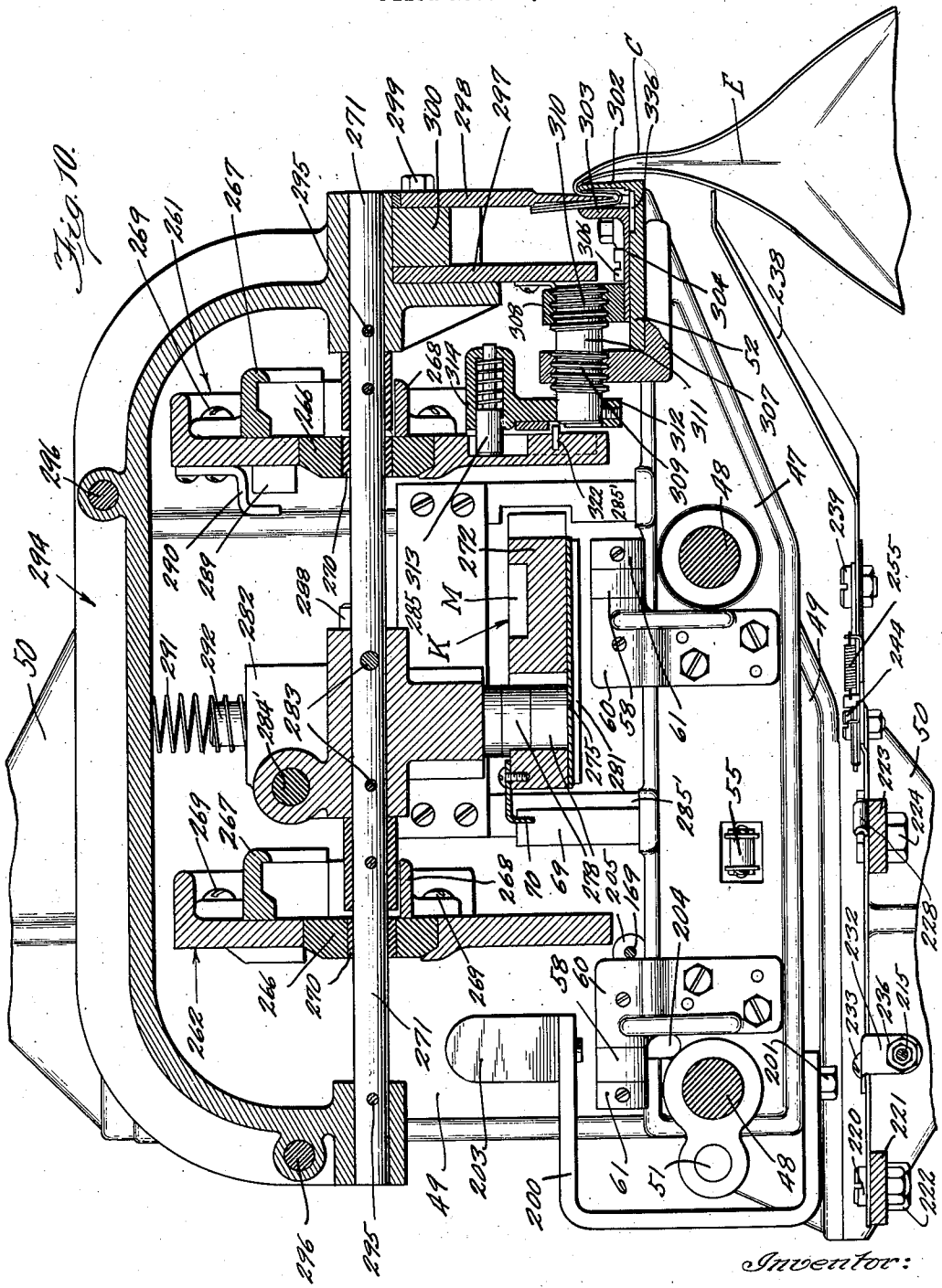
Inventor:
Isaac W. Litchfield
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Fig. 10.



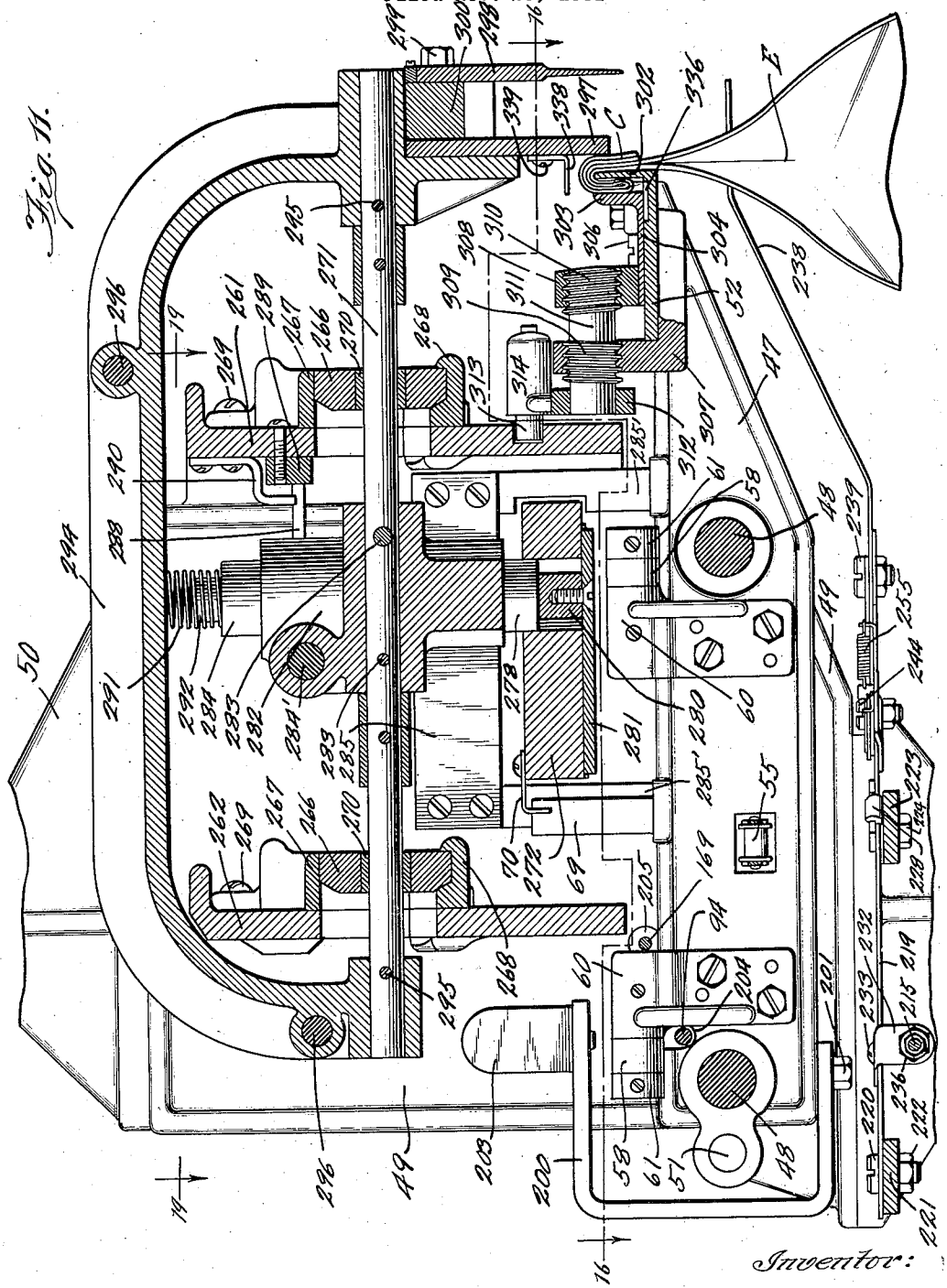
Inventor:
Isaac W. Litchfield
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BAG SEALING MACHINERY

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Fig. 11.



Inventor:
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BAG SEALING MACHINERY

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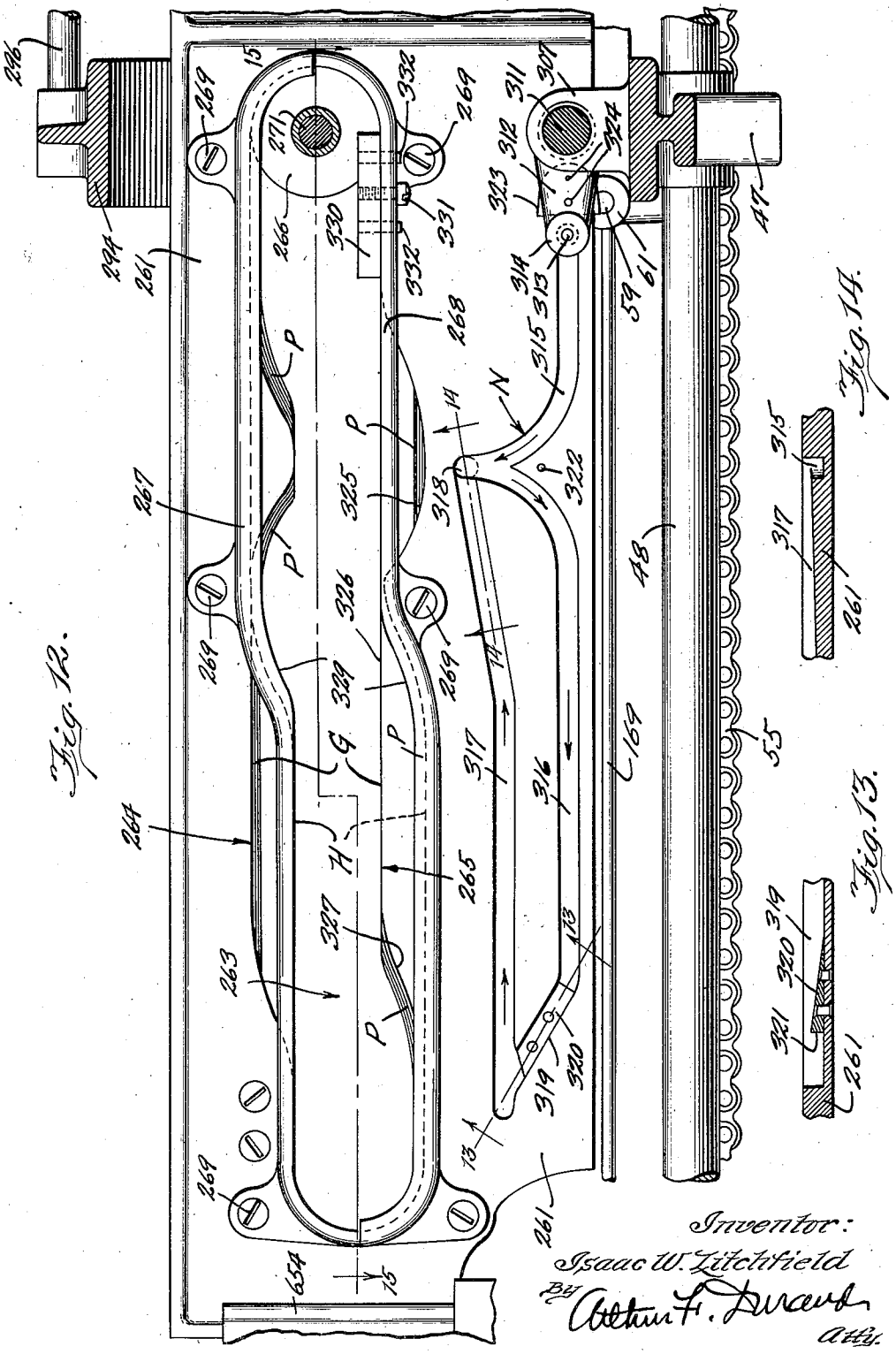


Fig. 12.

Fig. 14.

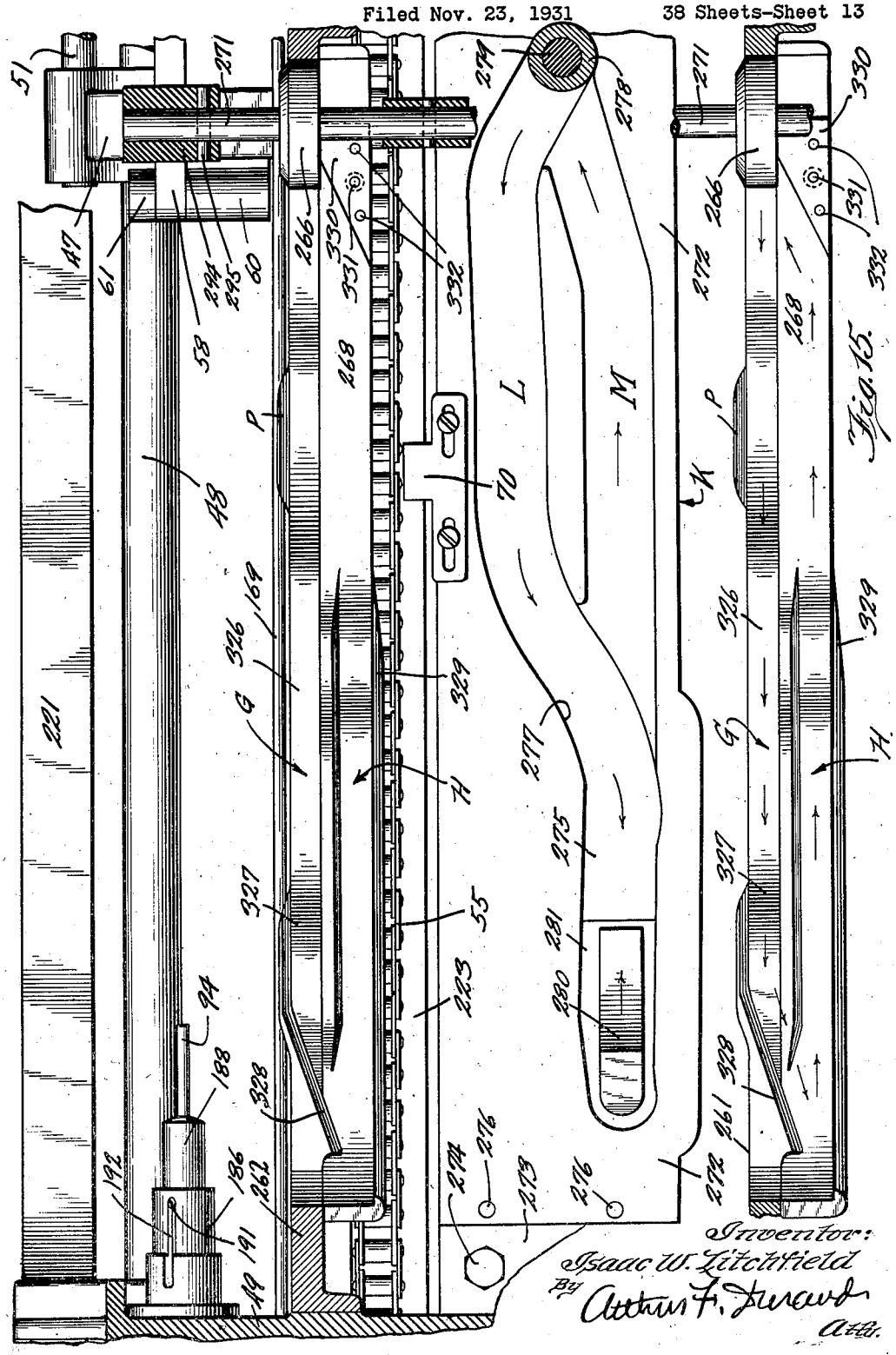
Fig. 13.

Inventor:
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Inventor:
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BAG SEALING MACHINERY

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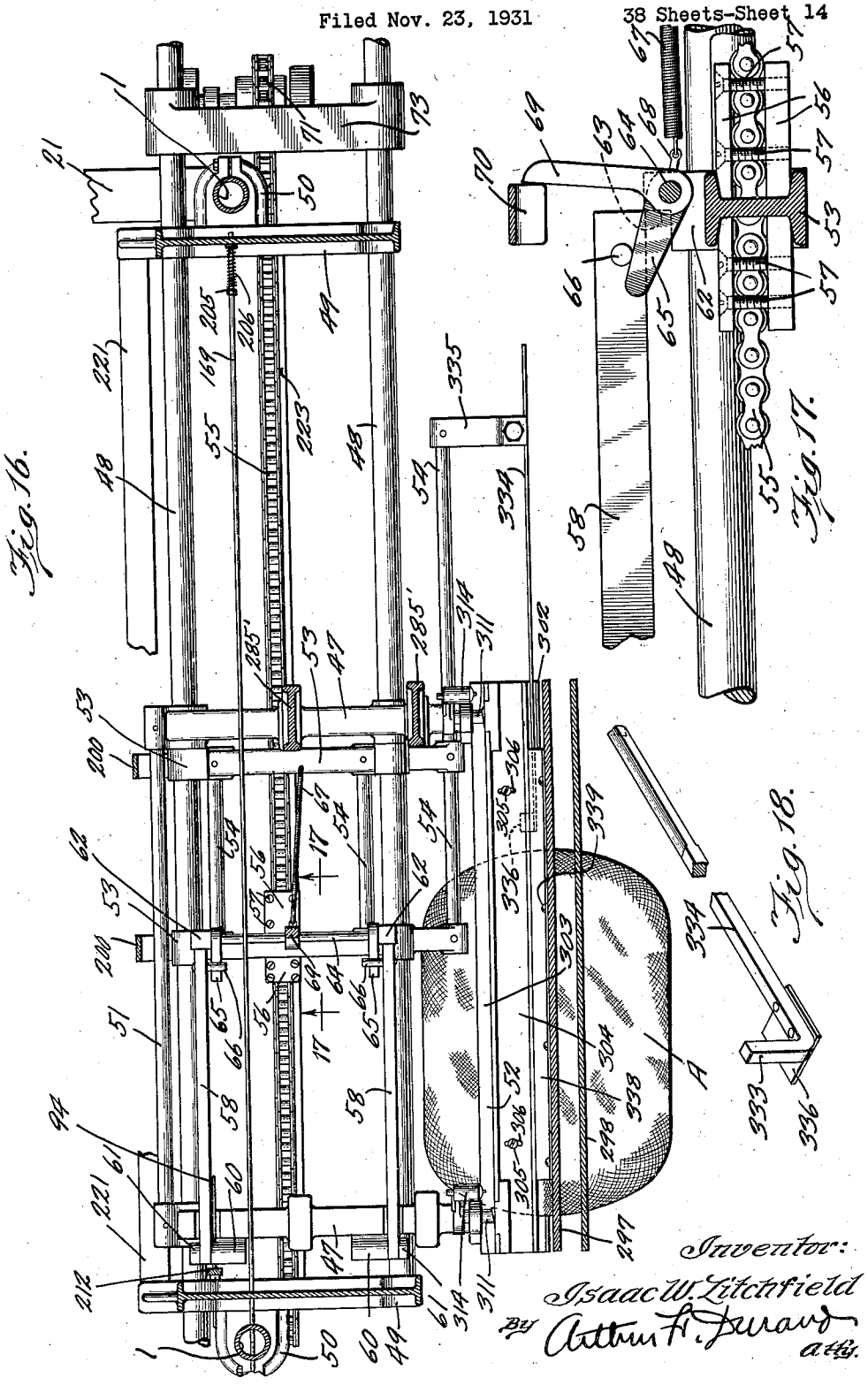


Fig. 16.

Fig. 17.

Fig. 18.

Inventor:
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BAG SEALING MACHINERY

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Fig. 19.

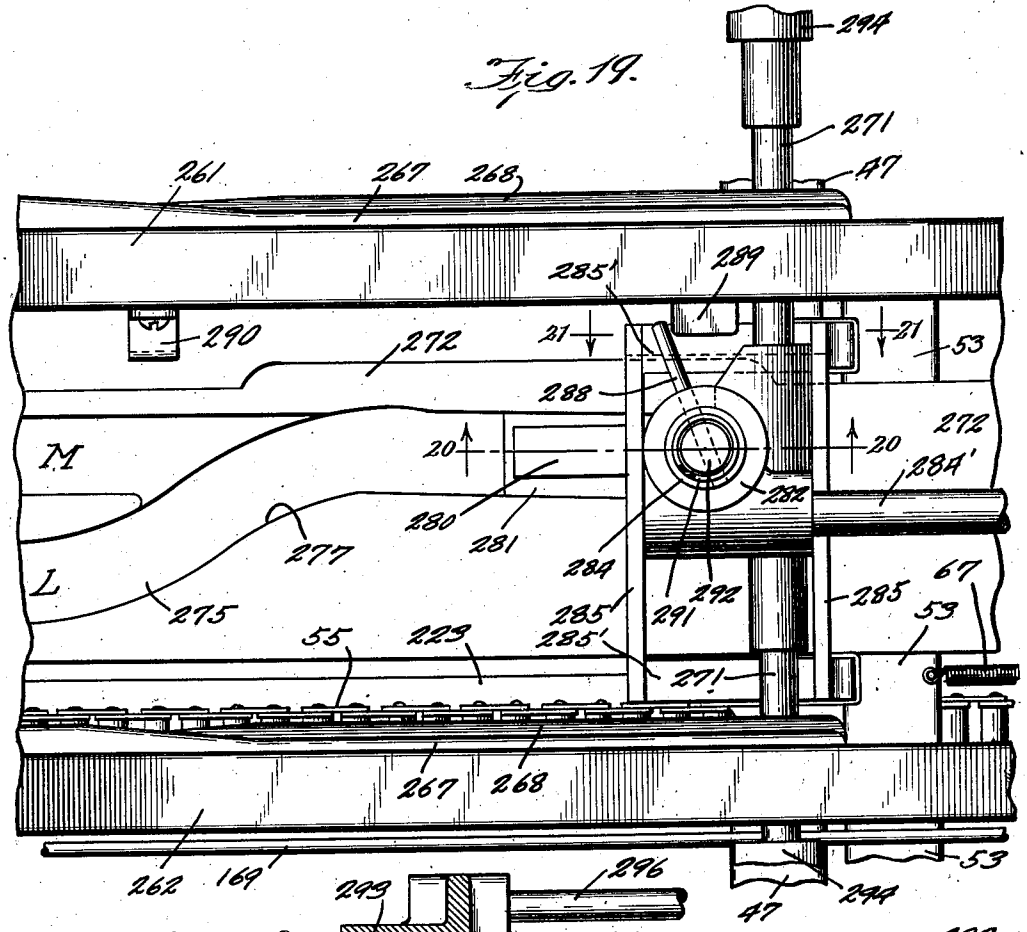
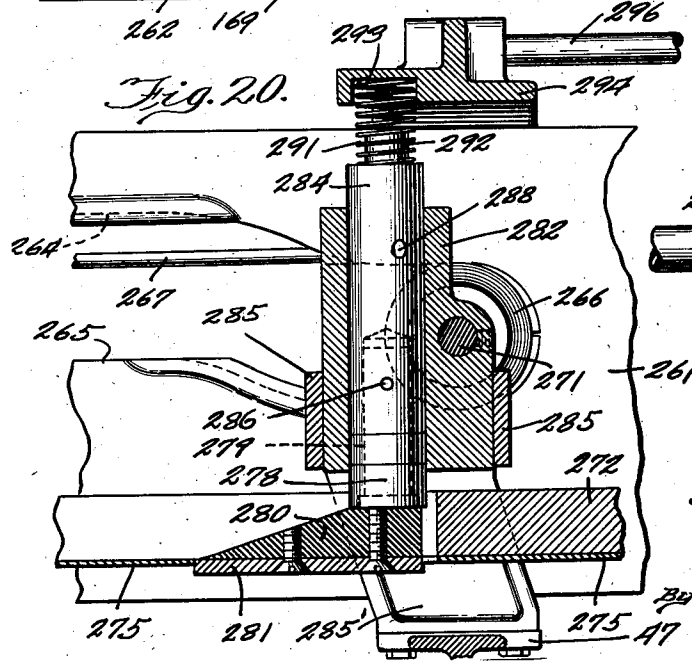


Fig. 20.



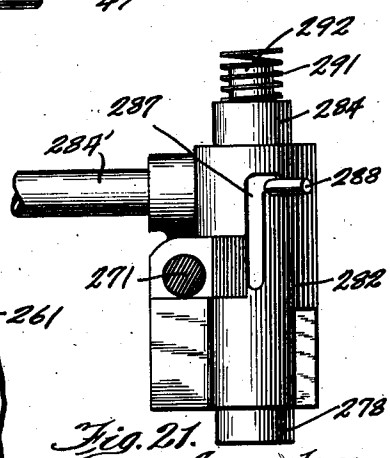


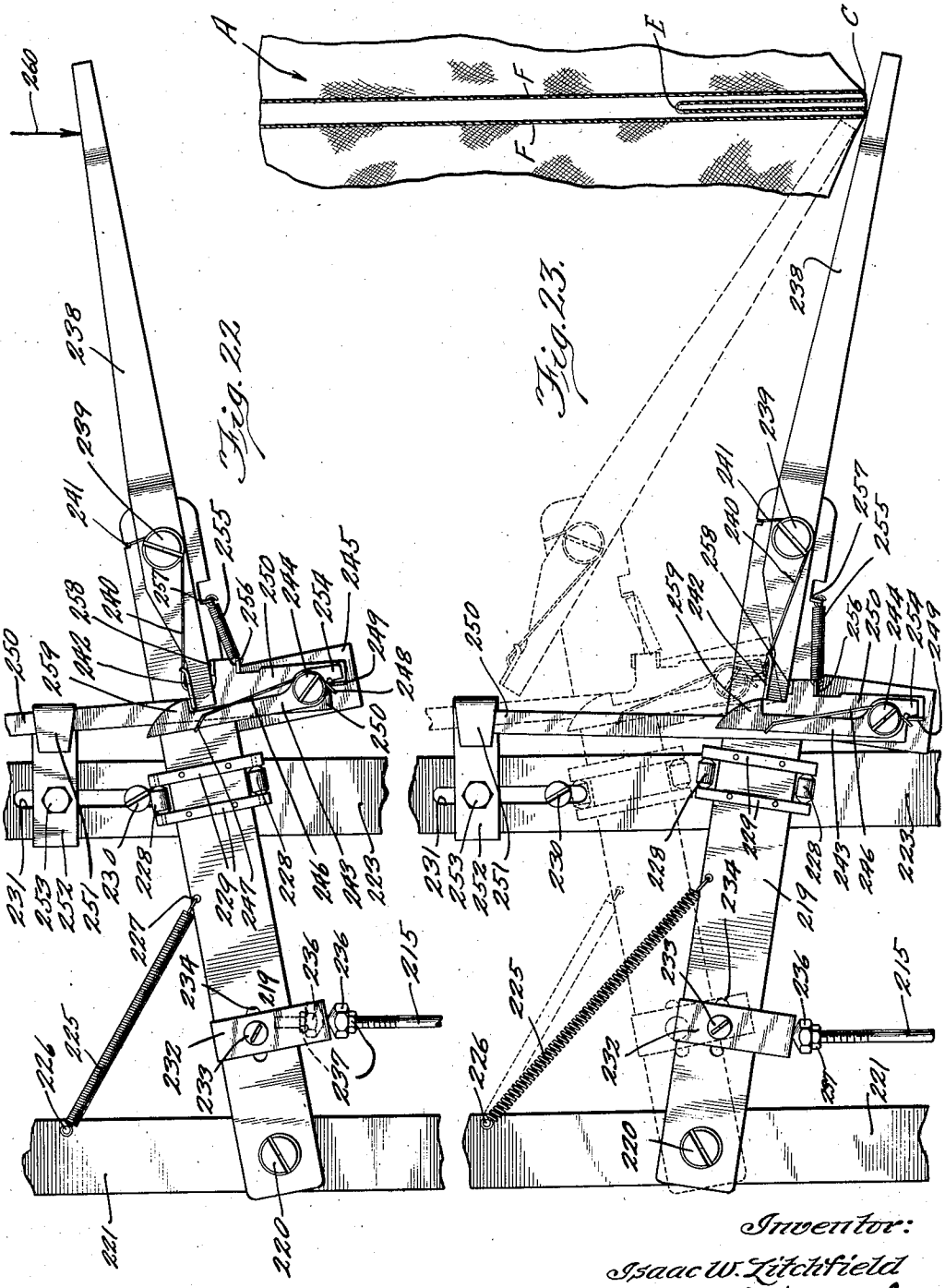
Fig. 21.

Inventor:
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BAG SEALING MACHINERY

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Inventor:
Isaac W. Litchfield
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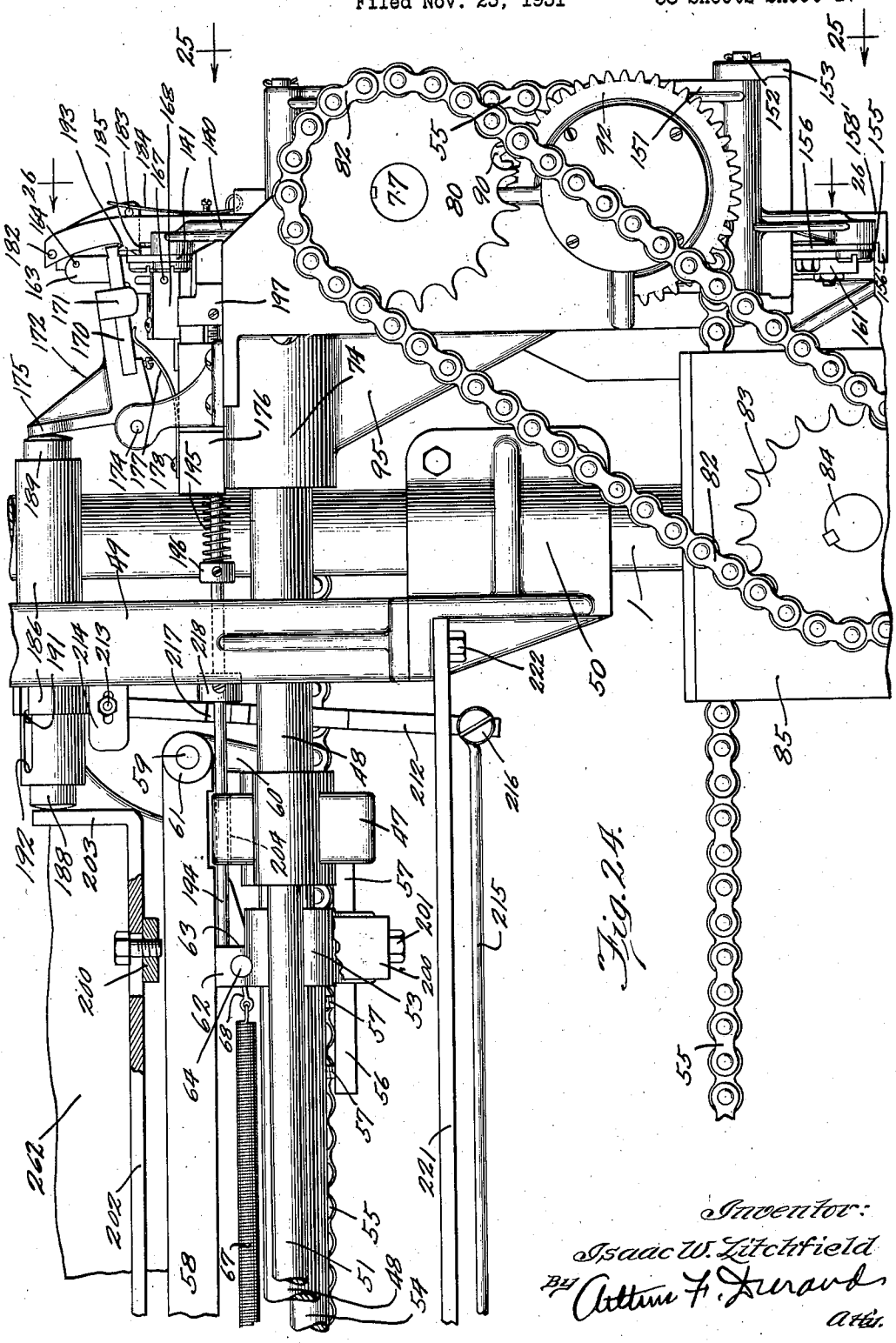


Fig. 24.

