July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 1

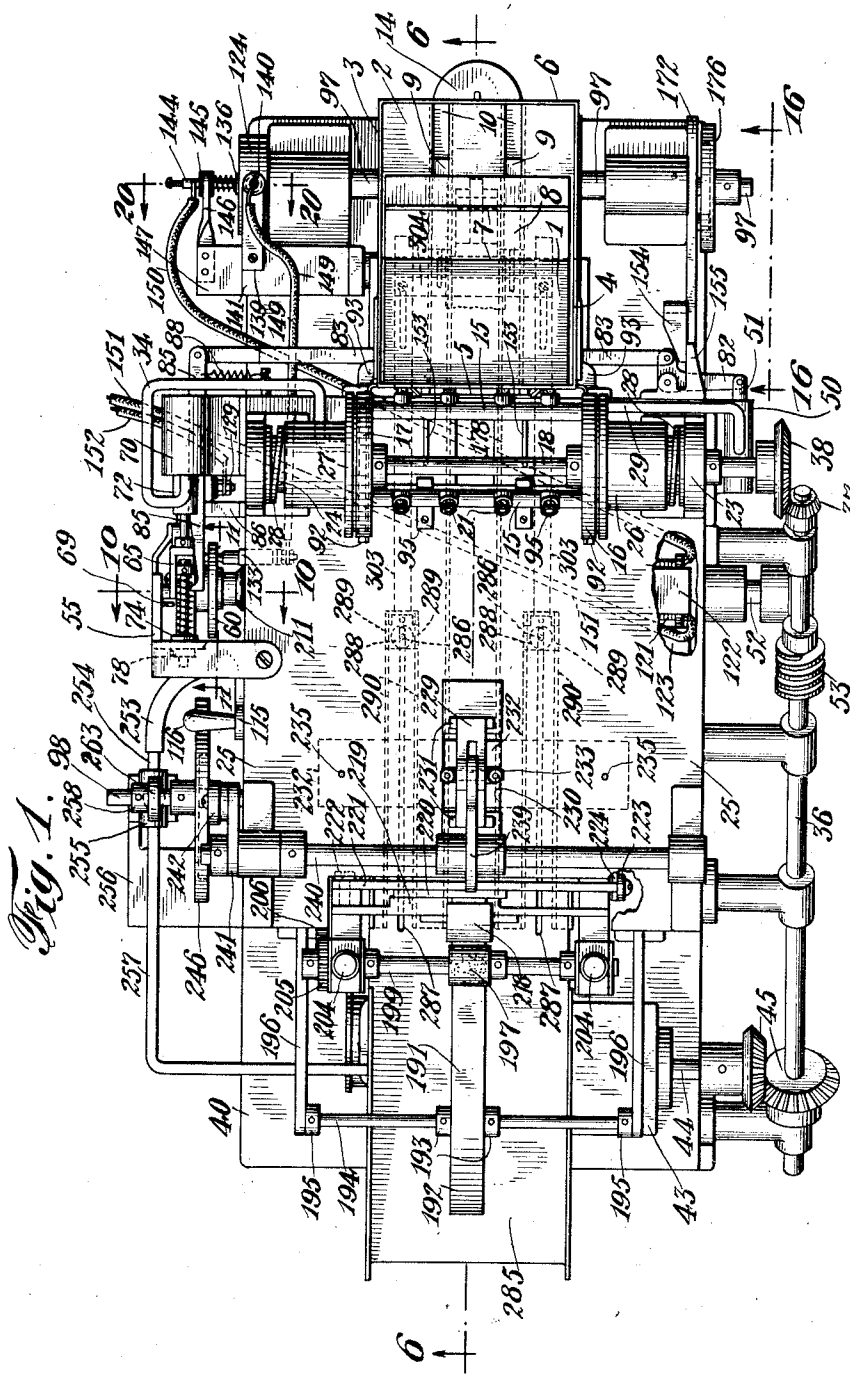


Fig. 1.

INVENTOR
Christian C. F. Reininger
BY
his ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 2

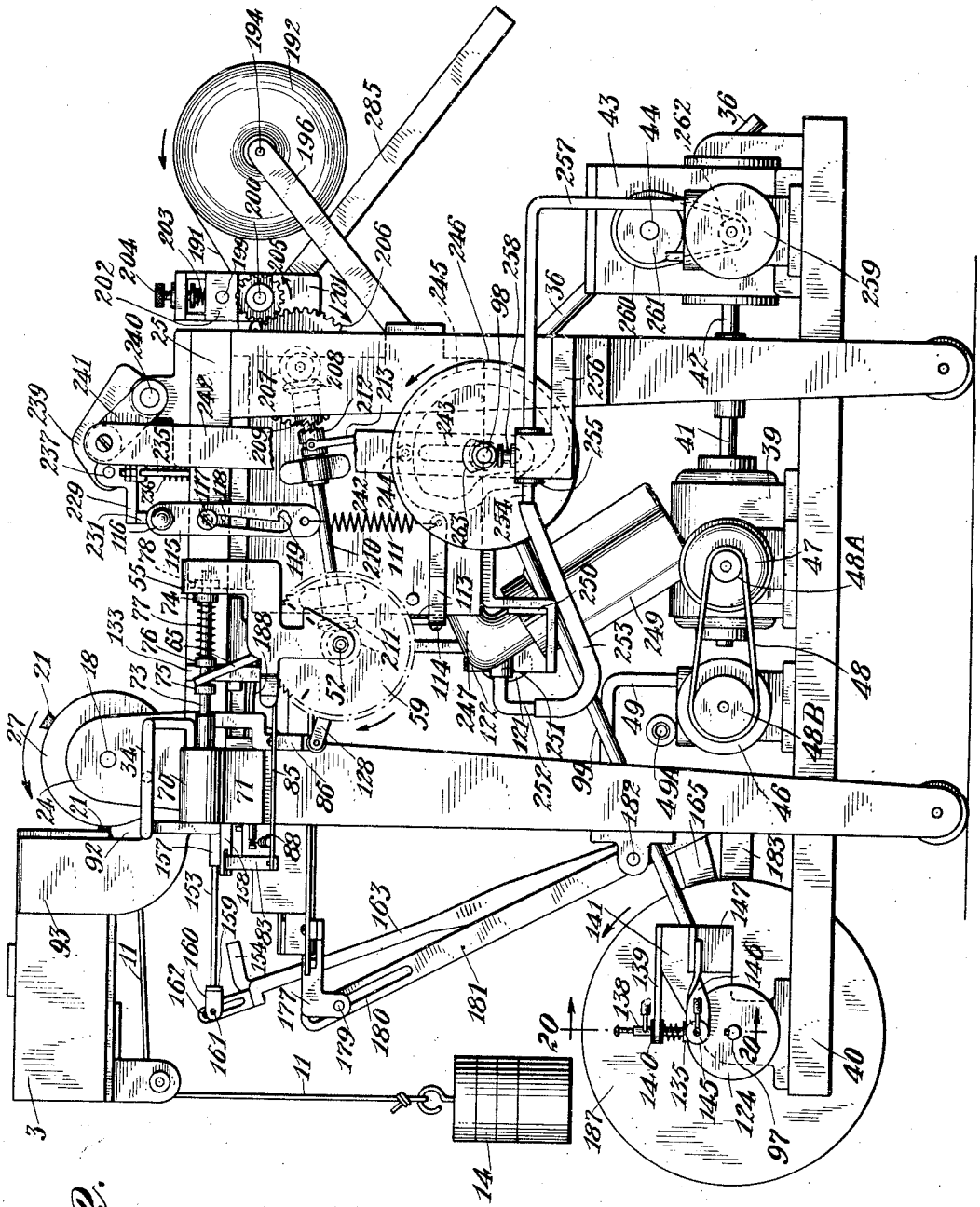


Fig. 2.

INVENTOR
Christian C.F. Reininger
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July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 3

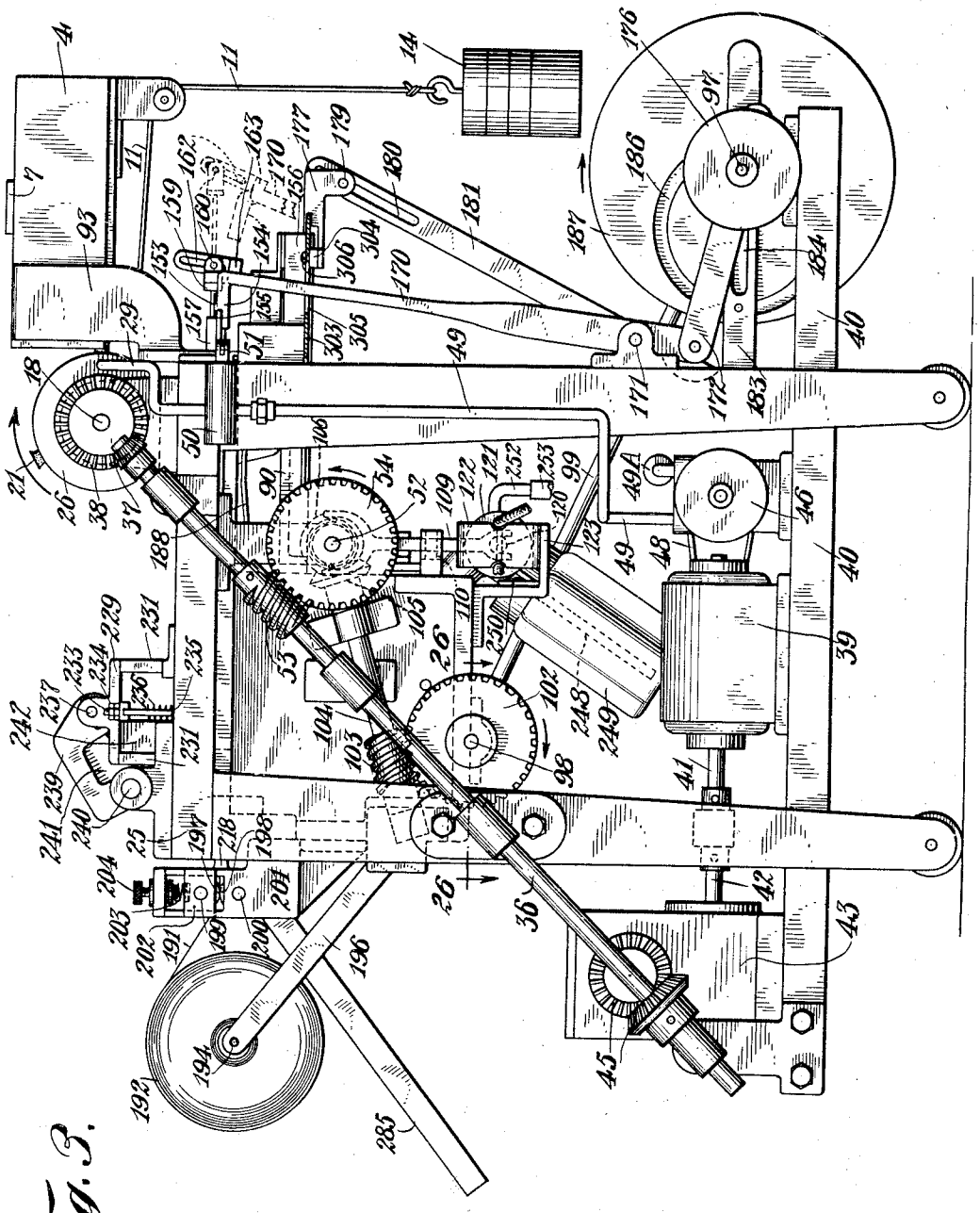


Fig. 3.

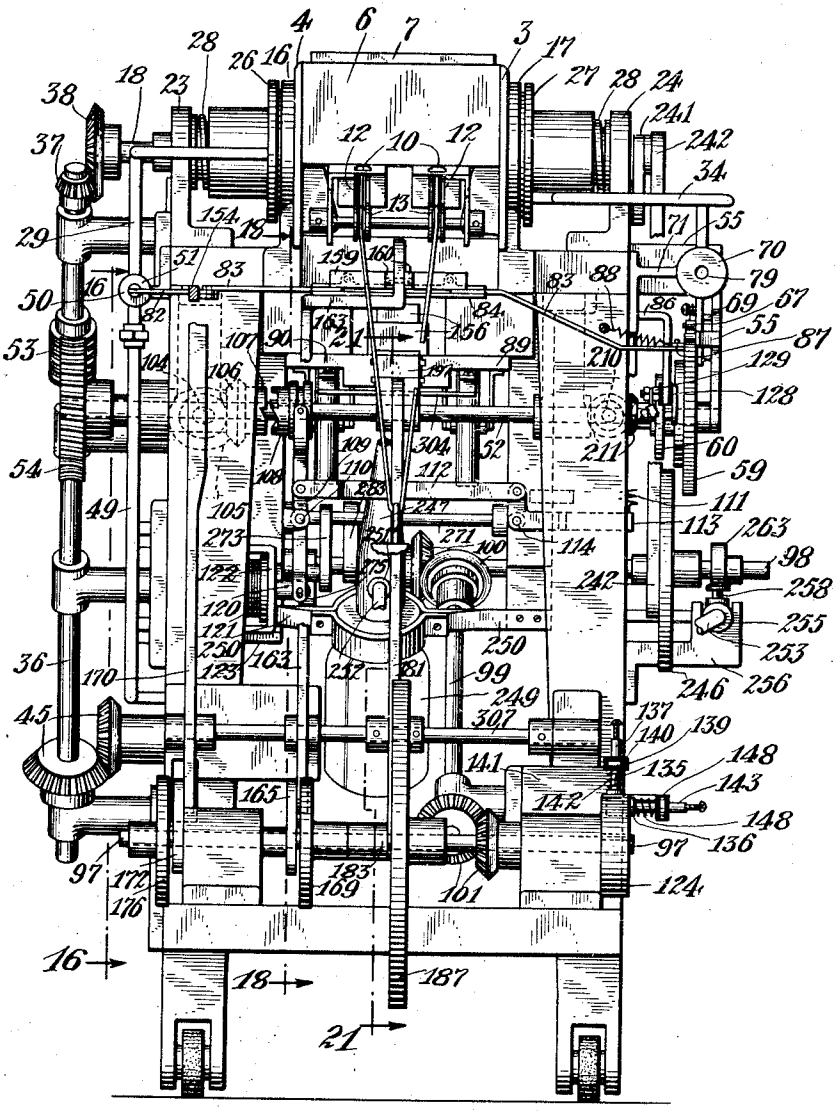
INVENTOR
Christian C. F. Reininger
BY
ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 4

Fig. 4.



INVENTOR

Christian C. F. Reininger

BY

Thurston Seaman

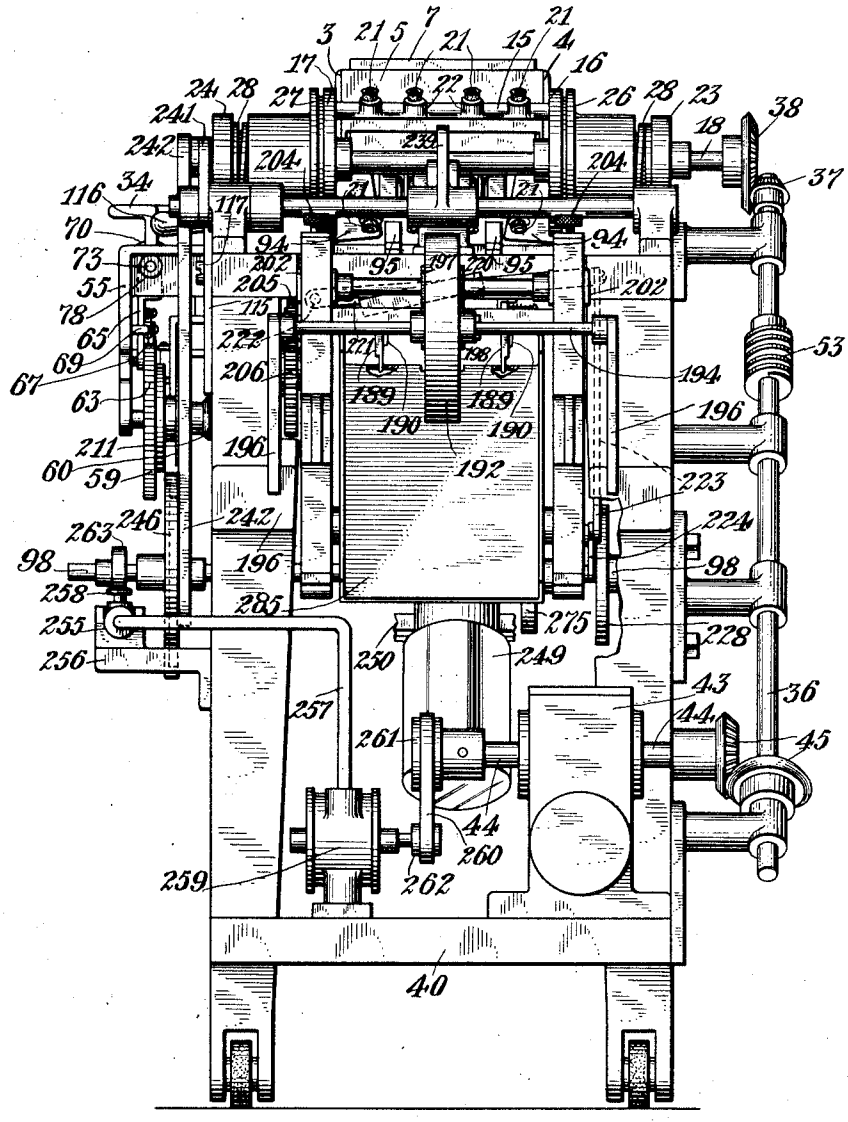
Her ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 5

Fig. 5.



INVENTOR
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Munn & Lemmon
Its ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 6

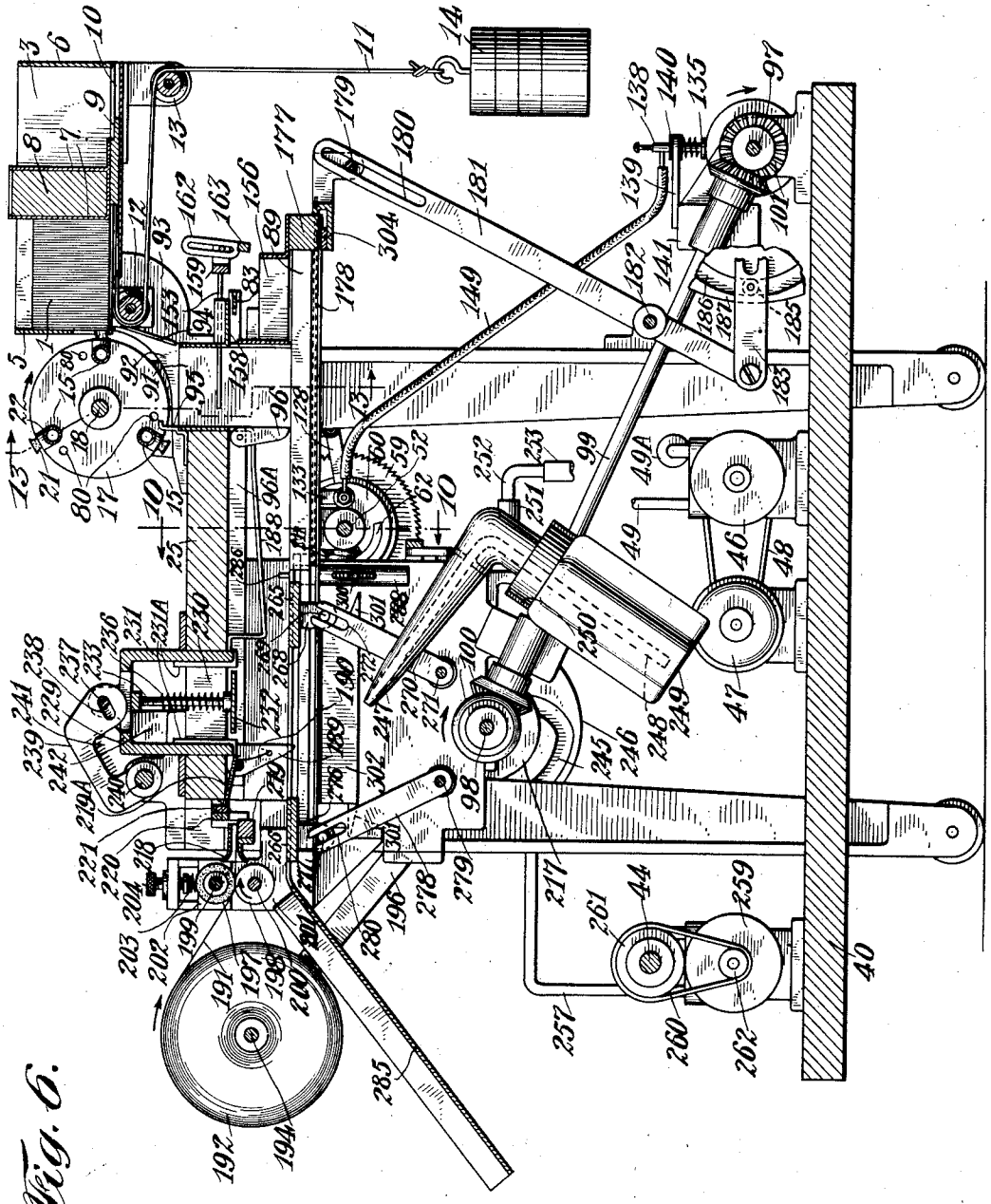


Fig. 6.