Inventor:
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BAG SEALING MACHINERY

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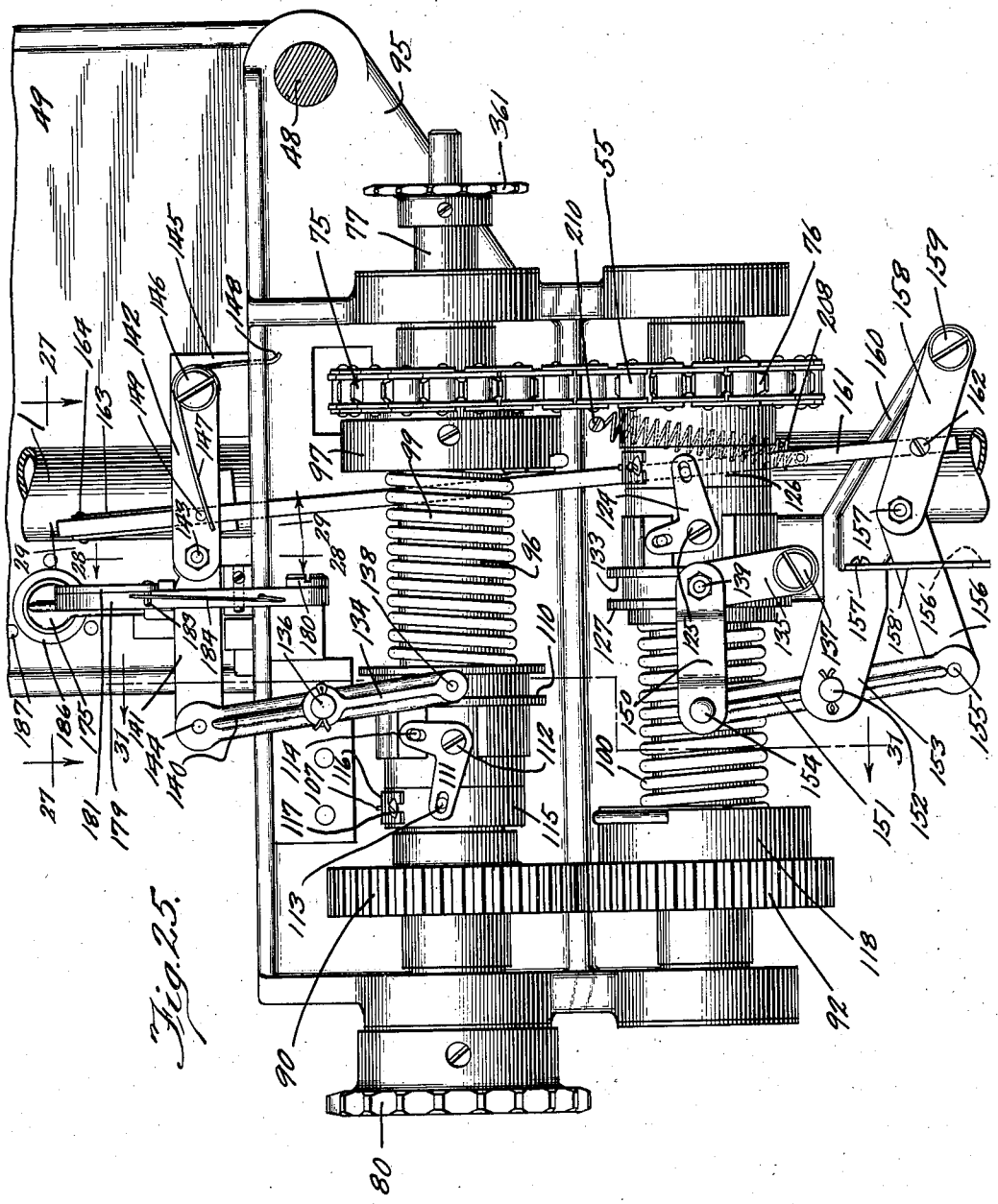


Fig. 25.

Inventor:
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BAG SEALING MACHINERY

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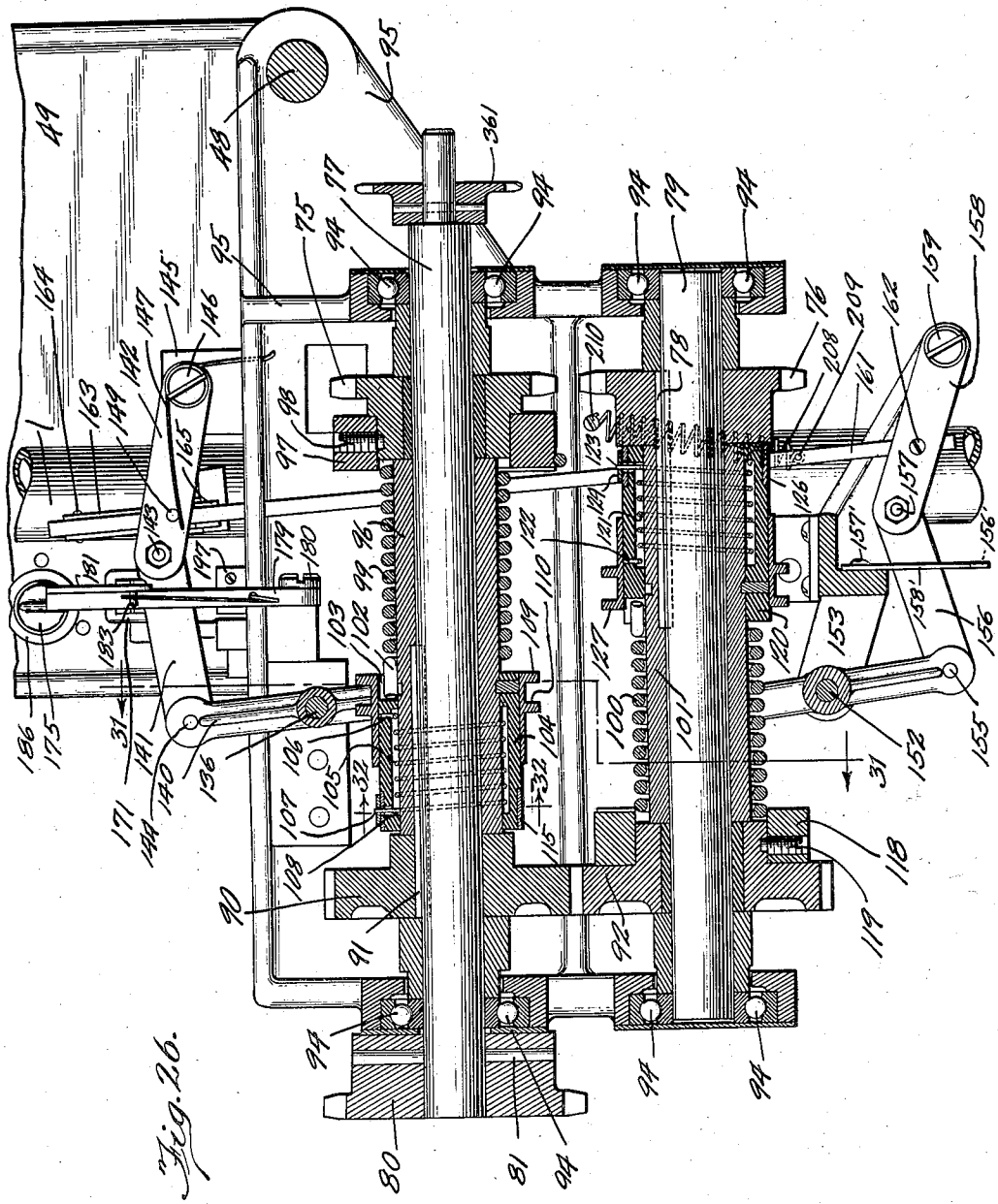


Fig. 26.

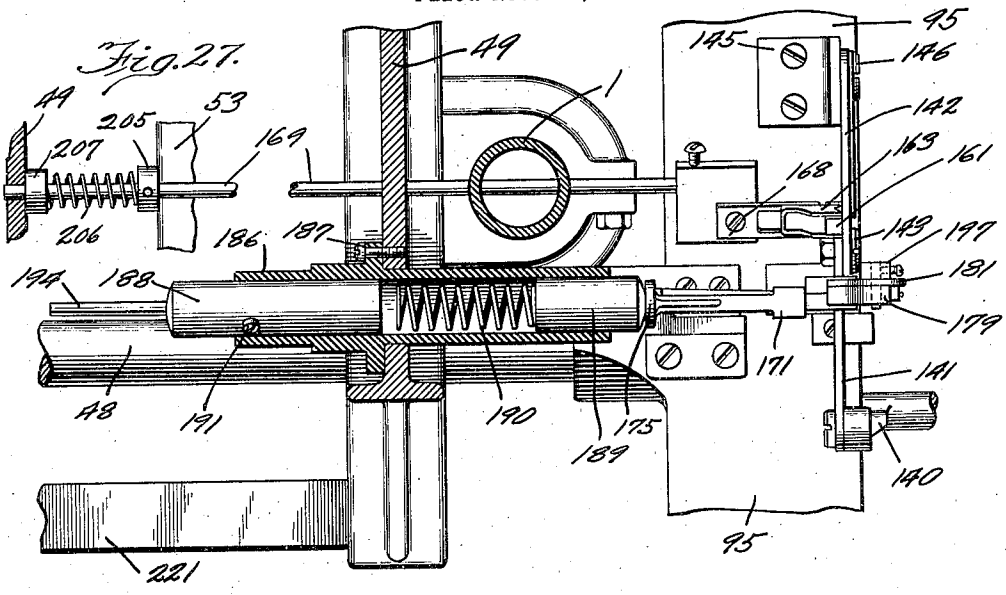
Inventor:
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BAG SEALING MACHINERY

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Fig. 27.



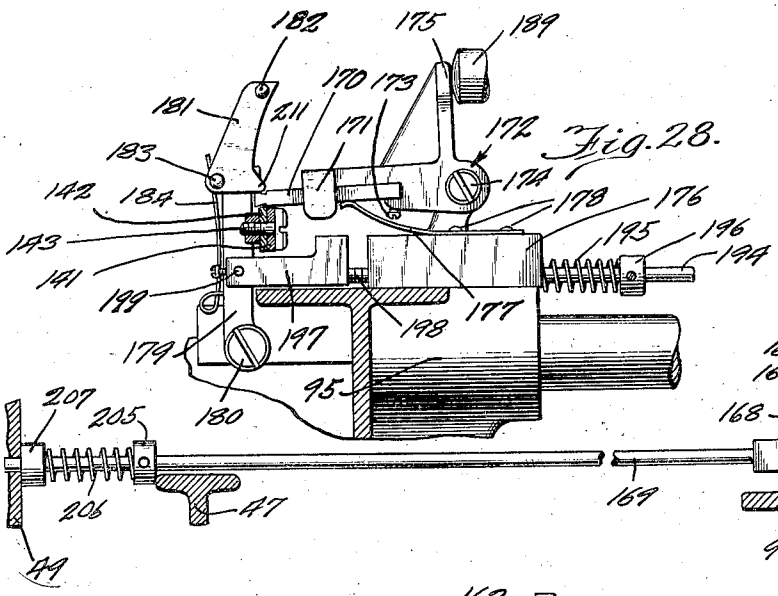


Fig. 28.

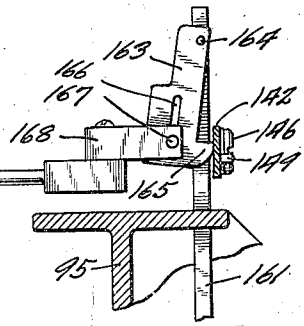
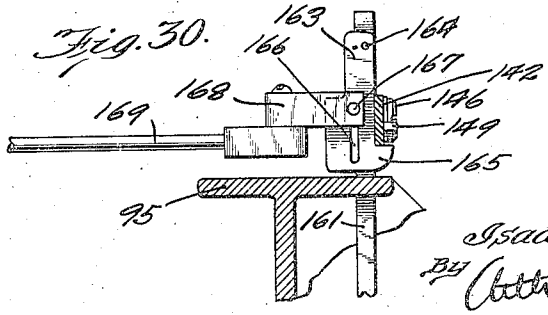


Fig. 29.

Fig. 30.



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Feb. 11, 1936. I. W. LITCHFIELD 2,030,067

BAG SEALING MACHINERY

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Fig. 31.

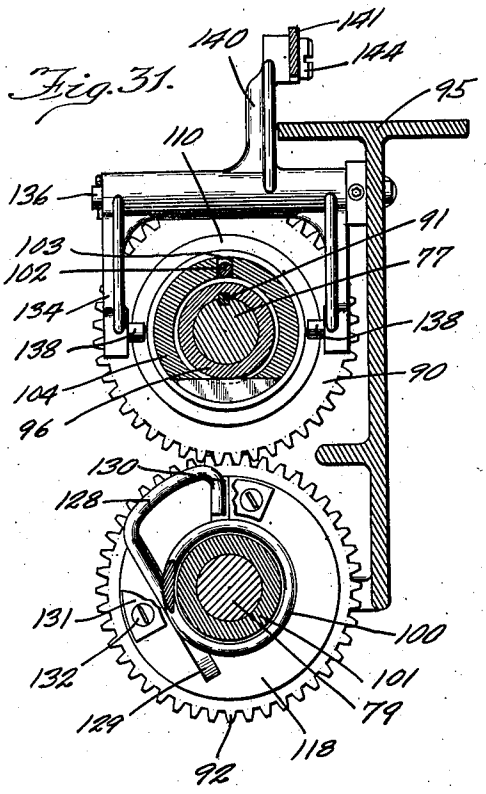


Fig. 32.

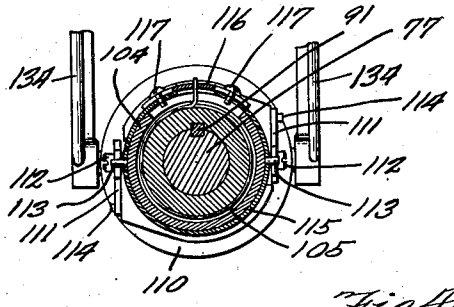
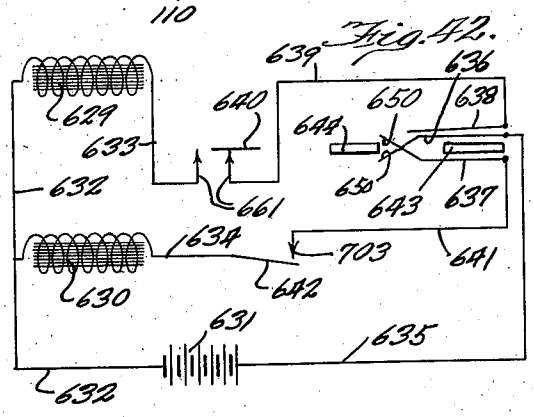


Fig. 42.



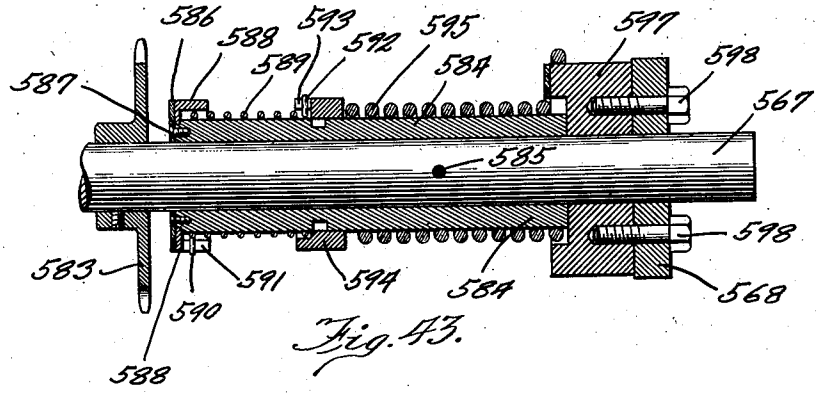


Fig. 43.

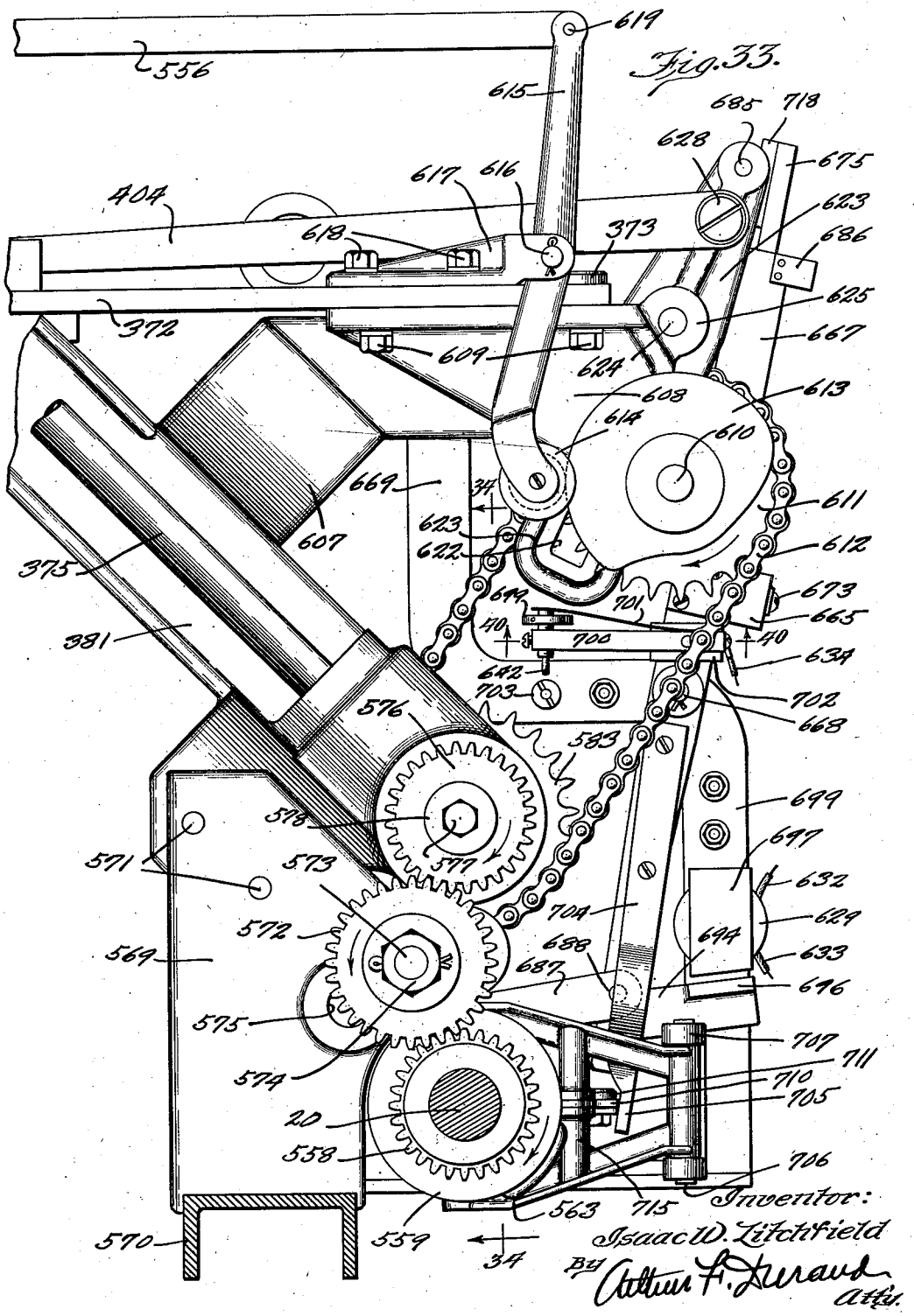
Inventor:
Isaac W. Litchfield
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Feb. 11, 1936. I. W. LITCHFIELD 2,030,067

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Fig. 33.



Inventor:
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BAG SEALING MACHINERY

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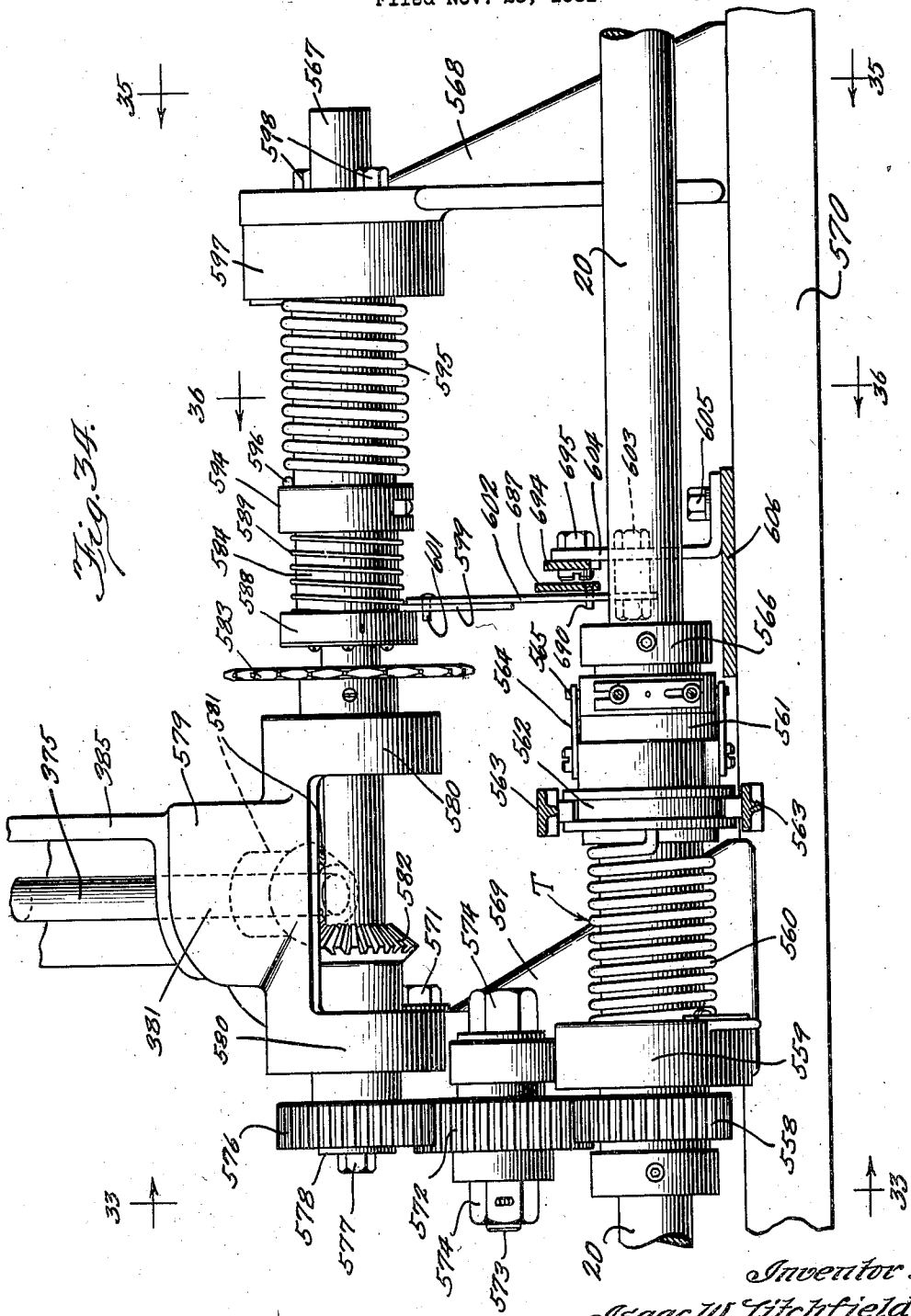


Fig. 34.

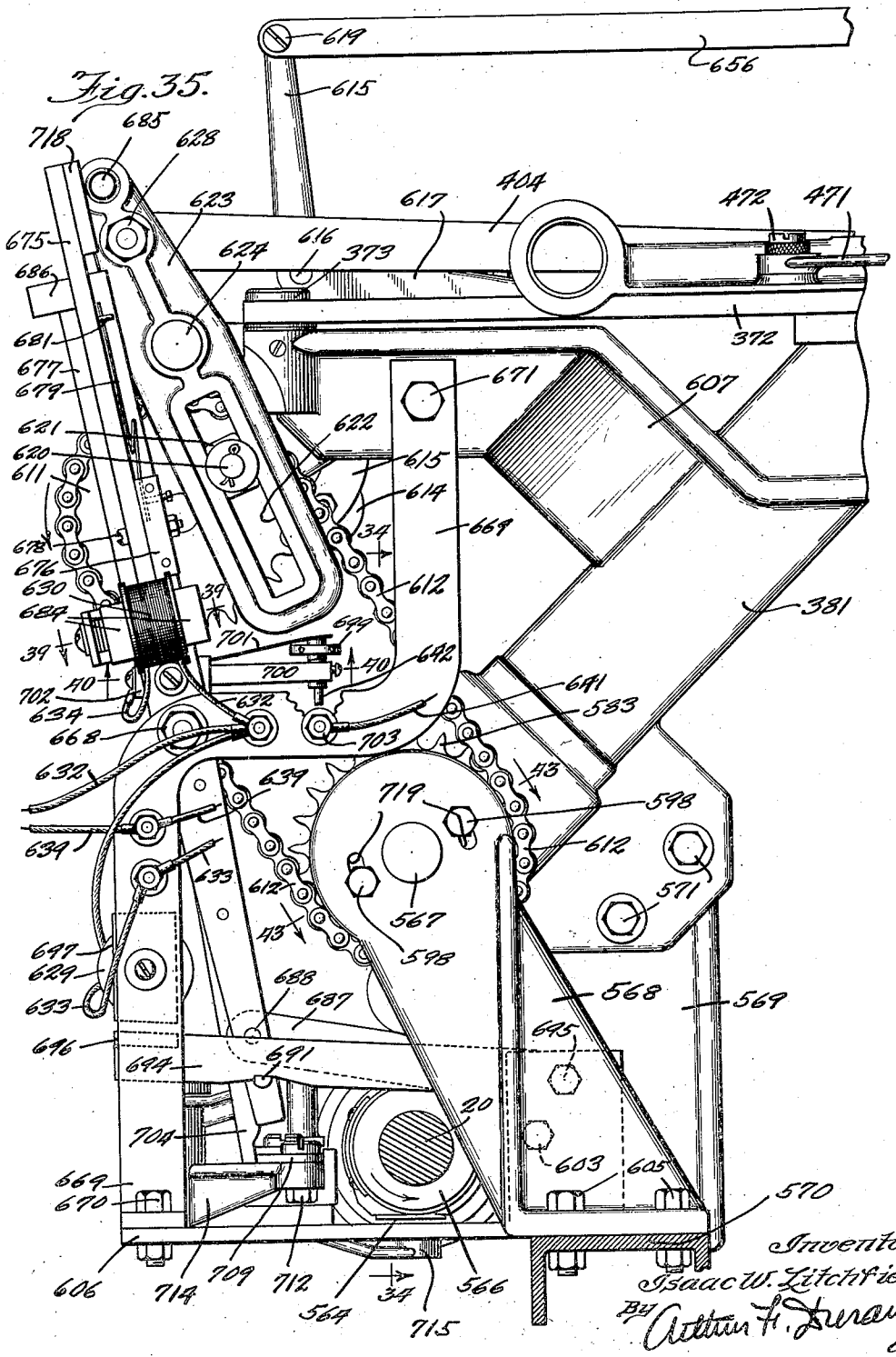
Inventor:
Isaac W. Litchfield
By Arthur H. Durand
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BAG SEALING MACHINERY

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Fig. 35.



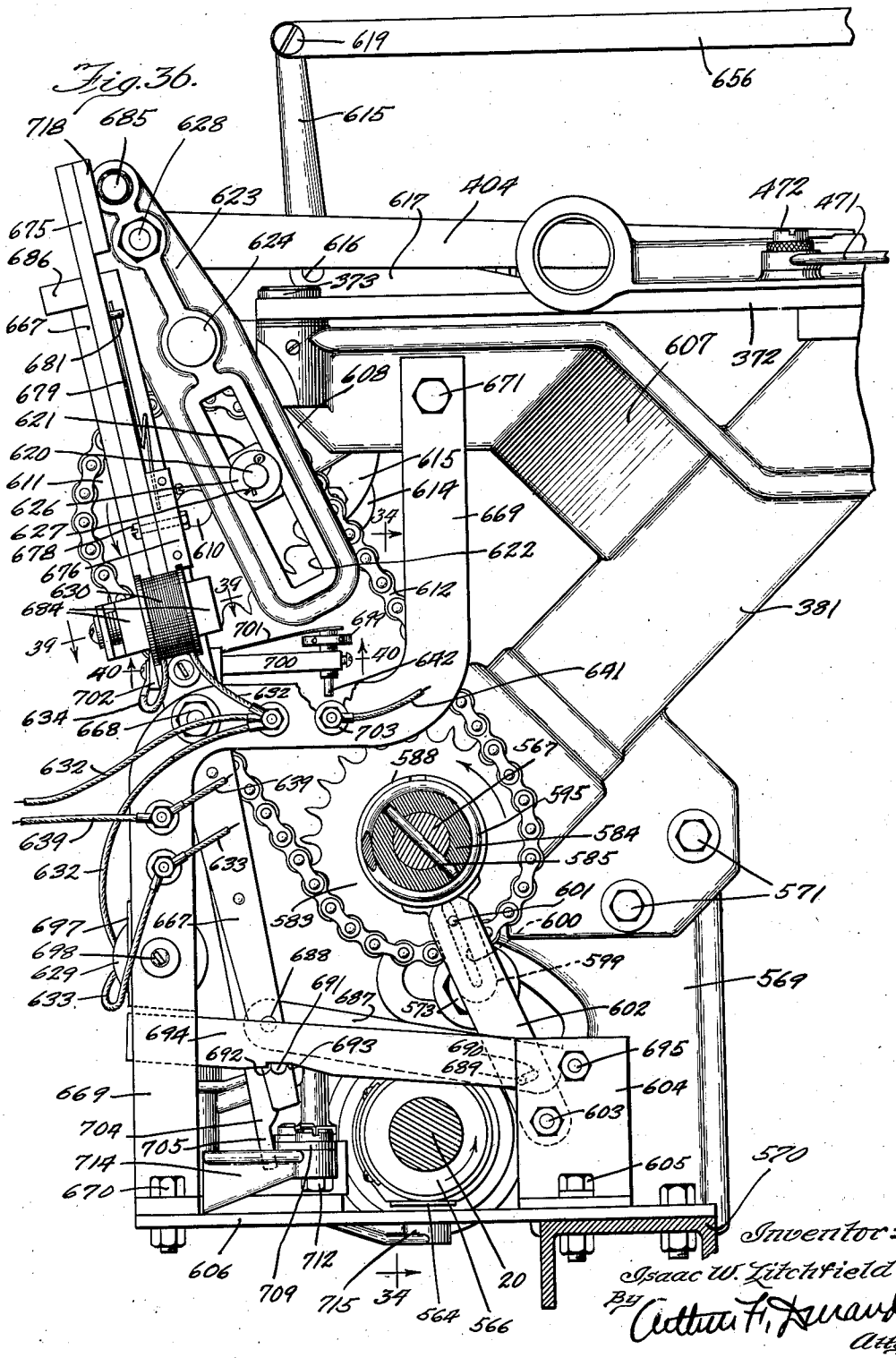
Inventor:
Isaac W. Litchfield
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Atty.

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BAG SEALING MACHINERY

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Fig. 36.



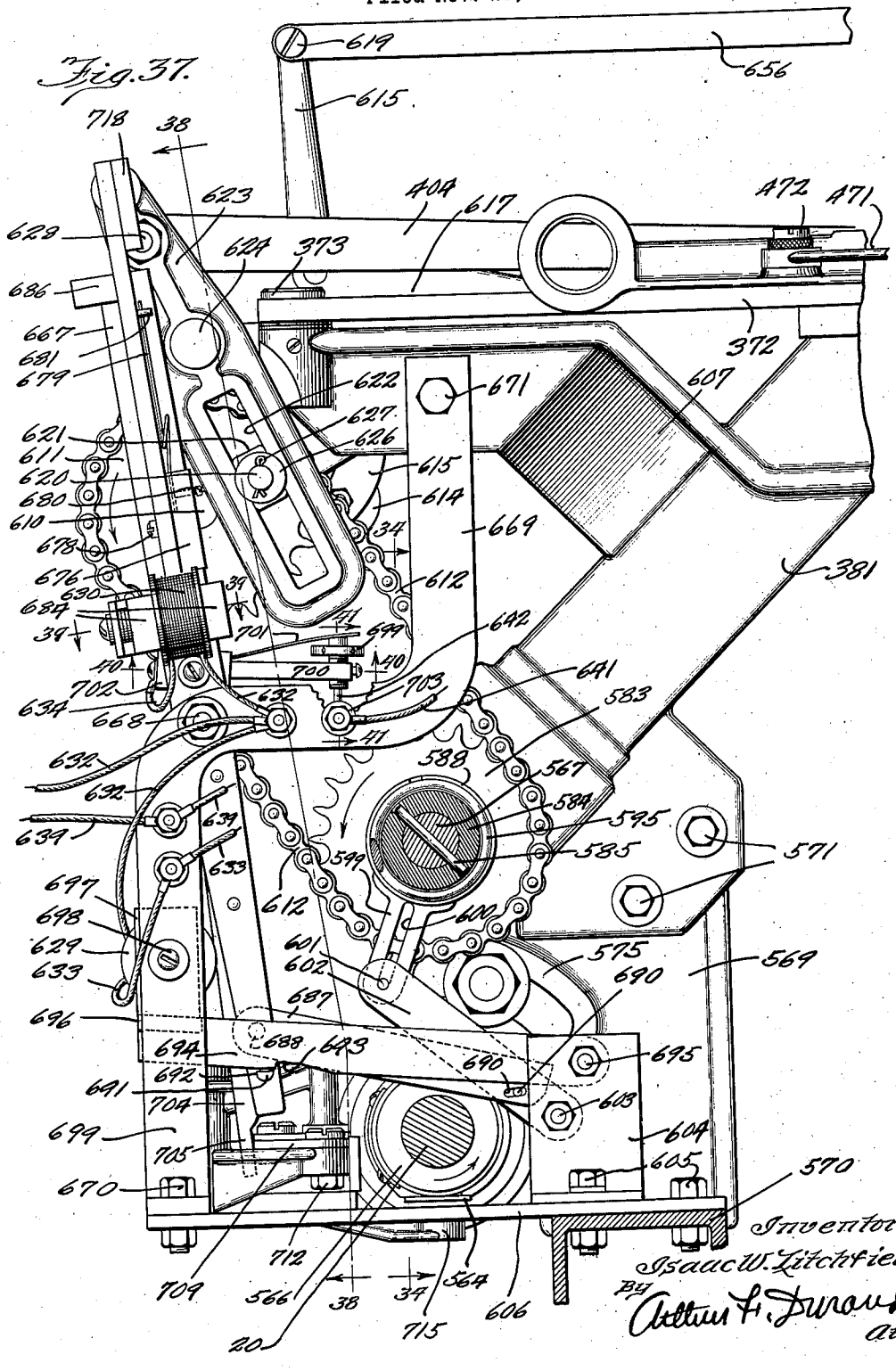
Inventor:
Isaac W. Litchfield
By Arthur F. Durand
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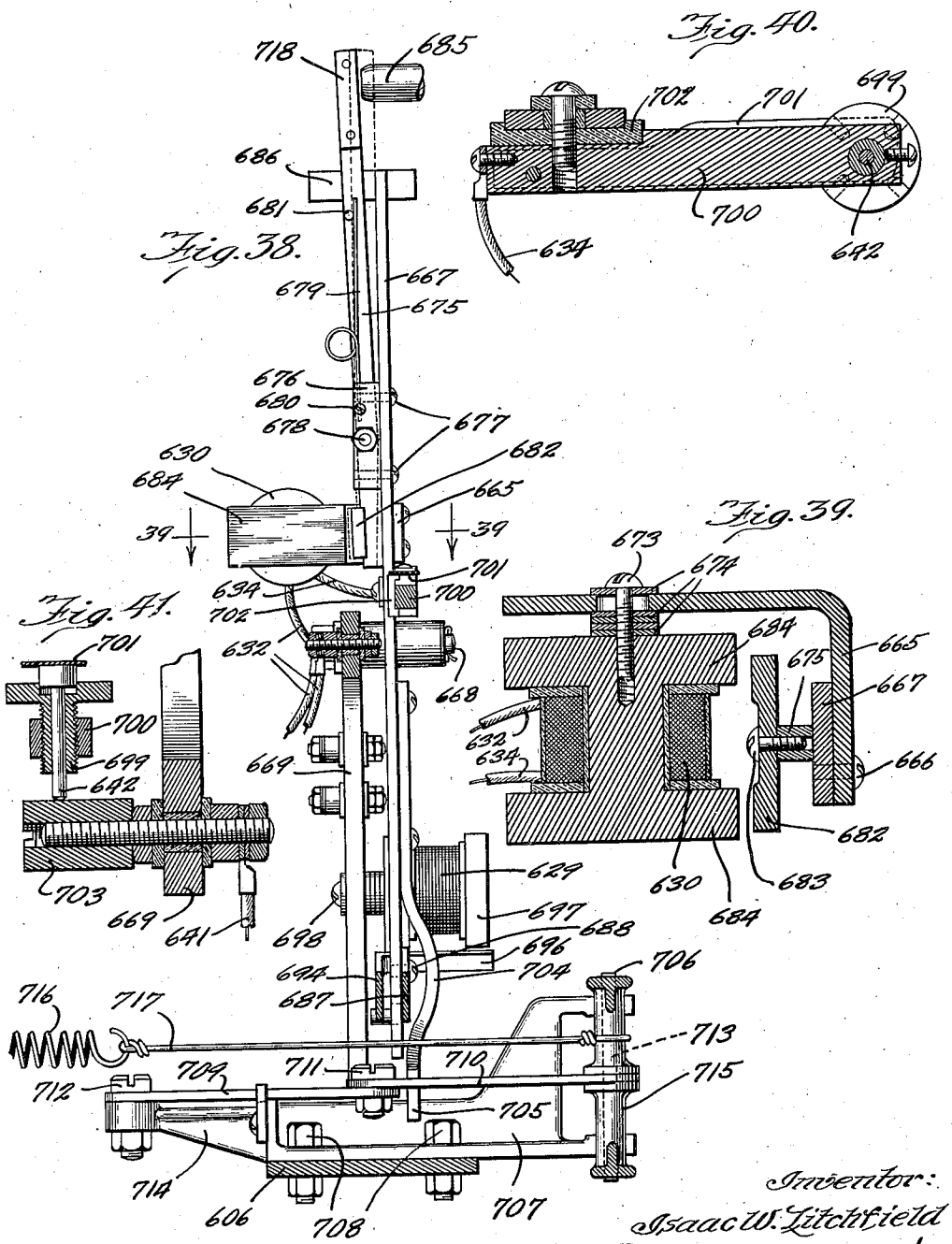
Fig. 37.



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Inventor:
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By Arthur F. Durant
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BAG SEALING MACHINERY

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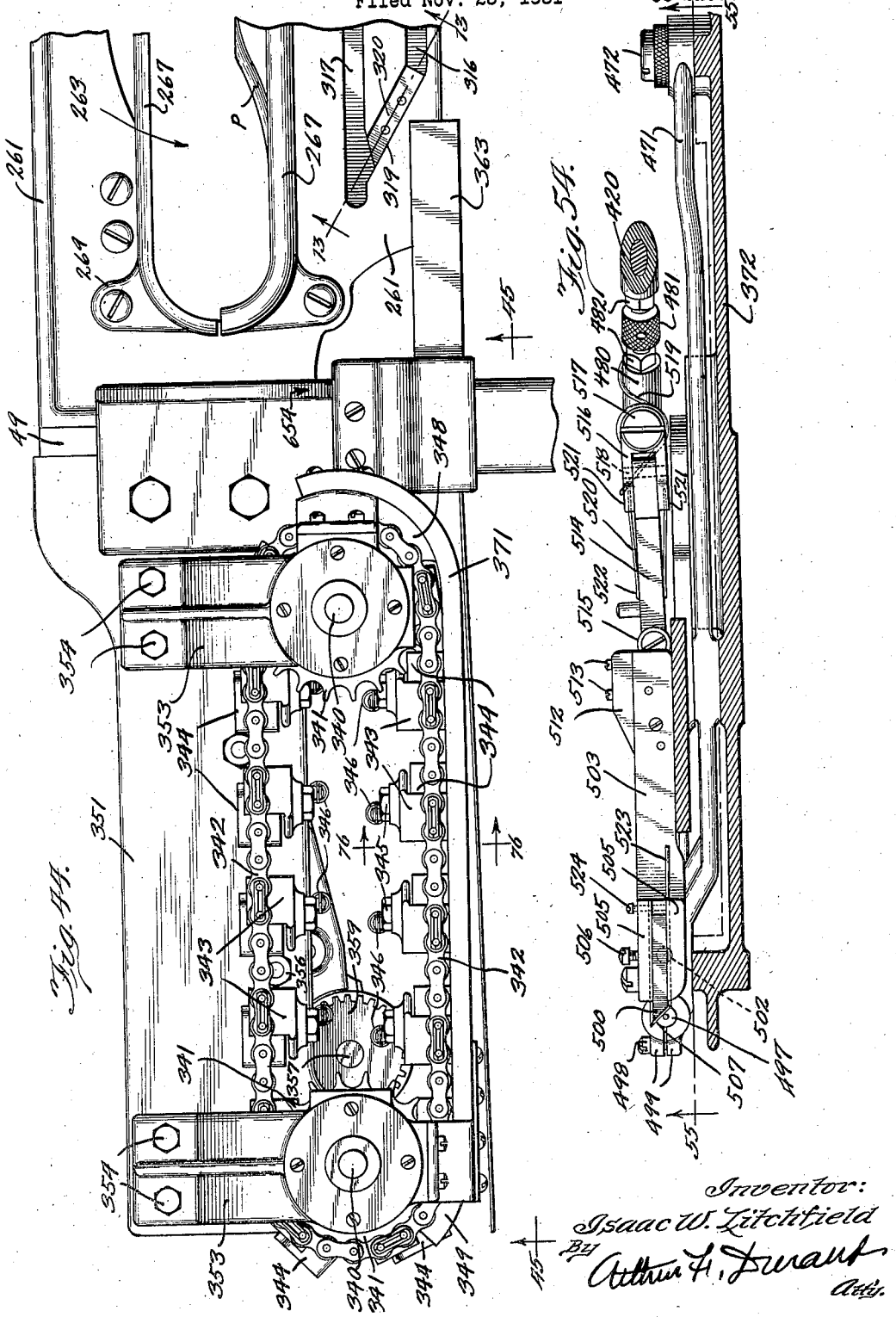


Fig. 54.

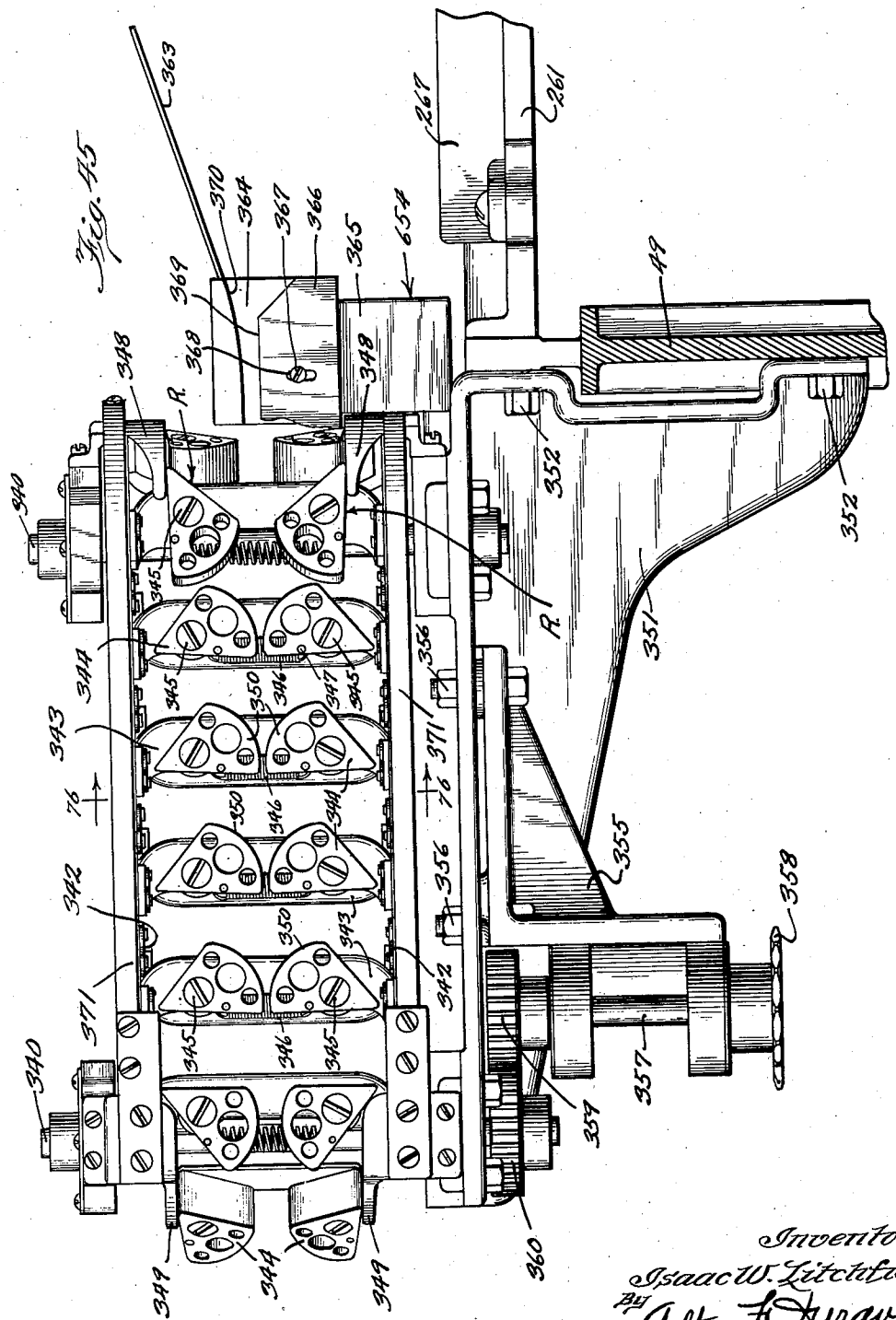
Fig. 54A.

Inventor:
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BAG SEALING MACHINERY

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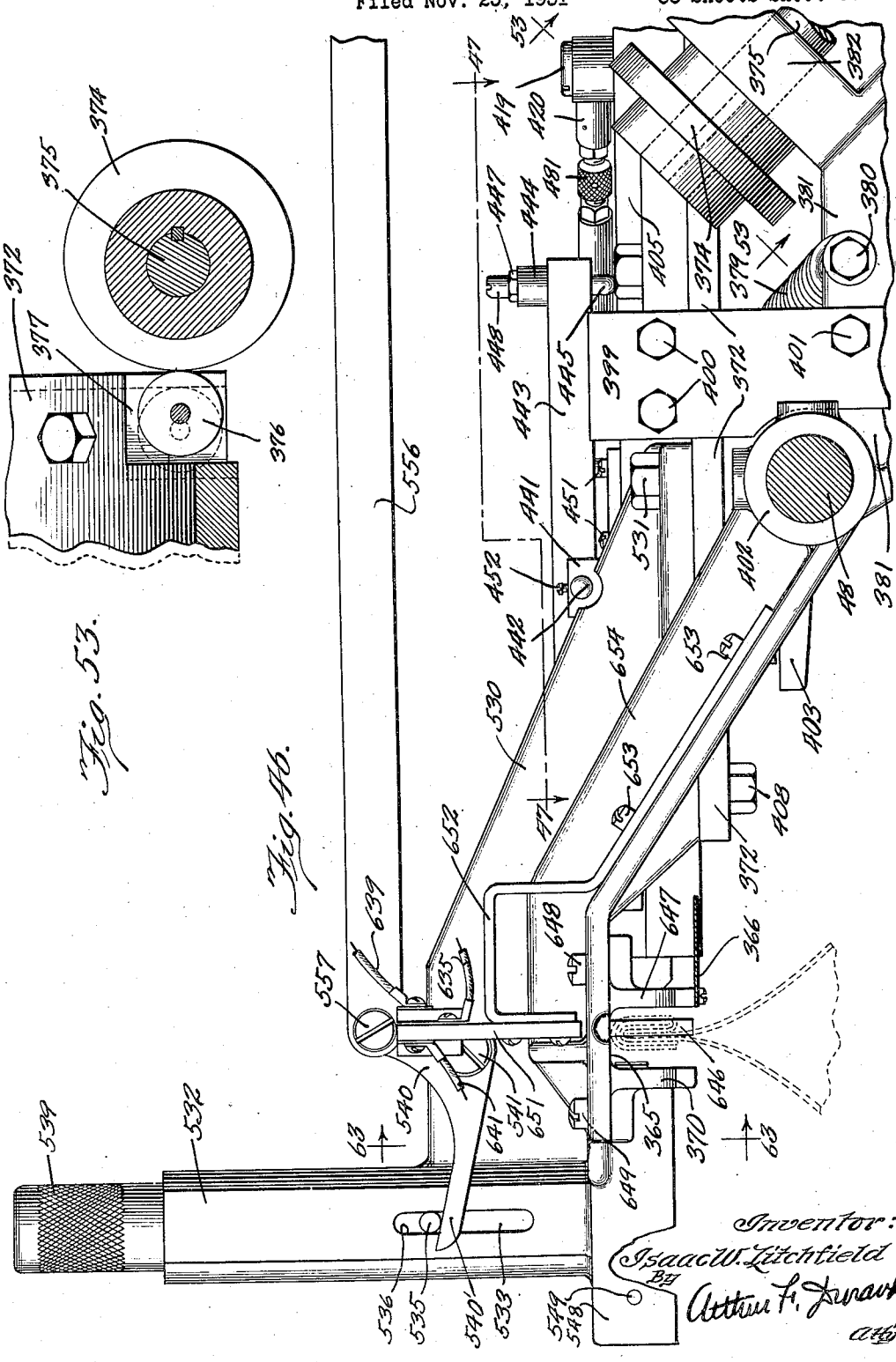


Inventor:
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By Arthur F. Duvall
Atty.

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BAG SEALING MACHINERY

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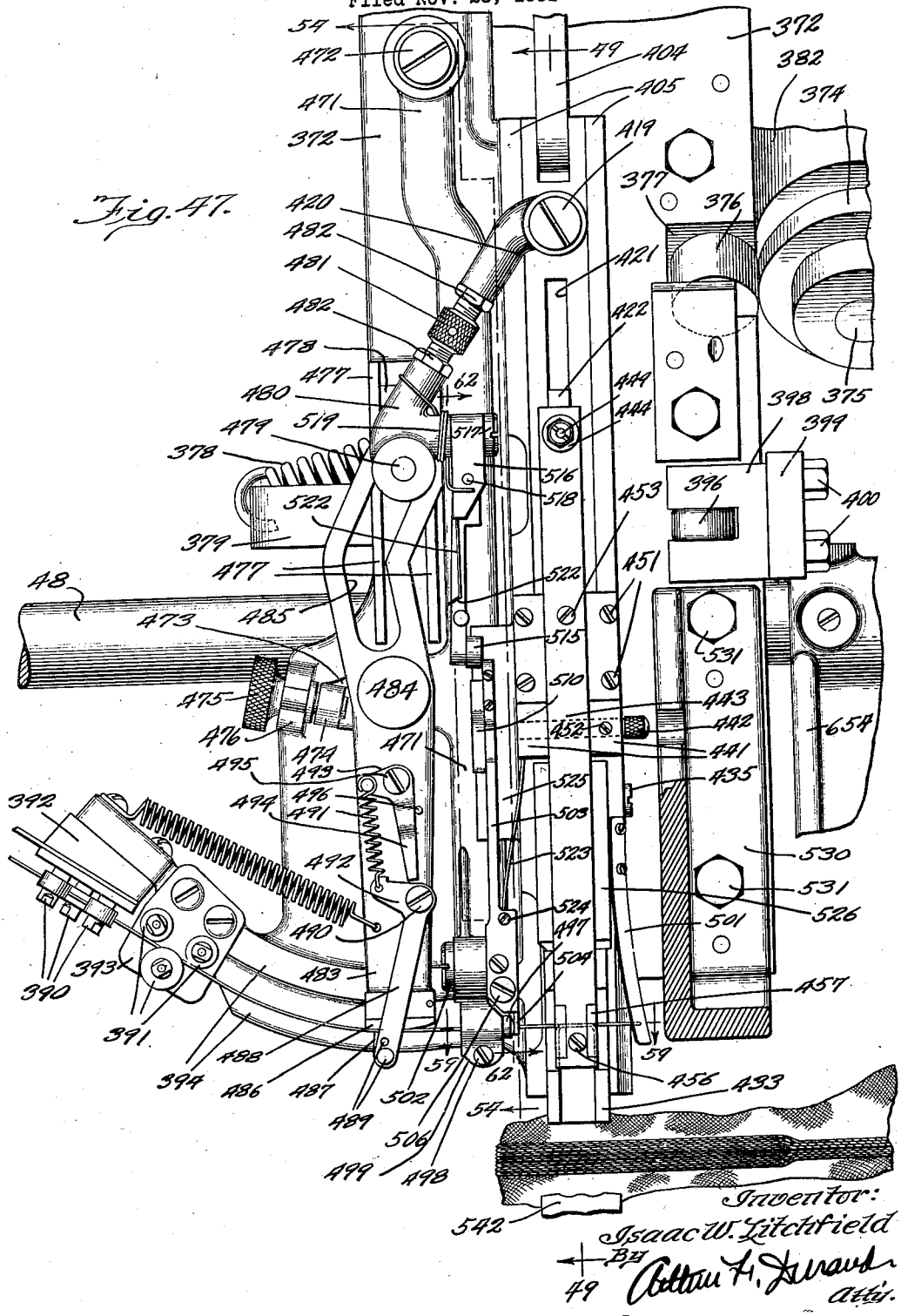


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Fig. 47.



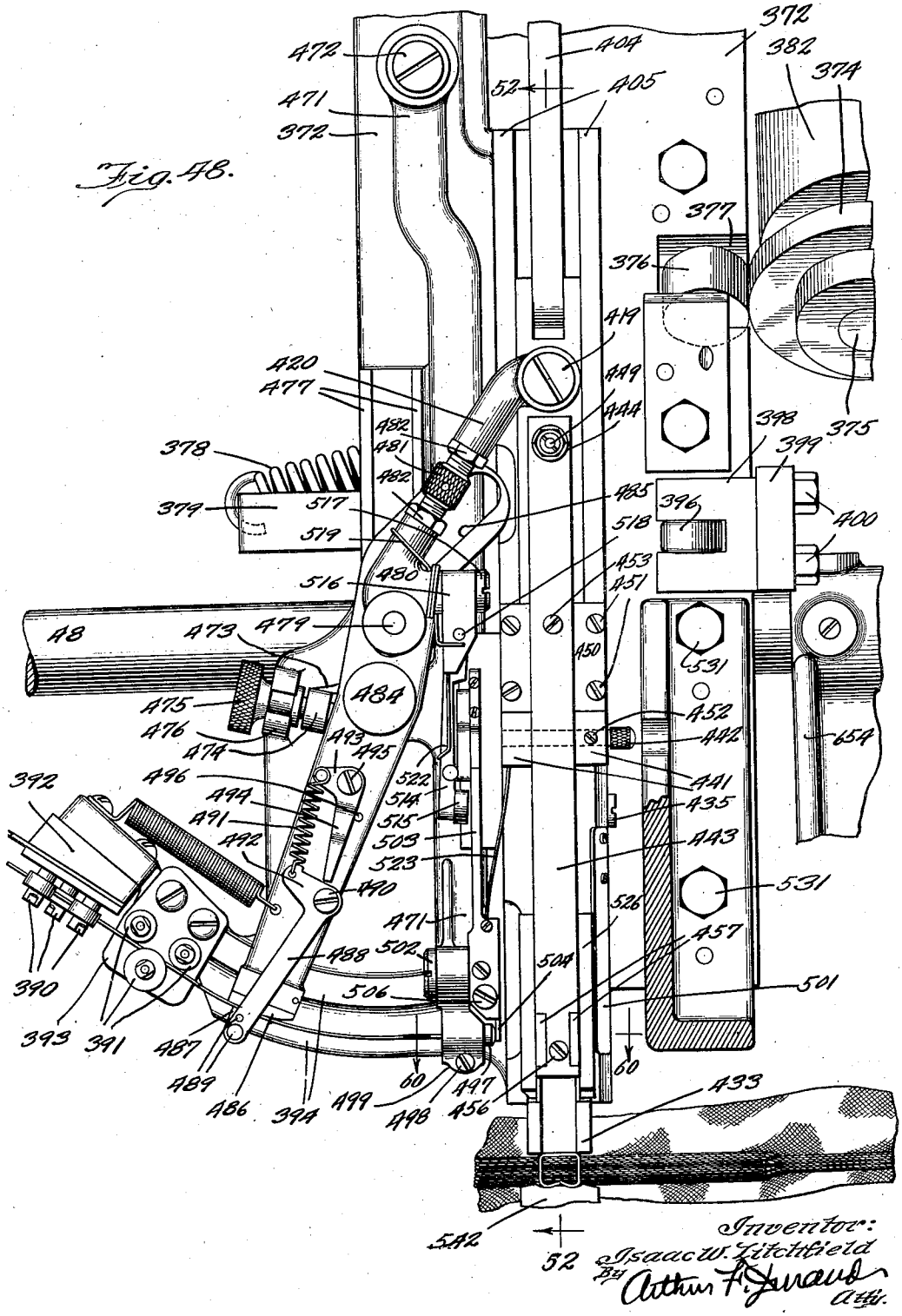
Inventor:
Isaac W. Litchfield
By
Wilbur H. Durand
Atty.

Feb. 11, 1936. I. W. LITCHFIELD 2,030,067

BAG SEALING MACHINERY

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Fig. 48.



Inventor:
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BAG SEALING MACHINERY

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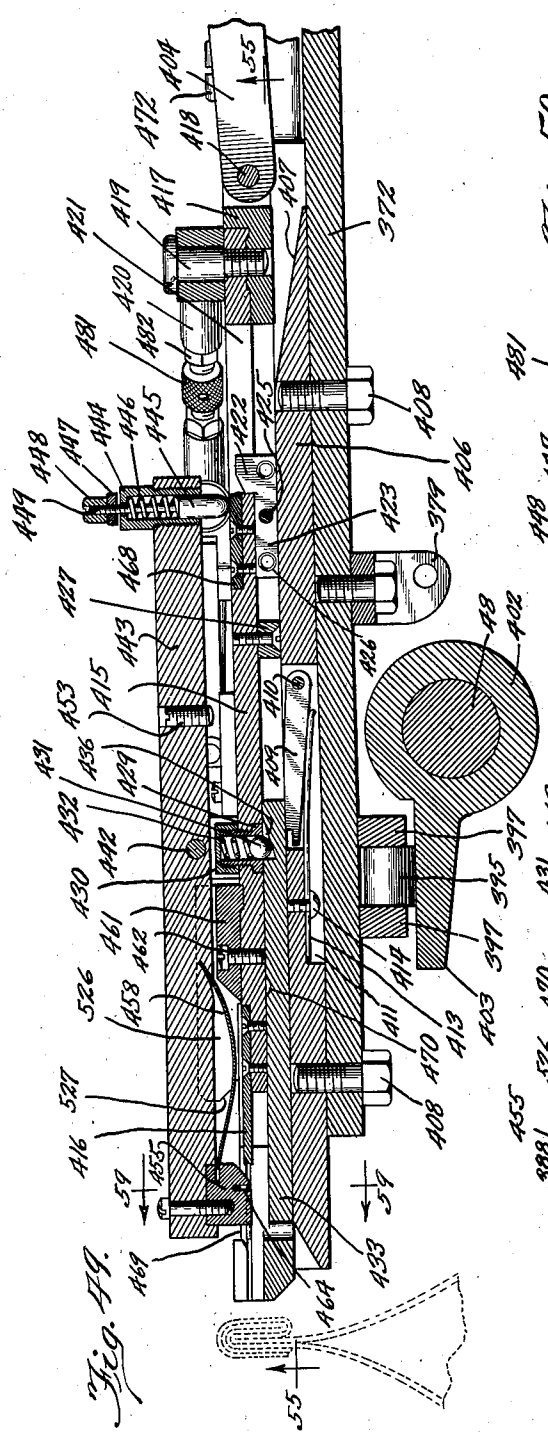


Fig. 49.

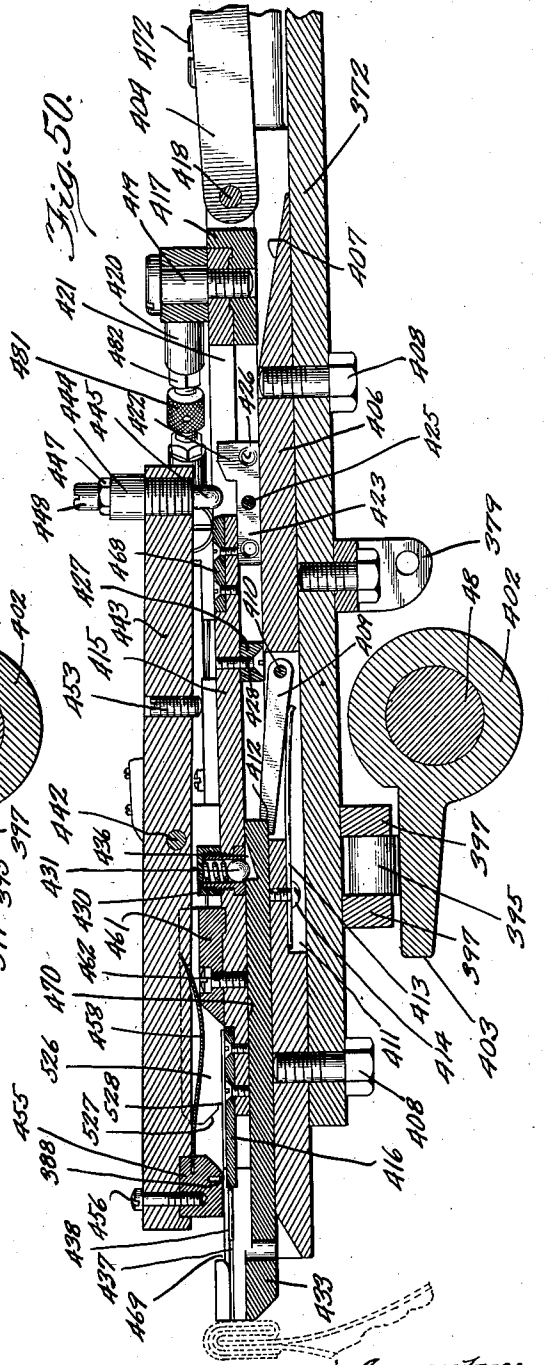


Fig. 50.

Inventor:
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Fig. 51.

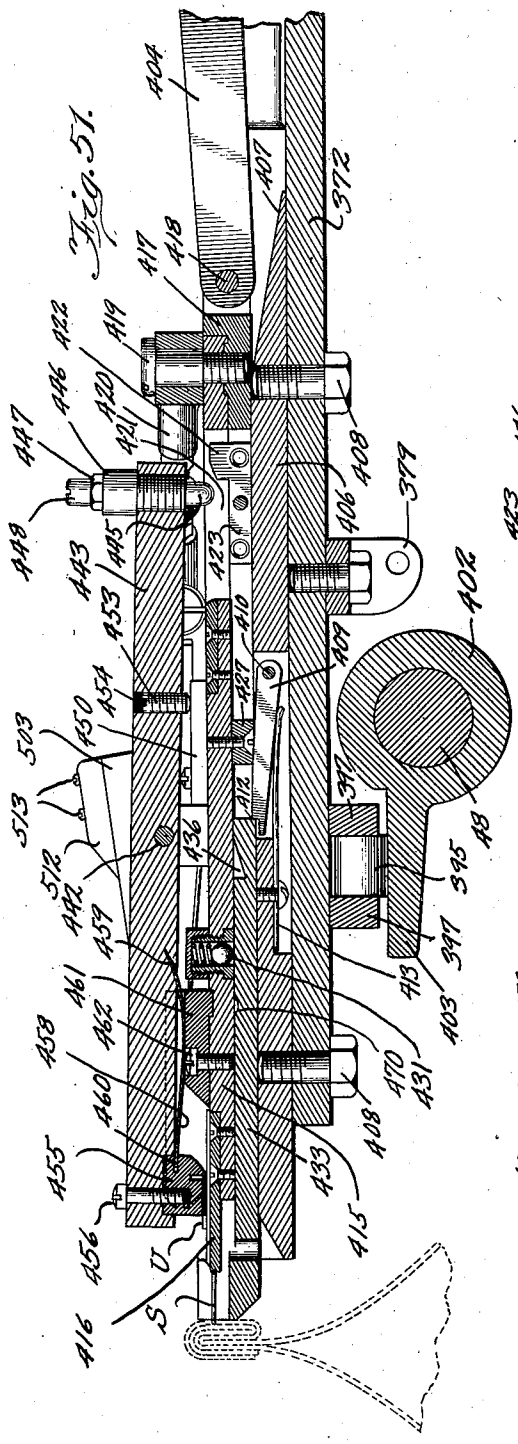
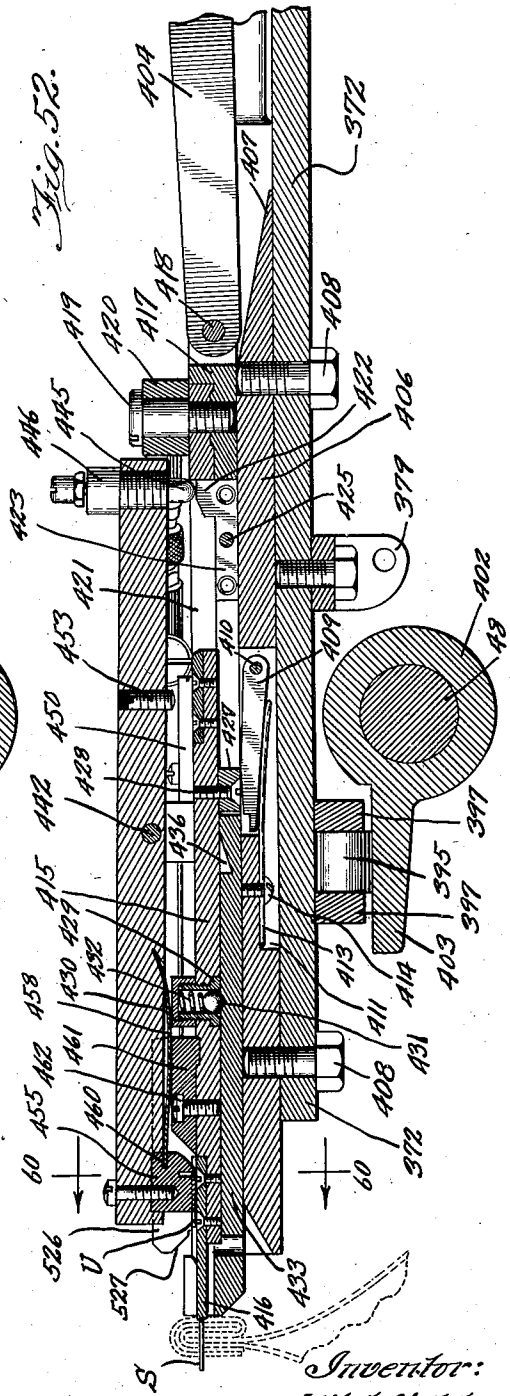


Fig. 52.



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BAG SEALING MACHINERY

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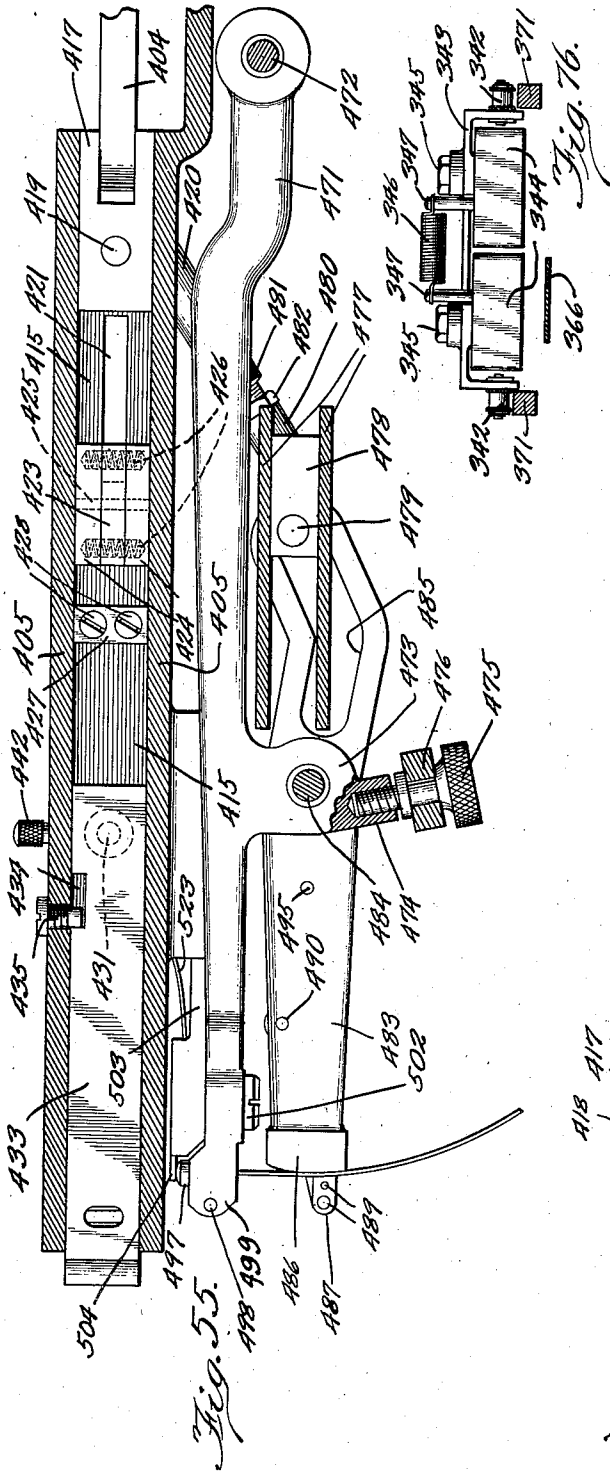


Fig. 55.