INVENTOR
Christian C.F. Reininger
BY
Marie Freeman
his ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 7

Fig. 7.

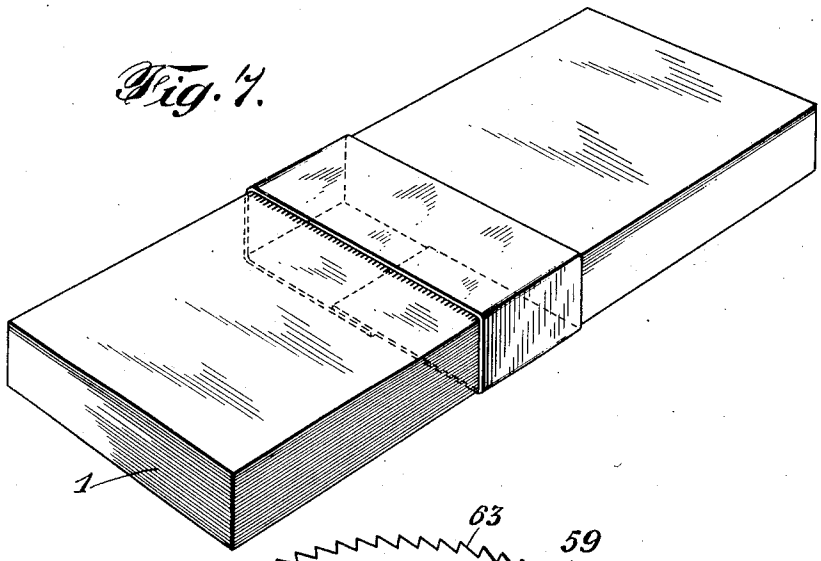


Fig. 8.

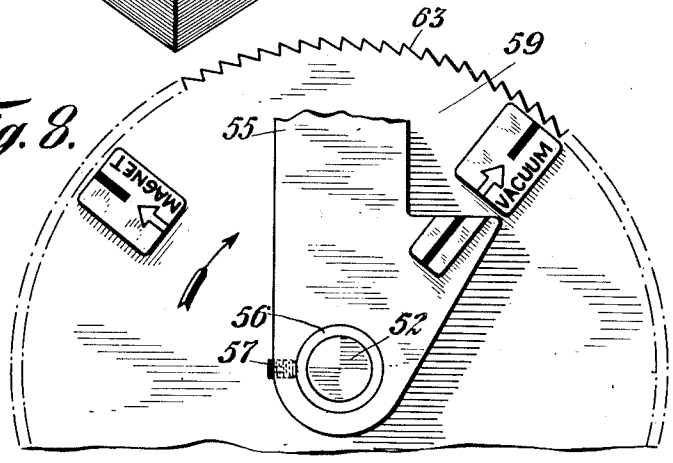
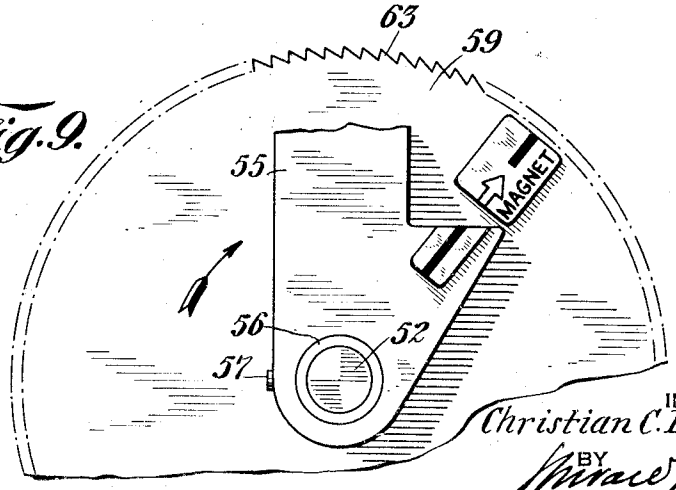


Fig. 9.



INVENTOR
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BY
Horace Seaman
his ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 8

Fig. 10.

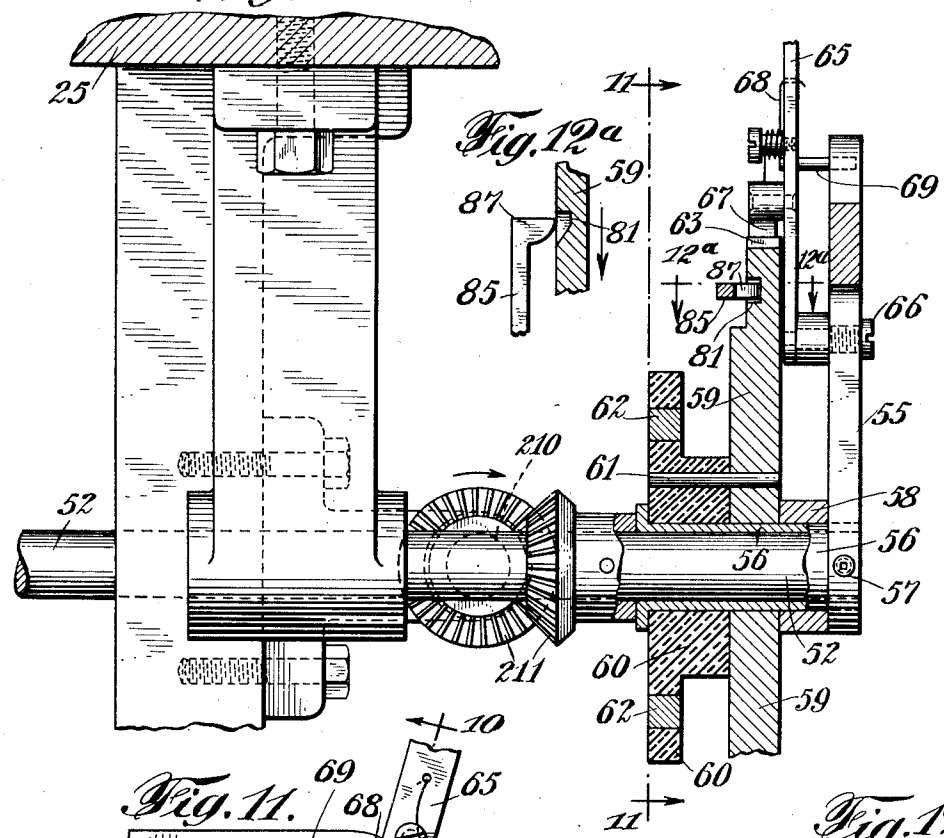


Fig. 12a

Fig. 11.

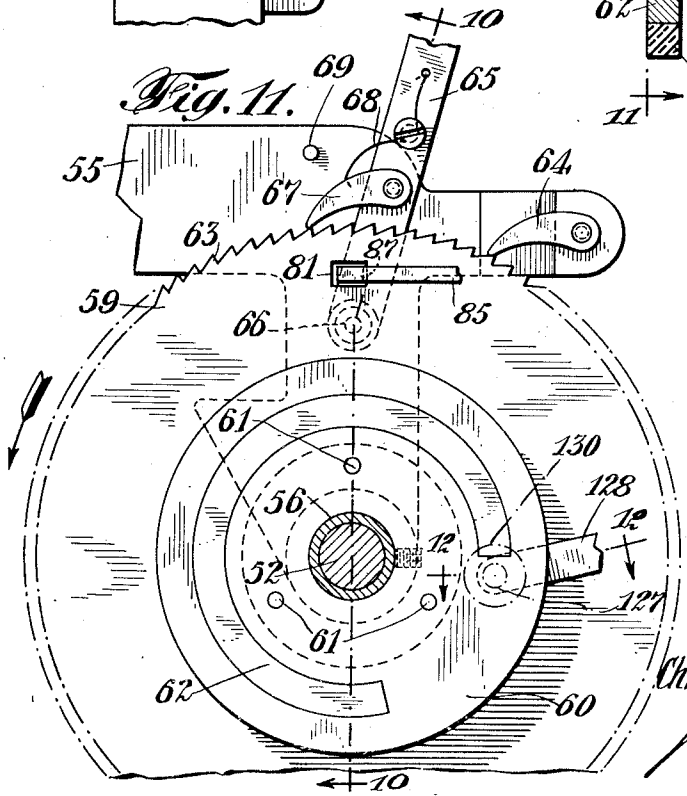
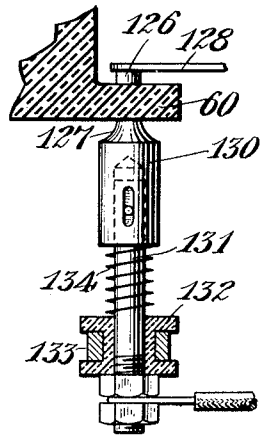


Fig. 12.



INVENTOR
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Horace Freeman
his ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

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Fig. 13.

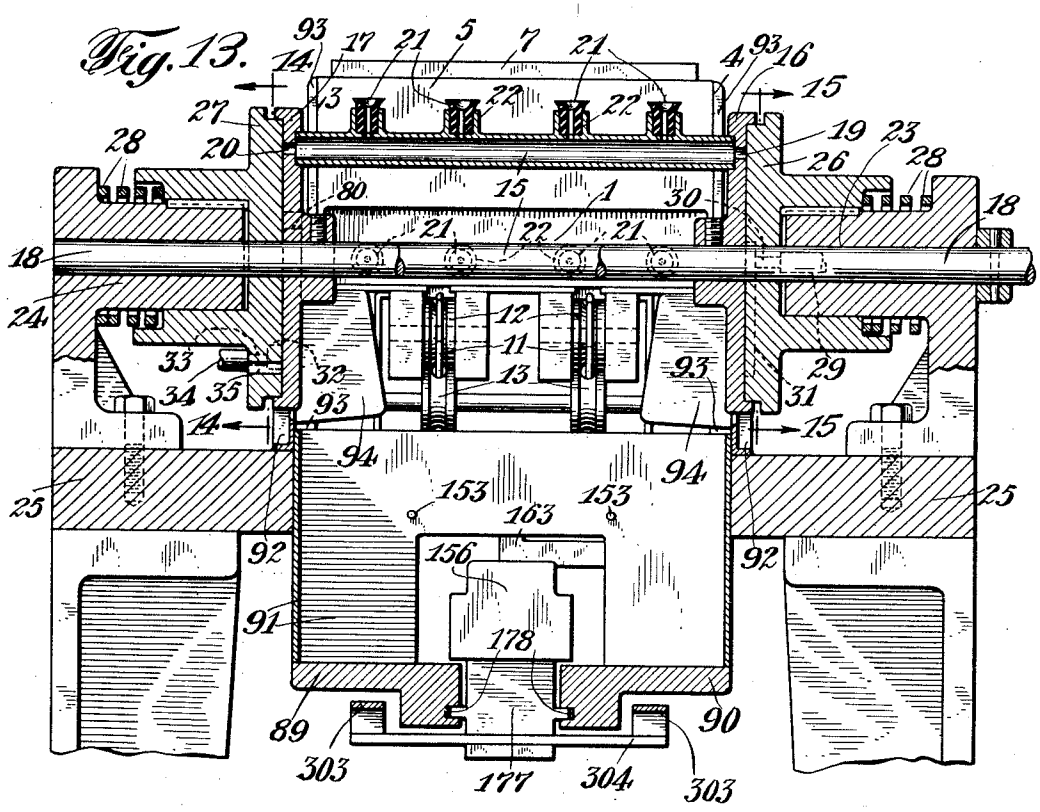


Fig. 14.

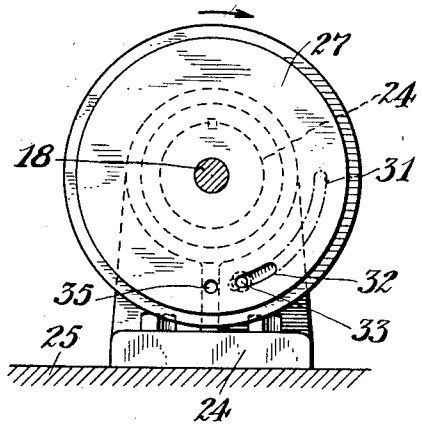
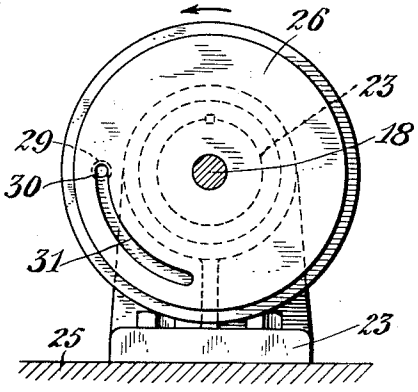


Fig. 15.



INVENTOR
Christian C. F. Reininger
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Shrader & Seaman
His ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 10

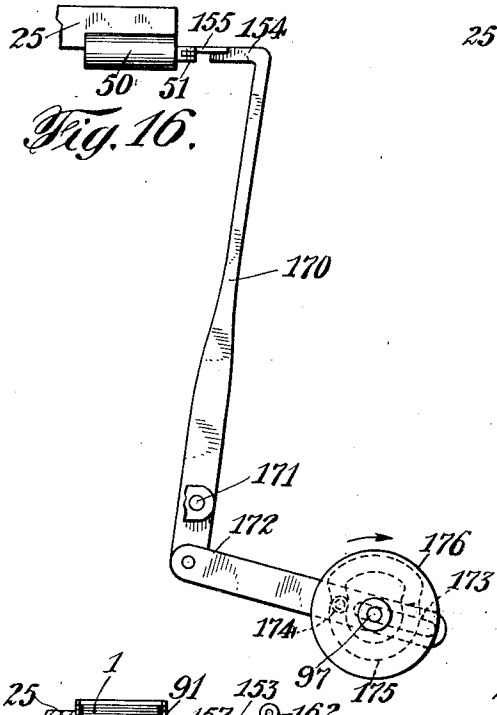


Fig. 16.

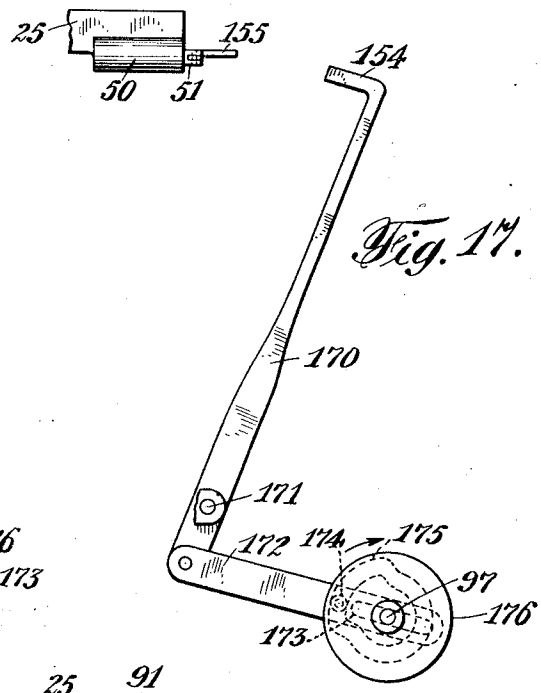


Fig. 17.

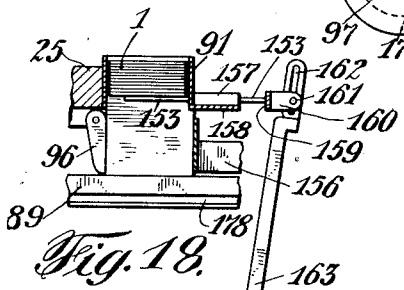


Fig. 18.

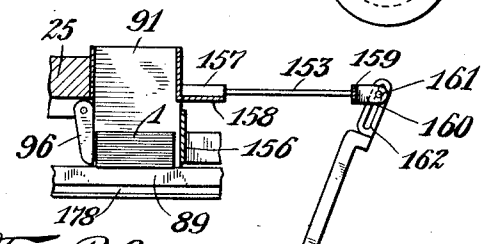
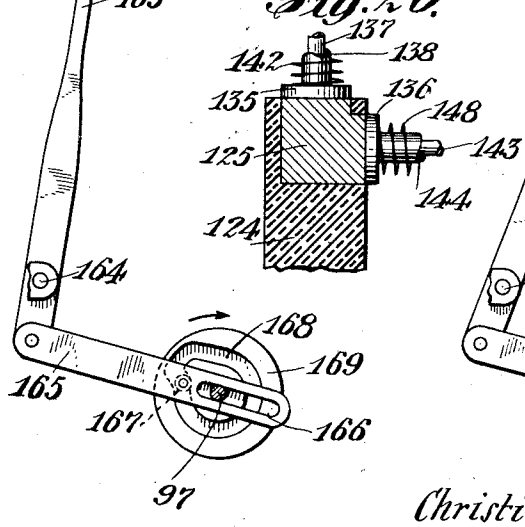


Fig. 20.



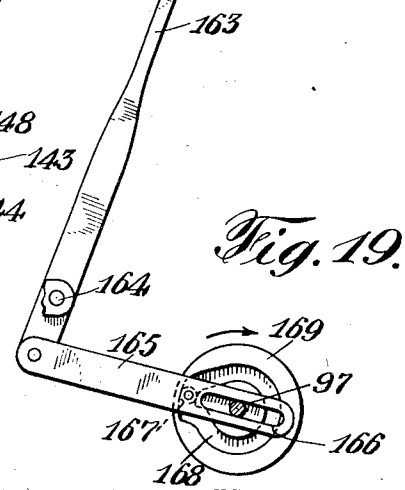


Fig. 19.

INVENTOR
Christian C.F. Reininger
BY
Spencer Thurman & Lee
ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Filed Oct. 7, 1933 13 Sheets-Sheet 11

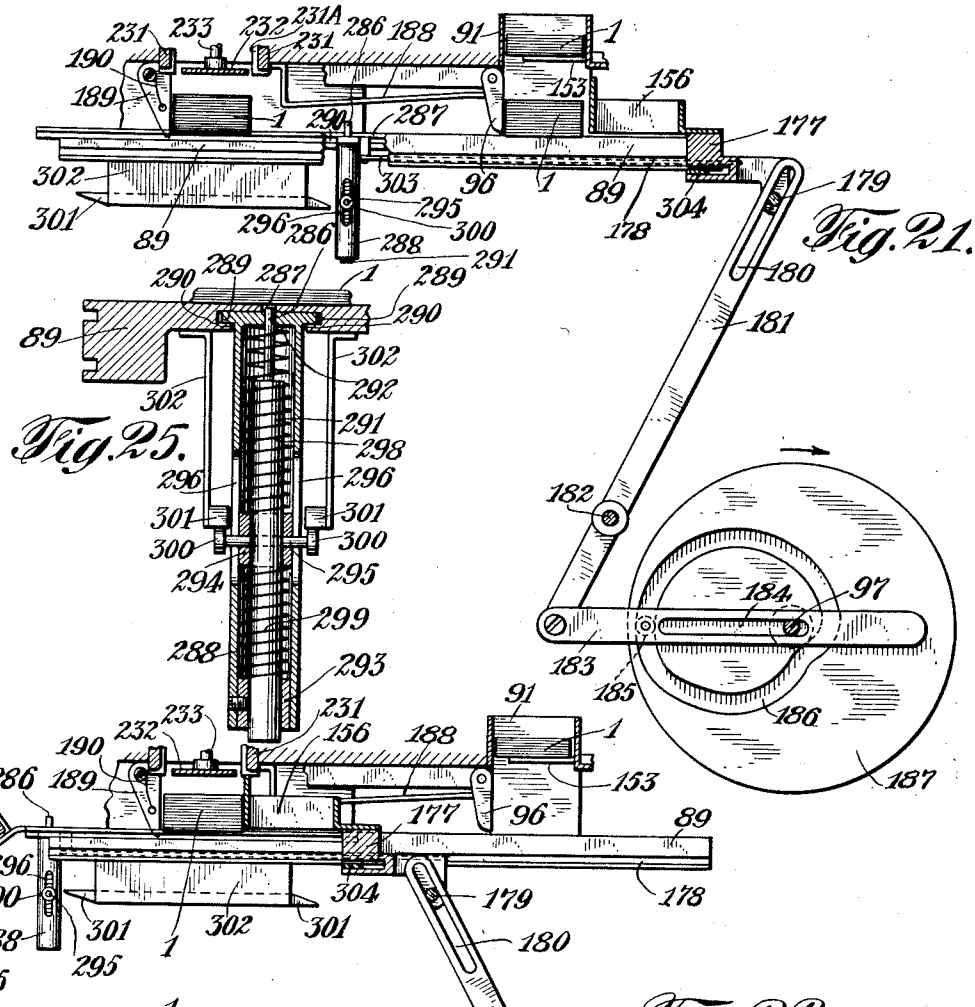


Fig. 21.

Fig. 25.

Fig. 22.

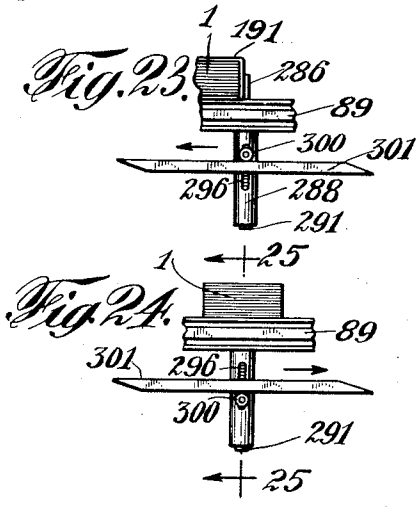


Fig. 23.

Fig. 24.

INVENTOR
Christian C. F. Reininger
BY
his ATTORNEY

July 28, 1936. C. C. F. REININGER 2,049,022

SHEET COUNTING AND PACKAGING MACHINE

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Fig. 26.

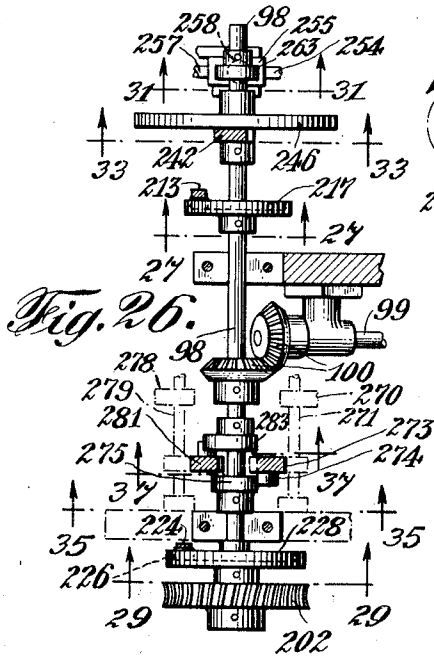


Fig. 27.

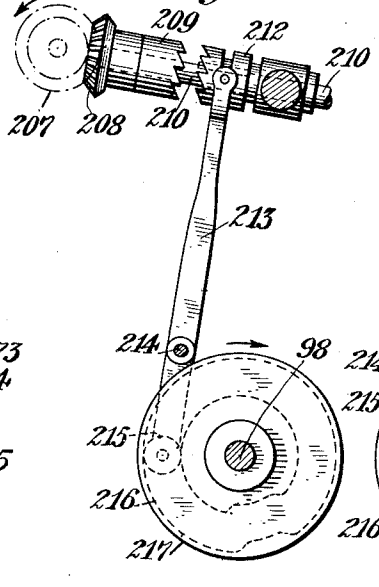


Fig. 28.

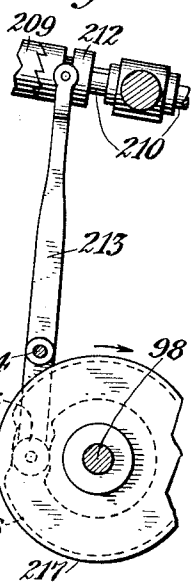


Fig. 29.

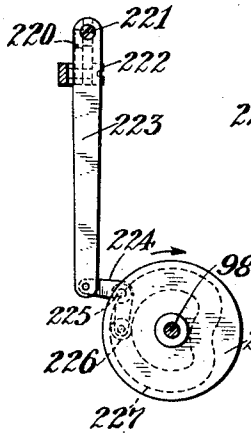


Fig. 30.

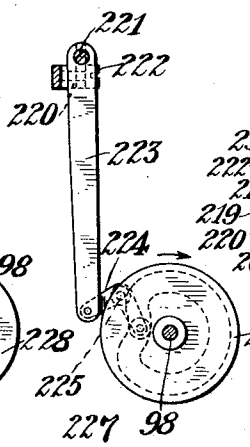


Fig. 33.

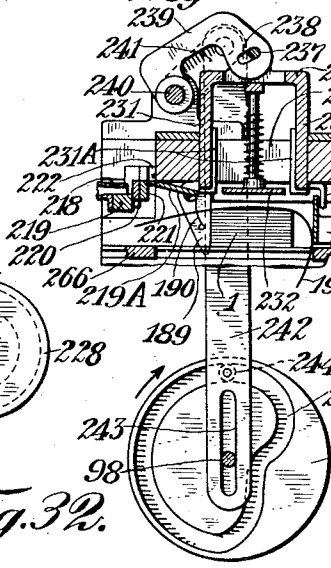


Fig. 34.

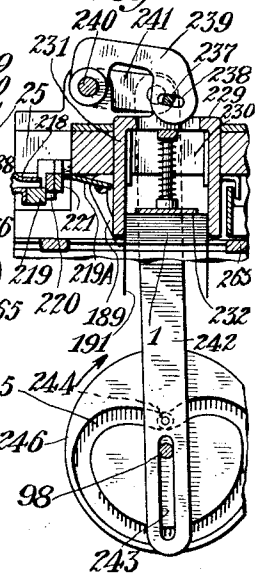


Fig. 31.

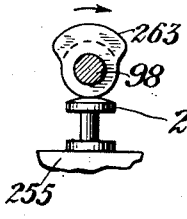
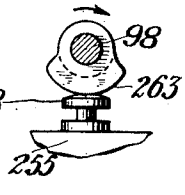


Fig. 32.



INVENTOR
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Murray Sherman
his ATTORNEY

SHEET COUNTING AND PACKAGING MACHINE

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Fig. 35.

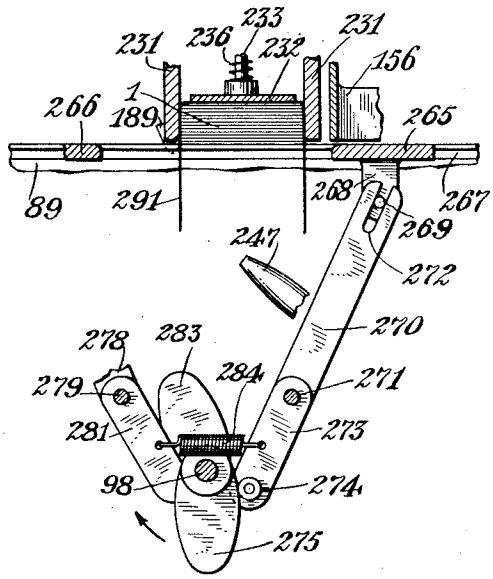


Fig. 36.

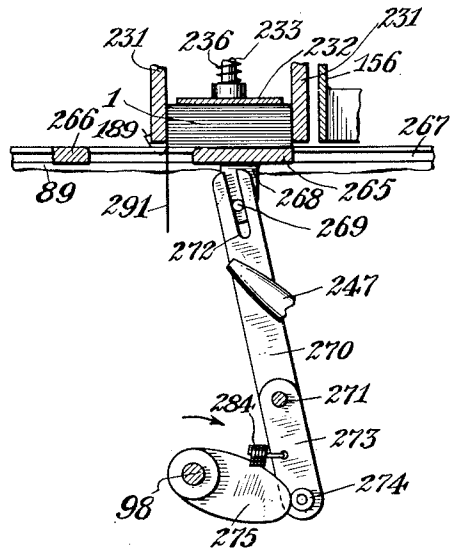


Fig. 37.

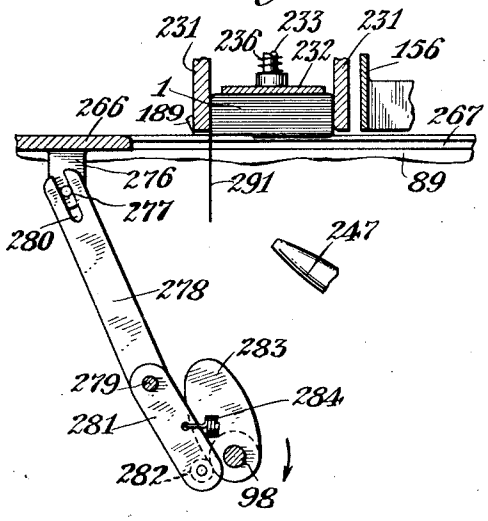
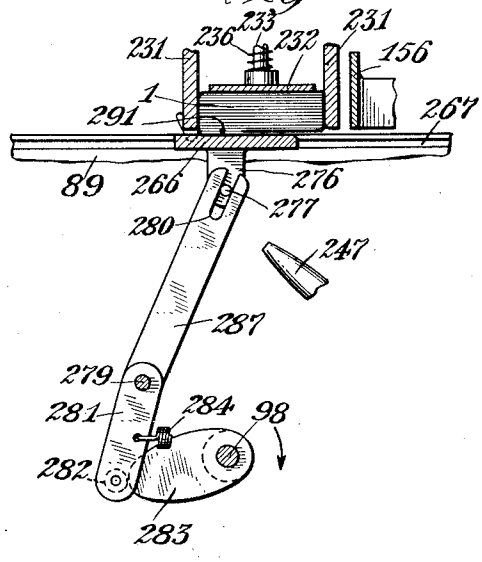


Fig. 38.



INVENTOR
Christian C. F. Reininger
BY
Howard Thomson
Her ATTORNEY

UNITED STATES PATENT OFFICE

2,049,022

SHEET COUNTING AND PACKAGING MACHINE

Christian C. F. Reininger, Hempstead, N. Y., assignor of one-half to William Skobliski, Valley Stream, N. Y.

Application October 7, 1933, Serial No. 692,609

27 Claims. (Cl. 93—93)

My invention relates to sheet counting and packaging machines and refers more particularly to a machine for automatically accurately counting relatively small sheets of paper or the like, or more or less similar articles, compressing them together and securely binding them into firm bundles or packages, each containing any desired predetermined uniform number of such accurately counted sheets or the like.

The counting and packaging machine of my invention as herein disclosed has been particularly designed and proportioned for thus counting and packaging the currency bills of paper money. Such an automatic machine has before it a rather extensive unoccupied or open field of utility in banks and other institutions where relatively large quantities of paper currency or bank notes must be counted and tied or otherwise bound up in packages. Heretofore as a matter of common and extensive practice this work has been done by hand, and so far as I am advised the machine of my present invention is the first practically operable machine for doing this work automatically, rapidly and accurately.

It is to be distinctly understood, however, that the automatic machine of my present invention is in no wise limited to the above noted particular use. Without any change whatever therein the herein disclosed embodiment of my invention may be in like manner used for similarly counting and packaging any kind of data-bearing, or blank slips, or small sheets having the dimensions for which the paper-handling parts of this particular machine have been built, i. e., of the same size and proportions as the bank notes or bills of paper currency.

For similarly counting and packaging other relatively small sheets or the like of different size and proportions, only slight changes and rearrangements will be required in the sheet-handling parts of the machine. For example, the machine can thus be readily adapted for counting and packaging envelopes, or postal cards. For similarly handling larger sheets, for example, letter size, which it is desired to count accurately and securely bind into packages, it is only necessary to build the machine, or parts thereof, on a correspondingly larger scale, as will be readily understood.

Other more particular objects, advantages and valuable attributes of the sheet counting and packaging machine of my invention will hereinafter appear.

My invention includes various features of construction and combinations of parts, as will appear from the following description. I shall now describe the automatic sheet counting and packaging machine embodying my invention illustrated in the accompanying drawings and shall thereafter point out my invention in claims. In these drawings similar parts are designated by similar reference numerals.

Figure 1 is a plan view of a sheet counting and packaging machine embodying my invention, as it appears in an automatically operating condition near to the beginning of such an automatic cycle of operation.

Figure 2 is a front side elevation of the machine as viewed from the rear in Figure 1, but with the machine in an idle condition, previously to the starting of its first operation.

Figure 3 is a rear side elevation of the machine in operation as viewed from the front in Figure 1, with the idle position of parts of the machine shown in broken lines.

Figure 4 is a front end elevation of the machine in the idle condition of Figure 2 and as viewed from the right in Figures 1 and 3 and from the left in Figure 2, this being the feed or intake end of the machine.

Figure 5 is a rear end elevation of the machine as viewed from the left in Figures 1 and 3 and from the right in Figure 2, this being the discharge or delivery end of the machine, with the parts of the machine at this end not yet in operation.

Figure 6 is a central longitudinal vertical section of the machine taken on the line **6—6** of Figure 1.

Figure 7 is a perspective view of a packaged bundle of small sheets, such as paper currency, which have been automatically counted and packaged by the machine of my invention.

Figure 8 is an enlarged partial front elevation of a suction-operated counting disc as viewed in Figure 2 which automatically controls the operation of the entire machine, the starting position of this disc being shown in Figures 2 and 8.

Figure 9 is a similar view showing the position of this counting and controlling disc after it has been operated through ninety degrees constituting a quarter turn of step-by-step rotative counting movement of this disc.

Figure 10 is an enlarged partial transverse vertical section taken on the lines **10—10** of Figures 1, 6, and 11, but with the adjacent end of a pawl lever at a different operated position than appears in Figure 1, this pawl lever co-operating with the counting disc and being a factor in the control of an air vacuum valve, and also further

showing a circuit controlling disc which is operated by the counting disc.

Figure 11 is a similarly enlarged partial longitudinal vertical section taken on the lines **11—11** of Figures 1 and 10, with the counting disc and the circuit-controlling disc at their idle or stationary position, as in Figure 10.

Figure 12 is a further enlarged partial horizontal section taken on the line **12—12** of Figure 11, showing further features of construction of an automatically controlled circuit-controlling switch which similarly appears in plan view in Figure 1.

Figure 12*a* is a partial horizontal section taken on the line **12*a*—12*a*** of Figure 10 showing the adjacent end of the above noted pawl lever for the air vacuum valve at a different operated position which is the position of this pawl lever shown in Figure 1.

Figure 13 is an enlarged transverse vertical section taken on the irregular line **13—13** of Figure 6, showing features of construction of a suction-controlled sheet-pulling and piling device which appears in each of Figures 1 to 6 inclusive.

Figure 14 is a vertical section longitudinally of the machine taken on the line **14—14** of Figure 13.

Figure 15 is a similar section taken on the line **15—15** of Figure 13.

Figure 16 is a segregated elevation, indicated by the lines **16—16** in Figures 1 and 4, of a valve-operating cam movement for the air vacuum valve and which similarly appears in full line elevation at the right hand end of Figure 3, this cam movement being shown as in operation in Figures 1, 3, and 16.

Figure 17 is a similar view showing the normally idle or stationary position of this cam movement, which is in part indicated by broken lines in Figure 3.

Figure 18 is a partial longitudinal vertical section taken on the line **18—18** of Figure 4 showing a cam movement for operating insertable and withdrawable horizontal sheet-supporting pins, with this cam movement in operation as in part similarly appears in Figure 3 at the top and right but mostly there concealed by the cam movement illustrated in Figure 16.

Figure 19 is a similar view showing the normally idle position of rest of this cam movement in which the sheet-supporting pins have been withdrawn and as in part appears in elevation from the other or front side of the machine at the top and left in Figure 2.

Figure 20 is a much enlarged partial transverse vertical section taken on the line **20—20** of Figures 1 and 2, showing an automatically operated circuit-controlling switch which similarly appears in elevation in Figure 4.

Figure 21 is a partial longitudinal vertical section taken on the line **21—21** of Figure 4 showing a slide-operating pile-moving and package-delivering cam movement, together with its adjuncts, at its normally retracted non-operating position, which also similarly appears in Figures 3 and 6 as well as in Figure 2 at the left.

Figure 22 is a similar view of this cam movement showing a subsequent position in the course of its operating movements.

Figure 23 is a similar partial view showing an intermediate position during the operation between the positions shown in Figure 21 and in Figure 22 respectively.

Figure 24 is a view similar to Figure 23 but showing positions of parts during the continued operation shown in Figure 22.

Figure 25 is a much enlarged partial transverse vertical section taken on the line **25—25** of Figure 24 and showing the same operating position of the several parts, and shows features of construction relating to one of the package-delivering vertical ejector pins.

Figure 26 is a partial transverse horizontal section of the machine taken on the line **26—26** of Figure 3 showing principally one of the transverse cam-carrying operating shafts together with its immediate adjuncts.

Figure 27 is a longitudinal vertical section taken on the line **27—27** of Figure 26 and shows the normally idle or stationary position of a clutch-operating cam movement, for feeding a packaging strip, this cam movement also in part appearing in opposite elevation from its other side in Figure 2.

Figure 28 is a view similar to Figure 27 showing the clutch-engaging operating position of this cam movement.

Figure 29 is a longitudinal vertical section taken on the line **29—29** of Figure 26 showing the normally idle or stationary position of a cam movement for operating a movable shearing jaw to sever the packaging strip, this cam movement also in part appearing in plan view in Figure 1 and in elevation in Figure 5.

Figure 30 is a view similar to Figure 29 showing this cam movement in operation.

Figure 31 is a longitudinal vertical section taken on the line **31—31** of Figure 26 showing the normally idle or stationary position of a cam movement to operate an air-pressure valve, for applying adhesive to an end portion of the severed packaging strip, this cam and valve movement similarly appearing in elevation from its other or outer side in Figure 2.

Figure 32 is a view similar to Figure 31 showing this cam as having operated such air valve in the course of operation of the cam.

Figure 33 is a longitudinal vertical section taken on the line **33—33** of Figure 26 showing the normally idle or stationary position of a cam movement for operating a plunger carrying a pressure plate and provided with a pair of folding jaws for bending the packaging strip, this cam movement also similarly appearing in part in Figure 6 and in Figure 3, as well as in opposite elevation from its other side in Figure 2 and in plan view in Figure 1.