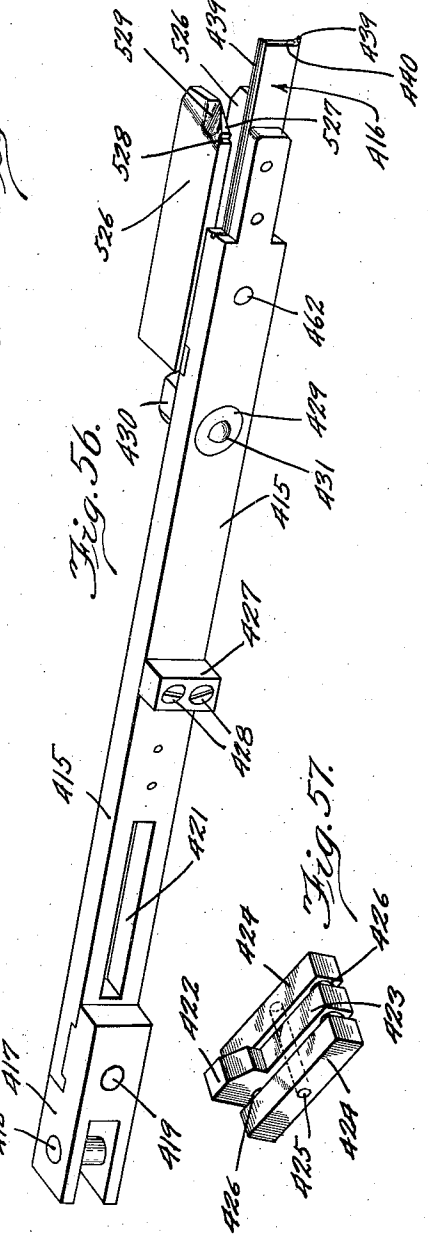


Fig. 56.

Fig. 57.

Fig. 76.

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BAG SEALING MACHINERY

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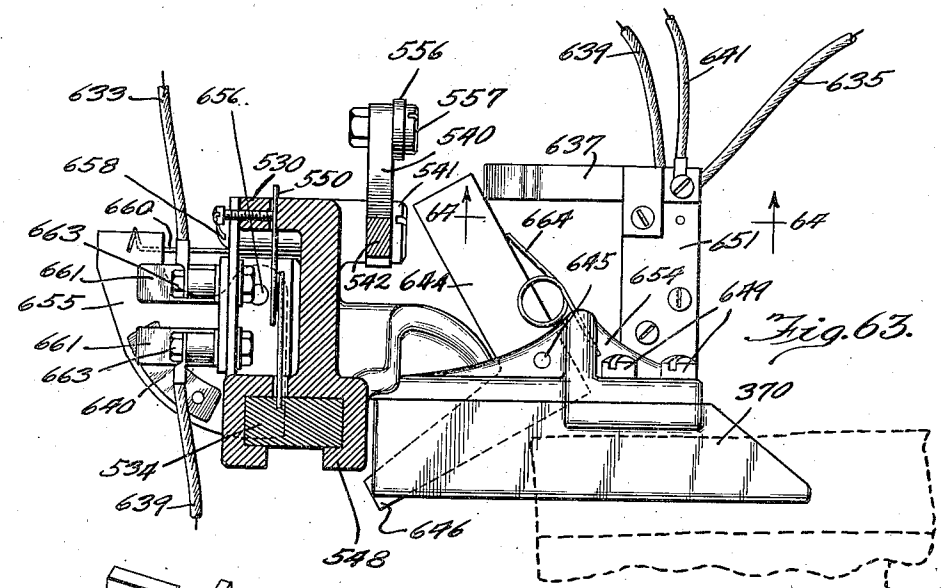


Fig. 63.

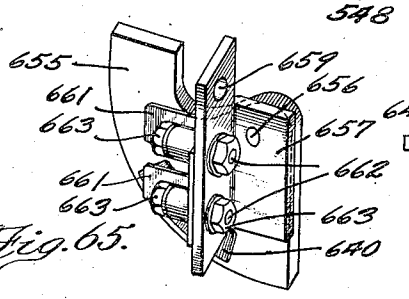


Fig. 65.

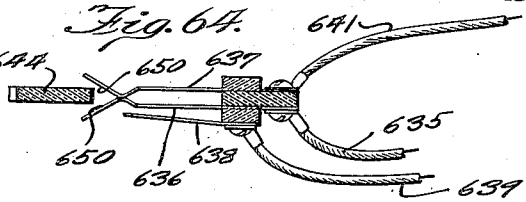


Fig. 64.

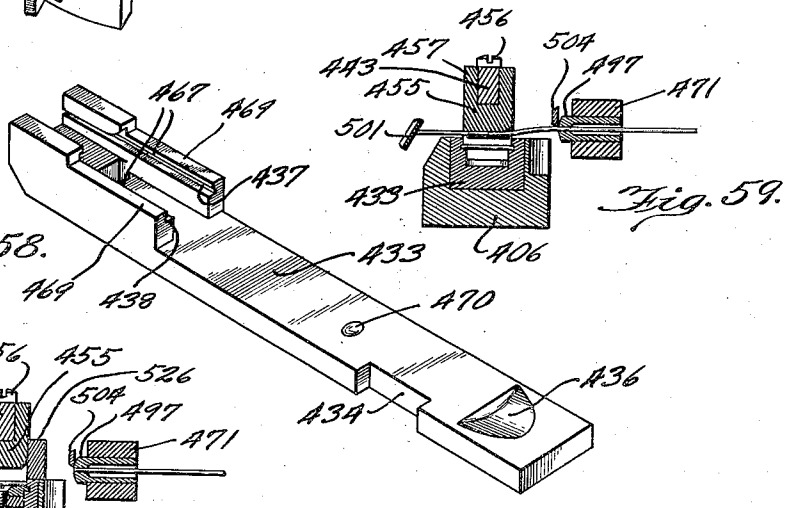


Fig. 58.

Fig. 59.

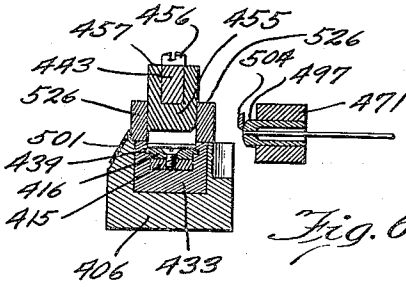


Fig. 60.

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BAG SEALING MACHINERY

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Fig. 66.

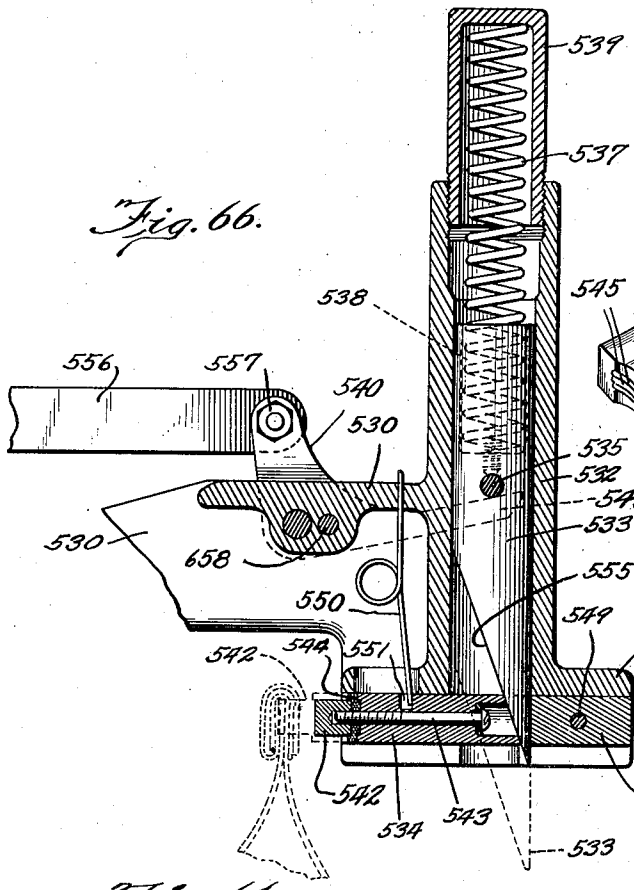


Fig. 67.

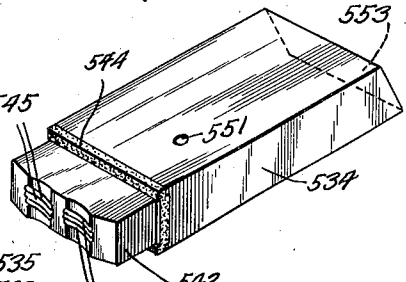


Fig. 68.

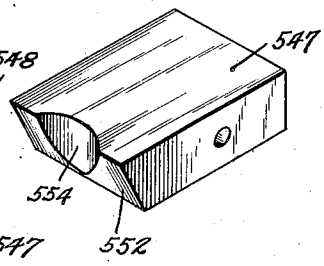
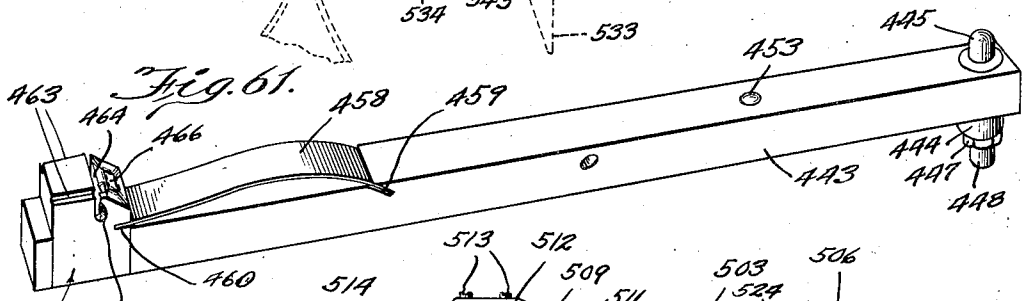


Fig. 61.



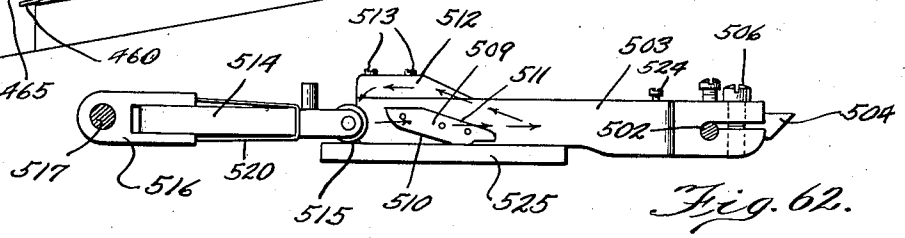


Fig. 62.

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BAG SEALING MACHINERY

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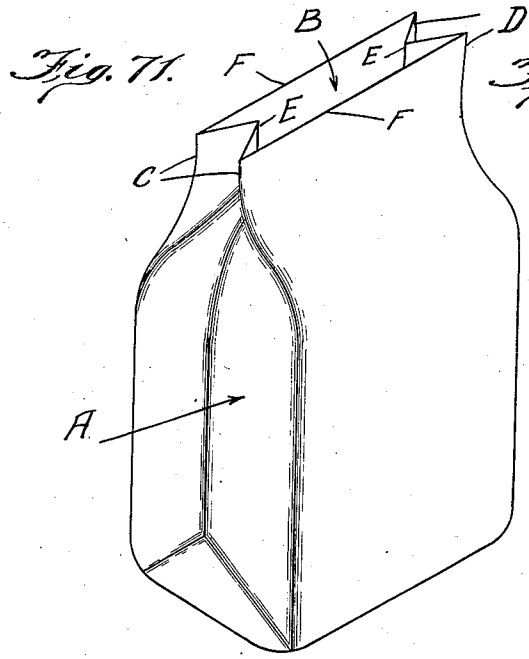


Fig. 71.

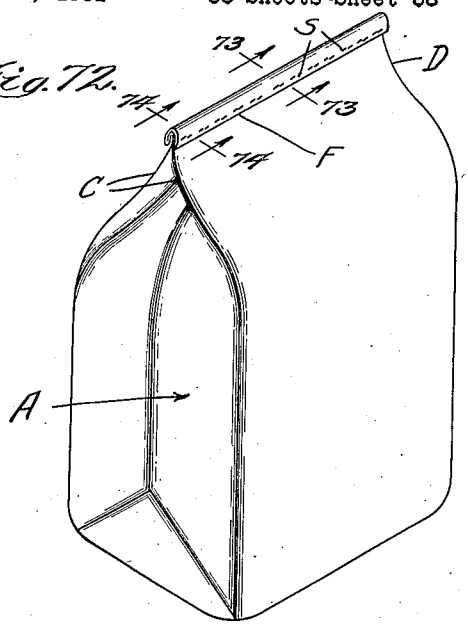


Fig. 72.

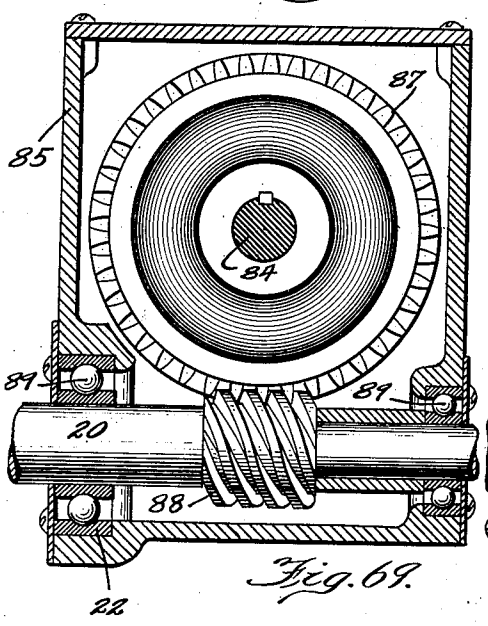


Fig. 69.

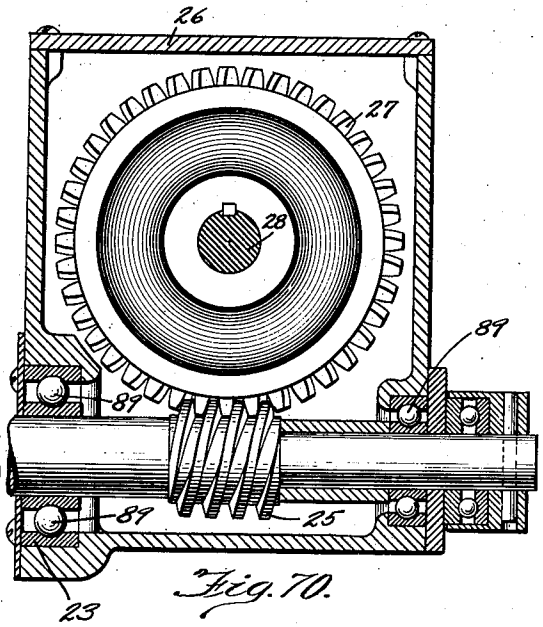


Fig. 70.

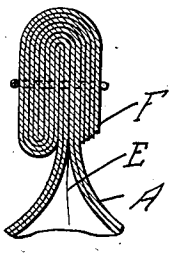


Fig. 74.

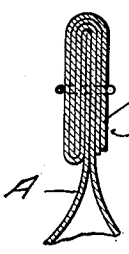


Fig. 73.

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UNITED STATES PATENT OFFICE

2,030,067

BAG SEALING MACHINERY

Isaac W. Litchfield, Medfield, Mass., assignor, by mesne assignments, to Saranac Machine Company, Benton Harbor, Mich., a corporation of Michigan

Application November 23, 1931, Serial No. 576,806

76 Claims. (Cl. 93—6)

This invention relates to bag sealing machines of a kind in which the filled or loaded bags are moved continuously by suitable feed mechanism through the machine, and in which means are provided for folding the mouth of each bag, and for thereafter stapling the fold to effectively seal the bags.

In certain respects, it will be seen that this is an improvement on the machinery disclosed in my prior application Serial No. 442,953, filed April 9, 1930.

Generally stated, the object of the present invention is to provide a novel and improved construction and arrangement whereby the filled or loaded bags are moved continuously through the machine, without stopping at any point therein, and whereby each moving bag is operated upon by a folding mechanism, thereby to fold the mouth of each bag in a more advantageous manner, and whereby the stapling mechanism by which each folded bag is stapled in order to seal the bag is adapted to operate more advantageously and more satisfactorily upon the fold of each bag, taking into account that the bags are ordinarily made of paper, whereby one object of the improvements is to effectively fold and staple the bags without danger of tearing or injuring the materials thereof, as well as in a manner to practically hermetically seal each bag, or at least to seal the bags in a manner to prevent sifting or leakage of any powder or powder-like commodities contained therein.

A special object is to provide a novel and improved construction and arrangement whereby the folding of the mouth of each bag is accomplished by a single mechanism for this purpose, whereby successive folding operations are performed on each bag, by one and the same set of blades or folding mechanism, thereby to obviate the necessity or partially folding each bag by one set of blades or folding mechanism, and thereafter completing the folding operation by another set of blades or folding mechanism.

Another special object is to provide a novel and improved construction and arrangement of the stapling mechanism, whereby another staple is being formed while the previous staple is being driven or inserted, thereby obviating the necessity of using the staple former secondarily as a staple guide to direct or guide the staples into the bag materials, which is of advantage in situations such as that disclosed herein, and in similar situations, where the use of the ordinary staple former as a staple guide also is not practicable or convenient.

Another special object of the invention is to provide a novel construction and arrangement whereby the bags are fed or transferred from the folding mechanism to the stapling mechanism by feeding means that operate in an improved manner to more safely and more satisfactorily transfer the bags from the said folding mechanism to the said stapling mechanism in synchronism with the means provided for continuously feeding the filled or loaded bags through the machine without stopping at any point therein.

Another special object is to provide a novel and improved arrangement whereby the stapling mechanism is automatically and electrically controlled in an advantageous manner, for the purpose of more satisfactorily insuring the desired character of stapling on each bag, with a stapling mechanism that moves a distance with the bag during the actual insertion of each staple.

To the foregoing and other useful ends, the invention consists in matters hereinafter set forth and claimed, and shown in the accompanying drawings in which—

Figs. 1 and 2 are front elevations of the left and right-hand sides of a machine embodying my invention;

Figs. 3 and 4 are top plan views of Figs. 1 and 2, respectively;

Figs. 5 and 6 are rear elevations of Figs. 2 and 1, respectively;

Fig. 7 is a fragmentary rear elevation of the carriage which supports the folding mechanism and the operating means therefor;

Fig. 8 is a view similar to Fig. 7, but with the parts in a slightly different position of adjustment;

Fig. 9 is a section taken along the line 9—9 of Figs. 1, 2, 4, 5 and 7, showing the position of the folding mechanism at the beginning of the folding operation;

Fig. 10 is a view similar to Fig. 9, showing the position of the folding mechanism after the first fold has been made;

Fig. 11 is a view similar to Figs. 9 and 10, showing the folding mechanism after the final fold has been made;

Fig. 12 is a section taken along the line 12—12 of Fig. 9, showing the cam slot for raising and lowering the folding blades;

Fig. 13 is a section taken along the line 13—13 of Fig. 12;

Fig. 14 is a section taken along the line 14—14 of Fig. 12;

Fig. 15 is a section taken along the line **15—15** of Figs. 1, 2, 7, 9 and 12;

Fig. 16 is a section taken along the line **16—16** of Fig. 11;

Fig. 17 is a section taken along the line **17—17** of Fig. 16;

Fig. 18 is a perspective view of the ejector-rod, which is shown in Fig. 16;

Fig. 19 is a horizontal section taken along the line **19—19** of Figs. 8 and 11;

Fig. 20 is a section taken along the line **20—20** of Fig. 19;

Fig. 21 is a section taken along the line **21—21** of Fig. 19;

Fig. 22 is a fragmentary top plan view of the starting trip for the folding mechanism;

Fig. 23 is a view similar to Fig. 22, showing the parts in a different position;

Fig. 24 is a detail fragmentary rear elevation, showing the trips for controlling the starting and reversing clutches which operate the carrier which supports the folding mechanism;

Fig. 25 is a section taken along the line **25—25** in Figs. 6 and 24;

Fig. 26 is a vertical sectional view through the clutches shown in Fig. 25 and taken on the line **26—26** of Figs. 3 and 6, showing these clutches in a different position of adjustment than in Fig. 25;

Fig. 27 is a section taken along the line **27—27** of Fig. 25, showing the clutch trips;

Fig. 28 is a fragmentary detail view of the trips, taken along the line **28—28** of Fig. 25;

Fig. 29 is a section taken along the line **29—29** of Fig. 25;

Fig. 30 is a view similar to Fig. 29, showing the parts in a slightly different position of adjustment;

Fig. 31 is a vertical section taken along the line **31—31** of Figs. 25 and 26.

Fig. 32 is a section taken along the line **32—32** of Fig. 26;

Fig. 33 is an elevational view of the operating mechanism for the stapling head and is a section taken along the line **33—33** of Figs. 3, 6 and 34;

Fig. 34 is a section taken along the line **34—34** of Figs. 33, 35, 36 and 37;

Fig. 35 is a section taken along the line **35—35** of Figs. 3, 6 and 34, showing the opposite side of the mechanism shown in Fig. 33;

Fig. 36 is a section taken along the line **36—36** of Figs. 3, 6 and 34;

Fig. 37 is a view similar to Fig. 36, showing the parts in a different position of adjustment;

Fig. 38 is a section taken along the line **38—38** in Fig. 37, showing the stapler control trips;

Fig. 39 is a horizontal cross section through the electromagnet which operates the brake for stopping the movement of the stapling head, and is a section taken along the line **39—39** of Figs. 35, 36, 37 and 38;

Fig. 40 is a section of the contact arm taken along the line **40—40** of Figs. 33, 35, 36 and 37;

Fig. 41 is a cross section taken along the line **41—41** of Fig. 37, showing the means for making and breaking the circuit to the magnet shown in Fig. 39;

Fig. 42 is a wiring diagram showing the manner in which the stapling head is started and stopped automatically by the bag as it moves into a position adjacent the operating head, and out of a position adjacent thereto;

Fig. 43 is a section of the brake for stopping the movement of the stapling mechanism after the drive thereto has been interrupted, and is a section taken along the line **43—43** of Fig. 35;

Fig. 44 is a fragmentary front elevation of the feed mechanism for the bags after the open ends of the bags have been folded, and is the means whereby the bag is fed to the stapling head;

Fig. 45 is a bottom plan view of Fig. 44, looking in the direction **45—45** of Fig. 44;

Fig. 46 is a section taken along the line **46—46** of Figs. 1 and 3, showing a portion of the stapling mechanism;

Fig. 47 is a section taken along the line **47—47** of Fig. 46, this being a plan view of the stapling mechanism;

Fig. 48 is a view similar to Fig. 47, showing the parts in a slightly different position of adjustment;

Fig. 49 is a section taken along the line **49—49** of Fig. 47;

Fig. 50 is a view similar to Fig. 49, showing the parts in a different position of adjustment;

Fig. 51 shows a still further adjustment of the parts shown in Figs. 49 and 50;

Fig. 52 is a view similar to Figs. 49, 50 and 51, showing the parts in still another position of adjustment, this being a section taken along the line **52—52** of Fig. 48;

Fig. 53 is a section taken along the line **53—53** of Fig. 46, showing the eccentric for the stapling mechanism;

Fig. 54 is a section through the stapling mechanism taken along the line **54—54** of Fig. 47;

Fig. 55 is a bottom plan view partly in section, the section being taken along the line **55—55** of Fig. 54;

Fig. 56 is a perspective view of the staple driving assembly;

Fig. 57 is a perspective of the loop bar control cam assembly;

Fig. 58 is a perspective of a part of the stapling mechanism;

Fig. 59 is a section taken along the line **59—59** of Figs. 47 and 49;

Fig. 60 is a section taken along the line **60—60** of Figs. 48 and 52;

Fig. 61 is a perspective of the loop bar;

Fig. 62 is a detail view of the cut-off knife, taken on the line **62—62** of Fig. 47;

Fig. 63 is a section taken along the line **63—63** of Fig. 46;

Fig. 64 is a section taken along the line **64—64** of Fig. 63;

Fig. 65 is a perspective view of the control contacts which are used for starting the stapling mechanism;

Fig. 66 is a vertical section through the clincher block assembly and is a section taken along the line **66—66** of Fig. 1;

Fig. 67 is a perspective view of the clincher block assembly;

Fig. 68 is a perspective view of the clincher bearing block;

Fig. 69 is a section taken along the line **69—69** of Fig. 3;

Fig. 70 is a section taken along the line **70—70** of Fig. 3;

Fig. 71 shows a bag as it appears when inserted into the machine;

Fig. 72 is a view showing the bag as it appears when it leaves the machine;

Fig. 73 is an enlarged section through the fold at the upper end of the bag and taken along the line **73—73** of Fig. 72;

Fig. 74 is a section through the fold, taken along the line **74—74** in Fig. 72;

Fig. 75 is a perspective view of the conveyor

belt pulley, showing the manner in which the supporting plate for the belt is fastened thereto; and

Fig. 76 is a detail section of feed mechanism, taken on the line 76—76 of Figs. 44 and 45.

The bag-sealing machine is composed essentially of the following elements:

Conveying mechanism, which is used for the purpose of conveying the bags along a predetermined path past the other mechanisms used for the purpose of sealing the open mouths of the bags;

Folding mechanism, used for the purpose of closing the open ends of the bags by producing a plural fold, which is later stapled in position to prevent sifting of the contents of the bags through the sealed ends thereof;

Feeding mechanism, which receives the folded portions of the bags and holds these portions folded, while at the same time moving at substantially the same speed as the conveying mechanism and presenting the folded ends of the bags to the stapling mechanism; and

Stapling mechanism, which inserts staples through the folds in the bags and seals the folds to prevent sifting of the contents of the bags therethrough.

I will describe the operation of the various parts of my machine in substantially the order enumerated above, it being understood that the conveying mechanism is carried along a substantially rectilinear path, and that the folding mechanism, feeding mechanism, and stapling mechanism are all located adjacent the path of travel of the bags, in position to perform their various functions on the open edges of the open ends of the bags, in a manner which will appear more clearly hereinafter.

In general, the supporting structure for the various mechanisms comprises a plurality of uprights 1, longitudinally extending bracing bars 2, and cross bracing members 3. Upon this framework, there is carried a conveying mechanism which can be adjusted vertically and has a portion thereof adjustable horizontally for different widths of bags, the vertical adjustment being used for sealing bags of different heights.

Conveying mechanism.—On each of the uprights 1, at the extreme right and left-hand ends, as viewed in Figs. 1 to 6, inclusive, there are provided arms 4, which are formed with split bearings 5 surrounding the uprights, the split bearings being clamped by bolts, in the usual manner, to secure the arms 4 in adjusted angular and vertical positions on the uprights. The arms 4 rotatably carry the shafts 6, two of these shafts at the left-hand end of the machine, as viewed in Fig. 1, having beveled gears 7 at the lower ends thereof. Additional arms 8, also carried by split bearing sleeves 9, are secured to the uprights in substantially the same manner as are the arms 4, and rotatably support the lower ends of the shafts 6.

The arms 8 also rotatably carry the shafts 10, one of which has beveled gears 11 secured thereto, and meshing with the beveled gears 7 on the shafts 6. The shafts 10 also have secured thereto the pulleys 12, over which is trained a conveyer belt 13, which has the upper run thereof supported by a rigid member 14, secured to, and supported by, the arms 8 and brackets 8*a*, so that the upper run of the belt will not yield downwardly when the bags are supported thereon.

Each of the shafts 6 rotatably support the swinging arms 15, which in turn rotatably support the shafts 16, to which the pulleys 17 are secured. There are two pulleys 17 on each of the shafts 16. Over these pulleys, are trained the conveying belts 18, which have their adjacent runs arranged in spaced parallel relation with each other, to form vertical driving surfaces which engage the bags and assist the conveyer belt 13 in conveying the bags past the other mechanisms which seal the open ends thereof and uniformly shape the filled bags. It will be understood that the speeds at which the conveyers 13 and 18 are driven are equal, or substantially so, in order to firmly grip the bags and convey the same, so that the contents of the bags will not be spilled.

The shafts 16, located at the left-hand end of the machine, as viewed in Figs. 1, 3 and 5, are driven from the shafts 6 by means of chains 19, trained over suitable sprockets secured to the shafts 6 and 16, respectively. In Figs. 5, 6 and 70, the mechanism for driving the conveyers is shown quite clearly. The main drive shaft 20, mounted in bearings 21, 22 and 23, which in turn are secured to the uprights 1, has a grooved pulley 24 secured thereto and is adapted to be driven from any suitable source of power by means of three V-shaped belts. The shaft 20 rotates continuously; and at the right-hand end thereof, there is secured thereto, or formed as an integral part thereof, the worm 25, arranged within the gear housing 26. The worm in turn drives a worm-wheel 27, secured to a shaft 28, rotatably mounted in suitable bearings in the gear housing 26 and protruding outside of said gear housing to the rear of the machine, or toward the front, as viewed in Fig. 6. To this extending portion of the shaft 28, there is secured a spur-gear 29, meshing with a spur idler gear 30 mounted upon an arm 31, rotatably mounted on the shaft 28 and held in adjusted position by a machine bolt 32 passing through a slot 33 in the arm 31. In Figs. 1, 3 and 6, it will be noted that there is an arm 34 secured to the bracket which supports the gear housing 26, and this arm carries a bearing which rotatably supports the shaft 35, having the beveled gear 36 secured thereto, and meshing with the beveled gear 37, keyed to the rear left-hand shaft 6, as viewed in Fig. 1, or the forward right-hand shaft, as viewed in Fig. 6. The gear 37, however, is permitted to slide longitudinally on the shaft 6, but is maintained in driving engagement with the gear 36, due to the arm 34, upon which both the gear 36 and the gear 37 are rotatably mounted, the gear 37 having a portion which cooperates with the portion 38 of the arm 34, to prevent longitudinal movement of the gear 37 along its axis relative to the arm 34. A spur-gear 39 (see particularly Fig. 6) meshes with the idler gear 30. Accordingly, when the main drive shaft 20 is driven, the shafts 6 will be driven through the intermediary of worm 25, worm-wheel 27, shaft 28, gears 29, 30, 39, shaft 35, and gears 36 and 37. In turn, the shafts 10 are driven from the shafts 6 by means of the beveled gears 7 and 11. The arm 31 is made adjustable, so that a spin gear 30, having the proper number of teeth, may be placed on the shaft 35. This is for the purpose of driving the conveyer belts at the desired speed, this speed being proportional to the speed of movement of the other mechanisms driven from the main drive shaft 20.

As is clearly illustrated in Figs. 4 and 75, there is a backing member 40 for each of the conveyer belts 18. These backing members 40 are arranged to prevent outward movement of the opposite runs of the belts away from the bags which are to be sealed, as is clearly illustrated in

Fig. 4. Each of these backing members comprises a flat board 41 having angle irons 42 extending the length thereof and secured thereto adjacent opposite edges thereof on the same broad side of the board, and the angle irons are joined together at their opposite ends by the plates 43, to which are secured the members 44, having ears 45 which embrace the shafts 16. These ears are arranged on opposite sides of the pulleys 17, so that if the pulleys 17 are adjusted vertically along the shafts 16, the backing members for the belts will move therewith.

The arms 4 are braced against horizontal movement by the cross tie members 46, secured to the outermost ends of the arms, as clearly shown in Figs. 3 and 4. These cross tie members 46 maintain the shafts 6 at a predetermined distance from each other. However, the arms 15 are free to pivot about the shafts 6 so that the opposed conveyor belts 18 may move toward and from each other.

When a bag is placed between the conveyers, the rotation of the upper and lower pulleys 17, as viewed in Figs. 3 and 4, would be in clockwise and counter-clockwise directions, respectively. The bag, being arranged between the conveyers, causes a resistance to the movement of the engaging runs of the conveyer belts, and due to the fact that the arms 15 are free to pivot about the shafts 16, there is a tendency for the driving chains 19 to exert such a pull on the pulleys that the arms 15 move inwardly toward the bag and assist in imparting a yielding pressure on the opposite sides thereof. Of course, it will be understood that, if desired, the arms 15 may be locked in adjusted position for different widths of bags, but since the driving forces of the chains 19 tend to move opposed conveyers 18 toward each other, the conveyers will always be held in driving relation to the bags.

It will be noted that the driving arrangement is such that the conveyers may be driven, regardless of the vertical positions to which the same are moved along the uprights 1, or along the shafts 6. The machine may, therefore, be adjusted for bags of different sizes, without necessitating a change in the driving means therefor.

Supporting means for the folding mechanism.—Generally speaking, the folding mechanism embodies a main carriage and a sub-carriage, the main carriage being used for the purpose of actuating the folding mechanism, and the sub-carriage being utilized for the purpose of actuating the main carriage. The main carriage, as well as the sub-carriage, are mounted upon suitable guide rods extending in a direction parallel with the path of movement of the bags. The sub-carriage has a greater extent of travel than the main carriage and for the particular purpose of ejecting the folded edge of the bags from between the folding blades into a position where they may be gripped by the feeding mechanism which feeds the bags to the stapling mechanism.