Figure 34 is a view similar to Figure 33 showing the operation of this cam movement.

Figure 35 is a longitudinal vertical section taken on the line **35—35** of Figure 26 showing the normally idle or stationary position of a double cam movement for folding together the ends of the packaging strip, this cam movement similarly in part appearing in elevation in Figure 6.

Figure 36 is a view similar to Figure 35 showing the right hand or front end element of this cam movement in an operating position.

Figure 37 is a section similar to Figure 35 taken on the line **37—37** of Figure 26 and showing the normally idle or stationary position of the other element of this cam movement, similarly to what appears in Figure 6.

Figure 38 is a view similar to Figure 37 showing the latter cam element of this cam movement in an operating position.

In order to enable a quicker grasp and clearer comprehension of my invention and of the construction shown in the accompanying drawings

for carrying it out, it is well to note briefly at this point the general characteristics and principles of operation before proceeding with a description in detail of the several parts and features which are combined to form the complete co-organization which constitutes the sheet counting and packaging machine of my invention as a whole.

Sheets in a hopper have compacting pressure applied thereto. These frictionally held sheets are drawn edgewise one by one from the hopper by means of a moving suction device. A sheet carried by the suction device causes the suction to operate a counting disc, so that thereby the latter will not be operated unless a sheet is carried by the suction device. When the desired predetermined number of sheets have been stacked in a pile by the suction device the counting disc causes a valve to close which shuts off the vacuum from the suction device and at the same time initiates the operation of a composite device for removing and subsequently packaging the counted sheets. Immediately a temporary false bottom, which may comprise horizontal sheet-supporting pins or rods, is inserted in spaced relation above the stack of counted sheets, followed by the opening of the previously closed vacuum valve, thereby again starting the interrupted sheet pulling and counting operations, these sheets being now deposited upon the inserted horizontal pins or the like.

A slide now moves away the pile or stack of counted sheets, after which this slide returns to its original position and stops there. When this slide has thus returned the sheet-supporting pins are withdrawn. While this slide is returning the removed stack of sheets is bound into a firm bundle or package. A strip of paper or the like is passed over this stack, severed from a roll thereof, the stack compressed, the severed strip folded around the compressed stack and the overlapping ends of this strip are glued together. When the above noted slide again moves for removing the next succeeding stack of counted sheets, an ejector device will deliver this bound package out of the machine at the rear end thereof, by means of upwardly projecting automatically controlled ejector pins carried by the slide in advance of the unbound stack of sheets which is at the same time being moved to the binding or packaging position by this slide.

The automatic sheet counting and packaging machine illustrated in the accompanying drawings as an embodiment of my invention will now be particularly described.

Preparatory to starting the operation of the machine, a collection of sheets 1, 1 are placed on edge in collated relation upon the bottom 2 of a feed hopper, between its sides 3 and 4, and against its rear end wall 5, as shown in Figures 1 and 6, this hopper also having a front end wall 6. These collated sheets 1, 1 are pressed together into compact relation and against the rear wall 5 by means of a slidable follower shown as comprising a metal shell 7 which is provided with a solid core 8 which may be of wood. This follower 7 is carried by a pair of small blocks 9, 9 which are secured to its bottom and are guided in undercut grooves 10, 10 in the hopper bottom 2.

The ends of a cable 11, or it may be a cord, are secured to the respective blocks 9, 9 from which this cable extends rearwardly around respective pulleys 12, 12 which are mounted on and beneath the hopper bottom 2 near its rear end, thence the cable 11 extends forward over respective similarly mounted pulleys 13, 13 at the front end and has a weight 14 hung thereon, all as clearly appears in Figures 2, 3, 4, 6 and 13. Thus the weight 14 will cause the follower 7 to apply a uniform compacting pressure to the sheets 1, 1 regardless of their number or the position of the slidable follower. This pressure may be adjustably varied by making use of a heavier or lighter weight 14, or by having this weight in sections, as indicated in the drawings.

It will be noted from Figures 5, 6 and 13 that the rear end wall 5 of the sheet hopper terminates at its lower edge some distance above the rear end of the hopper bottom 2, which latter desirably terminates slightly short of the end wall 5. The lower margin of the rearmost of the sheets 1 is thus exposed rearwardly, in the particular instance shown to the extent of nearly half the width of this sheet, with the lower edge of this sheet free, while its upper marginal portion is pressed against and frictionally gripped rather strongly by the rear end wall 5 of the hopper, thereby providing for the drawing out and removal of this sheet downwardly and rearwardly. An automatically acting device for withdrawing the sheets 1, 1 successively one by one and stacking them in a pile will now be described, such device being more particularly shown in Figures 1 to 6 inclusive, 13, 14 and 15.

A horizontal transversely extending sucker tube 15 has its ends fixed respectively radially outward from the center in end heads 16 and 17. These heads 16 and 17 are centrally fixed upon a horizontal transverse shaft 18 which continuously rotates during the operation of the machine thereby continuously revolving the sucker tube 15 transversely of its length in a circular orbit. In the particular construction shown in the drawings three such sucker tubes 15, 15, 15 are employed, all being equally radially spaced from the shaft 18 and equally circumferentially spaced from one another on the heads 16 and 17. The head 16 appears at the front or towards the bottom in Figure 1, at the left in Figure 4, at the right in Figures 5 and 13, while the other head 17 appears towards the top of Figure 1, at the right in Figure 4, at the left in Figure 5, in elevation in Figure 6 and at the left in Figure 13.

In line with each suction tube 15 the head 16 is provided with an eduction port 19 through which suction may be applied to this end of the tube 15, and similarly in line with the other end of each suction tube 15 the other head 17 is provided with an induction port 20 whereby suction within or through this tube may be applied to points beyond the head 17. Each of the suction tubes 15, 15, 15 is similarly provided with a longitudinal series of soft rubber suction cup nozzles or nipples 21, 21 which are respectively securely but removably and replaceably held in hollow bosses 22, 22 which are rigidly carried by the suction tube 15, which has a perforation in line with the suction hole through each of the nozzles or nipples 21, 21, as is clearly shown for one of these tubes in Figure 13.

All of the nipples 21, 21 and bosses 22, 22 project radially relatively to the operating shaft 18, with the cup-shaped suction mouths of these nipples projecting beyond the bosses 22, 22. The number of suction nipples 21, 21 in a series along the respective suction tubes 15, 15 may be varied as desired, being shown in the drawings as four. The operating shaft 18 is at a level slightly above the hopper bottom 2 and is sufficiently spaced rearwardly so that, with no suction in the tubes

15, 15, the suction ends of the nipples 21, 21 will barely graze or desirably not quite touch the exposed lower margin of the rearmost of the compacted sheets 1, 1 which has its upper margin pressed against the inner face of the rear wall 5 of the hopper.

The outer end faces of the rotatable heads 16 and 17 are flat and smooth and are shown as provided with shallow annular flanges. The outer end portions of the operating shaft 18 are journaled in similar bearings 23 and 24 which are fixedly mounted on a strong top plate 25 forming a part of the frame of the machine, each of these bearings being in the form of a bracket having an inner extension surrounding the shaft 18. An outwardly sleeved disc or plate 26 has its sleeve portion splined over the bearing 23 for slight sliding but non-rotative movement, and an in general similar but not identical outwardly sleeved disc or plate 27 is similarly splined over the other bearing 24 for similar sliding but non-rotative movement. The inner faces of these discs are flat and smooth and are respectively seated in sealing relation against the outer smooth flat faces of the respectively adjacent rotative sucker heads 16 and 17. These discs 26 and 27 are pressed into sealing relation with the respective heads 16 and 17 by means of similar sturdy thrust springs 28, 28 surrounding the extensions of the bearings 23 and 24.

The operating shaft 18 rotates in a direction to carry the orbitally revolving sucker tubes 15, 15, 15 and their suction nipples 21, 21 downwardly at the front of this shaft between this shaft and the sheet-containing hopper, as indicated by arrows in several views of the drawings, it being noted of Figures 14 and 15 that there the arrows indicate only the rotation of the shaft 18, since the sealing plates 26 and 27 are stationary, as above noted. The sealing plate 26 has a terminal section 29 of a suction pipe connected thereto at the forward portion of its outer side at the level of the shaft 18 and opening to the inner face of this plate through a port 30, the radial position of which coincides with the eduction ports 19, 19 of the sucker head 16.

An arcuate groove 31 in this inner face extends downwardly and rearwardly from the port 30, being shown as of a length somewhat less than ninety degrees. This groove is shown in full line face view in Figure 15 and for clarity of comparison has been indicated in dot-and-dash lines on the opposite sealing plate 27 in Figure 14. It will be evident that as the sucker head 16 rotates any one of its eduction ports 19 will be in communication with the suction pipe section 29 during the passage of this port 19 along the groove 31, while during the remainder and longer arc of such rotation this port 19 will be closed by the sealing face of the plate 26. Thus suction may be applied to the nipples or suckers 21, 21 of a sucker tube 15 only while this tube is traversing the arc of the groove 31.

As shown most clearly in Figure 14, the other stationary sealing plate 27 has in its inner face an arcuate groove 32 which is much shorter than the groove 31 in the sealing plate 26, being shown as only about one-fourth the length of the latter groove. This groove 32 radially coincides with the induction ports 20, 20 in the sucker head 17 and thus in radial position similarly coincides with the groove 31 in the sealing plate 26. This shorter groove 32 is opposed to the lower portion of the longer groove 31, with the lower end of this groove 32 shown as stopping slightly short of or not quite extending into line with the lower end of the longer groove 31. The sealing plate 27 has a port 33 through it from the lower end of its groove 32, so that thus the groove 32 extends forwardly and upwardly from this port. This port 33 opens into a suction pipe 34 which is connected to the sealing plate 27 at its outer side and is utilized for a purpose to be described later.

A relatively short distance rearwardly from its port 33 and similarly rearwardly beyond or out of line with the rear end of the groove 31 in the sealing plate 26, and shown as directly below the shaft 18, the sealing plate 27 has through it a relief port 35 opening outwardly to the atmosphere. This port 35 is in the path of movement of the induction ports 20, 20 of the sucker head 17 through which this port 35 admits air into a sucker tube 15 which destroys the residual vacuum therein at this point in the revolving movement of such sucker tube. As will later clearly appear, the vacuum in a sucker tube 15 will not be destroyed through its induction port 20 by the groove 32, port 33 and suction pipe 34. Except while traversing the arc of the short groove 32 and again while in communication with the relief port 35, the induction port 20 of each of the revolving sucker tubes 15, 15, 15 will be closed by the sealing face of the plate 27, in the particular construction shown.

Means for applying vacuizing suction to the pipe section 29 will be described later. It will now be evident from the preceding description that with suction applied to the pipe section 29, as each revolving sucker tube 15 comes down to about the level of the shaft 18 at the front thereof, as shown for one of these sucker tubes in the drawings, particularly in Figures 6 and 13, the series of sucker nipples 21, 21 on this sucker tube will have suction applied thereto whereby they will seize the lower margin of the rearmost of the collection of collated sheets 1, 1 closely adjacent to the lower edge of this sheet. The gripping of this sheet against the outer ends or mouths of this series of the soft rubber suckers 21, 21, due to the pressure of the outer air, seals these suckers against the entrance of such air.

This sheet 1 will now be drawn out of the hopper downwardly and rearwardly, this movement of such sheet being facilitated by reason of the fact that its lower edge becomes its leading edge during such movement. When this sucker tube 15 comes just about to its lowermost position, the partial vacuum therein will be destroyed by the admission of atmospheric air into such sucker tube, as above described, whereupon the series of sucker nipples 21, 21 of this tube 15 immediately releases this sheet for the latter to descend by its own gravity in a substantially horizontal position. Thus the sheets 1, 1 will be successively withdrawn and stacked in a pile, through the co-operation of means to be described later. When no suction is applied through the pipe section 29, as will be described later, then the above described sucker device will simply rotate idly and none of the sheets 1, 1 will be withdrawn from the feed hopper.

The means by which this sucker device may be continuously rotated will now be described. A main drive shaft 36 is journaled in bearings on the frame of the machine at the rear side thereof and inclines downwardly and rearwardly from the front end of the machine. A bevel pinion 37 fixed on the upper end of this shaft 36 meshes

with and drives a bevel gear **38** fixed on the adjacent outer end of the sucker device shaft **18**. This drive shaft **36** also is provided with connections for driving a major number of other parts of the machine, as will appear later.

It is desirable that the machine of my invention shall be self-contained. Accordingly, an electric motor **39**, forming a main driving motor for the machine, is mounted upon a lower platform **40** which forms a part of the machine frame. The shaft **41** of this motor is directly coupled to an aligned shaft **42** extending out of a gear box **43** containing reducing gearing and having a transverse shaft **44** the outer end of which is geared to the inclined drive shaft **36** by means of a pair of bevel gears **45, 45**. The reducing gearing nested within the gear box **43** may be of a usual type, the details of which are unnecessary to illustrate, since such devices are well known. Some of these are of a type providing for effecting changes in speed, and obviously that type may be employed in the machine of my invention, if so desired.

A vacuizing device for applying sheet-pulling suction to the pipe section **29** includes an exhaust pump or vacuum pump **46** mounted upon the platform **40**. In the illustrated machine, this exhaust pump, which as to its working parts may be of any suitable construction, is driven by means of an independent electric motor **47** mounted upon the platform **40** and geared to the pump **46** by means of a belt **48** and speed-reducing pulleys **48A** and **48B**. This exhaust pump **46** has an upwardly extending vacuum pipe **49** connected thereto and is provided with an outlet **49A** to the atmosphere. The vacuum pipe **49** is connected to the pipe section **29** through an interposed vacuum-controlling air valve **50**.

This vacuum valve **50** is shown as of the slidable plunger or piston type, having a valve stem **51** which when withdrawn forwardly opens the valve to establish communication of the vacuum pipe **49** with the pipe section **29** and which when pushed inwardly or rearwardly closes such communication, so that then the suction produced in the vacuum pipe **49** by the exhaust pump **46** cannot be transmitted or applied to the pipe section **29**. Actuating means for imparting valve-opening or valve-closing movement to the slidable stem **51** of the vacuum valve **50** are controlled in their operation by a combined counting and controlling device next to be described. Such opening and closing movements of this valve occur sequentially at different stages in a complete cycle of automatic operation of the machine. Also this valve is subject to manual control in its operation, as will be described later.

In order to drive other parts of the machine not yet described, as previously mentioned, the machine has a transverse shaft or countershaft **52** journaled in bearings on its frame towards the top and front end thereof below or forwardly from the inclined main drive shaft **36**. This countershaft extends through the machine from side to side and is geared to the main shaft **36** to be continuously rotated thereby by means of a worm **53** fixed on the drive shaft **36** and in engagement with a worm gear **54** fixed on the adjacent end of the countershaft **52**. In the particular machine shown, the direction of rotation of this countershaft **52** and its gear **54** is counterclockwise as viewed from the rear side of the machine in Figure 3 and as there indicated by the arrow.

At the front side of the machine, a supporting bracket **55** is fixedly secured to the top frame plate **25** from the edge of which it extends outwardly and thence downwardly. The outer end of a stationary sleeve **56** is fixed in the lower end of the depending arm of this bracket **55**, a set screw **57** being shown for this purpose. This sleeve **56** surrounds the outwardly extending end portion of the countershaft **52**, which may freely rotate therein, the inner end of this sleeve being provided with a radial flange, shown in Figure 10. Adjacent the bracket **55** the sleeve **56** has thereon a spacing collar **58**.

The above noted combined counting and controlling device includes a composite but unitary member which is freely rotatively mounted upon the stationary sleeve **56** between its inner end flange and spacing collar **58**. This member comprises a counting and controlling wheel or disc **59** adjacent to the sleeve collar **58** and a circuit-controlling disc **60** adjacent to the sleeve flange and with its circuit-controlling peripheral disc portion spaced from the counting wheel **59** by means of a boss or hub on this circuit-controlling disc **60**. The circuit-controlling disc **60** is connected to the counting wheel **59** to be rotated thereby by means of pins **61, 61**. The body part of the circuit-controlling disc **60** is of insulating material and its flange or rim portion has a gap-providing concentrically arcuate conductive contact element **62** firmly set therein and extending through it smoothly or evenly flush therewith at both of its opposite faces. The electric circuit which is in part controlled by the rotatable circuit-controlling disc **60** will be described later.

The counting and controlling disc **59** is a ratchet wheel having on its periphery a continuous circular series of ratchet teeth **63, 63** by which it is adapted to be rotated step by step and tooth by tooth in a clockwise direction as viewed in Figures 2, 8 and 9, which is in a counter-clockwise direction as viewed from its inner side in Figure 11. In the particular machine shown, this counting disc **59** has one hundred ratchet teeth **63, 63**. A loosely pivoted gravity pawl **64** is engageable with the teeth **63, 63** to prevent reverse or retrograde movement of the counting disc **59**, this pawl being mounted upon a forward extension of the bracket **55**.

An upstanding backwardly and forwardly swinging actuating lever **65** for the ratchet wheel counting disc **59** has at its lower end a fulcrum pivot **66** on the bracket **55** below the upper edge of this peripherally toothed disc. This lever **65** loosely pivotally carries an actuating pawl **67** engageable with the ratchet teeth **63, 63**. This actuating pawl **67** is a gravity pawl the unfailing engagement of which with the ratchet teeth **63, 63** is assured by a pawl spring **68** mounted on the pawl-carrying lever **65**.

In order to rotate the counting disc **59** to the extent of a single ratchet tooth **63** for each backward and forward rocking movement of the actuating lever **65**, the tooth-engaging end of its actuating pawl **67** must travel at least slightly more than the spacing between the ratchet teeth **63, 63**, and safely less than the distance between two of these teeth. In the illustrated construction, the backward disc-rotating movement of this actuating pawl is limited by means of a stop pin or stud **69** which projects from the bracket **55** into the path of movement of the actuating lever **65** and against which the latter may abut. The forward idle or retractive movement of this

actuating lever is limited by stop means which will presently be described.

A single-acting air motor of the reciprocating piston type and operated by atmospheric air pressure induced by suction is provided for imparting rocking movements to the actuating lever **65**, whereby step-by-step rotative movement is transmitted to the counting and controlling disc **59**, together with the circuit-controlling disc **60** carried thereby, as above described. This vacuum motor has a cylinder **70** provided with a supporting bracket **71** by means of which it is rigidly mounted on the frame of the machine at the top of the front side thereof at the front end, with the cylinder **70** extending longitudinally of the machine in line with the upper end of the rockable actuating lever **65**. The head of the cylinder **70** next to the actuating lever **65** fixedly carries a projecting sleeve **72** through which a piston rod **73** slidably extends from the cylinder **70**, the outer end of this piston rod being slidably guided by a bearing **74** on the upper part of the bracket **55**.

The piston rod **73** fixedly carries a pair of spaced similar collars **75, 76** which are adjustable longitudinally of this rod by means of the small set screws shown in Figure 1. The upper end of the actuating lever **65** extends between the spaced collars **75** and **76** and is of bent shape so that it extends inwardly across above the piston rod **73** between these collars and downwardly between these collars in hook form at the back of the piston rod, as shown in Figure 1. A thrust spring **77** on the piston rod **73** is interposed between its outer end bearing **74** and the neighboring piston rod collar **76**.

Obviously, movement of the piston rod **73** will move the actuating lever **65**. The spring **77** has a constant tendency to return the piston rod **73** and actuating lever **65** to and maintain them at their normally retracted idle position shown in Figures 1, 2 and 11. In the construction shown, this return movement of the piston rod **73** is limited by means of a collar **78** fixed upon and forming a head for the remote end of the piston rod and adapted to abut against the back face of the bracket **55** at the rear of the piston rod bearing **74**, as appears most clearly in Figure 5. Obviously the stop collar **78** may be adjustable if desired, similarly to the operating collars **75** and **76**.