The main carriage and the sub-carriage are perhaps best illustrated in Figs. 1 to 12, inclusive, 15 and 16. The main carriage has a movement in the direction of travel of the bags for the purpose of folding the edges of the bags while the bags are in motion. This does away with the necessity of stopping the bags while the folding mechanism is in operation. This is particularly advantageous where bags of large dimensions, containing heavy material, are to be sealed, for to make it necessary to stop and start the conveying mechanism so that the folding can take place while the bag is stopped, slows down the operation of the machine and increases the wear and tear on the parts. The main carriage comprises a frame consisting of the end castings 47, through which the guide rods 48 extend. These guide rods 48, as best illustrated in Figs. 7, 8, 9, 10, 11 and 16, are rotatably supported in the end bracket members 49, which in turn are supported on the brackets 50, secured to the central rear uprights 1, and by adjusting the brackets 50 vertically along the uprights 1, the vertical position of the folding mechanism may be regulated. The shaft 48, adjacent the forward side of the machine, runs substantially the entire length thereof, as it is used for a brace for certain other parts of the machine. The end castings 47 are secured to each other by means of the tie rod 51 and plate 52, the plate 52 also acting as a means for guiding a portion of the folding mechanism, to be described later. The end pieces 47 are adapted to reciprocate along the guide rods 48, and to be actuated to move along the guide rods, by the sub-carriage which comprises the end castings 53, connected together by the tie rods 54. The end castings 53 have bearings which surround the guide rods 48, and the sub-carriage is adapted to have reciprocating movement along the guide rods and also relative to the main carriage, the extent of the latter movement being limited by the end castings 53 coming against adjacent end castings 47. However, there is means for normally preventing this relative movement, so that, generally speaking, the main carriage and sub-carriage move as a unit. As is quite clearly illustrated in Figs. 16 and 17, there is a chain 55 arranged between two blocks 56, which are drawn against opposite sides of the chain by the screws 57. The chain passes through an opening in the casting 53 and the plates 56 are arranged in two sets, one set being arranged on each side of the casting 53 to prevent longitudinal movement of the chain relative to that casting, so that as the chain reciprocates, the casting will be caused to move therewith.

In Figs. 7, 8, 9, 10, 11 and 16, I have illustrated the means for normally connecting the main carriage and sub-carriage to each other, so that movement of the sub-carriage will cause movement of the main carriage. This means comprises a pair of detent members 58, pivoted on stub shafts 59, secured within bearings 60. Collars 61 retain the detent members 58 on the shafts 59. The bearings 60 are secured to one of the castings 47, namely, that casting at the left, as viewed in Fig. 16, or at the right, as viewed in Figs. 7 and 8. One of the castings 53 of the sub-carriage, namely, that at the left in Fig. 16, has a plurality of abutment members 62 arranged with vertical faces 63 (see particularly Figs. 7, 8 and 17), in a position to engage the ends of the detent members 58. A rock shaft 64, rotatably mounted in the abutment members 62, has the detent operating members 65 secured thereto, adjacent opposite ends thereof, and in a position below the pins 66 on the ends of the detent members 58, so that when the shaft 64 is rocked in a clockwise direction, as viewed in Fig. 17, the members 65 will engage the pins 66 and lift the detent members 58 clear of the abutment 62. Normally, however, the ends of the abutment members will rest against the vertical abutment surfaces 63 to prevent longitudinal movement of the sub-carriage relative to the main carriage in one direction, motion of the sub-carriage relative to the main carriage in the opposite direction being limited by the engagement of the right-hand casting members 53 and

47, as seen in Fig. 16. A spring 67 is secured at one end to an extension 68 on the rock shaft 64, and at the other end to the casting 53, shown at the right in Fig. 16, or at the left in Figs. 17 and 18. The rock shaft 64 is also provided with an upwardly extending operating member 69, adapted to engage a stop 70 located adjacent the path of travel of both the main and sub-carriages.

During the first part of the feeding movement from right to left, as viewed in Figs. 16 and 17, the sub-carriage and main carriage move in unison with each other. But at about the position shown for the carriages in Fig. 16 and Figs. 8 and 17 the operating member 69 strikes the stop 70 and rocks the shaft 64 to cause the members 65 to lift the detent members 58 and permit the sub-carriage to continue its movement without causing further movement of the main carriage. In other words, the sub-carriage continues its movement, and the main carriage comes to rest. When the motion of the sub-carriage is reversed by reversing the direction of movement of the chain 55, the sub-carriage again moves into the position shown in Fig. 16, and the detent members 58 drop downwardly into their operative positions, so that at the beginning of the next movement of the sub-carriage to the left, the main carriage will move therewith.

Driving and reversing mechanism for the supporting means for the folding mechanism.—The chain 55 is adapted to have its motion alternately reversed, so that the sub-carriage has a reciprocating movement along the guide rods 48. The chain itself is trained over sprockets 71, secured to shafts 72 which are rotatable in bearings in member 73, which is supported upon the guide rods 48, as is clearly illustrated, particularly in Figs. 7, 8 and 16. A second bearing member 74, also secured to the guide rods 48 at the right-hand end of the machine, as viewed from the rear in Figs. 6, and 24, is adapted to support the reversing mechanism for the chain, this mechanism embodying two additional sprockets 75 and 76 (see Figs. 25 and 26), over which the chain 55 is trained. The sprocket 75 is rotatably mounted on the shaft 77, whereas the sprocket 76 is keyed at 78 to a shaft 79. The shaft 77 is continuously rotating, the same being driven directly from the main drive shaft through the following mechanism:

A sprocket 80, secured to the shaft 77 by the pin 81, has a chain 82 trained thereover and over a sprocket 83, secured to a shaft 84, rotatably mounted in the gear housing 85 (as best illustrated in Figs. 24, 25, 26 and 69), the gear housing having an integral bracket thereon, secured to the adjacent upright 1. A cross section of the gear housing, shown in Fig. 69, discloses that the shaft 84 has a worm-wheel 87 secured thereto, which is in mesh with a worm 88 on the main drive shaft 20. It will be noted that the gear housings 85 and 26 in Figs. 69 and 70, respectively, have anti-friction bearings 89, which rotatably support the main drive shaft 20. It will be further noticed that the pitch of the worm 88 is about twice the pitch of the worm 25, the former being shown in Fig. 69, and the latter in Fig. 70. These pitches are arranged in this manner, so as to give the proper driving speeds to the various parts. Since the movement of the shaft 20 is continuous, the movement of the shaft 77 will likewise be continuous and in the same direction at all times. If, therefore, the motion of the shaft 77 is imparted alternately to the sprockets 75 and 76 in opposite directions, the chain 55 will likewise be moved in opposite directions to reciprocate the carriages.

I have provided mechanism for accomplishing this last-mentioned result, and this mechanism is best illustrated in Figs. 25, 26, 31 and 32, and comprises essentially two clutch mechanisms, each of which becomes operative at different times, and both of which can be moved to an inoperative position in order to stop the movement of the carriages. A gear 90, secured to the shaft 77 by the key 91, meshes with a similar gear 92, rotatably mounted on the shaft 79, both shafts being mounted in anti-friction bearings 94 in the bracket 95, secured to the guide rods 48 (see Figs. 3, 6, 24, 25 and 26).

As best illustrated in Fig. 26, the shaft 77 also has the sleeve 96 secured thereto by the key 91, so that the sleeve 96 will rotate with the shaft 77. A collar 97 is secured to the bearing of the sprocket 75 by a set screw 98, and a heavy coiled spring 99 surrounds the sleeve 96 and has one end thereof secured to the collar 97 in a manner which is best illustrated in connection with the spring 100, which surrounds a sleeve 101, secured to the shaft 79 by the key 78, this connection being illustrated clearly in Fig. 31. The other end 102 is arranged within an opening 103 in the end of a sleeve 104, which sleeve is rotatably mounted upon the sleeve 96 and has a portion thereof spaced therefrom, in which a light coil spring 105 is arranged, the same being wrapped about the sleeve 96 in the same direction as the spring 99, one end of the spring 105 being secured at 106 to the sleeve 104, the other end 107 passing through an opening 108 in the sleeve 104, to the exterior portion of the sleeve, the projecting end 107 being adapted to be operated for a purpose which will appear hereinafter. A clutch operating collar 109 is slidably mounted upon the sleeve 104 and has a groove 110 therein. A bell crank 111 (see Fig. 25), pivoted at 112 to the sleeve 104, and having pin and slot connections 113 and 114 with the ring 115 rotatably mounted on the sleeve, and the collar 109, respectively, is adapted to be rocked by longitudinal movement of the collar 109 relative to the sleeve 104. A ring 115 has a plate 116 adjustably secured thereto by a screw 117 and has an opening through which the projecting end 107 of the spring passes, so that rotation of the ring 115 will move the end 107 of the spring 105.

Both the spring 99 and the spring 105 are normally of an internal diameter just slightly more than the outer diameter of the shaft 77, so that normally there is no binding action between the spring and the outer surface of the sleeve 96. However, when the collar 109 is moved to the left longitudinally of the sleeve 104 to rock the bell crank 111 in a counter-clockwise direction, as viewed in Fig. 25, and thereby rotate the ring 115, the end 107 of the spring 105 is moved in a direction to reduce the internal diameter of the spring 105 and cause the spring to bind upon the sleeve 96, thereby causing the sleeve 104 to rotate with the sleeve 96. This rotation of the sleeve 104 causes the end 102 of the spring 99 to move in a direction to decrease the internal diameter of the spring 99 and cause the same to grip the sleeve 96. This in turn causes the spring to move with the sleeve 96, and since the spring is directly connected to the sprocket 75 through the intermediary of the collar 97 and screw 98, the sprocket will be caused to rotate. This rotation of the sprocket 75 results from the movement of the collar 109 to the left. At this time, the gear 92 is

rotating idly upon the shaft 79 and the sprocket 76 is stationary.

It will not be necessary to make a detail description of the manner in which the lowermost clutch causes the sprocket 76 to be rotated. It is sufficient to state that the only difference between the lowermost clutch and the uppermost clutch in Fig. 26 is that there is a complete reversal of the connections between the gear and the sprocket. That is, instead of having a collar, such as 97, secured to a sprocket, such as 75, there is a collar 118, secured by a screw 119 to the gear 92. The spring 100, corresponding to the spring 99, is secured to the collar and to a sleeve 120, rotatably mounted on the sleeve 101, and in which there is a weaker spring 121, similar to 105, connected at 122 to the sleeve, and at 123 to the ring 126, connected to the bell crank 124, pivoted at 125, the latter having pin and slot connections with the ring 126 and longitudinally adjustable collar 127. The only difference between the operation of the uppermost clutch in Fig. 26 and the lowermost clutch in that figure, is that, in the uppermost clutch, the sleeve 96 drives the spring 99, whereas in the lowermost clutch, the spring 100 drives the sleeve 101.

The means for connecting the heavy spring to the collar for both clutches, is best illustrated in Fig. 31 in connection with the spring 100, which has a hooked end 128 arranged with portions thereof in the grooves 129 and 130, the grooves being thereafter covered by a plate 131, secured to the collar 118 by the screws 132. The means for moving the end 107 on the spring 105 is best illustrated in Fig. 32, in which the adjustable plate 116 is clearly shown, so that it is adjustable by loosening the screws 117 and rotating the plate peripherally of the ring 115. It will also be noted that there are two bell cranks on opposite sides of the sleeve 104, in order to equalize the movement of the ring and of the collar 109.

Means are provided for insuring that one of the clutches will not be in engagement when the other clutch is in engagement, and at the same time permit both of the clutches to be moved to an inoperative position at the same time.

Thus, it will be seen that by alternately shifting the collars 109 and 127, the sprockets 75 and 76 will be alternately actuated through the clutch mechanisms just described. Of course, the sprocket 76 will rotate in a reverse direction to sprocket 75 and for the reason that the gear 90 is rotating in a direction opposite to the direction of rotation of the gear 92. I embody in my clutch operating mechanism, means for alternately shifting the collars 109 and 127 into and out of operative positions, and at predetermined times, to secure a reversal of the movement of the chain 55 and, ultimately, of the sub-carriage and main carriage. The collar 127 has a groove 133 therein, and yokes 134 and 135, pivoted at 136 and 137, respectively, having pins 138 and 139, which engage within the grooves 110 and 133, respectively, in a manner which is quite well known in the art relating to clutches. Fig. 31 shows quite clearly the manner in which the pins 138 are arranged within the groove 110 of the collar 109, and this same arrangement is used with pins 139 and collar 127. The yoke 134 has an extension 140, and toggle links 141 and 142, pivoted to each other at 143, are connected, respectively, at their free ends to the extension 140 at 144, and to a rigid support 145 at 146, as is best illustrated in Fig. 25. A spring 147, coiled about the pivot 146, has one end 148 thereof secured to the frame, and the other end thereof beneath a pin 149 on the toggle link 142, so that the links are normally urged upwardly toward the position shown in Fig. 26, there being means, later to be described, for holding the links in the position shown in Fig. 25.

Yoke 135 is pivoted to a link 150, which in turn is pivoted at 154 to one end of the arm 151, pivoted at 152 to a rigid support 153. The opposite end of the arm 151 is pivoted at 155 to a toggle link 156, which in turn is pivoted at 157 to a toggle link 158, pivoted at 159 to a fixed support 160.

An operating member 161 for operating the toggle links 141—142 and toggle links 156—158 is pivoted at 162 to the toggle link 158 and has a substantially U-shaped member 163, pivoted at 164 to the upper end thereof, as best illustrated in Figs. 29 and 30, the opposite legs of the U-shaped member straddling the upper end of the member 161, as clearly illustrated in Figs. 27 and 29. The member 163 has a detent 165 thereon and is provided with a slot 166 in which a pin 167 on arm 168 is slidably mounted. The arm 168 is secured to an operating rod 169, the operating rod being used to swing the U-shaped member 163 about its pivot 164 to bring the detent member 165 into and out of position beneath the toggle link 142, as shown in Figs. 30 and 29, respectively.

In Fig. 26, the uppermost clutch is in its operative position, and the lowermost clutch in its inoperative position, whereas in Fig. 25 both clutches are in their inoperative positions. When the parts are in the positions shown in Fig. 26, the sprocket 75 is being driven and is moving the chain from right to left in Fig. 16, and as a result the sub-carriage and main carriage move in the same direction. When the parts are in the position indicated in Fig. 17, the operating member 69 has just struck the stop 70 and raised the detent member 58 to permit the sub-carriage to move without operating the main carriage. The sub-carriage then continues its travel to the left until it arrives adjacent the bracket 47 of the main carriage, at which position of the sub-carriage it is desired to reverse the motion of the chain and start the sub-carriage moving in the opposite direction to its original position. In order to accomplish this result, I provide the mechanism which is best illustrated in Figs. 25 to 30, inclusive.

The reversal is accomplished by moving the toggle links 141—142 into the position shown in Fig. 25 and simultaneously moving the links 156—158 into a similar aligned position, which is not illustrated in the drawings, so that the clutch for the sprocket 75 is disengaged, and the clutch for the sprocket 76 is engaged, causing the chain to move in a reverse direction. The detent member 165 is provided for the purpose of causing simultaneous operation of the toggle links 141—142 and toggle links 156—158, for when the toggle links 141—142 are moved downwardly against the detent 165, the operating member 161 will also move downwardly and straighten out the toggle links 156—158, causing engagement of the clutch for the sprocket 76. The downward movement of toggle links 156 and 158 is limited by the stop 156' on the plate 158', secured by the screw 157' to the member 153. The means for moving the toggle links 141—142 into a horizontal position is perhaps best illustrated in Figs. 24, 27 and 28. The toggle operating element 170 is arranged immediately above the toggle link 141 and di-

rectly engages the same to move it downwardly. The operating element passes through a loop 171 on the bell crank 172 and is held in place by the set screw 173. The bell crank is pivoted at 174 and has an extension 175 for a purpose which will appear presently. The pivot 174 is carried by a block 176, directly supported by and secured to the bracket 95, as clearly illustrated in Fig. 28. A spring 177 is secured by screws 178 to the block 176 and engages the element 170 to rock the bell crank 172 in a clockwise direction, as viewed in Fig. 28, if and when the bell crank is permitted to have such movement.

The bracket 95 also has an arm 179 pivoted thereto at 180, to the upper end of which there is pivoted a detent 181 at 182, said detent having a pin 183, against which a spring 184, mounted on the arm 179, abuts, so as to normally hold the detent member 181 in the position shown in Fig. 28, but permitting its movement against the action of the spring in a clockwise direction. The pin 183 limits the counterclockwise movement of the detent 181 by its engagement with the arm 179. The arm 179 has a shoulder 185, facing downwardly, as is most clearly illustrated in Fig. 24, and this is adapted to engage the upper side of the element 170 and hold this element down in the position shown in Fig. 28, after it has been moved to that position by mechanism which I will now describe, it being understood that in Fig. 28 the links are shown in the same position as illustrated in Fig. 25.

In Fig. 27, there is shown a sleeve 186, which passes through an opening in the end bracket member 49 and is secured thereto by screws 187. Plungers 188 and 189 are slidably mounted therein, and a spring 190 is interposed therebetween, which spring is shown fully expanded in Fig. 27, so that no force is exerted on the plunger 189 in the direction of its length. The plunger 189 has the exposed end thereof engaging the extension 175 on the bell crank 172. A pin 191 on the plunger 188 slides in a groove 192, as best illustrated in Fig. 24, so as to prevent the plunger 188 from moving out of the sleeve 186. Referring now to Figs. 27 and 24, it will be noted that when a force is applied to the end of the plunger 188 and in a direction to move the same to the right, the spring 190 will be compressed and force the plunger 189 yieldingly against the extension 175, thereby rocking the bell crank in a clockwise direction, as viewed in Fig. 24, or in a counterclockwise direction, as viewed in Fig. 28, it being understood that before the plunger 188 is actuated, the bell crank 172 is in a position substantially as shown in Fig. 24, and the toggle links in the position illustrated in Fig. 26. As the bell crank rotates about its pivot, the end of the element 170 tends to move against the upper surface of the toggle link 141, to move the same downwardly, but is prevented from doing so by the stop shoulder 193 on the arm 179. The arm 179 must, therefore, be moved out of the position shown in Fig. 24 before the element 170 can move the toggle link 141 downwardly.

This latter result is accomplished by an operating rod 194, slidable in the block 176 and having a spring 195 arranged between the collar 196 on the rod 194 and the adjacent surface of the block 176. The rod 194 passes freely through the block 176 and has a member 197 threaded on the end thereof so that the length of the rod 194 may be adjusted by threading the rod more or less into the member 197. The threads on the rod 194 are indicated at 198. The member 197 is pivoted at 199 to the arm 179, so that when the rod 194 is moved against the action of the spring 195, the arm 179 will be rocked in a counter-clockwise direction about its pivot, as viewed in Fig. 28, or in a clockwise direction, as viewed in Fig. 24, thereby moving the stop shoulder 193 out of the path of movement of the end of the element 170 and permitting the element to continue its movement downwardly to thereby move the toggle links 141 and 142 into their horizontal position, illustrated clearly in Fig. 25.

As is illustrated quite clearly in Figs. 7, 8, 9 and 24, the sub-carriage has substantially U-shaped brackets 200, secured at one end thereof to the end castings 53 by the machine screws 201, the other ends of the U-shaped members carrying a bar 202, which has an upwardly extending stop 203 thereon, adapted to engage the plunger 188 when the sub-carriage has moved to substantially the end of its permitted travel. The end of the rod 194 passes freely through an opening in the end bracket 49 and is guided by the end bracket. The rod 194 also passes through an opening 204 (see Fig. 24), so that the end thereof will be in a position to be engaged by the abutment face 63 on the abutment 62 when the sub-carriage has moved to substantially the extreme right-hand position thereof, this position being illustrated in Fig. 24.

Referring now to Figs. 29 and 30, it will be noted that the rod 169 has a collar 205 secured thereto and that the left-hand end thereof bears in the end bracket 49, this end bracket being that shown on the left in Fig. 8. A spring 206 surrounds the rod 169 and abuts against collar 205 and a collar 207 on the rod 169, which collar in turn abuts against the end bracket 49, and normally urges the rod 169 to the right, so that it is in the position illustrated in Fig. 30. In this position, the detent 165 is beneath the toggle link 142, so that if the toggle link 142 is moved downwardly while the parts are in this position, it is obvious that the operating member 161 will move downwardly, and the toggle links 156 and 158 will be straightened out into a substantially horizontal position, in which position the clutch for the sprocket 76 becomes operative, and the sprocket 76 will drive the chain in a reverse direction, it being understood that the sprocket 75 is now idle, due to the fact that the straightening of the toggle links 141—142 causes the clutch for that sprocket to be disengaged.

Briefly, the operation of this clutch-reversing mechanism is as follows: When the sub-carriage has moved substantially to its extreme right-hand position, as viewed in Figs. 8 and 24, the stop 203 will engage the end of the plunger 188 and move the plunger to the right, thereby compressing the spring 190 and yieldingly urging the bell crank in a clockwise direction. After a further movement of the sub-carriage, the abutment face 63 of the abutment 62 engages the end of the rod 194, compresses the spring 195, and rocks the arm 179 to move the stop shoulder 193 out of the path of movement of the end of the element 170, thereby permitting the bell crank 172 to move into the position illustrated in Fig. 28, this movement causing the toggle links 141 and 142 to move to their positions illustrated in Fig. 25, and disengaging the upper clutch for the sprocket 75, and stopping the forward drive of the sub-carriage. Since the detent 165 is beneath the toggle link 142, the operating member 161 moves downwardly, and since it is directly pivoted to toggle link 158, the toggle links

156 and 158 move into substantially horizontal aligned relation with each other and, through the connections previously described, operate the clutch for the sprocket 76, which, due to its rotation in a direction opposite to that imparted to the sprocket 75, causes a reversal of the movement of the chain 55 and a reversal of the movement of the sub-carriage. The sub-carriage then continues its reverse movement to its starting position, and when it arrives adjacent its starting position, the end casting 47 (see particularly Fig. 29) engages the collar 205 and this shifts the rod 169, thereby releasing the detent 165 from its engagement with the under side of the toggle link 142. A spring 208, secured at 209 to the rod 161, and at 210 to the bracket 95, thereafter raises the rod into its uppermost position, as illustrated in Fig. 25. This causes the toggle links 156 and 158 to move to the position shown in Fig. 25, in which position the clutch for the sprocket 76 becomes inoperative. As the operating member 161 moves upwardly, the toggle links 141 and 142 are not operated and consequently the clutch for the sprocket 75 will remain in inoperative position, and the sub-carriage will come to rest.

The reason for bringing the sub-carriage to a position of rest is so that the mechanism need not be operated except when a bag is in a position to have the upper edges thereof folded.

I previously mentioned the fact that the operating element 170 was moved into the position illustrated in Fig. 28 to disengage the clutch for the sprocket 75. In doing so, it was necessary to move the arm 179 to the left, as viewed in Fig. 28. Therefore, as long as the arm 179 is positioned in such a position to permit the element 170 to move downwardly, the stop shoulder 185 will not be in a position to prevent the upward movement of the element 170 as the sub-carriage begins its reverse movement under the action of the driven sprocket 76. However, due to the fact that the detent 181 has a nose 211 protruding out beyond the adjacent surface of the arm 179, and is forced back by the end of the element 170 as it moves into the position shown in Fig. 28, and springs back into position as soon as the element 170 has passed the nose 211, the nose 211 will prevent upward movement of the element 170 until the stop shoulder 185 comes into position over the element 170 to positively retain the same in the position shown in Fig. 28. The arm 179 moves into the position shown in Fig. 28 shortly after the sub-carriage begins its return movement, and due to the fact that the spring 195 will urge the rod in that direction as the abutment 62 moves out of contact with the end of the rod.

When the sub-carriage has completed one complete cycle of movement, which I will hereafter refer to as the forward and reverse movements, the forward movement being that during which the edge of the bag is being folded, and the reverse movement being that during which there is no folding operation, both of the clutches are inoperative and the parts are in the positions shown in Figs. 5, 7, 25, 28 and 29. In order to start the forward movement of the folding mechanism and of the main and sub-carriages, it is necessary that the element 170 be released, so that the bell crank 172 will rock in a clockwise direction, as viewed in Fig. 28, and for this purpose I provide a pivoted arm 212, adjustably pivoted at 213 by a pin and slot connection to the bracket 214. A rod 215 is pivoted at 216 to the free end of the arm 212 for the purpose of rocking the arm about its pivot 213. The rod 194 passes through a notch 217 in the arm 212, so as to permit one side of the arm to engage the collar 218, secured to the rod 194 (see particularly Fig. 24). By moving the rod 215 to the right in Fig. 24, the rod 194 is shifted in the same direction, releasing the element 170 from the top shoulder 185 and permitting the bell crank 172 to move in a counter-clockwise direction, as viewed in Fig. 24. This permits the toggle links 141 and 142 to move upwardly under the influence of the spring 147, this movement causing the engagement of the clutch for the sprocket 75, which thereafter drives the chain 55 in a direction to cause the sub-carriage and main carriage to move forwardly. I have provided a novel means for operating the rod 215, and this means is constructed substantially as follows:

The means for operating the rod 215 is best illustrated in Figs. 9, 10, 11, 22 and 23. Figs. 9, 10 and 11 show the operating mechanism in elevation, and the three operative positions occupied thereby, as the bags are fed by the conveyers. In Fig. 23, there is shown a plan view of this mechanism, when the same is in the position illustrated in Fig. 9. The dotted line position in this figure illustrates a plan of this mechanism when the same occupies the position shown in Fig. 10, and the full line position in Fig. 22 shows this mechanism just before the same moves to dotted position. This mechanism comprises essentially an operating lever normally held in the position shown in Fig. 22, but adapted to be moved, when struck by the bag, to the position illustrated by full lines in Fig. 23, this movement causing the operation of the rod 215 in a manner which will now be described.

A main lever 219 is pivoted at 220 to a bar 221, secured to the brackets 50 by the bolts 222 (see particularly Figs. 5, 6, 7 and 8). There is also another bar 223 parallel to the bar 221 and fastened by bolts 224 to the brackets 50 (see Figs. 9, 10, 11, 22 and 23). A spring 225, secured at 226 to the bar 221, and at 227 to the arm 219, normally holds the arm in the position illustrated in Fig. 22. Rollers 228 rotatably mounted in the bars 229, secured to the upper side of the arm 219, are adapted to roll along the upper surface of the rod 223, so that the arm 219 will move freely about its pivot 220. A bolt 230, adjustably positioned in the slot 231, acts as a limiting stop for the arm 219, under the influence of the spring 225.

The arm 219 carries a member 232, secured thereto by a bolt 233, passing through a slot 234 in the arm, so as to permit adjustment of this member. This member has a downwardly projecting ear 235 (see Figs. 9, 10 and 11, also Figs. 7 and 8). The rod 215 passes through an enlarged opening in this ear and has the threaded members 236 threaded on the rod 215 on opposite sides thereof, the opposed faces of the members 236 being substantially conical, as illustrated clearly in Figs. 22 and 23, and being held in adjusted position by the lock nuts 237, so that the rod 215 will move whenever the arm 219 is moved in either direction about its pivot.

The arm 219 has an extension 238 pivoted at 239 to the arm 219; and a spring 240, embracing the pivot 239, normally urges the lever in a counter-clockwise direction, as viewed in Figs. 22 and 23, the opposite ends of the spring being arranged within a notch 241 and against an ear 242, struck up from the extension 238, as clearly illustrated in Figs. 22 and 23. A detent member

243 is pivoted at 244 to a laterally extending member 245, secured rigidly to the arm 219. A spring 246 embraces the pivot 244, and one end 247 of the spring engages the rear side of the detent member 243 and urges the detent member in a clockwise direction, as viewed in Figs. 22 and 23. The other end 248 of the spring is arranged against the upstanding lug 249, struck up from the end of the releasing member 250, also pivoted at 244. The releasing member 250 is embraced by the hook-shaped portion 251, formed on the end of the member 252, adjustably secured to the bar 223 by the bolt 253, which passes through the slot 231. The detent member 243 has a tail-piece 254 in a position adjacent to the upstanding lug 249 on the releasing member 250. A spring 255, connected at 256 and 257 to the releasing member 250 and to the arm 219, normally rocks the releasing member in a clockwise direction about its pivot, as viewed in Fig. 22. A lug 258 on the releasing member 250 acts as a stop to limit the counter-clockwise movement of the extension 238. The detent member 243 has a nose 259 arranged over the end of the extension 238, and is adapted to be engaged by the struck-up lug 242, when the parts are in the position shown in Fig. 22, whenever a force is applied in the direction of the arrow 260. In other words, when the parts are in the position shown in Fig. 22, the arm 219 and its extension 238 act as a unit, it being noted that in this position of the parts, the lug 249 and the tail-piece 254 are out of engagement with each other.

The bag, which I shall hereinafter refer to by the reference character A, has substantially the shape illustrated in Fig. 71 when the bag is placed upon the conveyer belt 13, and has the open mouth B, forward edges C, and rear edges D, as well as the folds E and longitudinal edges F. As the bag is moved forwardly into a position to be folded by the folding mechanism, the opposite edges F are moved toward each other, so that the parts assume the position illustrated in plan in Fig. 23, and also illustrated in Fig. 9 in end elevation. At a predetermined time in the path of movement of the bag, the same will strike the extension 238, which is offset upwardly, as illustrated in Figs. 9, 10 and 11, and the arm 219 will be rocked about its pivot 220 as the bag continues its movement and until the bag reaches substantially the position shown in Fig. 23. Since the movement of the arm 219 is about the pivot 220, the pivot 244 tends to move to the left, as viewed in Figs. 22 and 23, thereby bringing the end of the releasing member 250 into the position shown in Fig. 23. The free end of the releasing member 250, however, cannot move to the right, due to its engagement with the hook 251, and consequently the releasing member 250 is given a counter-clockwise movement about its pivot relative to the extension 245. This movement causes the struck-up portion 249 to engage the tail-piece 254 and thereby rock the detent member 243 in a counter-clockwise direction about its pivot relative to the extension 245. This releases the nose 259 from its engagement with the struck-up portion 242 and permits the spring 225 to rock the arm 219 into the dotted line position shown in Fig. 23. The extension 238 also rocks about its pivot 239, due to the fact that the spring 225 is stronger than the spring 240, and the bag is permitted to pass the end of the extension 238 (see Figs. 10 and 23). The bag then moves on, and when the bag is clear of the end of the extension 238, the spring 240 rotates the extension 238 about its pivot in a counter-clockwise direction to thereby cause the parts to assume the position shown in Fig. 22, the detent member 243 yielding to permit the struck-up portion 242 to pass the nose 259.

As previously explained, the movement of the rod 215 causes the arm 212 to operate the rod 194 through the intermediary of the collar 218. Therefore, the movement of the arm 219 to the position shown in Fig. 23 will release the element 170 in Fig. 28 and thereby permit the toggle links 141—142 to move into the position shown in Fig. 26, this position of the toggle links being that in which the clutch, which drives the sprocket 75, is operative. The chain 55 will therefore be moved in a forward direction and carry with it the main carriage and the sub-carriage which support the folding mechanism, which I will now describe, the folding operation taking place during the movement of the main carriage and sub-carriage along their paths of movement.

Folding mechanism.—The two end bracket members 49 (see particularly Figs. 1 to 8, inclusive) support the front cam plate 261 and the rear cam plate 262, which plates are bolted or otherwise secured to the end bracket members 49. These cam plates are constructed identically and are for the purpose of supporting some of the folding blades and also constructed so that the folding blades will move in a predetermined manner to produce the desired fold at the top of the bag. The construction of the cam plates is best illustrated perhaps in Figs. 7, 8, 12, 13, 14 and 15. One cam plate has two pairs of identical cam tracks, each pair comprising two differently constructed tracks corresponding to two differently constructed tracks of the other pair. The rear cam plate is similarly constructed. In other words, there is one set of four identically constructed cam tracks for supporting the carrier for the upper folding blades during the forward movement of the main carriage and sub-carriage, and another different set of four identically constructed tracks for supporting and guiding the carrier during the reverse movement of the main carriage and sub-carriage. There is also means for shifting the rollers, which will be described presently, from one set of tracks to the other, at the end of each movement of the main carriage. Since each pair of cam tracks is constructed in an identical manner, the description of one pair will suffice to describe all of the pairs thereof. Reference will be had particularly to Figs. 12, 13, 14 and 15.

The cam plate itself is provided with an opening 263, the upper and lower edges 264 and 265 of which are parallel and are shaped to give the desired up-and-down movement to the carrier for the folding blades during the forward movement of the main carriage. The edges 264 and 265 are spaced apart just sufficiently to permit a roller 266 to roll therebetween, so that the roller cannot have any vertical movement other than that imparted thereto by the cooperating edges 264 and 265. To the forward sides of each of the plates 261 and 262, are secured the upper and lower tracks 267 and 268, which form the second track, which is arranged in a plane parallel to the first track, these tracks being secured to the plates 261 and 262 by the screws 269. The cam tracks which guide the rollers on the forward movement of the main carriage, I shall hereafter designate by the letter G; and the tracks which guide the rollers on the reverse movement of the main carriage, I shall refer to as tracks H.

Each of the rollers **266** have bushings **270**, and rods **271** pass freely through the bushings of adjacent rollers on the front and rear plates **261** and **262**. In other words, the rods can move longitudinally of the axes of the rollers **266** and for a purpose which will appear hereinafter. The cam tracks G and H cause the rollers **266** to rise and fall in a predetermined manner, and there is also another cam, which I shall designate as K, and this causes the longitudinal movement of the rods in the direction of their axes. This cam is illustrated quite clearly in Figs. 9, 10, 11, 15, 19, 20 and 21. The cam K comprises a plate **272**, which is secured at its opposite ends to the lugs **273** by the bolts **274**. A bottom plate **275** (see Figs. 9, 10 and 11) is secured thereto in any suitable manner, as by screws **276**, extending upwardly from the bottom thereof, the ends of the screws being shown in Fig. 15. The plate **275** forms a bottom for the cam slot **277**, which, for the purpose of convenience, is cut clear through the plate **272**. It is obvious, however, that the plates **275** and **272** can be made as a single plate, if desired. A roller **278**, mounted on a pin **279**, is adapted to travel the cam slot **277** in the direction of the arrows shown in Fig. 15. As the roller travels from the position shown in Fig. 15 toward the left, it follows the course of the upper cam slot L, which cam slot is slightly deeper than the other portion M thereof, shown in Fig. 15, in which the arrows point in the opposite direction, and for the purpose of causing the roller **278** to move only along the upper portion L of the cam slot on the movement of the roller to the left. On the return movement of the roller to the position shown in Fig. 15, the same travels along the lower portion of the cam slot M, as indicated in that figure by the arrows. An inclined abutment **280**, secured to the plate **281**, arranged transversely of the cam plate **272**, is adapted to raise the roller vertically, as viewed in Fig. 20, when the same reaches the left-hand extremity of its movement, so that the roller may travel in the portion M of the cam slot **277**, as viewed in Fig. 15, on the return movement thereof.

The roller **278** and its mounting are perhaps best illustrated in Figs. 9, 10, 11, 19, 20 and 21, in which **282** represents a bearing secured by the pins **283** to the rod **271**. It will be understood, of course, that there are two cam slots **277** in the cam K, and two cooperating rollers **278** operating in those cam slots, so as to give parallel motion to the folding blades, in a manner which will appear presently The roller is secured to the end of a spindle **284** which slides vertically in the bearing **282** and the pin **279** is secured against longitudinal movement by the cross-pin **286**. The bearing **282** has an L-shaped slot **287** in one side thereof, as clearly illustrated in Fig. 21, and a pin **288**, secured to the spindle **284**, is adapted to travel in the slot **287**, and when in the uppermost position, as viewed in Fig. 21, the same can be moved into the horizontal portion of the L-shaped slot to retain the pin in its upper position. The pin, as previously mentioned, is moved upwardly by the inclined abutment **280**, and when the pin has been moved onto the top of the abutment, a means comes into play to engage the pin **288** and move same into the position shown in Fig. 21, this means being the stop **289**, secured to the cam plate **261**. The roller is, therefore, retained in this position until the carriage has entered the portion M of the cam slot **277**. At about this time, the pin **288** engages the stop **290**, also secured to the cam plate **261**, and this rocks the spindle until the pin is over the vertical portion of the slot **287** and the roller can then move downwardly to its original position. A spring **291**, coiled about a reduced portion **292** on the spindle **284**, and arranged within a recess **293** in a yoke **294**, secured by the pins **295** to the opposite ends of the rods **271** (see Figs. 9, 10 and 11), urges the spindle **284** downwardly and positions the roller in the bottom of the portion L of the cam slot **277** after the roller leaves the portion M thereof.

The bearings **282** are provided with flat faces which are engaged by the plates **285**, secured at each of their ends to the bearing brackets **285'**, which in turn are secured to one of the end casting members **47** of the main carriage (see particularly Fig 20). These plates permit the bearing block **282** to slide therebetween in the direction of the shaft **271**, but prevent longitudinal movement of the carrier in the direction of feed of the main carriage. Consequently, the bearing block **282** is caused to move with the main carriage, and as a result the carrier is caused to have simultaneous movement with the main carriage. Only one of the bearing blocks **282** is connected in this manner to the main carriage, the other bearing block being caused to move in unison with the first bearing block by the tie-rod **284'** (see Figs. 19, 20 and 21).

The mechanism, which has just been described, is constructed to give longitudinal movement to the rods **271** by means of the cam K and the cooperating roller **278**, whereas the up-and-down movements of the rods **271** are accomplished by means of the cam tracks G and H.

The yokes **294** are connected by means of the tie rods **296**, so that the rods **271**, yokes **294**, and tie rods **296** move as a unit and are supported by the rollers **266**. I shall hereafter refer to this unitary structure as the carrier for the upper folding blades. The forward ends of the yokes have the folding blades **297** and **298** secured thereto by the bolts **299**, the blades being spaced apart by the bar **300** arranged therebetween. The forward ends of the castings **47** are connected by the plate **52** which bridges the space therebetween and has an upwardly extending folding blade **302** rigidly formed thereon to cooperate with the folding blades **297** and **298**. An adjustable folding blade **303** has a base portion **304** slidable to and from the folding blade **302** (see Figs. 4, 9, 10 and 11). Screws **305**, passing through slots **306** (see Fig. 4), guide the folding blade **303** as it moves to and from the folding blade **302**. There are two angular brackets **307** integral with the castings **47**, and the plate **52** is secured thereto. Two lugs **308** are secured to the upper side of the base **304**, and the upwardly extending portions of **307** and **308** are threaded in opposite directions to receive the left-handed and right-handed threads **309** and **310**, respectively (see Figs. 9, 10 and 11), formed on the shaft **311**. A crank **312**, secured to the shaft **311**, carries a spring-pressed pin **313** in the sleeve portion **314** thereof. These pins **313** are adapted to travel in cam slots formed on the front cam plate **261** (see Fig. 12), these cam slots being indicated generally by the reference character N. The cam slot N has a portion **315**, which is used on both the forward and return strokes of the main carriage, and lower and upper portions **316** and **317**, used on the forward and reverse movements of the main carriage, respectively. The pin **313** travels along the slot

in the direction of the arrows shown in Fig. 12. As the main carriage moves along its path of travel from right to left in Fig. 12, the pin **313** will first travel horizontally in the horizontal portion of the cam slot **315**, and then will move upwardly upon the arcuate portion thereof to the position **318**, and continued movement of the main carriage will cause the pin to travel down the arcuate portion of the lower portion of the cam slot **316**, thus causing the crank **312** to rotate in a clockwise direction through substantially 180 degrees. This motion is such that the parts **307** and **308** are drawn rapidly toward each other and, as a consequence, the lower folding blades **303** and **302** are drawn toward each other, for a purpose which will hereinafter appear.

The lower folding blades are then retained in this position until the main carriage reaches substantially the full extent of its travel toward the left. The pin **313** then travels upwardly along the portion **319**, which has an inclined cam strip **320** (see Figs. 12 and 13) arranged therein, so that when the pin **313** arrives in the uppermost part **317** of the cam slot N, it will drop over the abrupt edge **321** of the member **320** and prevent the pin from traveling back along the portion **319** on the return movement of the main carriage. However, during the movement of the pin along the portion **319**, the crank is given a reverse or counter-clockwise movement, which tends to move the folding blades **303** and **302** away from each other slightly. On the return movement, the crank travels along the portion **317** of the cam slot N, and when the pin **313** again arrives at the position **318**, it will drop into the portion **315** of the cam slot and travel along the portion **315** to its initial position, shown in Fig. 12, the difference in the depths of the portions **317** and **315** of the cam slot being shown in Fig. 14. A pin **322** (see Fig. 12) engages the edges of a plate **323**, secured by pins **324** to the crank **312**, to insure that the pin **313** will travel along the desired portions **316** or **315** from the position **318**, depending upon whether the main carriage is moving forward or in a reverse direction.

As the rollers **266** travel from right to left in Fig. 12, the same drop into the depressions **325**, thereby bringing the upper folding blades down into the position illustrated in Fig. 10. Shortly before the cam rollers drop into the depressions **325**, the rollers **278** move rearwardly of the machine into the portions L of the cam slots **277**, shown in Fig. 15, and this causes the folding blade **298** to draw the upper edges of the bag to the left, as viewed in Figs. 9, 10 and 11, over the folding blade **302**. The upper folding blade **298** is moved into a position above and between folding blades **302** and **303**, so that when the rollers **266** drop into the depressions **325**, the upper edges of the bag are given a double fold as the blade **298** forces the upper edges of the bag into the space between the blades **302** and **303**.

As the rollers **266** move upwardly again onto the portions **326** of the cam G, the folding blade **298** is withdrawn and, about the same time, the pin **313**, which already has begun its clockwise rotation, begins to travel down along the portion **316** of the cam slot N, so that the folding blades **302** and **303** grip the folded portion of the bag therebetween. The rollers continue their travel along the cam G until they drop downwardly, due to the depressed portion **327**, formed therein. But prior to this movement, the rollers **278** have moved in the opposite direction to the extreme permitted extent toward the front of the machine, or to the right, as viewed in Fig. 11. As the rollers **266** drop into the depressed portions **327** of the cam G, the folding blade **297** will fold the free ends of the upper edges of the bag downwardly into the position illustrated in Fig. 11, to produce a double fold in the upper edges thereof. Simultaneously with this movement of the blade **297**, the pin **313** moves upwardly along the portion **319** of the cam slot N, to release the grip of the plates **303** and **302** upon the folded portion of the bag, to permit the bag to move along its path of travel under the influence of the belt conveyers, while the main supporting carriage is at rest, it being understood that the main supporting carriage comes to rest at substantially the time that the rollers **266** reach the end of their travel along the cam track G.

The rollers, as they reach the end of their path of travel to the left, as viewed in Fig. 12 or Fig. 15, strike the deflecting members **328**, which cause the rollers to be shifted onto the cam tracks H, so that on the return travel of the main carriage, the rollers will travel along the cam tracks H, rather than the cam track G.

Leaving aside, for the present, what happens to the bag after it is folded, I will proceed to describe the return movement of the carriage. This is a rather simple movement, as will be seen from the shape of the cam tracks H, it only being necessary for the cams H to raise the rollers once at the point **329** to position the rollers in their initial position, it being understood also that the rollers **278** travel along the portion M of the cam slots **277** during the return movement of the main carriage. The rollers **266** are slightly beveled on one side, as indicated in Figs. 9, 10 and 11, and are prevented from moving off of the cam tracks by the flanges P located at various points along the track on both sides thereof. Just before the rollers reach their initial position at the right in Figs. 12 and 15, the same strike the cam blocks **330**, secured to the cam tracks H by the screws **331** and locating pins **332**. The rollers are then in a position to move in the manner previously described for the forward movement of the carriage.

As is clearly illustrated in Figs. 9, 10, and 11, there is an angle piece **338** having a horizontal portion arranged over the folding blades **302** and **303** when the blade **297** is moving downwardly into the position shown in Fig. 11. This horizontal portion of the angle piece is for the purpose of moving the looped portion of the fold downwardly, in case the loop is formed rather loosely, and assists in preventing an incorrect fold. This angle piece is secured to the blade by the screws **339** and also serves as a guide during ejection.

As will be noted from the previous description of the action of the sub-carriage, the same had an extended movement when the detent members **58** were raised to an inoperative position. On this extended movement of the sub-carriage, the folded edges of the bag are moved out from between the folding blades in a direction longitudinally of said folding blades and toward a feeding mechanism which retains the fold in proper position while the same is being stapled. Of course, the sub-carriage is traveling at substantially the same rate as the conveyers, and when the main carriage stops, a vertically extending abutment **333** on a rod **334**, carried by a bracket **335**, secured to the end of the rod **54**, which acts also as a tie rod for the end pieces **53** of the sub-

carriage, engages the right-hand end of the folded portion of the bag, as viewed in Fig. 16, between the folding blades **302** and **303**, the rod **334** being guided by a plate **336** secured thereto on the under side thereof, and guided by a slot **337** in the plate **52**, and held in that slot by the base **304** of the folding blade **303**.

This causes the folded edges of the bag to be moved longitudinally from between the folding blades after the main carriage comes to rest. As the folded edges of the bag leave the folding blades at the left in Fig. 16, it is received by a feeding mechanism which feeds the bag to a stapling mechanism, which mechanism I will describe presently.

Feeding mechanism.—After the folded edge of the bag has been partially ejected from between the folding blades by the upwardly extending abutment **333**, the forward edge of the folded portion will be gripped by the feeding mechanism, which conveys the bag to the stapling mechanism. This feeding mechanism is shown in Figs. 1, 3, 44 and 45, and is perhaps best illustrated in the latter two figures. The mechanism is relatively simple and comprises two shafts **340**, carrying sprockets **341**, about which are trained the chains **342**. Cross-pieces **343**, connected to opposed links of the chains **342**, in a well known manner, are adapted to support gripping means for gripping the folded edges of the bag. The gripping means comprises the cam members **344**, having cam surfaces **350** pivoted at **345**, and yieldingly moved in one direction about their pivots by the springs **346**, connected to the pins **347** on adjacent cam members **344**. Normally, the springs move the cam members into the positions illustrated at the center in Fig. 45, and cams **348** and **349** are adapted to pivot the cam members **344** against the action of their springs, so as to space their opposed cam surfaces farther away from each other, as illustrated at the extreme right and left in Fig. 45. The cams **348** and **349** are so designed that when the cam members **344** are traveling horizontally from right to left, as viewed in Figs. 44 and 45, the same will be under the action of the springs, but when moving around the sprockets, the cam surfaces **350** will be moved away from each other so that there will be no tendency to lift the bag by the movement of the cam members about the sprockets.

The shafts **340** are rotatably mounted on a bracket **351**, secured to the end bracket member **49** by the bolts **352**, and auxiliary brackets **353**, bolted to the bracket **351** by the bolts **354**, assist in supporting the shafts **340**. The supplemental bracket **355**, secured to the bracket **351** by the bolts **356**, rotatably supports a shaft **357**, carrying a sprocket **358** at one end thereof, and a gear **359** at the other end thereof, which gear meshes with the gear **360** on the end of one of the shafts **340**, as is clearly illustrated in Fig. 45. In Figs. 1, 25 and 26, there is illustrated a sprocket **361** secured to the shaft **77** so as to rotate therewith. A chain **362** (see Fig. 1) is trained over the sprocket **361** and over the sprocket **358**, so that the shaft **357** is also continuously rotated, and as a consequence the feeding mechanism is continuously actuated. The folded edge of the bag comes into engagement with the guiding member **363**, which guides the folded edge into the recess **364**, formed on the under surface **365** on the arm **654** by the guiding members **370** and plate **366**. The latter being adjustably connected to the projection **647** on the arm **654** by the pin and slot connection **367—368**, has an edge **369** opposing the guide member **370**, so as to maintain the fold in the edge of the bag until the same is moved between the two cam members **344**, indicated at R. The conveyer is moving from right to left in Fig. 45, and it will be noticed that the tail-pieces on the cam members **344** are just about to move out of contact with the cams **348**. As soon as the tail-pieces move out of engagement with the cams **348**, the spring **346** moves the cam members **344** about their pivots and causes the cam surfaces **350** thereof to grip the opposite sides of the folding edge of the bag. The cam surfaces are slightly eccentric and it is obvious, from an inspection of Fig. 45, that as the lower run of the conveyer moves to the left, the reaction between the cam members and the bag will cause the cam members to increase their gripping action as the bag increases its resistance. Therefore, there will be a considerable pull on the bag and the cam members will not tend to release their grip on the edges thereof. The cam members **344** are moving at substantially the same speed as the conveyers and, therefore, all parts of the bag will move forward in unison. It will be understood, of course, that during a portion of the feeding movement of the feeding mechanism, the upwardly extending abutment member **333** is in engagement with the rear end of the folded edge of the bag and assists in moving the folded edge from between the folding blades. Supporting bars **371** support the lowermost rows of the chains **342**, as is clearly illustrated in Figs. 44 and 76. This prevents the sagging of the chains and insures a more uniform operation of the feeding mechanism.

Stapling mechanism.—The feeding mechanism feeds the bags between the pressure block and the stapling head of the stapling mechanism, the stapling mechanism being inoperative until the forward edge of the bag is in a position to receive the first staple, at which time the stapling mechanism begins to operate, and this operation continues until the bag has received its last staple, at which time means comes into operation for stopping the operation of the stapling mechanism. However, before proceeding with the means for driving the stapling mechanism, I will describe the operation of the stapling head itself.

This mechanism is perhaps most clearly illustrated in the enlarged views, Figs. 46 to 68, inclusive. In general, the stapling mechanism comprises a stapling head, a clincher block for clinching the staples, and means for feeding a wire to the stapling head, by which the staples are formed and driven. The stapling mechanism is adapted to have a slight movement in the direction of feed of the bag, so that when the stapling mechanism is driving a staple through the folded edge of a bag, the stapling mechanism will be moving at substantially the same speed as the bag, thereby making it unnecessary to hold the bag stationary while the staple is being driven. I will first describe the operation of the means for forming and driving the staple, together with the means for feeding the wire from which the staples are formed.

The stapling mechanism is carried by a supporting plate **372** which, as is illustrated in Fig. 3, is pivoted near the rear of the machine at **373** and is adapted to have a slight oscillating movement, which movement is imparted thereto by a cam **374**, secured to a shaft **375**, driven continuously in a manner which will be described later. The cam **374** is in the shape of an eccentric, although it is obvious that any desired form can

be given to the cam 374 to impart movement to the stapling mechanism. A roller 376 (see Figs. 47, 48 and 53) is rotatably mounted within a recess 377 in the plate 372, and the roller is set at substantially the same angle as the shaft 375 and engages the periphery of the cam 374. It is obvious that rotation of the cam will cause an oscillation of the plate 372 about the pivot 373; a spring 378, secured to a lug 379 on the plate 372, and to a bolt 380 on the bracket 381, which rotatably supports the shaft 375 in the bearings 382, acting to hold the roller 376 against the periphery of the cam 375.

The stapling mechanism has a rectilinear movement transversely to the path of movement of the bag, and during the forward stroke of the stapling head, one staple is driven through the folded edges of the bag, and another staple is simultaneously formed, to be driven through the folded edge of the bag on the next stroke of the stapling head. The staples are formed from a piece of wire coiled about the spool 383, carried by an arm 384, which in turn is secured to an arm 385, mounted on one of the uprights 1 by a split bearing 387 (see Fig. 3). The outer end of the arm 385 is bent laterally and supports one end of the forward guide rod 48, this guide rod supporting a portion of the stapling mechanism. The wire is indicated by the reference numeral 388 and is fed over a guide 389 and through straightening rollers 390 and 391, rotatably mounted on the blocks 392 and 393, secured to the arcuate extension 394 on the plate 372. These rollers operate to straighten the wire in a manner which is well known.

During the oscillating movement of the supporting plate 372, the same is guided by the rollers 395 and 396, mounted between the lugs 397 on the bottom of the plate 372 (see Figs. 51 and 52) and lugs on the U-shaped bracket 398, secured to the plate 399 by the bolts 400, the plate 399 in turn being secured by the bolts 401.

The bracket 381 has a tubular sleeve 402 surrounding the guide rod 48 (see Figs. 46, 51 and 52), and this has a lateral extension 403 having an upper flat surface upon which the roller 395 rides. The roller 396 engages the upper surface of the supporting plate 372, so as to prevent upward movement thereof.

The stapling head, which includes the staple-forming and driving means, is operated by a link 404, and this is given a reciprocating movement transversely to the bag feed by mechanism to be described later. The upper surface of the plate 372 is provided with the parallel guides 405, formed integrally therewith, and these guide the stapling head in its rectilinear movement. Between the guides 405, there is arranged a base member 406, tapered at 407 and secured by the machine screws 408 rigidly between the guides 405. A detent member 409, pivoted at 410 in a recess 411 in the base member 406, has a notch 412 in the free end thereof and is yieldingly urged upwardly by the spring 413, secured to the member 406 by the screw 414. Slidably supported upon the base member 406 between the guides 405, is a member 415 which carries the driving head 416 and part of the staple-forming mechanism, to be described presently. This member is illustrated in perspective in Fig. 56, and in cross section in Figs. 49, 50, 51 and 52. At one end of the member 415, there is a block 417 having a pivot 418 to which the driving link 404 is pivotally connected. The block 417 and member 415 are connected by a screw 419, threaded through the member 415 and into the block 417, the screw 419 having a shoulder thereon, abutting against the upper surface of the block 417, as is clearly illustrated in Figs. 49, 50, 51 and 52. The upper portion of the screw is smooth and acts as a pivot for the portion 420 of an adjusting link, the purpose of which will appear later.

The member 415 has a slot 421 therein, in which the projection 422 on a floating member 423 may reciprocate. The member 423 is mounted between guide blocks 424 and pivoted to a pin 425, freely received within the guide blocks 424 and member 423. Springs 426, passing through openings in the member 423 and engaging within recesses in guide blocks 424, yieldingly press the guide blocks against the vertical guides 405 to frictionally hold the member 423 in any position to which the same is moved. To the under side of the member 415, there is secured a block 427, by means of the screws 428. This block 427 is for the purpose of moving the detent member 409 in a counter-clockwise direction about its pivot, as viewed in Figs. 49 to 52, inclusive, and for a purpose to appear later. The member 415 also has a bushing 429 threaded therethrough, and a cap 430 is threaded over the protruding end of the bushing 429. A ball 431, spring-pressed by a spring 432, acts as a detent member, and the motion of the ball 431 in a downward direction is limited by the edge of the bushing surrounding the opening in which the ball is mounted, the same being slightly reduced in diameter in a manner which is quite well known to the mechanical arts. Between the lower surface of the member 415 and the upper surface of the member 406, there is arranged a staple-guiding member 433. This is illustrated in perspective in Fig. 58, and in cross section in Figs. 49 to 52, inclusive. This member is also illustrated in bottom plan in Fig. 55. There is a recess 434 in one side of the staple-guiding member 433, into which the end of a screw 435 protrudes, the screw being threaded into one of the guides 405. This screw positively limits the forward and backward movement of the guiding member 433. In Fig. 49, the parts are shown in their retracted position, namely, that position in which the parts are farthest from the bag. In this position, the bag may be fed forwardly without being frictionally retarded by the stapling mechanism. It is at this time also that the stapling mechanism is moving backwardly under the influence of the spring 379, or to the right, as viewed in Fig. 48. In this position of the parts, the ball 431 rests within a notch 436, formed in the upper surface of the member 433, in a manner quite clearly illustrated in this figure and in Fig. 58. If the link 404 then moves to the left, to the position shown in Fig. 50, the member 433 is carried along therewith, due to the ball 431 being in the notch 436. By this time, however, the member 433 has reached its full permitted extent of movement, due to the fact that the screw 435 has come into engagement with the end of the recess 434. This brings the forward edge of the member 433 substantially against the bag. The member 416, however, continues its forward movement, and the ball 431 leaves the notch 436 and continues its movement to the left.

The member 433 has opposed grooves 437, which have a U-shaped staple 438 arranged therein, with the legs of the staple in the grooves and pointing toward the left, as viewed in Figs. 49 to 52, inclusive. The driving member 416 has tongues 439 on opposite edges thereof, and these

are arranged to slide within the grooves 437. There is also a notch 440 in the forward edge of the driving member 416 to engage the portion which connects the legs of the U-shaped staple. Since the member 433 is stopped, and the member 416 is still moving, the staples will be pushed along the guides 437 into engagement with the folded edges of the bag, shown in dotted lines in Figs. 49 to 52, inclusive, as seen in Figs. 51 and 52.

In Fig. 48, there are shown the upstanding bearing members 441, secured to the guides 405, and these support a pivot pin 442, which in turn passes through a rocking arm 443 to provide a pivot about which the arm may rock relative to the guides 405. This rocking motion is in a vertical direction. To one end of the rocking arm 443, there is secured a bushing 444, which receives a round-nosed plunger 445, spring-pressed downwardly by the spring 446, and limited in its downward movement by a nut 447 and lock nut 448, threaded to a rod 449, secured to the plunger 445. The under side of this member is shown in perspective in Fig. 61. A plate 450, secured by the screws 451 to the guides 405, extend across the space between the guides between the members 415 and 443. The pin 442 is held in place by a screw 452. An adjustable screw 453, arranged within an opening 454, is adapted to contact with the plate 450 to limit the clockwise rotation of the rocking arm 443 in a clockwise direction. To the left-hand end of the member 443, and on the under side thereof, there is secured a block 455, secured thereto by a screw 456, the block having legs 457 which embrace the sides of the member 443, so as to make the block rigid with respect thereto. As is clearly illustrated in Fig. 61, and also 41 to 52, inclusive, there is a spring 458, having one end secured within a slit 459, and the other end thereof arranged slidably within the recess 460 in the block 455. This spring is adapted to engage a cam member 461, secured by the screw 462 to the upper surface of the member 415.

The block 455, which is quite clearly illustrated in Fig. 61, has notches 463 in the opposite lower edges thereof. There is also a slot 464, extending vertically therein, and one end of the slot, near the bottom thereof, is cut away at 465 to guide the wire into the slot. Adjacent the slot 464, is a rounded surface 466, which permits clearance for a purpose which will appear hereinafter. The surfaces 467 and member 433 are spaced apart a distance which is just a trifle greater than the overall width of the staple from the outside of one leg to the outside of the other. Thus, the staple may be forced down between the surfaces 467 into the grooves 437, the staple being slightly compressed during this operation, and expanding again after it is arranged within the grooves 437.

The operation of the stapling mechanism, so far described, is as follows: I will consider the operation of the mechanism through the various positions shown in Figs. 49, 50, 51 and 52. In Fig. 49, the forward movement is ready to begin. The ball 431 is in the nocth 436, secured to the upper side of the member 416, and the spring 458 is free of the cam member 461. This causes the left-hand end of the arm 443 to be depressed, due to the reaction of the spring 446. Movement of the link 404 to the left will cause the members 416 and 433 to move together as a unit, the cam 461 striking against the under side of the spring 458. Since the pin 442 is mounted upon stationary bearings, the plunger 445 rides off the hardened steel plate 468 into the position shown in Fig. 50, the spring 468 by this time having engaged the cam 461 to raise the left-hand end of the arm 443 clear of the driving head 416, so that the driving head can move the staple 438 along the grooves. It will be noted that in Fig. 49, the connecting portion of the staple is still arranged within the slot 464 and does not move out of the slot until substantially the time at which the driving member 416 is to engage the same. It is for this purpose that I have provided the rounded portion 466 on the block 455. Also, if the block has not been moved upwardly by the spring 458, the end of the driving plate 416 will engage and raise the block. However, by using the spring 458 to normally raise the block, wear is minimized between the end of the plate 416 and the block 455. The block 455 is not raised sufficiently, however, to pass out of engagement with the wire 388, which rests on the upper supporting surfaces 469, as the slot 464 acts as a guide for the wire at all times, as well as a means for holding the staple while it is being formed.

When the parts reach the position shown in Fig. 50, the notch 412 in the end of the detent member 409 receives the rear end of the member 433 and prevents its return movement, or movement to the right, as viewed in this figure. The ball 431 rides out of the notch 436 as the member 416 continues its movement to the left to drive the staple, the motion continuing until the parts reach the position shown in Fig. 52, in which the ball 431 rests within a notch 470 in the upper surface of the member 433, so that on the return movement of the member 416, the member 433 will be carried along therewith. Also, when the parts reach the position shown in Fig. 51, the block 427 engages the upper surface of the detent member 409 and begins to depress the same. When the parts reach the position shown in Fig. 52, the detent is fully depressed and the end of the member 433 will be out of the notch 412, permitting the ball 431 to draw the member 433 to the right again as the member 416 moves to its extreme right-hand position, as shown in Fig. 49.

It will be understood that during substantially all of the forward movement of the link 404, the member 423 remains stationary, due to the frictional engagement of the guide blocks 424 with the guides, and due to the fact that the nose 422 of the member 423 may move freely in the slot 421. Just before the end of the forward stroke, however, the right-hand end of the member 423 engages the end of the slot 421 and is caused to move with the member 415. This moves the upper side of the nose against the end of the plunger 445, and since the upper surface is inclined slightly, the plunger is raised into the position shown in Fig. 52, thereby causing the lever to be urged in a counter-clockwise direction by the spring 446. However, the block 455 cannot move downwardly any substantial amount, due to the fact that the driving plate 416 is arranged directly therebeneath and can only move downwardly a slight amount to bring the staple in between the guiding surfaces 467 on the member 433. The spring pressure, acting on the plunger 445, holds the member 423 in the position shown in Fig. 52, until the nose engages the opposite end of the slot 421, which is substantially at the end of the return movement of the link 404. As the member 423 moves to the right, the

plunger 445 rides down the inclined surface of the nose 422, thereby relieving somewhat the pressure which the block 455 has on the upper surface of the driving plate 416. By this time, the spring 458 is also substantially out of engagement with the cams 461. The final movement of the link 404 on the return stroke causes the plunger 445 to ride upwardly onto the surface of the hardened steel plate 468, to position the parts in the position shown in Fig. 49, the spring 458 now being completely out of engagement with the cam 461. The rocking arm 443 is now free to rock about its pivot under the influence of the spring 446. The block 455 will, therefore, move downwardly and position the legs of the staple in the notches 437, as seen in Fig. 49. The block 427 is also moved out of engagement with the detent member 409, which is now in a position to operate upon the next movement of the link to the left. It will be understood, of course, that the screw 435 limits the return movement of the member 433 by its engagement with the opposite end of the notch 434.

Staple-forming mechanism.—To the main supporting plate 372, there is pivoted an arm 471 at 472, and this arm has an extension 473, having an upstanding lug 474, in which is threaded a screw 475, having a knurled head thereon and mounted for rotative movement only in a lug 476, formed on the main supporting plate 372. By means of the screw 475, the arm 471 may be adjusted about its pivot. To upwardly extending guides 477, formed integrally with the plate 372 act as a guide for a block 478, which has a pin 479 extending therethrough and through a portion 480 of an arm, the other portion being indicated by the reference number 420. The portions 480 and 420 are connected by a turn buckle 481, threaded into each of the portions 420 and 480 and held in adjusted position by the lock nuts 482. A wire-feeding arm 483, pivoted at 484 to the extension 473, has the tail portion thereof provided with a slot 485 of a shape which is shown quite clearly in Fig. 47. Since the pin 479 moves whenever the link 404 is moved, due to its connection therewith by the adjustable arm 480—420 and pivot pin 419, the pin 479 will travel forwardly with the link 404 and be guided in a straight path by the guides 477. At the same time, however, the pin travels in the slot 485 and rocks the lever in a clockwise direction, as viewed in Fig. 47, to bring the parts into the position shown in Fig. 48. Due to the shape of the cam slot, the last portion of the movement of the feeding arm 403 is relatively slow, and when next it begins its counter-clockwise movement, the motion will also be slow to assist the friction mechanism, to be described presently, in taking hold of the wire and getting the same in motion, for it is during the counter-clockwise movement of the arm 483 that the wire is fed into a position to be cut off and formed into a staple.

On the free end of the arm 483, there is secured a hardened steel block 486, which acts as one part of the friction-gripping means for the wire. The other friction-gripping means comprises a block 487, secured non-rotatably to the end of an arm 488 by the pins 489. The arm 488 is pivoted at 490 and is connected by means of a spring 491 to a tail-piece 492 on the arm 488, and to a tail-piece 493 on the arm 494, pivoted at 495, and limited in its movement about its pivot, under the action of the spring 491, by a stop pin 496. The spring 491 always retains the arm 494 against the stop 496. The arm 494 is used purely for the purpose of releasing the block 487 manually, if and when desired. On the counter-clockwise movement of the arm 483, it is obvious that the resistance of the wire tends to rock the arm 488 in a clockwise direction to increase the gripping effect of the block 487 on the wire. However, on the clockwise movement of the arm 483, the resistance of the wire causes the block 487 to move away from the block 486 so that there is no substantial gripping action on the wire on the return movement. The end of the arm 471 (see Figs. 47, 48, 59 and 60) is provided with a tubular member 497, which is held firmly in position on the end of the arm by the screw 498, passing through the lugs 499. The wire is fed through an opening in the tubular member, which is substantially of the same diameter as the wire, but sufficiently larger than the diameter of the wire to permit the free passage of the wire therethrough. The tubular member projects outwardly from one side thereof, and a knife 504 is arranged adjacent the projecting end of the tubular member to cut off the wire at a predetermined time and thereby determine the length of the staple. The wire is fed through the slot 464, and the cut-away portion 465, previously described, acts as means for guiding the wire as it enters the slot. One end of the wire passes through and beyond the slot and engages the spring 501, which is arranged with its flat face at an angle (see particularly Figs. 47 and 59), so as to normally hold the end of the wire down, especially while the wire is being cut. This also prevents the wire from being moved too far through the slot 464, for there is some tendency of the cutting knife to throw the portion of the wire which is cut off from the main portion, which, of course, would be undesirable, in view of the fact that the staples would not be provided with legs of the same length.

The end of the arm 471 also carries a pivot 502, upon which is mounted the knife-carrying arm 503. As is best illustrated in Fig. 54, the knife 504 is beveled at the opposite edges thereof and guided between the beveled edges of the guides 505, secured to the arm 503, which is mounted to rock about the pivot 502, a set screw 506 being used to clamp the knife in adjusted position between the guides. The forward edge of the knife is also at an angle, as indicated at 507, and is adapted to be moved past the end of the tube 497 to cut the wire after the wire has been fed through the tube the proper amount. On the reverse side of the arm to that shown in Fig. 54 (see Fig. 62), there is secured a cam member 509, having the lower surface 510 and the upper surface 511. The upper side of the arm 503 also carries a block 512, secured thereto by screws 513, which block could be made as an integral part of the arm.

An arm 514, carrying a roller 515 at the free end thereof, has a universal connection with a portion 480 of the adjustable link 480—420. This universal connection comprises a block 516, pivoted at 517 to the portion 480, and a pin 518 extending transversely to the pivot 517 and extending through the block 516 and arm 514. A spring 519, embracing part of the portion 480 and having one end thereof overlying the upper side of the block 516, as indicated in Fig. 47, is adapted to normally move the block 516 in a counter-clockwise direction, as viewed in Fig. 54, or clockwise, as viewed in Fig. 62. A spring 520, having the ends 521 thereof embedded in openings in the block 516, has the end portion 522 thereof engaging a side of the arm 514 to urge the arm 514

in a counter-clockwise direction, as viewed in Fig. 47, so that the roller **515** is held against the side of the arm **503**, which carries the cam **509**. A spring **523**, secured by a screw **524** in an opening in the arm **503**, adjacent the guides **505**, has the opposite end thereof held in a recess in the adjacent bearing member **441** and is for the purpose of normally urging the arm **503** in a counter-clockwise direction, as viewed in Fig. 62, or a clockwise direction, as viewed in Fig. 54. Since the block **516** moves with the adjustable link **480—420**, it will move forward with the link whenever the actuating link **404** is moved to drive the staple. This causes the roller **515** to strike the lower surface **510** of the cam **509** (see Fig. 62) and rock the arm **503** in a clockwise direction, as viewed in Fig. 62, or a counter-clockwise direction, as viewed in Fig. 54. This brings the knife down against the wire and cuts the wire to form a piece of wire of the length desired for a staple. After a roller **515** has moved clear of the cam **509**, the arm **503** rotates back into its position shown in Figs. 54 and 62, under the influence of the spring **523**, to cause the knife to clear the opening in the tubular member **497**. The return movement of the roller **515** causes the roller to ride up over the surface **511** without actuating the arm **503**. The roller **515** is prevented from downward movement by the lug **525**, formed on the side of one of the guides **405**.