The outer end of the above mentioned suction pipe **34**, which is of the bent shape clearly shown in Figures 1, 2, 4 and 5, is connected to and opens into the motor cylinder **70** through its head end alongside of its piston sleeve **72**. With suction applied to a sucker tube **15** through its eduction port **19** and with all of the sucker nipples **21, 21** of this sucker tube closed by means of a sheet **1** carried thereby, as above described, then while the induction port **20** of this revolving sucker tube **15** is traversing the shorter groove **32**, suction will be applied to the suction pipe **34** directly through this sucker tube. The outer head end of the cylinder **70** is provided with a port **79** through which this end of the cylinder is in communication with the atmosphere.

Thus when suction is applied to the other end of this cylinder through the pipe **34** the piston rod **73** will be forced out of the cylinder, overcoming the opposing force of its return spring **77**, thereby rotating the counting disc **59** to the extent of one of its ratchet teeth **63, 63**, as above described. As soon as the induction port **20** passes beyond the lower or rear end of the groove **32** in the stationary sealing plate **27**, the suction applied to the motor cylinder **70** through the pipe **34** is discontinued, this induction port **20** then being closed by the sealing face of the plate **27**. Immediately after this a relief port **80** through the rotating sucker head **17** is brought into register with the upper or forward end of the slot **32**, which it traverses. This admits atmospheric air into this inner end of the suction pipe **34**, which destroys the remaining or residual vacuum in this pipe and similarly in the cylinder **70**.

It will be noted from Figure 6 that there are three such relief ports **80, 80, 80** through the sucker head **17**, one such port for each of the three sucker tubes **15, 15, 15** and its corresponding induction port **20**. When the vacuum in the cylinder **70** is thus destroyed, the return spring **77** acts instantly to retract the piston rod **73** and pawl-carrying actuating lever **65** to their original position shown in Figures 1, 2 and 11. A one-tooth step of counting movement will be similarly imparted to the counting and controlling disc **59** for each of the revolving nipple-carrying sucker tubes **15, 15, 15**. At times when the vacuum valve **50** is closed, it will now be evident that the counting disc **59** will not be operated, while the sucker tubes **15, 15, 15** then revolve idly and no sheets **1, 1** are carried or withdrawn by their sucker nipples **21, 21**, as already described.

In this connection it is to be further noted that, while suction is being applied through the open valve **50** to the sucker tubes **15, 15, 15**, as above described, should the series of sucker nipples **21, 21** on these tubes fail for any reason whatever to withdraw a sheet **1**, then no counting actuation of the disc **59** will take place. This might occur, for example, by reason of such sheet being wrinkled, crumpled or folded in such a way as to fail to close all of the nipples **21, 21** in a series thereof on a sucker tube **15**. With one or more of these sucker nipples left open, the consequent entrance of atmospheric air into a sucker tube **15** would prevent the forming of an operating vacuum in the motor cylinder **70**. Thus an absolutely accurate count of the sheets **1, 1** is assured under all conditions.

The opening and closing movements of the slidable valve stem **51** of the vacuum valve **50** are directly under the control of the counting and controlling disc **59**, as will now be described. Also the operation of this vacuum valve is indirectly under the control of the circuit-controlling disc **60**, as will be described later. It should here be noted, as already described, that the counting disc **59**, as well as the circuit-controlling disc **60** carried thereby, is itself in turn controlled as to its operation by the vacuum valve **50**.

The margin of the counting disc **59** at its inner face has therein a recess **81** the leading face of which is inclined and the trailing or following face of which is abrupt, as clearly shown in Figure 12*a*, where the direction of counting movement of the disc **59** is indicated by an arrow. The vacuum-controlling valve **50** is adapted to be operated through the intermediary of a bell-crank lever **82** having a vertical fulcrum pivot on the frame of the machine, with a longer outwardly extending arm pivoted to the end of the valve stem **51** and with a shorter actuating arm extending towards the front end of the machine, as clearly shown in Figure 1. The adjacent end of a long transversely extending valve-operating link **83** is pivoted to the shorter arm of the bell-crank **82** and extends across to the front side of the machine. A stationary slideway or guide **84** is provided on the front end of the machine for supporting and

stiffening this link, which, as will be noted from Figure 4, is bent downwardly and then outwardly adjacent the front side of the machine.

At the front side of the machine a longitudinally extending horizontal pawl lever **85** is pivoted intermediate of its length upon the lower portion of a downwardly extending bracket arm **86** which is fixedly mounted on the top plate **25** of the machine frame. The adjacent end of the long transverse valve-operating link is pivoted to the front end of this pawl lever **85**. The rear end portion of this pawl lever extends adjacently to the inner face of the counting and controlling disc **59** and terminates in a pawl end tooth or detent **87** which projects towards this disc **59**. This detent is shown as directly above the axis of the disc **59** and as disposed in the path of its recess **81** as this disc rotates, the detent **87** having an abrupt rear face at the end of the pawl lever **85** and having an inclined front face.

A retractile spring **88** connected to the tail arm of the pawl lever **85** adjacent to the link **83** and having its other end anchored to the machine frame exerts a constant tendency to urge the stem **51** of the vacuum valve **50** to its closed position and at the same time to press the pawl lever detent **87** towards and against the inner marginal face of the counting and controlling disc **59**. Thus as the disc **59** is rotated during a sheet-pulling and counting operation, as above described, the detent **87** will ride upon the face of this disc, thereby maintaining the vacuum valve **50** in open condition against the force of its valve-closing spring **88**. When the disc **59** has made one complete rotation, comprising one-hundred counts, the spring **88** will snap the detent **87** into the recess **81**, as shown in Figures 10 and 11, at the same time closing the vacuum valve **50**.

This discontinues the withdrawal of sheets **1**, **1** from the feed hopper and concomitantly discontinues the step-by-step rotative counting movement of the disc **59**, as already described. The sucker tubes **15**, **15**, **15** will now revolve idly while the counting disc **59** is locked against rotative displacement in either direction, being locked against forward movement by the detent **87** and against backward movement by the holding pawl **64** as well as also by its inactive actuating pawl **67**. This is the starting position of the counting disc **59**, shown in Figures 1, 8, 10 and 11, as well as also in Figure 12*a*. In the continued automatic operation of the machine, the vacuum valve **50** will be subsequently opened, for thereby resuming the sheet-pulling and counting operations, through the operation of means soon to be described.

A sectional bipart bedplate, consisting of the sectional parts **89** and **90**, suitably spaced below the top plate **25**, is fixedly mounted in the frame of the machine to extend from end to end thereof. The two sections **89** and **90** are similar and substantially alike excepting that one of them is of right hand construction and the other left hand as viewed from the front end of the machine in Figure 4. The right hand plate part **89** towards the front side of the machine is shown in inner edge view in Figures 6, 21 and 22 and in cross section in Figures 13 and 25, while the left hand plate part **90** towards the rear side of the machine is shown in part in outer edge view in Figure 3 and in cross section in Figure 13. The opposed inner edges of the bed-plate sections **89** and **90** are straight and spaced apart, as shown in the drawings, so as to leave a rather wide open slot between them.

As the withdrawn sheets **1**, **1** are released by the suckers **21**, **21**, as above described, they descend within a vertically disposed rectangular enclosure or chute **91** the top of which rises slightly above the top plate **25** and the bottom of which is closed by the bedplate parts **89** and **90**. The descending sheets are guided into the top of the chute **91** at the ends of such sheets by means of a pair of lateral ribs **92**, **92** the upper edges of which curve around the peripheries of the respective sucker heads **16** and **17**. In the construction shown these guide ribs form extensions from the lower portions of a pair of brackets **93**, **93** by which the feed hopper is supported and which are fixedly mounted upon the top plate **25** of the machine. These sheets **1**, **1** are guided into the chute **91** from the adjacent free edge of the hopper bottom **2** by means of a pair of inclined wings **94**, **94**.

The possibility of the released sheets passing beyond the chute **91** is prevented by means of a pair of upstanding forwardly turned stripper fingers **95**, **95** fixed upon the top plate **25** and projecting upwardly close to the path of the revolving sucker tubes **15**, **15**, **15**. The rear wall of the chute **91** is open in the space between the top plate **25** and the bedplate sections **89** and **90**. The rear edges of descending sheets **1**, **1** are there guided by means of a pair of freely swinging gravity fingers **96**, **96**, one of which is shown in Figure 6 while the other is shown in Figures 18, 19, 21 and 22. These latter guide fingers are pivoted at their upper ends to strips **96A**, **96A** which extend longitudinally of and are secured to the lower side of the top plate **25**.

A group of elements which co-operate to form a device which automatically removes to another location the stack of counted sheets **1**, **1** which have accumulated in a pile, of one hundred in this instance, upon the bedplate sections **89** and **90** at the bottom of the chute **91** will now be described. The operation of this device is periodical, such operation being automatically initiated each time immediately following the completion of a counted pile of sheets **1**, **1** and being automatically discontinued with such device reset for its next succeeding operation. The central element in such device is a transverse cam shaft **97** journaled in bearings fixed upon the front end of the platform **40**. In the automatic operation of the machine, this cam shaft is periodically driven from the continuously rotating countershaft **52** through the intermediary of clutch-controlled connections.

Another transverse cam shaft **98** is journaled on the frame of the machine towards its rear end rearwardly from and diagonally below the countershaft **52**. The individual adjuncts of this latter cam shaft will be described later. The cam shaft **97** is driven from the cam shaft **98**. For this purpose, these two cam shafts are coupled together, for unitary rotation in the same direction and at the same rate, by means of a downwardly and forwardly inclined coupling shaft **99** journaled in bearings fixed to the frame of the machine. The coupling shaft **99** is connected to the rear end cam shaft **98** to be rotated thereby by means of a pair of similar bevel gears **100**, **100**, and is connected to the front end cam shaft **97** for driving the latter by means of another pair of similar bevel gears **101**, **101**. In the particular machine shown in the drawings, the direction of rotation of these coupled cam

shafts 97 and 98 is counter-clockwise as viewed in Figure 2 and clockwise as viewed in Figure 3.

A worm gear 102 fixed on the rear end of the intermediary cam shaft 98 is engaged by a driving worm 103 fixed on a short shaft 104 journaled in bearings on the machine frame and extending at a slight upward inclination towards the countershaft or transmission shaft 52, where a bevel gear 105 is fixed upon its end. This bevel gear 105 is engaged by a similar bevel gear 106 provided with a toothed clutch element 107 fixed thereon and loosely mounted together therewith on the countershaft 52 for the rotation of the latter therein. This clutch element 107 is adapted to be engaged and driven by another toothed clutch element 108 which is splined upon the countershaft 52 to slide thereon and to be rotated thereby. The slidable clutch element 108 is controlled by a yoke lever 109 which extends downwardly and intermediate of its length has a fulcrum pivot 110 on the frame of the machine.

During the continuation of the fully automatic operation of the machine, a spring 111 exerts a constant tendency to urge the slidable rotating clutch element 108 into driving engagement with the other clutch element 107. A transversely extending thrust link 112 for shifting the splined slidable clutch element 108 into driving engagement with the rotatively loose clutch element 107 has a forked end pivoted to the upper arm of the yoke lever 109 and at its other end is pivoted to an upstanding shorter arm of a bell-crank lever 113 having a fulcrum pivot 114 on the machine frame. This bell-crank lever 113, as shown in Figures 2 and 4, has a longer bent operating arm extending to the front side of the machine and towards its rear end, with the lower end of the clutch-engaging spring 111, which is retractile, connected to the outer or remote end of this arm and extending upwardly therefrom.

The upper end of the spring 111 is connected to the lower end of an upwardly extending spring-controlling connecting link 115 the upper end of which is conveniently provided with a handle 116. This spring-controlling link is pivotally and slidably mounted on the edge of the top plate 25 by means of an outwardly headed stud 117. A longitudinal slot 118 through this link is engaged over the stud 117, the lower end of this slot being turned transversely of the link to provide a stud-engaging hook 119. With this hook 119 engaged over the stud 117 the spring 111 will be effective to perform its clutch-engaging operation at the proper time during the continued automatic operation of the machine, through the automatic operation of controlling means soon to be described.

When the hook 119 is disengaged from the stud 117, as shown in Figure 2 and indicated in Figure 4, in the idle condition of the machine, the connecting link 115 moves downward to its lowermost position. The released spring 111 is thus disabled or deprived of pulling force so it is then ineffective and unable to shift the slidable driving clutch element 108 into driving engagement with the clutch element 107, this being shown in Figure 4. The purpose of this manual control of the clutch-engaging spring 111 will be fully explained later.

The lower arm of the clutch-operating yoke lever 109 has a forked end pivoted to the exposed end of a horizontally slidable paramagnetic core 120 of a solenoid electromagnet 121 shown as having a magnet frame 122 fixedly mounted upon a supporting bracket 123 on the frame of the machine at the rear side thereof outwardly from the yoke lever 109, as shown in Figures 2, 3 and 4. During the time that the slidable clutch element 108 is maintained at its engaged driving position by the clutch-engaging spring 111, the magnet 121 must be in a de-energized condition.

When the magnet 121 is energized it is sufficiently strong to withdraw this clutch element 108 and thus to maintain it at a disengaged position in opposition to the force of the tensioned spring 111, the core 120 then being drawn into the magnet 121. When the magnet 121 is de-energized the tensioned spring 111 will be again set free and will slide the rotating splined clutch element 108 again into driving engagement with its co-operating clutch element 107. However, should the clutch-engaging spring 111 be relaxed, as shown in Figure 2, while the magnet 121 is in an energized condition, then later when this magnet is de-energized, the spring 111 will be unable to restore the disengaged clutch element 108 to its driving position and accordingly, with this spring 111 relaxed, this clutch element 108 will remain at its disengaged position as shown in Figure 4.

The magnet circuit and the means by which it is automatically controlled at two different points in a series circuit will now be described. Two automatically operated circuit-controlling switches are electrically connected in series with the coil or winding of the magnet 121. One of these switches includes the above described rotatable circuit-controlling disc 60 together with its contact element 62, while the other of these switches includes a rotatable circuit-controlling disc 124 of insulating material fixed, at the front side and front end of the machine, upon the end of the cam shaft 97 to be rotated thereby, as shown in Figures 1, 2 and 4. This circuit-controlling disc 124 has a conductive contact element 125 firmly embedded therein. This contact element 125 is shown as of short elbow shape with a peripheral contact face smoothly or evenly flush with the smooth circular periphery of the insulating disc 124 and with another contact face smoothly or evenly flush with the outer flat face of this disc, as most clearly appears in Figure 20.

The circuit-controlling disc 60 carried by the counting wheel 59 is rotative between outer and inner opposed stationary contact members 126 and 127 which are disposed in alignment with the path of rotative movement of its arcuate contact element 62. In the illustrated construction, these contact ends or contact members 126 and 127 are shown as disposed toward the front end of the machine from and slightly below the level of the axis of the disc 60, with the gap-providing contact element 62 co-operatively circumferentially disposed on this disc. The outer contact member 126 is carried by a conductive spring arm 128 by which it is pressed against the disc 60 or its contact element 62. The other end of this spring arm 128 is fixed upon and insulated from the lower end of the bracket 86, on which the above described pawl lever 85 is fulcrumed. The contact-carrying arm 128 is there provided with a binding post 129 for the connection of an electric conductor thereto.

The other contact member 127 is shown as formed on a conductive socket 130 extending away from the circuit-controlling disc 60 and telescoping over a conductive stud 131. This stud 131 is fixed in an insulating sleeve 132 which is fixedly carried by the lower end of a depending bracket 133 fixedly mounted on the top plate 25 of the machine frame (Figures 1, 2, 4 and 12).

The contact end 127 is pressed against the circuit-controlling disc 60, including its arcuate gap-providing contact element 62, by a thrust spring 134 on the stud 131 between the slidable socket 130 and the insulating sleeve 132. Beyond this insulating sleeve from the spring 134 the stud 131 forms a binding post for the connection of an electric conductor thereto.

The contact disc 124 carried by the cam shaft 97 is peripherally engaged by a stationary contact member 135 and is engaged at its outer side by a similar stationary contact member 136. These contact members 135 and 136 are disposed in the same radial plane relatively to the cam shaft 97 and are both in the path of rotative movement of the contact element 125, the latter being co-operatively circumferentially disposed on the disc 124 relatively to these contact members. In the illustrated construction, these stationary contact members 135 and 136 are shown as positioned above the cam shaft 97. These stationary contact members or contact heads are shown as of disc shape and are similarly supported and insulated.

The peripheral disc-like contact member 135 has a stem 137 slidably telescoped into the lower end of a vertical tube or sleeve 138. This tube is fixedly mounted on and insulated from the end of a small bracket arm 139, through the intermediary of an insulating sleeve 140. This bracket arm 139 is fixed upon a support 141 which fixedly extends from the adjacent bearing of the cam shaft 97. The contact head 135 is pressed against the periphery of the circuit-controlling disc 124 by a thrust spring 142 on the tube 138 between this contact head and the insulating sleeve 140. The conductive tube 138 extends above its insulating sleeve 140 and there forms a binding post for the connection of an electric conductor thereto.

The other stationary contact head 136 at the outer side of the circuit-controlling disc 124 is mounted and supported similarly to the peripheral contact head 135. This contact head 136 has a stem 143 slidably telescoped into the inner end of a conductive tube 144 fixedly extending through an insulating sleeve 145 which is fixedly carried by the end of a small bracket arm 146 fixed to an intermediate bracket 147 which in turn is fixed to the support 141. The contact head 136 is pressed against the outer side face of the circuit-controlling disc 124 by a thrust spring 148 on its carrying tube 144 between this contact head and the tube-insulating sleeve 145, beyond which the outer end of the tube 144 forms a binding post for the connection of an electric conductor thereto.

It is obvious that the electrical connections in series through the magnet 121 and the two above described automatically operated circuit-controlling switches, having respectively the rotative circuit-controlling discs 60 and 124, together with a connection to a source of current supply, may be varied considerably, while still producing the same result.

Only one arrangement of circuit connections is shown in the drawings, more particularly in Figure 1, as an example and that will now be described. The two above noted switches are electrically connected together by an insulated wire 149 extending between the binding post of the stud 131 for the switch including the circuit-controlling disc 60 and the binding post of the tube 138 for the other switch which includes the circuit-controlling disc 124. Another insulated wire 150 electrically connects together the binding post of the other tube 144 of this latter switch and one of the terminals of the magnet 121. An insulated lead wire 151 extends away from the other terminal of the magnet and another insulated lead wire 152 extends away from the binding post 129 which forms the other connection for the switch having the circuit-controlling disc 60. These leads 151 and 152 come together to form a usual two-wire cord, as shown at the top in Figure 1. This conductive cord may be plugged into a usual socket or other wall receptacle which may include a usual cut-out switch, as is common.

The circuit-controlling disc 60 carried by the counting wheel 59 and the other circuit-controlling disc 124 carried by the cam shaft 97 at all times have a co-operative relation with each other. This relation is such that with the intermittently operated counting wheel 59 moving the arcuate contact element 62 between the contact members 126 and 127 and with the cam shaft 97 at rest, the contact element 125 of the other circuit-controlling disc 124 then being in engagement with the contact members 135 and 136, as shown in Figure 20 and indicated in Figures 2 and 4, the circuit of the magnet 121 will be in a closed condition, thereby holding the slidable clutch element 108 at its disengaged position, which maintains the cam shaft 97 at rest during this part of the rotational movement of the circuit-controlling disc 60.

When the trailing end of the intermittently moving arcuate contact element 62 moves beyond and escapes from between the stationary contact members 126 and 127, which then ride upon the insulating disc body 60, as shown in Figures 11 and 12 and indicated in Figure 1, then the magnet circuit is broken at this point. This takes place when the counting wheel 59 is positioned at or reaches its normally idle or starting position shown in Figures 2, 8 and 11. The clutch-engaging spring 111, is then in a tensioned condition corresponding to the continued automatic operation of the machine, now acts to slide the clutch element 108 into driving engagement with the other clutch element 107. However, should the spring 111 be in a relaxed condition, as shown in Figure 2, it will be ineffective and the clutch element 108 will remain at its disengaged position shown in Figure 4, with the magnet circuit open.

In any case the counting wheel 59 is now stopped and locked at its starting position and the sheet-withdrawing operation has ceased, as above described. When the clutch element 108 is moved to its engaging position, the cam shaft 97 immediately begins to rotate, through the driving connections already described. This moves the contact element 125 carried by the circuit-controlling disc 124 out of contact with the stationary contact members 135 and 136, thus rendering the magnet circuit discontinuous or open at this point also. As soon as the completed pile of counted sheets 1, 1 has been removed, by the aforementioned automatically operated device including the cam shaft 97 and to be fully described later, the withdrawing and counting of sheets 1, 1 is automatically resumed.

When by reason of rotative movement of the counting wheel 59 the leading end of the gap-providing contact element 62 enters between the stationary contact members 126 and 127 the continuity of the magnet circuit will be restored at this point, while this circuit will still be open

between the other stationary contact members **135** and **136**. When the continued rotation of the cam shaft **97** brings the contact element **125** into contact with these contact members **135** and **136** the circuit of the magnet **121** is completed, whereby the energized magnet disengages the clutch element **108**, whereupon the cam shaft **97**, together with all parts operated thereby, comes to rest with the contact element **125** conductively connecting the stationary contact members **135** and **136**. The magnet **121** remains energized until its circuit is again broken by the trailing end of the arcuate contact element **62**, as above described, at the completion of a succeeding counting operation.

The length of the arcuate contact element **62** in the direction of its leading end is not critical, and may be either somewhat more or somewhat less than shown in Figure 11, where the length of this contact element is shown as slightly more than two-hundred and seventy degrees. It is only necessary that the magnet circuit shall be maintained open at this point until the recess **81** in the counting wheel **59** has moved out of register with the detent **87** and also until the cam shaft **97** has moved the contact element **125** out of engagement with the stationary contact members **135** and **136**. On the other hand, it is necessary that the arcuate contact element **62** shall be of sufficient length towards its leading end to establish a conductive connection between the stationary contact members **126** and **127** before the rotating cam shaft **97** has moved the contact element **125** into engagement with the stationary contact members **135** and **136**.

It should now be evident that the above described electrical construction and arrangement constitutes an electrical controlling device which is directly controlled by the counting wheel **59** and also indirectly controlled thereby through the intermediary of the cam shaft **97**. In turn this electrical device is in control of the counting wheel itself, as will presently clearly appear, as well as also being in control of most of the operating parts of the machine, some of which are yet to be described. Thus it will be seen that the counting wheel **59** is a central controlling element in the machine.

In the continuous automatic operation of the machine, just as soon as the predetermined number of sheets **1**, **1**, in this instance one-hundred, have accumulated upon the floor formed by the bedplate sections **89** and **90** to form a completed pile, the automatic operation of means already described stops the withdrawal of sheets **1**, **1** by the sucker nipples **21**, **21** of the continuously revolving sucker tubes **15**, **15**, and also the cam shaft **97** at this time begins to rotate, as above described. The parts operated by the cam shaft **97**, which are concerned with the removal of the pile of counted sheets **1**, **1** and the resumption of the sheet-withdrawing and counting operation, this cam shaft **97** forming the central element in the above mentioned automatically operated device for this purpose, will now be described.

Preparatory to resuming the withdrawal and counting of sheets **1**, **1**, pins or rods **153**, **153**, shown as two in number, are inserted in horizontal position across the chute **91**, to form a temporary support for these sheets. A cam wedge **154**, having an outer flat face guided by a backing block **155** fixed on the frame of the machine at the top and rear side thereof, is now thrust between this guide block and the adjacent outer side of the end of the shorter actuating arm of the bell-crank lever **82**. This opens the air vacuum valve **50** and at the same time moves the pawl lever detent **87** out of the recess **81** in the counting wheel **59**, against the force of the spring **88**, as shown in Figures 1 and 12*a*, whereupon the withdrawal and counting of sheets **1**, **1** are immediately resumed, as previously described.

These sheets now drop upon the pins **153**, **153** within the chute **91**, these pins being spaced above the level of the top of the completed stack of previously counted sheets upon the floor-forming bedplate parts **89** and **90**, as shown in Figure 21 and indicated in Figure 6. About this time this completed pile of sheets is moved away and out of the chute **91** by a rearwardly moving pusher slide **156**. After this slide has returned to a position of rest clearing the chute **91** at the front thereof, the sheet-supporting pins **153**, **153** are quickly retracted or withdrawn out of the chute, thus clearing the chute and dropping the sheets **1**, **1** thus far counted upon the chute bottom formed by the bedplate sections **89** and **90**, while the withdrawal and counting of sheets **1**, **1** continues without interruption. The means by which the pins **153**, **153**, cam wedge **154** and pusher slide **156** are automatically operated in the above described manner will now be described.

In the particular construction shown in the drawings, the sheet-supporting pins **153**, **153** are slidable into and out of the sheet-receiving and collating chute **91** at the front end of the machine, through guides **157**, **157** fixed upon a bracket member **158** upon the front wall of the chute **91**. The outer ends of these pins are coupled together by a cross piece **159** having at its middle a pair of outstanding ears **160**, **160** which carry a pivot pin **161**. This pivot pin is engaged in a slot **162** extending longitudinally through the laterally and upwardly turned upper end of an upstanding operating lever arm **163**. A relatively short distance above its lower end this lever arm has a fulcrum pivot **164** on a bracket fixed on the machine frame.

An operating link **165** is pivoted at its rear end to the lower end of the lever arm **163** and at its forward or outer end is provided with a longitudinally extending slotted opening **166** by which it is guided on the cam shaft **97**. Inwardly from its guide slot **166** this link carries a cam roller **167** engaging in a cam slot **168** in the face of a pin-operating cam **169** fixed on the cam shaft **97**, so that thus in the construction shown the sheet-supporting pins **153**, **153** will be longitudinally shifted in each of their opposite directions of movement by this double-throw or box cam **169**. The cam **169** is of course shaped and timed to perform its above noted functions, the sheet-supporting pins **153**, **153** being held stationary at their retracted position when the cam shaft **97** comes to rest as above described, as indicated in Figure 2 and as clearly shown in Figure 19.

The cam wedge **154**, for operating the vacuum valve **50** and the pawl lever **85**, is fixed upon and projects rearwardly from the upper end of an upstanding operating arm or lever **170** which nearer to its lower end has a fulcrum pivot **171** on a supporting bracket fixed on the machine frame. An operating link **172** is pivoted at its rear end to the lower end of the lever arm **170** and at its outer or forward end has through it a longitudinally extending slot **173** by which it is guided on the cam shaft **97**. Inwardly from its

guide slot 173 this link carries a cam roller 174 engaging in a cam slot 175 in the face of a wedge-operating cam 176 fixed on the cam shaft 97. Thus in the construction shown the cam wedge 154 will have each of its opposite movements imparted by this double-throw or box cam 176.

It is only required that the vacuum-controlling valve 50 shall be held open by the cam wedge 154 until the recess 81 in the counting wheel 59 has passed beyond the detent 87 of the pawl lever 85, so that this detent can then ride upon the face of the counting wheel 59 and thus hold open the vacuum valve 50, as already described, without any need then of the cam wedge 154. Therefore the time at which the cam wedge 154 is retracted is not critical, although it must be in its retracted position when the cam shaft 97 returns to its position of rest, in order that the spring 88 can snap the detent 87 into the recess 81 so that this spring can close the vacuum valve 50 at this time. Thus when the cam shaft 97 comes to rest the cam wedge 154 will be stopped and held at its retracted position, as perhaps shown most clearly in Figure 17. This cam 176 which as above noted opens the air vacuum valve 50 and disengages the detent 87 so as thereby to resume the withdrawal and counting of sheets 1, 1, is of course shaped and timed so it will perform its above described functions.

The pusher slide 156, which removes a completed pile of sheets out of the chute 91 so as to provide for the accumulation therein of the next succeeding pile, is fixed upon a slide block member 177 which extends down through the wide slot between the opposed edge faces of the floor-forming bedplate parts 89 and 90. This slide block is guided at its opposite sides by means of tongues thereon which run in grooves 178, 178, with one of these grooves in and extending along the edge face of each of the bedplate floor parts 89 and 90. A pair of ears extend forward and downward from the guided slide block 177 and are connected together by a transverse pivot pin 179. This pivot pin is engaged in a slot 180 extending through and longitudinally of the upper end portion of an upstanding operating arm or lever 181 which above its lower end has a fulcrum pivot 182 carried by a supporting bracket fixed on the machine frame.

An operating link 183 is pivoted at its inner or rear end to the lower end of the lever arm 181 and at its outer or forward end has through it a longitudinally extending slot 184 by which it is guided on the cam shaft 97. Inwardly from its guide slot 184 this link carries a cam roller 185 engaging in a cam slot 186 in the face of a slide-operating cam 187 fixed on the cam shaft 97. Thus in the construction shown the pusher slide 156 will have each of its opposite movements imparted to it by this double-throw or box cam 187. When the cam shaft 97 has come to rest, as hereinbefore described, the pusher slide 156 will have been withdrawn to a retracted position of rest clear of the chute 91, as indicated in Figure 2 and as clearly shown in Figures 6 and 21. This slide-operating cam 187 is of course shaped and timed so as to perform its above described functions in proper sequence and relation with the operation of the cam 169 which operates the sheet-supporting pins 153, 153 and the cam 176 which operates the vacuum-controlling valve 50, as previously described.

As a completed pile of counted sheets is pushed towards the rear end of the machine by the pusher slide 156, the top of this pile will be gradually and firmly pressed downward by a pair of laterally spaced compression strips 188, 188, which are fixed at their ends to the lower side of the top plate 25 and which gently incline downward away from the chute 91, the inclined portions of these strips terminating abruptly adjacent their rear ends, substantially midway of the length of the machine. These strips preliminarily compact the pile of sheets moved beneath them. One such strip 188 toward the front side of the machine is shown in Figures 2, 6, 21 and 22, while the one toward the rear side of the machine is shown in part in Figure 3. The operating cam 187 stops the rearward movement of the pusher slide 156 with the advancing rear face of the latter slightly beyond the abrupt end portion of the presser strips 188, 188, as shown in Figure 22.

Further rearward sliding movement of the positioned pile of sheets, as well as consequent probable disarrangement of its sheets, under the impetus which has been given this pile by the pusher slide 156, is prevented by means of a pair of restraining or check fingers 189, 189. These check fingers are respectively pivoted at their upper ends to the rear ends of the above noted longitudinal strips 96A, 96A, which at their front ends pivotally carry the guide finger 96, 96. The check fingers 189, 189 may swing rearwardly and are yieldingly pressed toward their vertical position by springs 190, 190, these fingers having upper front corners which then abut against the lower face of the top plate 25. The movement of the pile is thus stopped with the edges of its sheets in collated alignment between the pusher slide 156 and the check fingers 189, 189, as shown in Figure 22.

The lower ends of the check fingers 189, 189 extend respectively into longitudinal slots provided respectively through the bedplate floor sections 89 and 90, these slots serving a useful purpose, as will be evident later. The contour of the cam groove 186 in the slide-operating cam 187 is such that the pusher slide 156 will be returned to its forward idle position clear of the front of the chute 91 before the sheet-supporting pins 153, 153 have been retracted out of the chute by their operating cam 169, as shown in Figure 6. The pusher slide thus remains stationary at its retracted position while its operating cam 187 continues its rotation during the time that the pin-operating cam 169 is withdrawing the sheet-supporting pins 153, 153 to their retracted position out of the chute 91, as shown in Figure 19 and indicated in Figure 2, following which the cam shaft 97 comes to rest.

The other cam shaft 98, which as previously described serves in the particular machine illustrated also as an intermediary transmission shaft, constitutes the central element in a group of elements which co-operate to form a device which is automatically operated to bind the above noted rearwardly positioned pile of sheets into a compact unitary package. It is evident from the preceding description that this cam shaft 98 periodically makes a single rotation concomitantly with cam shaft 97, and also that both of these cam shafts are in like manner subject to the control of the above described controlling devices, which are operated automatically during the continuous automatic operation of the machine. An automatically operated ejector device, to be described later, delivers the bound package out of the machine. The parts operated by the cam shaft 98, together with parts, the operation of which is controlled thereby, will now be described.

A strip 191 of sufficiently strong paper or other suitable wrapping or binding material is drawn from a supply roll 192 thereof held in place by longitudinally adjustable collars 193, 193 on a transverse reel shaft 194 having positioning collars 195, 195 adjacent its respective ends which are journaled in brackets 196, 196 extending rearwardly from and fixed on the frame of the machine. The binding strip 191 is drawn from its roll 192 by upper and lower feed rolls 197 and 198 fixed respectively upon upper and lower transverse shafts 199 and 200, of which the latter is journaled in frame pieces 201, 201, while the upper shaft 199 is journaled in bearing blocks 202, 202, slidably mounted in the respective frame pieces 201, 201. In the construction shown, the upper feed roll 197 is of yieldable gripping material such as soft rubber while the lower feed roll 198 is of suitable metal such as steel and is knurled. The upper feed roller 197 is spring-pressed toward the lower one by a pair of coiled thrust springs 203, 203 acting upon the respective bearing blocks 202, 202, these springs being adjustable by means of screws 204, 204.

The lower feed roller 198 is positively driven, having a spur gear 205 fixed upon its end at the front side of the machine for this purpose. A larger spur gear 206 meshes with the gear 205 and carries a smaller bevel gear or pinion 207, together with which the large spur gear is rotatively mounted in the frame of the machine. The bevel gear 207 meshes with a similar bevel gear 208 which fixedly carries a toothed clutch element 209. This latter bevel gear 208 together with the clutch element 209 fixed thereto is loosely mounted on the rear end of a secondary transmission shaft 210 for rotation of the latter therein. At its front end this secondary shaft 210 is coupled to the first transmission shaft or countershaft 52 to be continuously rotated thereby by means of a pair of similar bevel gears 211, 211. This slightly inclined longitudinally extending shaft 210 is journaled in bearings on the frame of the machine at the front side thereof.

A slidable toothed clutch element 212 is splined upon the continuously rotating secondary shaft 210, to be shifted into and out of engagement with the loose clutch element 209. With this slidable clutch element out of engagement with the loose clutch element, as shown in Figures 2 and 27, the feed rolls 197 and 198 are idle, while with the clutch element 212 engaged with the clutch element 209, as shown in Figure 28, these feed rolls will be rotated for feeding forward the paper strip 191 to the desired extent.

The slidable clutch element 212 is automatically shifted at the proper time in each direction of its movement by means of a cam-operated lever 213 having a forked clutch-operating upper end from which this lever extends downwardly and intermediate of its length has a fulcrum pivot 214 on the machine frame. The lower end of this clutch-operating lever 213 carries a cam roller 215 engaging in a cam groove 216 in the face of a clutch-operating feed-controlling cam 217 which is fixed upon the cam shaft 98. Thus in the construction shown the clutch element 212 will be positively actuated in both of its movements by this double-throw box cam 217.

As will be noted from Figures 27 and 28, where the cam groove 216 is shown in dotted lines, this cam groove has a very long outer concentric portion by which the slidable clutch element 212 will be held at its normal disengaged position during the major portion of a rotation of the cam 217, this cam groove having a much shorter inner concentric portion for maintaining the clutch element 212 at its engaged position for a correspondingly limited time, during which time the feed rollers 197 and 198 will be quickly rotated through the speed-multiplying gears 205 and 206. It is of course understood that the cam 217 is timed to perform its functions in proper relation to the operation of other parts of the machine, as will later more clearly appear.

The binding strip 191 is pushed forward by the feed rolls 197 and 198 through a rearwardly flaring guide 218 which is fixed upon a transverse stationary shearing bar 219 fixedly mounted at its ends upon the machine frame. The binding strip 191 is thus pushed beneath a guide plate 219A and freely over the top of the repositioned pile of sheets and when its advancing end comes into engagement with the face of the pusher slide 156, which at this time has moved only a relatively short distance away from such pile, as shown in Figure 33, the end of this strip, having a natural tendency to curl somewhat, is deflected downward through the space between the bedplate floor sections 89 and 90, beneath which this end of such strip now projects.

A movable shearing bar or blade 220 co-operates with the stationary shearing bar or blade 219 to cut a binding blank or piece of the proper length from the strip 191 following each above described actuation of the feed rollers 197 and 198. The movable shearing blade or bar 220 is disposed at an inclination transversely for effective shearing action with the horizontal stationary shearing blade or bar 219. This movable blade 220 is fixed upon a transversely extending actuating bar in the form of a lever 221 which at its end toward the front side of the machine has a fulcrum pivot 222 on the machine frame. A downwardly extending link 223 pivotally connects the other end of this blade-carrying lever 221 with a rear arm of a bell-crank lever 224 having a fulcrum pivot 225 on the machine frame and a downwardly extending arm of which carries a cam roller 226 engaging in a cam groove 227 in the face of a cutter-operating cam 228 fixed upon the cam shaft 98.

As shown in dotted lines in Figures 29 and 30, the cam groove 227 has a long outer concentric portion by which the cutter blade 220 will be held at its normal elevated inactive waiting position during the major portion of a rotation of the cam 228 and a shorter inner portion of this cam groove effects the strip-severing operation of the movable shearing blade and returns it to its upper waiting position, the time at which this return movement is effected, however, not being critical. The cam 228 is so timed as to operate the shearing blade 220 for severing the binding strip 191 immediately following the feeding operation of the feed rolls 197 and 198, the latter being operated in proper relation with the movements of the pusher slide 156.

When the binding strip 191 has been severed as above described, the cut-off piece thereof at first lies loosely across the top of the pile of sheets substantially as shown in Figure 33. This pile of sheets is now to be compressed into a compact condition and the end portions of the severed piece of binding strip 191 are to be turned down closely against the front and rear edges or sides of this pile, as shown in Figures 34 and 35, in the illustrated machine both of these operations being performed at the same time.

A vertically movable head 229, which is normally at rest above the top plate 25, as shown in Figures 2, 3, 5, 6 and 33, is in vertical alignment with a rather large rectangular opening 230 through this top plate directly above the middle of the length of the pile of sheets, this opening being in alignment with the space between the bedplate floor sections 89 and 90. This head rigidly carries a pair of similar depending front and rear forming or bending jaws 231, 231 which are guided in the opening 230 and which are spaced apart only a trifle more that the width of the pile of sheets. Further guides 231A, 231A for these formers 231, 231, at their inner lateral margins, are fixed upon the top plate 25. When the head 229 descends the piece of binding strip 191 will have its end portions turned or bent downward at right angles in conformity with and closely against the pile of sheets, as shown in Figures 34 and 35.

While the formers 231, 231 are descending, a downwardly spring-pressed presser plate 232 carried by the head 229 is moved downward thereby. This presser plate extends horizontally above and normally in spaced relation with the pile of sheets and its binding strip 191. This presser plate is rigidly fixed upon the lower ends of a pair of similar vertical rods 233, 233 which are slidable through the head 229 at the opposite sides thereof respectively and are adjustably held in place by means of nuts 234, 234 thereon above the head 229. The presser plate 232 is steadied in its movement by means of a pair of small vertical guide rods or pins 235, 235 fixed at their lower ends to the presser plate and slidably guided through the top plate 25, which it will be noted is shown as of considerable thickness, the upper ends of these guide pins being shown in Figure 1 adjacent the ends of the presser plate.

The presser plate 232 is pressed downward by thrust springs 236, 236 on its respective rods 233, 233. When the head 229 descends, together with its forming or shaping jaws 231, 231, the springs 236, 236 will be compressed and will press the presser plate 232 down firmly upon the top of the pile of sheets, thereby compressing and compacting the latter. The pile of sheets is maintained in this compressed condition with the turned-down piece of binding strip 191 held in place thereon, as shown in Figures 34 to 38 inclusive, for a sufficient time to enable the depending ends of the binding strip to be folded into overlapping relation and glued together, by means of devices for this purpose to be described later, and as is shown in Figures 7 and 38. The means for automatically operating the head 229 together with the above described parts carried thereby will now be described.