Staple-driving mechanism.—When the parts are in the position shown in Fig. 51, the wire has just been cut, as will be clear from the position of the right-hand end of the arm **503**, and the staple has just been formed by the staple-forming blocks **526**, secured to the opposite sides of the member **415** and the block **461**. Each of the staple-forming blocks **526** has a forward edge thereof sloping, as at **527** (see Figs. 49, 50, 52 and 56), there also being a notch **528** at the lowermost forward end thereof, the notch **528** being adjacent the sloping surface **527**. The blocks **526** also have the forward edges **529** thereof sloping rearwardly on the outer faces thereof, as seen in Fig. 56.

At about the time the knife has cut the wire, the wire is arranged within the notches **528** and notch **464**, the wire resting upon the surfaces **469** of the member **433**. After the wire has been severed, the continued movement of the blocks **526** to the left, as viewed in Figs. 51 and 52, causes the ends of the wires, which project beyond the opposite sides of the block **455**, to be turned inwardly toward each other and into the notches **463**. This forms the staple into a U shape, and the blocks **526** continue their movement with the staple-driving member **416** to cause the staple to be driven through the folded edge of the bag. The staple, which is thus formed, is held firmly against the surfaces **469** by the action of the spring-pressed plunger **445**, which is raised onto the nose **422** of the block **423** when the previous staple is driven through the folded edge (see Fig. 52). The block **455** continues to be moved downwardly by the action of the plunger **445** until almost to the end of the return stroke of the link **404**. This causes the completed staple to be forced downwardly into the recesses **437** in the member **433** as soon as the driving member **416** clears the block **455**, and the staple is ready to be driven through the bag at the next forward movement of the link **404**.

Mechanism for changing size of staples.—As previously stated, the arm **471** is adjustable about its pivot **472** by the thumb screw **475**. This is for the purpose of changing the length of the legs of the staples, for it is obvious, from an inspection of Figs. 47 and 48, that if the arm **471** were rotated in a clockwise direction, the end of the tubular portion **497** would also be moved farther away from the block **455** and thereby increase the length of the wire protruding beyond the block **455** after the wire has been cut. This movement of the arm **471** about its pivot also causes a bodily movement of the rocking arm **483** in a clockwise direction. At the same time, the end of the slot **485**, which is nearest the pivot **484**, is moved farther away from the center line of the space between the guides **477** for the pin **479**. When the pin **479** reaches the end of the slot nearest the pivot **484**, the arm will be given more of a movement about its pivot than when this end of the slot is nearer to the center line just referred to. The reason for this is quite apparent if one were to consider one position of the pivot **484**, namely, the position in which the center line thereof is in alignment with the center line of the space between the guides **477**. In this position of the pivot **484**, there will be no movement of the arm **483** after the pin **479** reaches the bend in the slot **484**, for the remaining portion of the slot will be parallel with the space between the guides **477**. This is not true with respect to the parts when in the position shown in Fig. 47, for in this position of the parts, it will be noticed that after the pin **479** reaches the bend in the slot **485**, the remaining portion of the slot is still at an angle to the space between the guides, and continued movement of the pin **479** will cause a further rocking movement of the arm **483**. The result is that whenever the arm **471** is adjusted about its pivot, not only is the wire cut off at a different point, but the wire is fed a greater amount through the slot **464**. The additional amount which the wire is fed, upon adjustment of the arm **471**, is approximately twice the amount that the end of the tubular member **497** is moved away from the block **455**, so that both ends of the staple are increased a like amount upon adjustment of the arm **471**. Reverse movement of the arm **471**, of course, causes a shortening of the length of the staple.

Clinching mechanism.—The clinching mechanism is supported upon a bracket **530**, secured by the bolts **531** to the upper surface of the supporting plate **372**, and extends upwardly and outwardly, as is best illustrated in Fig. 46. Formed on the outer end of the bracket, is a sleeve **532**, in which the backing pin **533** for the clincher block **534** is adapted to slide, the pin being guided for vertical movement by the cross-pin **535** sliding in the slot **536** in the sleeve **532**. A spring **537**, arranged within a recess **538**, and within the adjusting cap **539**, screw-threaded into the upper end of the sleeve **532**, normally presses the pin **533** downwardly. A crank **540**, pivoted at **541** to the bracket **530**, has the fingers **540'** formed integral therewith and arranged beneath protruding end portions of the cross-pin **535**, so that when the crank is rocked about its pivot in a clockwise direction, as viewed in Fig. 46, the backing pin **533** will be raised into the full line position shown in Fig. 66. The clincher block **534** has a clinching head **542** secured thereto by a screw **543**, there being a layer of fibre **544** interposed between the head **542** and clincher block **534**. The clincher head is provided with two sets of parallel grooves **545** and **546** to engage and clinch the ends of the staple. It will be noted

that there are a plurality of grooves arranged in a vertical direction, so that in the event the staple does not pass through the material in a horizontal direction, the ends of the staple will nevertheless be engaged and clinched. A block **547**, arranged in the base **548** of the sleeve **532**, is secured in place by a cross-pin **549**. The clincher block **534** is arranged to slide in parallel grooves in the opposite sides of the base **548**, the clincher block being normally urged into the position shown in Fig. 66 by the spring **550**, arranged within the notch **551** and extending through an opening in the bracket **530** (see Fig. 66). When the fingers of the bell crank **542** are rocked in a counter-clockwise direction, as viewed in Fig. 46, or in a clockwise direction, as viewed in Fig. 66, the spring pressure of the spring **537** urges the backing pin **533** downwardly and projects the clinching head **542** into the dotted line position shown in Fig. 66, the pin **533** occupying the dotted line position shown in that figure. The forward side of the block **547** is beveled at **552**, corresponding to the bevel **553** on the back of the clincher block **534**, and is also recessed at **554** to substantially the same shape as the rear side of the circular pin **533**. The pin **533** also is beveled at **555** so as to cause the clincher block **534** to move to the left when the pin **533** is moved downwardly. The angle of the bevel **555** is such that when the force is applied to the clincher head to drive the staple, the pin **533** will not move upwardly and will thus prevent retrograde movement of the clincher block. On the other hand, the pin **533** will always project the clincher head **542** into engagement with the folded edge of the bag, regardless of the width of the folded edge within certain limits. While the bag is being fed between the end of the member **433** and the clincher head **542**, the parts are in the position shown in Fig. 66; but when the stapling operation is about to begin, the link **556**, pivoted at **557** to the crank **540**, moves to the left, as viewed in Fig. 46, and thereby permits the clincher head **542** to be projected into the dotted line position shown in Fig. 66. The manner in which the ends of the staple are turned in by the grooves **545** and **546**, is quite well known and needs no further explanation.

Starting and stopping mechanism for the stapling mechanism.—This mechanism is best illustrated in Figs. 32 to 43, inclusive, and Fig. 6, the latter showing the arrangement of this mechanism with relation to the other parts of the driving mechanism. The drive from the main drive shaft **20** is best illustrated in Figs. 33 and 34, in which **558** is a gear normally free to rotate on the shaft **20**, but caused to rotate with the shaft by a clutch mechanism similar to that used in reversing the motion of the main carriage, and in which the collar **559**, spring **560**, sleeve **561**, collar **562**, yoke **563**, and bell crank **564**, connected to the spring **565** within the housing **561**, correspond to the similar parts **97**, **99**, **104**, **109**, **134**, **111**, **105** and **104** in Figs. 25 and 26, and operating in the same manner to drive the collar **559**, attached to the gear **558**, as the corresponding parts in Figs. 25 and 26 operate to drive the sprocket **75** from the shaft **77**. A collar **566**, secured to the shaft **20**, prevents endwise movement of the housing **561** away from the gear **558**. A stub shaft **567**, parallel with the main drive shaft **20** is supported on the brackets **568** and **569**, which in turn are supported by the casting **570** bridging the space between adjacent uprights **1**, the casting having the ends thereof formed into split bearings to secure the casting **570** in adjusted vertical position along the uprights. The casting **570** has one end thereof integral with the bracket **85**, and the other end thereof secured to a bracket similar to **85**, which supports the gear housing **26**. The bracket **569** also has the casting **381** secured thereto by the bolts **571**. An idler **572** (see Figs. 33 and 34), mounted on a pivot **573**, provided with the nut **574** threaded on the end thereof, for securing the pivot **573** in adjusted position in the slot **575**, formed in the bracket **569**, meshes with the gear **558** and with a gear **576** keyed to the shaft **567**, the gear being held in place by a lock nut **577** and a washer **578**. The casting **381** has a yoke **579** formed on the lower end thereof, and has the portions **580** embracing the shaft **567**. A beveled gear **581** on the shaft **375** meshes with a beveled gear **582** on the shaft **567**. The result is that whenever the clutch on the shaft **20**, which I shall designate by the reference character T, is operative, the shaft **375** will be driven through the intermediary of the gears **558**, **572**, **576**, shaft **567**, gear **582** and gear **581**. The shaft **567** also has a sprocket **583** secured thereto, and this sprocket drives the means which reciprocates the link **404** and rocks the crank **540**.

In other words, when the clutch T is operative, the cam shaft **375** for operating the support which carries the stapling mechanism, and also the stapling mechanism, will be operative; but whenever the clutch T is inoperative, the stapling mechanism and the oscillating means therefor are inoperative. When a bag has been stapled, it is desired to bring the stapling mechanism to rest in a given position, and for this purpose a brake is provided for stopping the rotation of the shaft **567** whenever the clutch T is disengaged. The brake, which is shown in Fig. 34 and also in Fig. 43, is constructed similar to the clutch T and the clutches shown in Figs. 25 and 26. This brake comprises the cylindrical sleeve **584**, which normally rotates with the shaft **567**, since it is secured thereto by the cross-pin **585**. To the end of the cylindrical sleeve **584**, there is secured a plate **586** by the screws **587**. The plate **586** holds a drum-shaped member **588** against longitudinal movement relative to the cylindrical sleeve **584**, but permits rotative movement thereon. A light spring **589** has one end **590** thereof arranged within a slot **591** in the drum-shaped member **588**, the opposite end **592** thereof being arranged within a slot **593** in a collar **594**, rotatably mounted on the drum. A second and heavier spring **595** has one end **596** secured to the collar **594**, and the other end thereof secured to the collar **597**, secured by the bolts **598** to the bracket **568**. It will be understood that the spring **595** is secured to the collar **597** in the same manner that the springs **99** and **100** are secured to their respective collars **97** and **118**. The member **588**, as is best illustrated in Figs. 34, 36 and 37, has an extension **599** secured thereto, and this extension has a slot **600**, in which a pin **601** on a link **602** is adapted to travel, the link **602** being in turn pivoted at **603** to an angle bracket **604**, secured at **605** to a plate **606**, which in turn is secured to the casting **570**. When the link **602** is moved from the position shown in Fig. 37 to the position shown in Fig. 36, the drum-shaped member **588** will be rotated about the sleeve **584** in a direction to tighten the spring **589** upon the sleeve **584**. This starts the collar **594** to rotating, and this in turn winds the spring **595** about the sleeve **584** and causes the spring **595** to tighten

its gripping action upon the sleeve 584. Due to the fact that one end of the spring 595 is held stationary by the collar 597, the springs cannot rotate except to tighten their grip upon the sleeve 584. The result is that a braking effect is had upon the sleeve 584 and consequently upon the shaft 567. The arm 602 is timed to operate at a predetermined position of the link 404, and since the braking action is substantially uniform at all times, the result is that the parts are stopped at substantially the same position whenever the arm 602 is actuated. Of course, the operating means for the brake is so adjusted that the parts will come to rest in a position such that the stapling mechanism will be arranged to permit the bags to be fed between the clincher head and the end of the member 433. The casting 381 has an upwardly and an outwardly extending portion 607 (see Figs. 33, 35, 36 and 37). It is to this extension that the plate 372, which supports the stapling mechanism, is pivoted (see pivot 373). A bracket 608, secured by the bolts 609 to the under side of the plate 372, rotatively supports a shaft 610, which has a sprocket 611 thereon, driven by the chain 612, trained over the sprocket 611 and sprocket 583 on the shaft 567. The plate 372 has a slight rocking movement about the pivot 373, but this does not materially affect the drive through the flexible chain 612 to the shaft 610. A cam 613, secured to the end of the shaft 610, is engaged by a grooved roller 614, rotatably carried on the end of a lever 615, pivoted at 616 to a bracket 617, secured to the upper surface of the plate 372 by the bolts 618. The upper end of this lever 615 is pivoted at 619 to the link 556, which operates the crank 540 to raise the pin 533.

The sprocket 611 has a laterally extending pin 620, upon which is rotatably mounted a bearing block 621, operating in a slot 622 in a lever 623, pivoted at 624 in a bearing 625 of the bracket 608. A washer 626 and cotter-key 627 on the pin 620 prevents the block 621 from moving out of the slot 622. It is obvious that as the sprocket 611 rotates, the lever 623 will rock about the pivot 624. The rocking movement of the lever 623 is imparted to the link 404, which is pivoted at 628. This motion of the link 404 causes the reciprocation of the driving and forming means for the staple and is so timed with reference to the operation of the cam 613, that the clinching head 542 is moved against the folded edge of the bag at substantially the same time, or just prior to the movement of the staple into engagement with the folded edge. Naturally, whenever the clutch T is rendered inoperative, the driving mechanism for the stapling mechanism will be rendered inoperative, and will be operative whenever the clutch T is operative. I, therefore, provide means for rendering the clutch T operative and inoperative at predetermined times, these times being controlled by the movement of the bag itself into position to receive a staple, or out of a position wherein it may receive a staple. Diagrammatically, this is illustrated in Fig. 42, in which there is illustrated a starting magnet 629 and a stopping magnet 630. These magnets are connected in parallel to a source of power 631 by the lead 632. The opposite ends of the circuits for the magnets 629 and 630 have the leads 633 and 634, respectively. The live side of the source of power 631 has a lead 635, leading to a spring contact member 636, which normally is spring-pressed into engagement with another spring contact member 637. A third spring contact 638 is connected to a lead 639 and has continuous engagement with a sliding contact 640. The spring contact member 637 has a lead 641. A spring pressed key 642, held out of engagement with the contact 703 on the end of the lead 641, when the stapling mechanism is inoperative, is adapted to close the circuit through 631, 635, 636, 637, 641, 703, 642, 634, 630 and 632. The two spring contact members 636 and 638, and the sliding contact member 640, are adapted to close the circuit through 631, 635, 636, 638, 639, 640, 633, 629 and 632. In Fig. 42, I have illustrated the position for the bag, as 643, as during its movement along its path, it passes from right to left in Fig. 42, between the contacting portions of the contact members 636 and 637, and later comes into contact with the sliding contact 640 to operate the same.

The reference character 644 (see Figs. 63 and 42) represents the upper end of a pivoted angular member, pivoted at 645 to the arm 654, formed integral with the bearing 402 (see Figs. 63 and 46). The member 644 is formed of insulating material and has a tail-piece 646 adapted to be engaged by the bag which passes just beneath the surface 365 of the arm 654, as is best illustrated in Fig. 46, being guided in this movement by the guide plate 366, secured to an auxiliary guide 647, secured by means of a bolt 648 to the under side of the surface 365 of the arm 654, and the guide member 370 is also secured to the under surface 365 by the screw 649. As will be noted from the inoperative position of the parts shown in Figs. 46, 63 and 64, as well as 42, when the bag engages the tail-piece 646, the insulating member 644 moves in a clockwise direction about the pivot 645 between the beveled faces 650 of the spring contact members 636 and 637 to break the connection to the lead 641 and make operative contact between the contact members 636 and 638. As yet, the circuit to the magnet 629 is not completed, for the sliding contact 640 is still inoperative. The spring contact members 636 and 637 are secured to the supporting member 651 carried by a U-shaped bracket 652, which in turn is secured by the screws 653 to the arm 654. The bag continues its movement to a position between the clincher head 542 and the driving member 416, where it engages a segment 655, pivoted at 656 to an angle piece 657, secured by a bolt 658 passing through the opening 659 into the arm 530, which supports the sleeve 532. A spring 660 normally urges the segment 655 in a counter-clockwise direction, as viewed in Fig. 63. The sliding contact 640 is secured to the face of the segment 655, and when in the position shown in Fig. 63, engages only one of the contacts 661. However, when rotated in a clockwise direction, the sliding contact 640 will engage both contacts 661 to complete the circuit through the leads 639 and 633 to the starting magnet 629. The contacts 661 are bolted to the angle piece 657 by the bolts 662 and nuts 663 (shown in Fig. 65).

Therefore, when the bag engages the forward edge of the segment, it will rock the segment in a clockwise direction and complete the circuit through the leads 639 and 633, it being understood that the contact members 638 and 636 are still in engagement. The circuit to the starting magnet being completed, the magnet will set in operation certain mechanisms which will operate the clutch T and start the stapling mechanism. It will be noted that the bag is in a position to receive a staple after it strikes the segment 655, but not before. It is also desired to stop the action of

the stapling mechanism just before the bag leaves a position between the driving member 416 and the clinching block 542. The angle piece, pivoted at 645, has a spring 664, having one end engaging the portion 644 of the angle piece, and the other portion arranged within an opening in the arm 654 (see Fig. 63). Therefore, as soon as the bag moves out from under the tail piece 646, the spring 664 will rock about the pivot 645 in a counter-clockwise direction to allow the contact members 636 and 637 to engage each other and break the circuit to the starting magnet 629 by moving the contact members 636 and 638 out of engagement with each other.

The stopping magnet 630 is used to operate the brake (shown in Fig. 43) as soon as the starting magnet is inoperative, and is so arranged in the embodiment illustrated that as soon as the machine begins to function, the key 642 will be closed. In other words, after the contact members 636 and 637 are moved out of engagement with each other, and the sliding contact 640 operated to start the machine, the key 642 will also be closed and held closed until the member 644 moves out from between the contact members 636 and 637. This latter movement of the member 644 brings the contact members 636 and 637 into engagement with each other to thereby complete the circuit through the stopping magnet 630. The energizing of the stopping magnet operates to release the clutch T and at the same time apply the brake to stop the movement of the stapling mechanism.

The stopping magnet, as illustrated best in Figs. 35, 36, 37, 38, 39, 40 and 41, is mounted on a bracket 665, secured by a set screw 666 to a lever 667, pivoted at 668 to a bracket 669, secured at one end to the plate 606 by the bolt 670, and to the extension 607 by the bolt 671. An electromagnet, indicated by the reference character 630, is connected by a screw 673 to the bracket 665, and insulated therefrom by the insulating washers 674. As clearly illustrated in Fig. 38, the lever 667 has a detent arm 675, pivoted to a block 676, secured by screws 677 to the lever 667, the pivot being indicated at 678. A spring 679, secured to the block 676 by a set screw 680, has the free end thereof engaging a pin 681 on the detent arm 675 to normally move the arm to the full line position illustrated in Fig. 38. The lower end of the detent arm carries a keeper 682, secured thereto by a screw 683. The poles of the magnet in Fig. 39 are indicated at 684, and when the magnet 672 is energized, the keeper 682 is drawn toward the poles and this rocks the detent arm 675 into the dotted line position shown in Fig. 38, the dotted line position of this arm being in the path of movement of the pin 685, mounted on the end of the crank 623. In the full line position shown in Fig. 38, however, the upper end of the detent arm 675 is not in the path of movement of the pin 685.

The lever 667 carries a stop 686, extending laterally thereof behind the detent arm 675 to form a backing member for the detent arm 675 when the detent arm is engaged by the pin 685. To the lower end of the lever 667, there is pivoted a link 687 at 688, the opposite end of the link 687 being connected by the pin and slot connection 689—690 to the link 602, which latter link operates the brake for stopping rotation of the shaft 567. The lower end of the lever 667 also carries a pin 691, having a squared shoulder 692, adapted to engage a cooperating shoulder in the recess 693, the said recess being formed in the arm 694, pivoted at 695 to the bracket 604. The end of the arm 694 is provided with a keeper 696, which opposes the pole pieces 697 of the magnet 629, secured by the screw 698 to the bracket 669. The reference numerals used in designating the leads for the electrical circuit correspond to the reference numerals used in Fig. 42. The key 642, shown in Figs. 33, 35, 36 and 37, slides in an adjustable bushing 699, threaded in the end of an arm 700, the key 642 being normally urged downwardly by the spring 701, secured to the upper side of the arm 700, the arm being in turn secured to a block 702 on the lever 667. Consequently, when the lever 667 rocks about its pivot 668, the arm 700 will rock therewith and move the key 642 into and out of operative engagement with the contact 703. The spring 701 holds the key 642 in yielding engagement with the contact 703 while the machine is in operation.

The lower end of the lever 667 also carries an extension 704, having the lowermost end 705 thereof adapted to engage toggle mechanism, which toggle mechanism causes the clutch T to be disengaged. This mechanism is best illustrated in Figs. 33, 34, 35, 36, 37 and 38. The yoke 563, previously referred to, is pivoted at 706 to the bracket 707, secured by the bolts 708 to the plate 606. Toggle links 709 and 710, pivoted to each other at 711, are in turn pivoted at 712 and 713, to the extension 714 and intermediate portion 715 of the yoke 563. Whenever the toggle links 709 and 710 move into a position in which the same become substantially aligned with each other, the intermediate portion 715 of the yoke 563 is moved to the right, as viewed in Fig. 38, or to the left, as viewed in Fig. 34. This causes the movement of the collar 562 to the left, as viewed in Fig. 34, which in turn causes the bell crank 564 to be rocked about its pivot and release the spring 565, so that the clutch T becomes inoperative.

The toggle links 709 and 710 are adapted to be moved toward aligned position by the extension 704, which, as clearly illustrated in Figs. 33, 35, 36 and 37, engages one of the links 710. A spring 716, connected by a wire 717 to the intermediate portion 715 of the yoke 563, normally causes the links to move out of aligned position, so that normally the spring clutch T is operative to drive the gear 558 in the manner previously described.

It will be understood that the connecting points for the leads on the framework of the machine are insulated therefrom in the usual manner.

The starting and stopping mechanism is actuated in the following manner: In describing the operation, it is believed that it will be best to start with the parts in their inoperative position, namely, that shown in Fig. 35. In this position, both the magnet 629 and the magnet 630 are inoperative, and the electrical contacts are in the position shown in Fig. 42. The bag moves against the tail-piece 646 (see Fig. 63) and causes the insulated member 644 to separate the contacts 637 and 636 and bring the contact 636 into engagement with the contact 638, thereby completing the circuit to the starting magnet 629, except across the contacts 661. The bag moves farther along its path of movement until it strikes the segment 665, which segment is rocked by the movement of the bag thereagainst to complete the circuit through the contacts 661 by the sliding contact member 640. This energizes the starting magnet 629 and attracts the keeper 696 to the pole pieces 697 of the magnet, thereby

raising the arm 694 and permitting the pin 691 to move out of the recess 693, it being understood that when the pin 691 is in the recess 693, the clutch is held in its disengaged position and the toggle links 709 and 710 being more nearly aligned than at any other time. As soon as the arm 694 is raised and the pin 691 released, the lever 667 will rock about its pivot in a clockwise direction, as viewed in Figs. 35, 36 and 37, under the influence of the spring 716. The spring also causes the clutch T to become operative in the manner just described, and the operation of the clutch T starts the drive to the shaft 667 and consequently to the shaft 610, which carries the crank pin 620 and cam 613. As the shaft 610 rotates, the cam also rotates therewith and periodically operates the link 556 through the arm 615 to thereby raise the backing pin 533 and cause the clincher head 542 to move to an inoperative position. The rotation of the crank pin 620 about the shaft 610 causes an oscillation of the crank 623 which in turn reciprocates the link 404 to cause the driving and forming of the staples in the manner previously described.

While the parts are in operation, the lever 667 and associated mechanism are in the position illustrated in Fig. 37, the lever 667 having moved slightly in a clockwise direction about its pivot. This clockwise motion of the lever 667 brings the key 642 into operative engagement with the contact 703, the key remaining in contact until the stapling mechanism is stopped.

The motion of the parts continues until the time when the rear end of the bag moves out from under the tailpiece 646 in Fig. 63. This moves the member 644 from between the contact members 636 and 637, thereby breaking the circuit to the starting magnet 629, which has been holding the arm 694 in its raised position during the operation of the stapling mechanism. The breaking of the circuit to the starting magnet 629 permits the arm 694 to drop downwardly and rest on the pin 691. The same movement which breaks the circuit between the contact members 636 and 638 makes the circuit through the contact members 636 and 637 (see Fig. 42), and since the key 642 is closed, the circuit to the stopping magnet 630 is completed. This causes the keeper 682 to be drawn to the left, as viewed in Fig. 38, and the keeper-arm to be moved into the dotted line position shown in that figure, the arm in this position being in the path of movement of the pin 685. If the pin 685 happens to be behind the detent arm 675, such as in Fig. 37, of course, the magnet cannot move the detent arm 675 to the dotted line position shown in Fig. 38; but since the crank 623 is rocking, it will soon move into a position clear of the arm 675, and the arm will move into a position to the left of the pin 685, as viewed in Fig. 36. The block 718 on the end of the arm 675 is merely for the purpose of making an enlarged head on the arm and could be made integral therewith, if desired. Since the block 718 is in the path of movement of the pin 685, after the energizing of the magnet 630, it is obvious that on the next return stroke of the link 404, the parts will be moved to the position illustrated in Fig. 36, the pin engaging the block 718 on the arm 675 to cause a counter-clockwise rotation of the arm 667 through the intermediary of the backing member 686 on the arm 667 and the pivotal connection 678 which the arm 675 has with the arm 667. This motion of the arm 667 also moves the key 642 out of engagement with the contact 703, thereby breaking the circuit to the stopping magnet 630. Since the starting magnet 629 is de-energized, the arm 694 can move downwardly, and as soon as the pin 691 is opposite the recess 693, the arm 694 will move downwardly to prevent the rotation of the arm 667, so that the arm 667 cannot again move in a clockwise direction until the energizing of the starting magnet.

The counter-clockwise movement of the arm 667 also causes a clockwise movement of the arm 602 through the pin and slot connection 689—690, and the rotation of the arm 602 in turn causes the operation of the brake on the shaft 567 through the arm 599, secured to the member 588, in the manner previously described. Since the brake is always actuated at the same position of the crank 623 and requires substantially the same amount of time to completely stop rotation of the shaft 567, the result is that the stapling mechanism is stopped in substantially the same position every time the stopping magnet is energized, this position being one in which the bag can pass freely between the withdrawn clincher head and the end of the member 433. The parts continue to rotate slightly farther than the position illustrated in Fig. 36, namely, into substantially that position shown in Fig. 35. In order to regulate the position in which the parts may come to rest, the collar 597, shown in Fig. 34, which is secured to the bearing bracket 568 by the screws 598, is adjusted angularly, this being permitted by the slots 719, shown in Fig. 35, it being understood that the greater the tension in the springs 595 and 589, the quicker the shaft 567 will be brought to rest.

It will be understood, of course, that as soon as the bag moves out of engagement with the segment 655, the same will be rotated in a counter-clockwise direction, as viewed in Fig. 63, to move the sliding contact 640 out of engagement with one of the contacts 661.

Operation.—The bags to be sealed are supported upon the conveyer 13 and conveyed from right to left in Figs. 1 to 6, inclusive, by the conveyer belts 13 and 18, the same being driven from the main drive shaft 20 through the gearing previously described. Before the bags reach the folding mechanism, the parts of the folding mechanism are in the positions shown in Figs. 2, 4, 6, 16 and 9, with the main carriage and sub-carriage at their extreme right-hand position. The upwardly extending edges C, D, E and F of the bag are held together by the operator, and as the bag is fed along by the conveyers, the operator brings the edges between the folding blades 297 and 298, as best illustrated in Fig. 9. As soon as the bag is fed forward far enough by the conveyers, the edges C of the bag engage the extension 238 on the lever 219, causing the lever to be rocked about its pivot from the position shown in full lines in Fig. 22 to the position shown in full lines in Fig. 23, thereby causing the rod 215 to be operated by its connection with the bracket 232. The movement of the rod 215 to the right, as viewed in Fig. 24, causes the member 212 to be rocked about its pivot 213, thereby shifting the rod 194 to the right by the engagement of the arm 212 with the collar 218 on the rod 194, thereby compressing the spring 195 and rocking the arm 179 (see Fig. 28) in a counter-clockwise direction to release the end of the element 170 from its engagement with the abutment surface 185 on the arm 179. The spring 177 then rotates the bell crank 172 in a clockwise direction, as shown in Fig. 28, thereby permitting the toggle

links 141 and 142 to move vertically under the influence of the spring 147, to thereby cause the upper clutch, shown in Figs. 25 and 26, to drive the sprocket 75 and, as a result, the chain 55, in a direction such that the upper run of the chain is moving from right to left in Figs. 1 to 6, inclusive, and 16, or from left to right in Figs. 7 and 8. This motion of the chain causes the sub-carriage, comprising the end brackets 53 and tie rods 54, to slide along the guides rods 48 from right to left. Due to the fact that the detent members 58 have the ends thereof against the abutment shoulders 63 on the abutment 62, the main carriage, comprising the end brackets 47 and tie rods 51, is caused to move with the sub-carriage in the same direction. This in turn causes the upper folding blades 297 and 298, as well as the lower folding blades 303 and 302, to move from right to left and at substantially the same speed as the bag, it being understood that the bag has the edges thereof arranged substantially wholly between the folding blades 297 and 298 at the beginning of this movement.

As the carriage moves along its path a short distance, the carrier, comprising the rods 271, yokes 294 and cross-tie members 296, is moved bodily toward the rear of the machine, or to the left, as viewed in Figs. 9, 10 and 11, from the position shown in Fig. 9, to a position in which the folding blade 298 is directly above and between the lower folding blades 303 and 302, the upwardly extending edges of the bag overlying the folding blades 303 and 302. This motion is caused by the cam groove 277, shown best in Fig. 15, which cam groove has the portion L in which the roller 278 travels during the motion of the carriage from right to left. The carrier then stops its rearward movement and begins its downward movement to carry the folding blades 298 into the position shown in Fig. 10. This downward movement is caused by the rollers 266 dropping into the depressions 325 in the cam tracks G. This folds the edges of the bag in a manner clearly illustrated in Fig. 10.

The carrier then moves vertically, due to the rollers 266 moving out of the depressions 325 into the horizontal portions 326, and the carrier is then moved forwardly, or to the right in Fig. 10, to a position shown in Fig. 11, but with the carrier higher than illustrated in Fig. 11. This motion is caused by the left-hand portion of the cam slot 277, which extends downwardly in Fig. 15. Slightly later, the rollers 266 drop into the depressions 327, and this causes the carrier to move downwardly into the position shown in Fig. 11, so that the folding blade 297 will cause the fold, shown in Fig. 11, to be formed. The main carriage has at this time reached substantially the full extent of its movement, but the sub-carriage has a still further movement along the guide rods 48. This extended movement of the sub-carriage is caused by the engagement of the operating member 69 for the rod 64 engaging the stop 70, which is secured to the upper surface of the plate 272, as the engagement of the operating member 69 with the stop 70 will lift the detent members 58 and permit the abutments 62 to ride therebeneath. This continued movement of the sub-carriage, which has the rod 334 secured thereto by the bracket 335 and tie rod 54, brings the vertical abutment member 333 of the rod 334 into engagement with the rear end of the folded edges of the bag, so that the folded edges of the bag are stripped from the folding blades and moved into such a position that the folded edges may be gripped by the feeding means.

During the folding operation, the lower blades 303 and 302 are moved toward each other by the crank 312, which operates in the cam slot N, the rotation of the crank 312 causing the rotation of shaft 311 and screws 309 and 310. The rotation of these screws in turn moves the folding blades toward each other, or away from each other, as the case may be. During the forward movement of the carriages, however, the folding blades move toward each other and just after the folding blade moves upwardly clear of the folding blades 303 and 302 in Fig. 10. The portions 315 and 316 of the cam slot N cause the blades to move toward each other on the forward stroke, and the portion 319 moves them away from each other just before the vertical abutment 333 begins to eject the folded edges of the bag from between the folding blades.

The motion of the sub-carriage continues at least until the forward folded edges of the bag are arranged between the cam-gripping members 344, the cam members then operating to move the folded edges of the bag to the stapling mechanism. It will be understood that the feeding means, shown particularly in Figs. 44 and 45, is being continuously actuated from the main driving shaft through the driving connections previously described.

Before proceeding with the description of the operation of the stapling mechanism, I will proceed to describe the return movement of the carriage and sub-carriage. As the sub-carriage moves to its extreme left-hand position, as viewed in Figs. 1 to 6, inclusive, and 16, or to the position shown in Fig. 24, which is the position looking from the rear of the machine at the end of the travel of the sub-carriage, the stop 203 engages the plunger 188, compressing the spring 190 (see Fig. 27), thereby exerting a yielding pressure on the plunger 189, which in turn tends to rotate the bell crank 172 about its pivot 174 in a clockwise direction, as viewed in Fig. 24. This motion of the bell crank, however, is prevented, due to the abutment shoulder 193 on the arm 179, but a continued movement of the sub-carriage causes the abutment 62 to engage the end of the rod 194 to move this rod to the right, as viewed in Fig. 24, or to the left, as viewed in Fig. 28, thereby rocking the arm 179 about its pivot and moving the stop shoulder 183 out of operative position with respect to the element 170. The downward movement of the element 170 causes the same to engage the toggle link 141 (see Figs. 25 and 26) and moves the toggle and its companion toggle 142 from the position shown in Fig. 26 to the position shown in Fig. 25. This causes the clutch for the sprocket 75 to become disengaged in the manner previously described, and at the same time, since the detent 165 (see Fig. 30) is beneath the toggle link 142, the rod 161, which carries the detent 165, moves downwardly to straighten out the toggles 156—158 and thereby cause the clutch for the sprocket 76 to become operative. Since the sprocket 76 rotates in a direction opposite to the sprocket 75, the motion of the chain 55 is reversed, and the sub-carriage begins its return movement, being first returned to the position shown in Fig. 16, at which position the detent members 58 move downwardly so that the ends thereof engage the abutment surfaces 63 on the abutments 62.

The sub-carriage and main carriage then move together as a unit to the position illustrated in

Figs. 1 to 6, inclusive, at which position the end casting **53** of the sub-carriage strikes the collar **205** (see Fig. 29) and moves the rod **169** to the left, thereby releasing the detent **165** from its engagement with the under side of the toggle link **142**. The spring **208** (see Fig. 25) then moves the rod **161** vertically until the lower clutch is disengaged by the movement of the toggle links **156** and **158** to the positions illustrated therefor in Fig. 25.

During the return movement of the main carriage and sub-carriage, the roller **278** travels along the portion M of the cam slot **277**, and the rollers **266** travel along the tracks H. The folded edge of the bag moves into contact with the tail-piece **646** (see Fig. 63) and thereby causes the circuit to the starting magnet **629** to be partly completed, and continued movement of the bag to a position between the member **433** of the stapling mechanism and the clincher block **542**, causes the forward edge of the bag to engage and rock the segment **655** about its pivot **656** and thereby connect the contacts **661** by the sliding contact member **640**. This completes the circuit to the starting magnet, which, through the intermediary of the mechanism previously described, causes the reciprocation of the link **404**. On the forward movement of the link **404**, this being the movement to the left, as viewed in Figs. 49 to 52, inclusive, the member **433** is first moved into the position shown in Fig. 50, this being a position in engagement with one side of the folded edges of the bag. Substantially simultaneously with this movement, the cam **613** causes the link **556** to move to the left and lower the fingers **542**, shown in Figs. 56 and 46. This permits the spring **537** to urge the pin **533** downwardly and, as a result, move the clincher block **534** and clinching head **542** to the left, as viewed in Fig. 66, against the opposite side of the folded edges of the bag. The folded edges of the bag are, therefore, yieldingly gripped. As the link **404** continues its movement to the left in Fig. 50, the parts continue their movement until they reach the position shown in Fig. 51, in which position the staple-forming members **526** have engaged the extending ends of the wire cut from the roll of wire, and folded the same into the recesses **463** and on top of the surfaces **469** of the member **433** (see Fig. 58). The staple which was previously formed, and shown at S in Fig. 51, is beginning to enter the folded edge, and continued movement will drive the staple through the folded edge, as illustrated in Fig. 52. The staple, which has just been formed, is indicated by the reference character U, and as the driving member **416** drives the staple through the folded edge, the pressure of the spring, which actuates the plunger **445**, causes the staple U to be forced down between the surfaces **467** and on top of the driving member **416**, so that on the return movement of the member **433** and member **415**, which carries the driving member **416**, the continued pressure of the spring, which acts on the plunger **445**, will cause the staple U to be forced down into the grooves **437** in a position to be driven into the folded edge at the next forward movement of the member **416**.

During the driving of the staple, the eccentric **374** causes the supporting plate **372** to be rocked slightly in the direction of the feed for the bag, so that the staple is driven through the folded edge while the bag is in motion. The wire is fed intermittently by the cooperating friction blocks **486** and **487**, carried by the arm **372**, which arm is pivoted at **484** and is rocked by means of the pin **479**, operating in the cam slot **485**. After each feeding movement of the wire, the same is cut off by the knife **504**, carried by the arm **508**, which rocks about the pivot **502**.

After staples have been driven the entire length of the folded edge, and the next staple to be driven would, if driven, not pass through the bag, means comes into operation for discontinuing the drive to the stapling mechanism and for stopping the parts thereof in a predetermined position of adjustment.

The bag, as it moves out from under the tail-piece **646**, permits the tail-piece to drop downwardly and rock the member **644** into the position shown in Fig. 63. This causes the contacts **637** and **636** to move into engagement with each other, and since the key **642** is already in engagement with the contact member **703**, the circuit to the stopping magnet **630** is completed (see Fig. 42). The actuation of the stopping magnet **630** throws out the clutch T and brings the brake, shown in Fig. 43 and at the upper right-hand part of Fig. 34, into operation to impart a braking effect to the shaft **567**, and stop the shaft **567**, and the stapling mechanism driven thereby, at a position such that the member **433** and the clincher head **542** are in their retracted positions. The details of the operation of this means are described more clearly in the detailed description. The stapling mechanism is then ready to start its operation as soon as the next bag is fed thereto by the feeding means.

In Fig. 73, I have illustrated a section through the upper folded edge of the bag at substantially the center thereof, and it will be seen that this section of the folded edge has only one-half of the number of layers as the section shown in Fig. 74, taken near the end of the folded edge. It is for this reason, and for the reason that bags of different ply and of material of different thicknesses, are to be used therewith, that I provide a yielding backing for the clincher block **534**, as otherwise the mechanism could not adjust itself to different thicknesses through which the staples must be driven. While the clincher block **534** is adjusted, and automatically so, it provides a solid backing so that the staples can be driven through and clinched by the clinching head **542** without any difficulty.

From the foregoing, it will be seen that the bags are folded by a single mechanism, or by a single set of blades, so to speak, instead of subjecting each bag to a partial folding operation by one mechanism, and to a final folding operation by another mechanism. In the machine shown and described, the two successive folding operations, comprising the entire operation of folding the mouth of the bag, are performed by one and the same set of blades or folding mechanism, by successive operations of this single mechanism, in the manner shown and described. This is done while the filled or loaded bags are moving continuously through the machine, without stopping at any point therein; and although the said single set of blades or single folding mechanism, thus given successive operations to perform the preliminary and final folding operations on each bag, could be used in conjunction with bag feeding means of any suitable or desired character, it is obvious that this method of folding the bags is especially advantageous in connection with means for continuously feeding the bags through the machine without stopping at any point therein. Moreover, the stapling

mechanism is electrically and automatically controlled, being movable with the bag a distance each time a staple is inserted, and is constructed to advantageously insert the staples, without using the staple former as a guide for the insertion of the staples, which for the work shown and described is better calculated to insert the staples effectively, and to avoid injury to the paper or other materials from which the bags are made. Again, the bags are effectively fed from the folding mechanism to the stapling mechanism, by means operating thereon in a manner to obviate the danger of tearing or injuring the paper or other materials from which the bags are made, and in properly timed relation to the other elements of the machine. Thus each bag, after being filled or loaded, is placed in the machine, on the continuously operating feeding means, and is then effectively folded at the mouth thereof, then fed forward in a manner to preserve the desired fold of the materials, and is thereafter stapled to render the fold permanent, in such a manner that the fold is sift-proof or leak-proof, so to speak, when the bags are filled with powder or powder-like commodities. All of which is calculated to render more efficient and satisfactory the general operation of filling and sealing bags.

Looking at Figs. 9, 10, and 11 of the drawings, it will be seen that the folding blades are operative to first fold the edge or upper portion of the bag horizontally entirely at one side of the bag, over the upper edge of the blade **302**, preliminary to forming successive creases, whereby the folded top portion of the bag is entirely at one side of the bag before the materials are successively and sharply creased by the subsequent action of the blades. Also, it will be seen that the blades **302** and **303** form a clamp for gripping and creasing one fold while the final folding is in process, as illustrated more clearly in Fig. 11 of the drawings, whereby these blades **302** and **303** form a clamp for tightly gripping a folded and creased portion of the bag materials while the final folding by the blade **297** is being completed.

It will also be seen that the stapling devices form a part of the bag closing means, as they cooperate with the folding blades to effect the final permanent closing of the bag, inasmuch as the stapling devices as well as the folding blades cooperatively travel a distance with the traveling bag, in the manner shown and described.

What I claim as my invention is:

1. In bag closing machinery for sealing filled bags by a double fold in the mouth portion of the bag, the combination of a single set of folding blades operable to produce the double fold, having means to grip one fold while the final folding is in process, and means for causing relative movement of said blades, whereby the single set of blades is operative by successive relative movements of the same blades to produce the entire double fold in the mouth portion of the bag.

2. A device as claimed in claim 1, in which the folding blades move toward each other from opposite sides of the edge of the bag to be folded to produce one fold, and thereafter move apart and toward each other again to produce a second fold in the edge of the bag to be folded.

3. Folding mechanism for bag closing machinery, comprising a single set of blades, and operating means therefor, operative for folding the projecting edges of a bag upon themselves, by first folding the mouth edges horizontally and entirely to one side of the bag, to form a right angle fold, and subsequently producing a second fold and then an additional reverse fold upon the first fold, one of said blades being operative to flatten the end edges of the bag upon the outer side of the bag.

4. In folding machinery for bag-sealing machines, the combination with opposed folding blades movable toward and from each other and adapted to receive the edge to be folded therebetween, having means to grip one fold while the final folding is in process, and means for moving said folding blades toward and from each other a plurality of times to produce a multiple fold in the edge to be folded.

5. A device as claimed in claim 4, in which the folding blades are first moved toward each other while bearing a predetermined relation to each other to produce the first fold, and are subsequently moved away from each other and then toward each other in a different manner to produce a subsequent fold in the edge already having a single fold.

6. Bag closing mechanism for folding the open mouths of bags, comprising a pair of folding blades extending substantially parallel to the edge to be folded and an additional folding blade substantially parallel to said first folding blades and adapted to cooperate with said first-mentioned blades to produce first a single fold in the edges of the mouth of the bag and then a double fold by the use of the same folding blades presented to each other in a different relation as each fold is made.

7. A device as claimed in claim 6, in which means is provided for continuously moving bags to be folded along a predetermined path and in which the folding blades move with the bags as the edges of the bags are folded.

8. Bag closing mechanism for producing a fold in the meeting edges of an open-mouthed bag after the edges have been brought substantially into engagement with each other, comprising means for moving the bags continuously along a predetermined path, and means moving with said first-mentioned means for folding said edges while the bag is in motion.

9. A device as claimed in claim 8, in which the folding mechanism produces first a single fold, and subsequently a reverse fold of the edges already folded.

10. In bag closing machinery, the combination with means for a feeding a bag continuously along a predetermined path, means moving at substantially the same speed as the bag and in a path substantially parallel to the path of said bag for folding the extending edges of the mouth of said bag upon themselves to close the mouth and produce a fold in said edges.

11. A device as claimed in claim 10, in which a feeding means is provided for feeding the folded edges of the bag in the direction of the bag travel while holding the folded edges in folded position after leaving the folding means.

12. A device as claimed in claim 10, in which a feeding means is provided for feeding the folded edges of the bag in the direction of the bag travel while holding the folded edges in folded position after leaving the folding means and in which there is a means for moving the folded edges of said bag positively from between the folding means after the edges have been folded and into a position to be received and moved by said feeding means.

13. A device as claimed in claim 10, in which a feeding means is provided for feeding the folded

edges of the bag in the direction of the bag travel while holding the folded edges in folded position after leaving the folding means and in which there is a means for moving the folded edges of said bag positively from between the folding means after the edges have been folded and into a position to be received and moved by said feeding means, and in which means is provided for stapling the folded edges as said bag arrives at a predetermined position.

14. Folding mechanism for the edges of open-mouthed bags and the like, comprising opposed pairs of folding blades arranged substantially parallel to each other and adapted to be moved toward each other and in two directions transversely to the longitudinal dimensions of said blades, one of said blades of one pair being adapted to force a portion of the bag surrounding the mouth of the bag between the two blades of the other pair to produce a single fold in the meeting edges of the mouth of the bag and the other of the blades of the first pair being adapted to subsequently carry a free portion of the edge of said bag over the first folded portion and over one of said lower blades to produce a double fold in the edges of said bag.

15. A device as claimed in claim 14, in which the edges of the bag are received between the first-mentioned pair of blades and carried over one of the other pair of said blades by a motion of the upper blades transversely to the longitudinal dimension of said blades and then downwardly between the second-mentioned pair of blades to produce a single fold in the edges of said bag with a free portion thereof extending upwardly above said second-mentioned folding blades and in which a reverse movement of said first folding blades in a direction transversely of the longitudinal dimensions thereof causes said free portion of said edges to be folded over the first folded portion, the final folding being accompanied by a movement of the blades of each pair toward each other.

16. Folding mechanism for bag-sealing machines comprising a pair of folding blades movable relatively to each other to bring said folding blades closer or farther away from each other, a third folding blade adapted to fold the edges of a bag over one of said first-mentioned blades and tuck a portion thereof between the first pair of folding blades, leaving the mouth edges of the bag temporarily upstanding, and means for moving said first-mentioned blades toward each other to grip the portion tucked therebetween by said third-mentioned folding blade, whereby one fold is gripped by the pair of blades while the final folding is in process.

17. A device as claimed in claim 16, in which there is a fourth folding blade which folds a free portion of the edges of said bag over the folded portion produced as set forth, and after said third folding blade has been removed from a position between said first two mentioned folding blades.

18. Folding mechanism for producing a double fold in the extending edges of an open-mouthed bag or the like, comprising two pair of folding blades extending substantially parallel to each other, one pair of said folding blades being movable toward the other pair and having an additional movement transversely to the length of said blades, the motion of said blades toward each other being substantially in a rectilinear direction, and the transverse motion being also in a substantially rectilinear direction.

19. Folding mechanism for bag-sealing machines comprising means for imparting a continuous feed to a bag, folding mechanism having blades for folding the edges of said bag, said folding mechanism traveling along a track shaped to produce a movement of the blades toward and from each other as the folding mechanism moves with the bag.

20. A device as claimed in claim 19, in which means is provided for shifting the folding mechanism transversely to its path of movement along said track to assist in producing the fold in the edges of said bag.

21. Folding mechanism for bag-sealing machines comprising parallel tracks, a carriage guided by said tracks and movable therealong, folding blades mounted on said carriage, means for shifting said carriage transversely to its direction along said tracks as said carriage moves along said tracks, and additional folding means moving with said carriage to cooperate with said folding blades to produce a fold in the edges of a bag as the folding blades move along said tracks in one direction.

22. A device as claimed in claim 21, in which additional tracks are used to guide the folding mechanism in a direction reverse to that mentioned.

23. A device as claimed in claim 21, in which additional tracks are used to guide the folding mechanism in a direction reverse to that mentioned, and in which means are provided for shifting the supporting means for said carriage from one of said tracks to the other independently of the means for shifting the folding blades.

24. Folding mechanism for folding the edges of a bag, comprising a main carriage and a sub-carriage normally constrained to move with each other, folding mechanism carried by said main carriage, means for driving said sub-carriage to thereby cause said sub-carriage and main carriage to move along a predetermined path while the folding mechanism operates to fold the edge of a bag, means for releasing said constraining means to thereby permit the sub-carriage to be moved independently of said main carriage, and means carried by said sub-carriage to eject the folded edge of a bag from said folding mechanism after a fold has been produced in said bag, said ejection of said folded edges taking place during the extended movement of said sub-carriage independent of said main carriage.

25. A device as claimed in claim 24, in which means is provided for returning the sub-carriage to its original position with respect to said main carriage after the ejection of said folded edges and for re-establishing in operative relation the constraining means which normally constrains the main carriage and sub-carriage to move with each other.

26. In bag closing machinery, the combination with folding mechanism adapted to be moved with a bag as said bag moves along a predetermined path of travel, to fold the edges of said bag during the movement thereof, and means for reciprocating said folding mechanism.

27. In bag closing machinery, the combination with folding mechanism adapted to be moved with a bag as said bag moves along a predetermined path of travel, to fold the edges of said bag during the movement thereof, means for reciprocating said folding mechanism comprising separately driven sprockets and a chain connected to said folding mechanism operated by said sprockets, each of said sprockets being driven in a direction to cause reversal of the movement of

said chain, and means for alternately driving each of said sprockets and for preventing each of said sprockets from being actuated while the other is operative, and means for applying staples to said fold after said bag leaves said folding means.

28. In bag closing machinery, the combination with driving means for the folding mechanism thereof, a driven element connected to said folding mechanism, a driving element for said driven element, operative connections to a source of power, and clutch means for connecting said operative connections to said driving element comprising a rotatable element continuously actuated by the connections to the source of power whenever the source of power is operative, and a plurality of coil springs surrounding said rotatable element but normally not engaging the same, and means for successively bringing each of said springs into gripping engagement with said rotatable element.

29. A device as claimed in claim 28, in which one of the springs is a light spring and the other of said springs is a heavier spring, the lighter of said springs being brought into gripping engagement with said rotatable element first and being caused to rotate therewith by its gripping engagement and also to cause said heavier spring to move into gripping engagement with said rotatable element subsequent to the gripping of said rotatable element by said lighter spring.

30. A device as claimed in claim 28, in which an additional clutch device and driving element for said driven element is provided for driving said driven element in a direction opposite to that in which it is driven by said first driving element.

31. In bag closing machinery, the combination with a movable carriage, folding mechanism supported by said carriage, means for moving said carriage in opposite directions, a restraining means for normally preventing movement of said carriage, and a trigger operated by the bag, the edges of which are to be sealed, upon the arrival of the bag adjacent the folding mechanism for releasing said restraining means and permitting the actuation of said carriage by said moving means to cause said carriage to move in the same direction as said bag, and means for actuating said folding mechanism as said carriage moves with said bag.

32. A device as claimed in claim 31, in which means are provided for reversing the movement of said carriage after the folding mechanism has produced a fold in the edges of said bag to bring the carriage back to its initial inoperative position where it is held in position by its restraining means.

33. In folding machinery, the combination with means for folding the edges of a bag while the bag is in motion, and gripping means for maintaining the folded edges of said bag in folded relation and for advancing the folded edges to a position in which the same may be sealed in folded position.

34. A device as claimed in claim 33, in which the gripping means comprises a plurality of cams for engaging the opposite folded edges of a bag and in which said cams are carried by an endless conveyor which moves the cams and consequently the folded edges toward a sealing position.

35. In bag closing machinery, the combination with means for feeding a bag along a predetermined path continuously, means for folding the edges of said bag as it moves along said path comprising a reciprocating carriage having folding means thereon adapted to move in unison with said bag while said folding mechanism is operative, means for actuating said folding mechanism during the movement of said carriage with said bag to produce a fold in said bag, a sub-carriage on said main carriage having an extended movement in the direction of travel of said bag after said main carriage has come to rest, means for arresting the movement of said main carriage, means for thereafter continuing the movement of said sub-carriage, advancing means on said sub-carriage for engaging the bag adjacent said fold rearwardly thereof, whereby the extended movement of said carriage causes said advancing means to move said folded edges from between said folding members, and additional feeding mechanism for gripping and feeding the folded edge of said bag toward a stapling position while said first feeding mechanism moves the bag bodily toward said stapling position.

36. A device as set forth in claim 35 which includes means for releasing said folding blades slightly prior to the extended movement of said sub-carriage to permit movement of said folded edges from between said folding blades by said advancing means on said sub-carriage.

37. A device as set forth in claim 35 in which said additional feeding mechanism includes members disposed on opposite sides of the path of movement of said folded edges as they leave said folding mechanism for positively gripping said edges, said last mentioned means moving bodily with said edges toward stapling position and being releasable adjacent said stapling position as said folded edges move into staple receiving position.

38. In bag closing machinery, the combination with means for moving a bag along a predetermined path with a continuous motion, means for folding the edges of said bag at one position along its path of movement, a stapling position at a subsequent position of said bag along its path of movement and spaced from said first position, and means arranged between said positions for gripping the folded edges of said bag to maintain the folded edges in folded relation while said bag is moving from said folding means to said stapling position, said means gripping said folded edges as they leave the folding means, and releasing said folded edges as they are presented to the stapling means, and said folding means and stapling means being both movable in unison with the movement of said bag during their operative movements for the purposes set forth.

39. In bag closing machinery, the combination with means for advancing a bag along a predetermined path to a stapling position, means for applying a staple to said bag at said position in a fold thereof, and means for producing said fold in said bag prior to the arrival of said bag at said position, comprising a carriage movable in unison with said bag during the folding operation and including a pair of folding members movable against opposite sides of the fold, a carriage to which said folding mechanism is connected, means for moving said carriage to move said folding members in unison with said bag, a sub-carriage slidably mounted on said main carriage in a direction substantially parallel to the direction of bag movement normally restrained from movement with respect to said main carriage by a latch mechanism, means for actuating said sub-

carriage, means operable after said main carriage has moved a predetermined distance along its path of travel for releasing said latch mechanism, said means for actuating said carriage continuing in operation after said latch mechanism is released, whereby said carriage continues its movement in the general direction of the bag movement, means on said sub-carriage for engaging the rear edge of said bag adjacent the fold produced thereon for stripping the fold from said folding means while said folding means remains operative to maintain said fold, gripping means for gripping the fold as it is moved out of engagement with said folding means for gripping and advancing the folded portion of said bag toward stapling position, and means for thereafter moving said sub-carriage and main carriage into the same operative relation with respect to each other as they occupied at the beginning of the folding operation and for restoring the latch mechanism to its operative position.

40. A device as set forth in claim 39 in which there is a means actuated by said bags for instigating the operation of said folding mechanism and the means for advancing said main carriage and sub-carriage and for discontinuing the operation thereof when said bag arrives at predetermined positions in its path of travel and independently of the position of the means for feeding the bag along its path of movement.

41. In bag closing machinery, the combination with means for continuously advancing a bag along a predetermined path through a folding position and a stapling position, means for folding the edges of said bag at said folding position, and means arranged between said positions for gripping the folded portion of said bags positively and for advancing said folded portion toward stapling position, said means including members movable into engagement with opposite sides of the folded portion to grip said folded portion, and means for moving said members bodily in the direction of bag movement at substantially the same rate of speed as said advancing means for said bag.

42. A device as set forth in claim 41 in which said members are carried by endless flexible elements which periodically return said members into a position to receive successive folded portions of said bag therebetween, and for releasing said portions when said portions arrive adjacent said stapling position.

43. In bag closing machinery for sealing bags by a double fold in the mouth portion of the bag, the combination of a single set of folding blades movable relative to each other, means for causing relative movement of said blades toward each other to produce a single fold in the bag, means for moving said blades away from each other, means for holding said fold during the movement of said blades away from each other, and means for again moving said blades toward each other in a different relation with respect to each other to produce an additional fold in said single fold whereby one set of blades is operative by successive relative movements of the same blades to produce the entire double fold in the mouth portion of the bag, and means located at the stapling position for maintaining the fold during the stapling operation.

44. In bag closing machinery for sealing bags by producing a double fold in the mouth portion of the bag and applying staples to said double fold to maintain the same, the combination with two pair of folding blades, the blades of one pair being fixed with respect to each other and the blades of the other pair being movable relatively toward and from each other, means for moving a bag with the edge to be folded between one of the blades of said first pair and the blades of said second pair, means for advancing said pairs of blades toward each other with the one blade of said first pair moving to a position between the blades of said second pair to force a portion of said bag adjacent said edges between said blades of said second pair, means for thereafter moving said blades of said second pair toward each other to grip said folded portion of said bag, means for moving said pairs of blades away from each other, means for thereafter moving said pairs of blades toward each other in a manner to bring the other of the blades of said first pair against the free edge of said bag and along side the outer surface of one of the blades of said second pair to produce a double fold in said bag, means for thereafter moving the folded edges of said bag from between the blades of said first and second pairs in a direction longitudinally of the fold while maintaining said blades in operative engagement with the fold, and means for gripping the fold as it leaves said blades and for advancing said fold toward a stapling position.

45. A device as set forth in claim 44 in which said bag moves continuously along a given path past said folding blades and stapling position, and in which said folding blades move in unison with said bag as it advances along its path of movement.

46. In a bag closing machine for sealing bags by producing a double fold therein and stapling said fold, the combination with a set of folding members movable into engagement with a bag to form a single fold in said bag, means for moving said folding members away from each other, and means for subsequently re-presenting said members in different relation with respect to each other to said single fold for folding said single fold upon itself to form a double fold.

47. In bag closing machinery, the combination with means for advancing a bag along a predetermined path, of means moving with said bag for folding a portion thereof comprising a pair of folding blades movable toward and from each other, of a third blade for moving a portion of said bag between said pair of blades and simultaneously folding said portion, and means for thereafter moving said pair of blades toward each other to grip the portion of the bag arranged therebetween.

48. In bag closing machinery, the combination with means for moving a bag along a predetermined path, of folding mechanism moving substantially in unison with said bag moving means for producing a fold in said bag comprising a pair of blades movable toward and from each other, a third blade for moving a portion of said bag into a position between said pair of blades while the same are spaced from each other to produce a fold in said bag, the bag being engaged at such a position that the free end of the same extends outside the space between said pair of blades, and means for thereafter engaging said free end and for folding the same back against said bag.

49. In a bag closing machine, the combination with means for advancing a bag along a predetermined path with the edges thereof protruding upwardly, folding mechanism moving with said bag advancing means substantially in unison therewith having a blade adjacent to and extending in the same direction as said edges of said

bag, said edges projecting above the upper edge of said blade, a second blade for engaging the side of said edges opposite to that on which said first blade is arranged, and for folding said edge of said bag over said first blade, a third blade arranged substantially parallel to said first blade on the side thereof away from said bag for engaging the free end of said bag to fold the same backwardly over the edge of said second blade to produce a fold in the edge of said bag, and means moving in unison with said second blade for folding the free end portion of said bag subsequently against said bag to complete the fold.

50. A device as set forth in claim 49, which includes means for moving said first and third blades toward each other after the operation of said second blade to grip the portion of the fold arranged therebetween.

51. In bag closing machinery, the combination with a pair of spaced folding blades movable toward and from each other, means for forcing a portion of a bag spaced from the edge thereof downwardly into a position between said blades to produce a fold in that portion of said bag, and means for thereafter moving said blades toward each other to crease said fold, serving to clamp said fold while the final folding is in process.

52. A device as set forth in claim 51, in which an additional folding blade is provided for moving the free edge of said bag which extends outside of the space between said blades, against the side of said bag.

53. In bag closing machinery, the combination with means for moving a bag continuously along a given path, folding mechanism moving with said bag at substantially the same speed as the bag, pairs of opposed folding blades movable toward and from each other, and also substantially at right angles to their direction of movement toward or from each other for producing a double fold in the edge of said bag with one fold between the blades of one pair, and means for moving said latter pair of blades toward each other to crease the fold arranged therebetween.

54. A device as set forth in claim 52, in which means is provided for thereafter moving said last mentioned pair of blades away from each other, and in which there are means provided for moving the folded portion of said bag from between said last mentioned blades in a direction substantially parallel to the crease in the fold after said last mentioned pair of blades are moved apart.

55. A device as set forth in claim 52 in which the means for moving said blades toward each other comprises a shaft having reverse screw threads thereon cooperating with correspondingly threaded members movable in unison with said blades, and means for rotating said shaft.

56. Bag folding and closing machinery comprising a pair of folding blades having threaded members movable therewith, and a single operating member having threaded portions cooperating with the threads on said threaded member, and means for rotating said operating member to move said blades toward and from each other, thereby to first grip and then release a fold, and creasing the latter.

57. Bag folding and closing machinery comprising relatively slidable members arranged substantially parallel with each other, each with a folding blade extending at a substantial angle to the direction of sliding movement, and a threaded portion on each of said members also extending at a substantial angle to the direction of sliding movement, the respective threaded portions of said members being reversely threaded, and an operating member having threads thereon cooperating with the threads on said members, whereby upon rotation of said operating member said threaded members, and consequently said blades, are moved toward and from each other, depending on the direction of rotation of said operating member, thereby to first grip and then release a fold, and creasing the latter.

58. Bag closing machinery as called for in claim 57, which includes in addition a folding blade for moving a portion of said bag to be folded between said first mentioned blades while the same are spaced substantially from each other, and in which after the withdrawal of said additional blade, said operating member moves said folding blades toward each other to crease the portion of said bag arranged therebetween.

59. In bag closing machinery, the combination with a pair of folding blades spaced from each other, and movable toward and from each other, a third blade for moving a portion of the bag over adjacent edges of said folding blades and then into the space therebetween to produce a fold in said bag, and means for thereafter moving said first-mentioned blades toward each other to crease the fold produced therebetween, serving to clamp said fold while the final folding is in process.

60. A device as set forth in claim 59, in which said blades are subsequently moved apart, and in which an ejecting member moves against the edge of said bag in a direction substantially parallel to the fold produced therein to strip the folded portion from between said folding blades.

61. Folding mechanism for bag closing machinery comprising means for moving a bag along a predetermined path, a main carriage movable substantially parallel to the direction of said first mentioned means and carrying folding mechanism, a second carriage having folding mechanism thereon to cooperate with said first folding mechanism, and movably mounted on said first carriage for movement substantially transversely to the path of movement of said first mentioned means, and means for moving said folding mechanism on said first and second carriage toward and from each other as said main carriage moves along its path of movement, and for moving said folding mechanism transversely of the path of movement of said first mentioned means during the movement of said main carriage along its path of movement to produce first a single fold and then a double fold in the edge of a bag carried by said first mentioned means.

62. A device as set forth in claim 61, in which the movements of said second carriage relative to said first carriage are controlled by stationary cams cooperating with means on the second carriage for moving the said carriage in the aforementioned manner.

63. In bag closing machinery, the combination with means for advancing a bag along a predetermined path, of normally stationary folding mechanism adapted to move with a bag when a bag is presented at a given position, adapted to first fold the top portion of the bag horizontally entirely at one side of the bag, preliminary to forming successive creases, means controlled by said bag as the latter reaches a predetermined position along its path of movement for bodily moving the folding mechanism

in the same direction as that in which said bag is moving, and means for thereafter operating said folding mechanism to produce a fold in said bag while said bag and folding mechanism are moving along said path.

64. A device as set forth in claim 63, in which said folding mechanism includes an ejector arranged to the rear of the said bag adjacent the portion thereof being folded for ejecting the folded portion from between the folding mechanism after the fold is produced therein, and means for stopping the movement of said folding mechanism without stopping the forward movement of said ejector, whereby while the forward movement of said folding mechanism is arrested, the ejector will move the folded edge of said bag from operative engagement with said folding mechanism.

65. In bag closing machinery, the combination with a moving conveyor on which bags are to be placed at any position along said conveyor, folding mechanism located adjacent the path of movement of said conveyor, adapted to first fold the top portion of the bag horizontally entirely at one side of the bag, preliminary to forming successive creases, and means controlled by the arrival of a bag at a given position along its path of movement for starting the folding operation of said folding mechanism.

66. In bag closing machinery, the combination with a conveyor for moving bags along a predetermined path, folding mechanism movable along a path substantially parallel to the path of movement of said conveyor for producing folds in bags on said conveyor during the movement thereof along with said conveyor, adapted to first fold the top portion of the bag horizontally entirely at one side of the bag, preliminary to forming successive creases, and means for changing the distance between the paths of movement of said conveyor and folding mechanism, whereby bags of different heights can be folded by the same folding mechanism.

67. In bag closing machinery, the combination with means for moving a bag continuously along a predetermined path, folding mechanism operable while said bag is moving along said path for folding and creasing a portion of said bag, means for tightly gripping the folded portion of said bag after the same leaves the folding mechanism, even though the thickness of the folds of different bags varies somewhat, and for advancing the folded portion thereof substantially at the same rate as the bag, and means for thereafter tightly gripping the fold adjacent the portion at which a staple is to be driven and while that portion is in a staple receiving position.

68. Bag closing mechanism comprising means for moving a bag along a predetermined path, means for producing a fold in said bag as said bag moves along said path, and cam members movable into engagement with opposite sides of said fold to positively grip the fold, and means for moving said cams while gripping the fold in the direction of movement of said bag, and at substantially the same rate of speed as said bag.

69. A device as set forth in claim 68, in which the said cams are adapted to grip the folded portion of said bag irrespective of the thickness thereof within predetermined limits and exert substantially the same gripping force for folds of different thicknesses.

70. In a machine for sealing the end of a bag after it is filled, the combination of a pair of lower parallel blades normally spaced apart and extending upwardly, upper blade means for folding the top portion of the bag downwardly and horizontally across the upper edges of said lower blades, so that the horizontally disposed portion of the bag is entirely at one side thereof, means for then operating said upper blade means to double and push the horizontally disposed portion down between said lower blades, and for causing the upper blade means to then withdraw from between said lower blades, means for causing the lower blades to move toward each other to tightly grip the folded portion between them, and means for then causing said upper blade means to fold the upstanding end portion of the bag over and against the other side of the latter.

71. A structure as specified in claim 70, said upper blade means comprising one downwardly extending blade for tucking the bag between said lower blades, comprising another downwardly extending blade for effecting said final folding of the end portion of the bag against the other side thereof.

72. A structure as specified in claim 70, said means for causing the operation of said upper blade means comprising a support therefor, together with means for causing said support to move up and down and also back and forth transversely of said blades.

73. A structure as specified in claim 70, comprising means having continuous feeding motion for feeding the bags successively to said blades and blade means, and means whereby the blades and blade means travel a distance with each bag.

74. A structure as specified in claim 70, comprising means having continuous feeding motion for feeding the bags successively to said blades and blade means, and means whereby the blades and blade means travel a distance with each bag, together with means for perpetuating the double fold thus produced by said blades and blade means, adapted to travel a distance with each bag while operating thereon.

75. A structure as specified in claim 70, comprising means having continuous motion for feeding the filled bags successively into position to be operated upon by said blades, and means for automatically causing the operation of said blades upon the arrival of a filled bag in predetermined position for the closing thereof.

76. A structure as specified in claim 70, comprising auxiliary means for pushing the folded material from between said lower blades.

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