The head 229 has a pair of laterally spaced upstanding ears which carry a pivot pin 237 engaging in a radial slot 238 through the front end of a rocking lever 239, shown as bent or bowed upwardly, which at its rear end is fixed upon a transverse horizontal rock shaft 240 journaled in bearings on the top of the machine frame. A forwardly extending and normally upwardly inclined operating lever 241 is fixed upon the end of the rock shaft 240 at the front side of the machine. A downwardly extending link 242 is pivoted at its upper end to the lever 241 and has through its lower end portion a longitudinal slot 243 by which it is guided on the cam shaft 98. Upwardly from this guide slot this link carries a cam roller 244 engaged in a cam groove 245 in the face of a cam 246 fixed upon the cam shaft 98 to be rotated thereby. The cam groove 245 is so shaped and the cam 246 so timed as to operate the head 229 together with its operating parts in the above described manner. In this particular construction, the head 229 will be positively actuated in each direction of its movement by the illustrated double-throw box cam 246.

During the time that the rearward end portion of the piece of binding strip 191 is extending down below the lower side of the floor formed by the spaced bedplate sections 89 and 90, an adhesive is applied to the forward or inner surface of the extremity of this end portion. This is accomplished automatically by means of an air spray device now to be described. A discharge nozzle 247 is directed at an inclination rearwardly and upwardly towards the above noted front face portion of the piece of binding strip 191. This nozzle has an inner tube 248 extending down within and terminating near the bottom of a closed container 249, by the removable top of which the nozzle 247 and its inlet tube 248 are carried. The receptacle 249 is supported by means of a transverse bracket member 250 fixed to frame parts of the machine, as shown in Figures 2, 3, 4 and 6. A quick-drying adhesive, such as liquid glue of suitable fluidity and composition, is contained in the receptacle 249.

Compressed air may be admitted into the container 249 around the upper portion of the tube 248 through a top connection 251, shown as having a short pipe section 252 connected thereto. A bent piece of tubing 253, which may be a flexible tube or hose, connects the pipe section 252 with a nipple 254 leading from one end of a valve body or casing 255 fixedly supported upon the machine frame by means of a bracket 256. A supply pipe 257 for compressed air is connected to the other end of the valve body 255. The air valve comprising the body portion 255 may be, as indicated, of a usual type, having an upwardly air-pressed stem 258 which closes communication through the valve body 255 between the supply pipe 257 and the outlet nipple 254, this valve stem being shown as terminating in an upwardly rounded head, directly below the cam shaft 98 at the front side of the machine.

It has already been noted that the sheet counting and packaging machine of my invention should be self-contained as to all of its parts and accessories. Accordingly, the air supply pipe 257 is connected to the delivery outlet of an air compressor 259 mounted upon the platform 40. This compressor is shown as driven from the gear box shaft 44 by means of a belt 260 and speed-multiplying pulleys 261 and 262. The means for automatically operating the air valve stem 258 at the proper time comprises a cam 263 fixed upon the adjacent end of the cam shaft 98. The valve stem 258 is moved to its valve-closing position by means of compressed air acting thereon. The valve-opening cam 263 has an inner concentrically arcuate peripheral cam face provided for the normal open-valve position of the valve stem 258 as shown in Figures 2, 4, 5 and 31, and has an outer concentrically arcuate peripheral cam face forming a cam rise by which at the proper time the valve stem 258 is depressed to and maintained for the desired interval of time at its valve-opening position as shown in Figure 32.

An automatically operated device now to be described is provided for folding the downwardly

extending end portions of the binding strip piece 191 firmly and smoothly against the bottom of the compressed pile or pack of sheets, with such end portion to which the adhesive has been applied overlapping the other end portion beneath the latter and firmly pressed against it, thus becoming attached thereto by means of the adhesive, thereby to produce a unitary securely bound package as shown in Figures 7 and 38.

Similar front and rear slidable folding plates 265 and 266, shown in Figures 6 and 35 to 38 inclusive, are guided at their lateral edges in respective grooves 267, 267 extending along the laterally spaced opposed edge faces of the respective bedplate floor sections 89 and 90, above the rearward portions of the above noted grooves 178, 178 therein. The flat upper surfaces of these slide plates 265 and 266 are flush with the floor surface of the bedplate sections 89 and 90, the rearward upper corner of the front plate 265 and the forward upper corner of the rear plate 266 being rounded, for the passage of these strip-folding plates snugly beneath the pile of sheets and its binding strip without catching thereon.

The front strip-folding plate 265 is normally inactively positioned with its rear edge just forwardly from the front strip-bending former jaw 231, as shown in Figures 6 and 35, while the rear strip-folding plate 266 is normally inactively positioned with its front edge at a somewhat greater distance rearwardly beyond the rear strip-bending former jaw 231, as shown in Figures 6, 35, 36 and 37. In performing their folding and gluing operations, the front folding plate 265 is first moved rearward substantially to the position shown in Figure 36, thereby folding the forward strip end portion rearwardly snugly and smoothly against the lower side of the compressed pile of sheets, as there shown. Immediately following this the rear folding plate 266 is moved forward substantially to the position thereof shown in Figure 38.

During the latter part of this forward movement of the rear plate 266 the front plate 265 has sufficient retractive or forward movement imparted thereto as to provide clearance for the advancing rear plate 266, as well as also for the rear strip end portion which is being folded by the latter plate. This rear folding plate 266 folds the rear strip end portion snugly and smoothly beneath the compressed pile of sheets with the adhesive bearing face of its extremity overlapping and pressed against the lower face of the folded forward strip end portion, whereby the overlapped strip end portions are adhesively secured together. Both of the folding plates 265 and 266 are now finally fully retracted to their normal inactive waiting positions.

The automatically operated means for operating the strip-folding slide plates 265 and 266 in the above described manner in performing their functions will now be described. The two separate groups of elements for separately operating the two strip-folding plates 265 and 266 in coordinated co-operative relation as above described have a close resemblance and operate in substantially the same manner.

The slidable strip-folding plate 265 on its lower side has a rather long downwardly extending rigid ear 268 which rigidly carries a transverse pivot pin 269. An upstanding operating lever 270, fixed at its lower end upon the middle portion of a transverse fulcrum-providing rock shaft 271 journaled at its ends in lateral frame parts of the machine, as shown in Figure 4, has at its upper end a longitudinal slot 272 through which the pivot pin 269 extends. Toward the rear side of the machine the rock shaft 271 has fixed thereon the upper end of a downwardly extending lever arm 273 the lower end of which on its side towards the rear side of the machine carries a cam follower roller 274. This lever arm 273 is shorter than the upstanding lever 270 and is shown as substantially in the same radial plane therewith.

The fulcrum shaft 271 is located at a level above the cam shaft 98 and in a vertical plane forwardly therefrom towards the front end of the machine. The spacing of the cam follower roller 274 from the fulcrum shaft 271 is shown as slightly greater than the spacing of the latter above the level of the cam shaft 98, so that the cam follower roller 274 is thus adapted to swing in an arc slightly below the level of the latter shaft. A quick-acting lever-like cam 275 having a peripheral cam face of elongated elliptical contour is fixed adjacent one of its ends upon the cam shaft 98 in position to have engagement with the cam follower roller 274.

When substantially at its normal inactive position this cam extends downward from the cam shaft 98 as shown in Figures 4 and 35. This cam 275 when in operation rotates in a clockwise direction when viewed from the rear side of the machine, as is indicated in Figures 26, 35 and 36. At the proper time during the rotation of the cam 275 it will quickly and positively impart strip-folding movement to the plate 265, from its normal inactive position shown in Figures 6 and 35, to its operated position shown in Figure 36. Spring means for retracting this front slide plate 265 under the control of its operating cam 275 in co-ordinated timed relation with the movements of the rear slide plate 266 will be described a little later.

The automatically operated group of elements constituting means for operating the rear strip-folding slide plate 266, as compared with those just described for the front strip-folding slide plate 265, for similarly performing its corresponding functions as described above, are as follows: Rigid lower ear 276 on the rear slide plate 266, transverse pivot pin 277 rigidly carried by the latter, upstanding operating lever 278 fixed at its lower end upon a transverse fulcrum shaft 279 journaled at its ends in frame parts of the machine, slot 280 for the pivot pin 277 longitudinally through the upper end of the operating lever 278, downwardly extending lever arm 281 fixed at its upper end upon the fulcrum shaft 279, cam follower roller 282 carried by the lower end of the latter, and quick-acting elongated elliptical cam 283 fixed adjacent one of its ends upon the cam shaft 98.

At its normal inactive position shown in Figures 4, 35 and 37 the cam 283, which is disposed toward the front side of the machine from the other similar cam 275, extends upwardly from the cam shaft 98 at a slight inclination towards the rear end of the machine. It will be noted that the fulcrum shaft 279 is towards the rear end of the machine from the cam shaft 98 and at the same level as the other fulcrum shaft 271. The lever arm 281, which is shown as at a slight forward inclination from the radial plane of the upstanding lever 278, carries its cam follower roller 282 on its side towards the front side of the machine, in position to be engaged by the cam 283. This cam follower roller 282 swings in an arc rearwardly from the cam shaft 98 towards the rear end of the machine, with the two lever

arms 273 and 281 thus opposed to each other at opposite sides of the cam shaft 98. See Figure 26.

A coiled retractile spring 284 connects together the two lever arms 273 and 281 for retracting both of the strip-folding slide plates 265 and 266 under the control of their respective operating cams 275 and 283. At the proper time during the rotation of the cam 283 it will quickly and positively impart strip-folding movement as above described to the slide plate 266, from its normal inactive position shown in Figures 6, 35, 36 and 37, to its operated position shown in Figure 38, in timed relation with the above described movements of the slide plate 265. It will be noted that the cam 283 rotatively lags behind the cam 275 as to the time of operating engagement of these cams with their respective cam follower rollers 274 and 282. This provides the above noted clearance between the two strip-folding slide plates 265 and 266, so that they cannot strike against one another.

An automatically operated ejector device for successively delivering the bound packages from the machine remains to be described. In the particular machine shown in the drawings, this ejector device is operated by the above described operating means for the pusher slide 156, and is shown as thus operated from the slide block member 177 which carries the pusher slide 156, as will be described a little later. In the construction shown, the packages of bound sheets are ejected rearwardly from the rear end of the machine and are received upon the upper end of a downwardly and rearwardly inclined delivery chute 285 down which they slide and from which they drop and may fall into any suitable receptacle placed at this end of the machine.

A pair of ejector pins 286, 286 arranged in a vertical plane transversely of the machine are suitably spaced apart for ejecting engagement with a bound package at a suitable distance inwardly from its opposite ends. In their ejecting position and movement the vertical ejector pins 286, 286 project an effective distance above the floor formed by the bedplate sections 89 and 90, as shown for one of them in Figures 6, 21, 22 and 23. During practically all of their retractive or return movement these pins are in a depressed or withdrawn position with their upper ends below the floor surface of the bedplate sections 89 and 90, as shown in Figure 25. These pins respectively have travelling movement in slots 287, 287 which extend through the bedplate sections 89 and 90 longitudinally thereof. A description of the means for mounting and controlling the operation of one of these ejector pins 286 will serve for both, and such means illustrated more particularly in Figures 21 to 25 inclusive will now be described.

A vertical cylindrical housing 288 at its top has lateral flanges 289, 289 which are slidably guided in the lateral wings of a wide shallow T-slot 290 in the lower side of the floor plate section 89 extending longitudinally thereof in parallel alignment with the ejector pin slot 287, there being a similar T-slot in the other floor plate section 90. The ejector pin 286 is rigidly carried by the upper end of a rod 291 which is movable longitudinally within the housing 288.

The housing 288 has a flat closed top 292 through an aperture in which the ejector pin 286 slidably projects. A tubular bottom plug 293 is shown as removably fixed in the lower end of the housing 288 by means of a screw and forms a guide for the rod 291.

A collar or sleeve 294 surrounds the middle portion of the rod 291 and is slidable within the housing 288.

A transverse pin 295 extends through the housing 288 in vertical slots 296, 296 therein, through apertures in the slidable sleeve 294 and through an aperture in the longitudinally movable or slidable ejector pin-carrying rod 291. Similar upper and lower coiled thrust springs 298 and 299 on the rod 291 are interposed respectively between its slidable collar 294 and its upper and lower abutments 292 and 293 formed respectively by the top wall 292 and the bottom guide plug 293 of the housing 288. The projecting ends of the transverse pin 295 carry a pair of cam rollers 300, 300. A pair of stationary bar-like or rail-like cams 301, 301, are disposed in the path of travel of the cam rollers 300, 300 and form cam tracks therefor. These cams are respectively fixedly supported from a floor-forming bedplate section such as 89, by means of a pair of depending bracket plates 302, 302. These cams 301, 301 are straight or flat along their upper and lower faces but have upper front end cam faces inclined downwardly and lower rear end cam faces inclined upwardly.

When the cam rollers 300, 300 are free from the cams 301, 301, either beyond the front ends thereof as shown in Figures 6 and 21 or beyond the rear ends thereof as shown in Figure 22, the opposed springs 298 and 299 have a tendency to center these rollers in a plane between the upper and lower faces of these cams. Consequently, when the ejector pin 286 has package-ejecting movement imparted thereto, the cam rollers 300, 300 will travel over the top of the cams 301, 301 as shown in Figure 23, thereby compressing the upper spring 298, whereby the transverse pin 295 will raise the ejector pin 286 to an effective ejecting position. Contrawise, when the ejector pin 286 has return movement imparted thereto, the cam rollers 300, 300 will travel beneath the cams 301, 301 as shown in Figures 24 and 25, compressing the lower spring 299, while the ejector pin 286 will then be withdrawn downwardly by the transverse pin 295, so that the upper end of this ejector pin can then pass freely below the lower side of the next succeeding pile of sheets 1, 1, which has in the meantime been repositioned by the pusher slide 156, to be bound into a package as will soon clearly appear.

The upper end of the housing 288 has an end of an operating bar 303 fixed thereto and extending to the front end of the machine. There is another similar operating bar 303 for the other housing 288. A transverse bar 304 is fixedly carried by the slide block member 177 of the pusher slide 156. The front end of each of the operating bars 303, 303 has an elongated slot 305 with closed ends through it extending longitudinally thereof, and a headed stud 306 fixedly carried by the transverse bar 304 passes through this slot, as clearly shown in section in Figure 3 and in dotted lines in Figure 1, thereby forming a lost-motion operating connection for the ejector pins 286, 286.

It will now be evident that, during the continuous automatic operation of the machine, when the pusher slide 156 repositions a counted pile of sheets, the ejector pins 286, 286 will at the same time deliver a bound package the pile for which has been next previously repositioned. The purpose of the above noted lost-motion connection

is because the ejector pins **286**, **286** do not need to travel the full length of throw of the pusher slide **156**, which would necessitate making the machine as a whole of greater length.

It should be clear from the preceding description that the rapidity of the successive one-by-one sheet-counting operations performed by the revolving sucker tubes **15**, **15**, **15** should be in timed relation with the speed of operation of all other parts of the machine. It might be further noted that the adjustable collars **75** and **76** on the piston rod **73** of the counting motor **70** may be utilized in adjusting both the position and extent of throw of the actuating lever **65**, in each direction of its movement. For example, by adjusting these collars towards each other, the length of throw of the actuating lever **65** may be reduced, by reason of the hooked upper end of this lever abutting against both of the collars **75** and **76** at the same time and at an angle between them, as should be clear from Figures 1 and 2.

When counting and packaging paper currency, when the operation or use of the machine is discontinued for any length of time, with no attendant present, as when this work has been completed for the time being, or when discontinuing work for the day, or other periods, all of this currency is removed from the machine, as a matter of its security. Then the machine should be reset with its operating parts at their starting position. In the illustrated machine this is accomplished by manually rotating the combined counting and controlling wheel or disc **59** to its starting position shown in Figures 2 and 8; and also the clutch-engaging spring **111** is to be placed in a relaxed condition, by disengaging the hook **119** of the spring-controlling link **115** from the stud **117**, as shown on Figure 2, thereby assuring that the clutch element **108** will be maintained at its disengaged position shown in Figure 4. The motors **39** and **47** are of course stopped, and as a precaution the circuit of the magnet **121** is manually broken or switched out.

In beginning work or starting the operation of the empty machine, the supply hopper, having the bottom **2**, is first loaded with the paper currency, such as the sheets **1**, **1**, while all of the three electric circuits are of course to be switched in. The pawl lever **85** is now operated manually to remove its detent **87** from the recess **81** in the counting wheel disc **59**, which results in the immediate starting of the sheet-withdrawing and counting operations, as will be clear from the foregoing description. After only a very few sheets **1**, **1** have been counted, the pawl lever **85** is released from manual control, for its detent **87** then to ride upon the face of the counting disc **59**.

The clutch spring **111** is left in its relaxed condition until the rotative operating movement of the counting disc **59** has brought it to the position thereof shown in Figure 9, the arcuate contact element **62** having then traversed its gap and made conductive contact with the contact members **126** and **127**, whereupon the spring **111** is hooked up into its stretched effective condition, after which the machine may be operated continuously and automatically as long as desired, and as hereinbefore described. The purpose of this arrangement is to prevent the operation of the binding or packaging device before a first pile of sheets **1**, **1** have been counted out and this pile repositioned in the machine, i. e., while the rear of the machine is still empty.

The three fulcrum pivots **164**, **171** and **182** for the respective cam-operated lever arms **163**, **170** and **181**, shown in Figures 16 and 17, 18 and 19, 21 and 22, are shown in Figure 4 as combined into a transverse fulcrum rod **307**.

It has been found and might be noted that looseness of the piston in the vacuum motor cylinder **70**, thereby providing leakage, will effectively perform the function of the relief ports **80**, **80**, without these relief ports.

The compressed air valve **255** is of a standard type, having its movable valve element moved to closed position by fluid pressure, in this instance, by compressed air from the air compressor **259**, which thus has a constant tendency to raise the valve stem **258**.

It is obvious that the pusher slide **156** is an intermediary member which serves as a pile-remover for the counting mechanism and as a pile-positioner for the packaging mechanism.

It is thought that both the construction and operation of the sheet counting and packaging machine illustrated in the accompanying drawings as an embodiment of my invention have now been fully described. A similar machine has been found to operate effectively. However, it is obvious that various modifications may be made in the construction shown in the drawings and above particularly described, within the principle and scope of my invention as defined in the appended claims. I do not specifically limit myself to the materials, size, shape, proportions, or particular relationship of parts, these being given simply as a means for clearly describing the sheet counting and packaging machine of my invention.

What I claim is:—

1. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to pull and count and pile sheets to be packaged, said mechanism comprising supply means adapted to hold a supply of sheets in compact collated relation, a sucker device adapted to withdraw said sheets successively one-by-one from said supply means, a counting device adapted to count said withdrawn sheets successively one-by-one before they are deposited to form a pile thereof, and receiving means adapted to form a deposited pile of said withdrawn and counted sheets; and a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, a binding strip feeding device adapted to feed a binding strip across said repositioned pile, a strip-cutting shearing device adapted to sever a binding piece from said strip, a combined pile-compressing and strip-holding device adapted to bend said cut-off strip piece around said pile and compress the latter, an adhesive-applying device adapted to apply an adhesive to a projecting end portion of said binding strip piece, a strip-folding device adapted to fold over into overlapping relation and press together the end portions of said strip piece with the adhesive between them, and an ejector device adapted to deliver the bound package out of the machine.

2. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to pull and count and pile sheets to be packaged, said mechanism comprising supply means adapted to hold a supply of sheets in compact collated relation, a sucker device adapted to withdraw said sheets successively one-by-one from said supply means, a counting device adapted to

count said withdrawn sheets successively one-by-one before they are deposited to form a pile thereof, and receiving means adapted to form a deposited pile of said withdrawn and counted sheets; and a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, a binding strip feeding device adapted to feed a binding strip across said repositioned pile, a strip-cutting shearing device adapted to sever a binding piece from said strip, a combined pile-compressing and strip-holding device adapted to bend said cut-off strip piece around said pile and compress the latter, an adhesive-applying device adapted to apply an adhesive to a projecting end portion of said binding strip piece, a strip-folding device adapted to fold over into overlapping relation and press together the end portions of said strip piece with the adhesive between them, and an ejector device adapted to deliver the bound package out of the machine; and an electrical controlling device adapted to be jointly operated by said counting mechanism and said packaging mechanism and adapted to have co-ordinating control of the operation of both of said mechanisms.

3. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to pull and count and pile sheets to be packaged, said mechanism comprising supply means adapted to hold a supply of sheets in compact collated relation, a sucker device adapted to withdraw said sheets successively one-by-one from said supply means, a counting device adapted to count said withdrawn sheets successively one-by-one before they are deposited to form a pile thereof, receiving means adapted to form a deposited pile of said withdrawn and counted sheets, and operating means adapted to operate said devices automatically in proper timed relation with each other; and a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, a binding strip feeding device adapted to feed a binding strip across said repositioned pile, a strip-cutting shearing device adapted to sever a binding piece from said strip, a combined pile-compressing and strip-holding device adapted to bend said cut-off strip piece around said pile and compress the latter, an adhesive-applying device adapted to apply an adhesive to a projecting end portion of said binding strip piece, a strip-folding device adapted to fold over into overlapping relation and press together the end portions of said strip piece with the adhesive between them, an ejector device adapted to deliver the bound package out of the machine, and operating means adapted to operate said devices of said packaging mechanism automatically in proper sequence.

4. In a sheet counting and packaging machine, in combination, a composite counting mechanism adapted to pull and count and pile sheets to be packaged, said mechanism comprising supply means adapted to hold a supply of sheets in compact collated relation, a sucker device adapted to withdraw said sheets successively one-by-one from said supply means, a counting device adapted to count said withdrawn sheets successively one-by-one before they are deposited to form a pile thereof, receiving means adapted to form a deposited pile of said withdrawn and counted sheets, and operating means adapted to operate said devices automatically in proper timed relation with each other; and a composite packaging mechanism adapted to bind said pile of counted sheets into a unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, a binding strip feeding device adapted to feed a binding strip across said repositioned pile, a strip-cutting shearing device adapted to sever a binding piece from said strip, a combined pile-compressing and strip-holding device adapted to bend said cut-off strip piece around said pile and compress the latter, an adhesive-applying device adapted to apply an adhesive to a projecting end portion of said binding strip piece, a strip-folding device adapted to fold over into overlapping relation and press together the end portions of said strip piece with the adhesive between them, an ejector device adapted to deliver a bound package out of the machine, and means adapted to operate said devices of said packaging mechanism automatically in proper sequence; and an electrical controlling device adapted to be jointly operated by said composite counting mechanism and said composite packaging mechanism and adapted to have coordinating control of the operation of both of these two composite mechanisms.

5. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to pull and count and pile sheets to be packaged, a packaging mechanism adapted to bind the pile of counted sheets into a unitary package, and an electrical controlling device adapted to be jointly operated by said counting mechanism and said packaging mechanism and adapted to have co-ordinating control of the operation of both of said mechanisms, said electrical controlling device comprising a series circuit, a circuit-controlling switch included in series in said circuit and adapted to be operated by said counting mechanism, and another circuit-controlling switch included in series in said circuit and adapted to be operated by said packaging mechanism.

6. A sheet counting and piling mechanism having, in combination, a supply hopper adapted to contain a supply of sheets on edge in compact collated relation against a rear wall thereof which terminates downwardly in spaced relation above the rear end of the hopper bottom, a follower in said hopper adapted to press said sheets continuously towards said rear hopper wall, a sucker device having sucker means adapted to move downwardly in proximity to and rearwardly from the lower edge of said rear hopper wall and adapted to withdraw said sheets downwardly from said hopper successively one-by-one and to release them downwardly, a counting device adapted to count said withdrawn sheets successively one by one before they are thus released by said sucker means, a vacuum-operated air motor adapted to operate said counting device, vacuumizing means adapted to apply sheet-holding vacuumizing suction to said sucker device and to apply operating vacuizing suction to said vacuum air motor, and a receptacle adapted to receive and form a collated pile of said counted and released sheets.

7. In a sheet counting and packaging machine, in combination, supply means adapted to hold a supply of sheets in compact collated relation, a sucker device adapted to withdraw said sheets

successively one-by-one from said supply means and to deposit them to form a pile thereof, a counting device adapted to count said withdrawn sheets successively one-by-one while they are being held by said sucker device, a pile-removing device adapted to remove said deposited pile of counted sheets, packaging means adapted to bind said removed pile of counted sheets into a unitary package, and an electrical controlling device adapted to be jointly operated by said counting device and said pile-removing device and adapted to have co-ordinating control of the operation of said three devices and of said packaging means.

8. In a sheet counting and packaging machine, in combination, supply means adapted to hold a supply of sheets in compact collated relation, a sucker device adapted to withdraw said sheets successively one-by-one from said supply means and to deposit them to form a pile thereof, a counting device adapted to count said withdrawn sheets successively one-by-one while they are being held by said sucker device, a pile removing device adapted to remove said deposited pile of counted sheets, packaging means adapted to bind said removed pile of counted sheets into a unitary package, and an electrical controlling device adapted to be jointly operated by said counting device and said pile-removing device and adapted to have co-ordinating control of the operation of said three devices and of said packaging means, said electrical controlling device comprising a series circuit, a circuit-controlling switch included in series in said circuit and adapted to be operated by said counting device, and another circuit-controlling switch included in series in said circuit and adapted to be operated by said pile-removing device.

9. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to count and pile sheets to be packaged, said mechanism comprising supply means to hold a supply of sheets, a piling device adapted to withdraw said sheets successively one-by-one from said supply means and to deposit them to form a pile thereon, and a counting device adapted to count said withdrawn sheets successively one-by-one before they have been deposited into a pile; a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, and packaging means adapted to bind said repositioned pile of counted sheets into a unitary package; and an electrical controlling device adapted to be jointly operated by said counting device and said packaging mechanism and adapted to have coordinating control of the operation of both of said mechanisms, said electrical controlling device comprising a series circuit, a circuit-controlling switch included in series in said circuit and adapted to be operated by said counting device, and another circuit-controlling switch included in series in said circuit and adapted to be operated by said packaging mechanism.

10. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to count and pile sheets to be packaged, said mechanism comprising supply means to hold a supply of sheets, a piling device adapted to withdraw said sheets successively one-by-one from said supply means and to deposit them to form a pile thereof, and a counting device adapted to count said withdrawn sheets successively one-by-one before they have been deposited into a pile; a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, and packaging means adapted to bind said repositioned pile of counted sheets into a unitary package; means adapted to be controlled by said counting device and adapted to discontinue the operation of said counting mechanism when a predetermined fixed number of sheets have been counted and piled, and means adapted to be controlled by said packaging mechanism and adapted to start said counting mechanism into operation again after said pile of counted sheets have been removed by said repositioning device; and an electric controlling device adapted to be jointly operated by said counting device and said packaging mechanism and adapted to have co-ordinating control of the operation of both of said mechanisms, said electrical controlling device comprising a series circuit, a circuit-controlling switch included in series in said circuit and adapted to be operated by said counting device, and another circuit-controlling switch included in series in said circuit and adapted to be operated by said packaging mechanism.

11. In a sheet counting mechanism, in combination, a supply hopper adapted to contain a supply of sheets on edge in compact relation against a rear wall thereof having its lower edge spaced above the rear end of the hopper bottom a sheet-withdrawing sucker device having sucker means adapted to move downwardly in proximity to and rearwardly from the lower portion of the rear end of said hopper and adapted to withdraw said sheets successively one-by-one downwardly from said hopper and thereafter to release them, a counting device adapted to count said withdrawn sheets successively one-by-one before they are released by said sucker means, and co-ordinating vacuumizing means adapted to apply sheet-withdrawing suction to said sucker device, and to operate said counting device in co-ordinated timed relation with the sheet-withdrawing operation of said sucker means.

12. In a sheet counting mechanism, in combination, a supply hopper adapted to contain a supply of sheets on edge in compact relation against a rear wall thereof having its lower edge spaced above the rear end of the hopper bottom, a rotary sheet-withdrawing sucker device having an orbitally revolving sucker tube which moves transversely of its length and is provided with sucker means adapted to move in an arc downwardly in proximity to and rearwardly from the lower portion of the rear end of said hopper and adapted to withdraw a single one of said sheets downwardly from said hopper each time said sucker tube thus passes in proximity to said hopper and thereafter to release said withdrawn sheet, a counting device adapted to count singly each of said withdrawn sheets successively one-by-one before they are released by the sucker means of said sucker device, and co-ordinating vacuizing means adapted to apply sheet-withdrawing suction to said sucker device and to operate said counting device in co-ordinated timed relation with the sheet-withdrawing operation of said sucker means.

13. In a sheet counting mechanism, in combination, a supply hopper adapted to contain a supply of sheets on edge in compact collated relation against a rear wall thereof having its lower edge spaced above the rear end of the hopper

bottom, a rotary sheet-withdrawing sucker device having a circular series of equally spaced sucker tubes movable downwardly at the rear of and in proximity to the lower portion of the rear end of said hopper and carrying suckers adapted to withdraw said sheets successively one-by-one downwardly from said hopper and thereafter to release them, a counting device adapted to count said withdrawn sheets successively one-by-one before they are released by said sucker device, means adapted to rotate said sucker device continuously, vacuumizing means adapted to apply sheet-withdrawing suction successively to each of said sucker tubes successively and individually and only while it is moving through its sheet-withdrawing and releasing arc, and a vacuum-operated air motor adapted to have operating suction applied thereto from one of said sucker tubes only when the latter is carrying a withdrawn sheet and thus adapted to operate said counting device in co-ordinated timed relation with the sheet-withdrawing operation of said sucker device.

14. In a sheet counting mechanism, in combination, a supply hopper adapted to contain a supply of sheets on edge in compact collated relation against a rear wall thereof having its lower edge spaced above the rear end of the hopper bottom, a rotary sheet-withdrawing sucker device having a circular series of equally spaced sucker tubes movable downwardly at the rear of and in proximity to the lower portion of the rear end of said hopper and carrying suckers adapted to withdraw said sheets successively one-by-one downwardly from said hopper and thereafter to release them, and a counting device adapted to count said withdrawn sheets successively one-by-one before they are released by said sucker device, means adapted to rotate said sucker device continuously, vacuumizing means adapted to apply sheet-withdrawing suction successively to each of said sucker tubes successively and individually and only while it is moving through its sheet-withdrawing and releasing arc, a vacuum-operated air motor adapted to have operating suction applied thereto from one of said sucker tubes only when the latter is carrying a withdrawn sheet, thus adapted to operate said counting device in co-ordinated timed relation with the sheet-withdrawing operation of said sucker device, a toothed counting wheel forming an element in said counting device, a back-and-forth movable element adapted to be operated by said vacuum air motor and adapted to impart sheet-counting rotation to said counting wheel step-by-step in co-ordinated timed relation with the sheet-withdrawing operation of said sucker device, and means adapted to be controlled by said counting wheel and adapted to discontinue the operation of said counting mechanism when a predetermined fixed number of sheets have been counted.

15. In a sheet counting mechanism, in combination, supply means to hold a supply of sheets to be counted, a sheet-withdrawing device adapted to withdraw said sheets successively one-by-one from said supply means and thereafter to release and deposit them to form a pile thereof, a counting device adapted to count said withdrawn sheets successively one-by-one before they are released by said withdrawing device, discontinuing means adapted to be controlled by said counting device and adapted to discontinue concomitantly the operation of said sheet-withdrawing device and of said counting device when a predetermined fixed number of sheets have been counted and piled, and a pile-removing device adapted to be controlled by said counting device and adapted to remove said deposited pile of counted sheets, said latter device comprising an insertable and withdrawable temporary sheet support adapted to be inserted above said completed pile of counted sheets preparatory to the resumption of the sheet-withdrawing and counting operations and to be withdrawn after the completion of the pile-removing operation, a movable element adapted to be operated to start such sheet-withdrawing and counting operations, a back-and-forth movable slide adapted to remove said deposited pile of counted sheets and to return to its original retracted position, co-ordinated operating means adapted to assure the proper timed sequence of operation of said sheet support and said starting element and said pile-removing slide, and controlling means adapted to be operated by said pile-removing device and adapted to discontinue the operation of said pile-removing device at the end of each successive cycle of its operation.

16. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to count and pile sheets to be packaged, said mechanism comprising supply means to hold a supply of sheets, a sheet-withdrawing device adapted to withdraw said sheets successively one-by-one from said supply means and thereafter to release and deposit them to form a pile thereof, a counting device adapted to count said withdrawn sheets successively one-by-one before they are released by said withdrawing device, discontinuing means adapted to be controlled by said counting device and adapted to discontinue the operation of said counting mechanism when a predetermined fixed number of sheets have been counted and piled; a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, and packaging means adapted to bind said repositioned pile of counted sheets into a unitary package, said pile-repositioning device comprising means adapted to be controlled by said packaging mechanism and adapted to start concomitantly the operation of said sheet withdrawing device and of said counting device after said deposited pile of counted sheets has been removed by said re-positioning device; and a controlling device adapted to be jointly operated by said counting device and said packaging mechanism and adapted to have co-ordinating control of the operation of both of said mechanisms.

17. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to count and pile sheets to be packaged, said mechanism comprising supply means to hold a supply of sheets, a sheet-withdrawing device adapted to withdraw said sheets successively one-by-one from said supply means and thereafter to release and deposit them to form a pile thereof, a counting device adapted to count said withdrawn sheets successively one-by-one before they are released by said withdrawing device, discontinuing means adapted to be controlled by said counting device and adapted to discontinue the operation of said counting mechanism when a predetermined fixed number of sheets have been counted and piled; and a packaging mechanism adapted to be controlled by said counting device and adapted to bind said pile of counted sheets into a

unitary package, said latter mechanism comprising a pile-repositioning device adapted to remove and reposition said deposited pile of counted sheets, and packaging means adapted to bind said repositioned pile of counted sheets into a unitary package, said pile-repositioning device comprising an insertable and withdrawable temporary sheet support adapted to be inserted above said completed pile of counted sheets preparatory to the resumption of the sheet-withdrawing and counting operations and to be withdrawn after the completion of the pile-removing operation, a movable element adapted to be operated to start such sheet-withdrawing and counting operations, said pile-repositioning device including a back-and-forth movable slide adapted to remove and reposition said deposited pile of counted sheets and to return to its original retracted position, co-ordinated operating means adapted to assure the proper timed sequence of operation of said sheet-support and said starting element and said pile-removing slide, and controlling means adapted to be operated by said packaging mechanism and adapted to discontinue the operation of said packaging mechanism at the end of each successive cycle of its operation.

18. A packaging mechanism for binding a pile of sheets into a unitary package including, in combination, a pile-moving device adapted to move and position a pile of sheets to be packaged, packaging means adapted to bind said positioned pile of sheets into a unitary package, an ejector device adapted to deliver the bound package out of the machine, and co-ordinating connections between said pile-positioning device and said ejector device whereby while said pile-positioning device is moving a pile of sheets into position to be packaged said ejector device is at the same time delivering the previously bound package.

19. In a sheet counting and packaging machine, in combination, supply means adapted to hold a supply of sheets to be counted and packaged, a rotary sheet-withdrawing device adapted to withdraw said sheets successively one-by-one from said supply means and thereafter to release and deposit them to form a pile thereof, a counting device including an intermittently rotative counting wheel and adapted to count said withdrawn sheets successively one-by-one before they are released by said withdrawing device, a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, operating means adapted to rotate said sheet-withdrawing device, a rotative operating connection from said sheet-withdrawing device to said packaging mechanism, a clutch interposed in said connection, and an electrical controlling device adapted to have co-ordinating control of the operations of said sheet-withdrawing and counting devices and of the operation of said packaging mechanism, said electrical controlling device comprising a series circuit, a magnet included in series in said circuit and adapted to operate said clutch, a circuit-controlling switch included in series in said circuit and adapted to be operated by said counting wheel, and another circuit-controlling switch included in series in said circuit and adapted to be operated by said packaging mechanism.

20. In a sheet counting and packaging machine in combination, supply means adapted to hold a supply of sheets to be counted and packaged, a rotary sheet-withdrawing device adapted to withdraw said sheets successively one-by-one from said supply means and thereafter to release and deposit them to form a pile thereof, a counting device including an intermittently rotative counting wheel and adapted to count said withdrawn sheets successively one-by-one before they are released by said withdrawing device, a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, operating means adapted to rotate said sheet withdrawing device, a rotative operating connection from said sheet-withdrawing device to said packaging mechanism, a clutch interposed in said connection, and an electrical controlling device adapted to have co-ordinating control of the operations of said sheet-withdrawing and counting devices and of the operation of said packaging mechanism, said electrical controlling device comprising a series circuit, a magnet included in series in said circuit and adapted to operate said clutch, a circuit-controlling switch included in series in said circuit and having a rotative circuit-controlling element adapted to be rotated by said counting wheel, and another circuit-controlling switch included in series in said circuit and having a rotative circuit-controlling element adapted to be rotated by said packaging mechanism.

21. In a sheet counting and packaging machine, in combination, a counting mechanism adapted to count and pile sheets to be packaged, a packaging mechanism adapted to bind the pile of counted sheets into a unitary package, operating means adapted to operate said counting mechanism, a disconnectible operating connection adapted to operate said packaging mechanism from said counting mechanism, a controlling device adapted to be jointly operated by said counting mechanism and said packaging mechanism, and including means adapted to disconnect said disconnectible connection, and manually operable disabling means adapted to render said controlling device ineffective thereby to enable the operating parts of said machine to be set at their starting position.

22. In a sheet counting and packaging machine, in combination, supply means adapted to hold a supply of sheets to be counted and packaged, a rotary sheet-withdrawing device adapted to withdraw said sheets successively one-by-one from said supply means and thereafter to release and deposit them to form a pile thereof, a counting device including an intermittently rotative counting wheel and adapted to count said withdrawn sheets successively one-by-one before they are released by said withdrawing device, a packaging mechanism adapted to bind said pile of counted sheets into a unitary package, operating means adapted to rotate said sheet-withdrawing device, a rotative operating connection from said sheet-withdrawing device to said packaging mechanism, a clutch interposed in said connection, and an electrical controlling device adapted to have co-ordinating control of the operations of said sheet-withdrawing and counting devices and of the operation of said packaging mechanism, said electrical controlling device comprising a series circuit, a magnet included in series in said circuit and adapted to operate said clutch, a circuit-controlling switch included in series in said circuit and adapted to be operated by said counting wheel, another circuit-controlling switch included in series in said circuit and adapted to be operated by said packaging mechanism, and manually operable disabling means adapted to render said magnet ineffective to operate said clutch so as thereby to enable said counting wheel to be set at its starting position.

23. In a sheet counting mechanism, in combination, a supply hopper adapted to contain a supply of sheets on edge in compact relation against a rear wall thereof having its lower edge spaced above the rear end of the hopper bottom, a sheet-withdrawing sucker device having sucker means adapted to move downwardly in proximity to and rearwardly from the lower portion of the rear end of said hopper and adapted to withdraw said sheets successively one-by-one downwardly from said hopper and thereafter to release them, a counting device adapted to count said withdrawn sheets successively one-by-one before they are released by said sucker means, and controlling means adapted to prevent the operation of said counting device when no sheet is withdrawn by said sucker means.

24. In a sheet counting mechanism, in combination, a supply hopper adapted to contain a supply of sheets on edge in compact relation against a rear wall thereof having its lower edge spaced above the rear end of the hopper bottom, a rotary sheet-withdrawing sucker device having an orbitally revolving sucker tube which moves transversely of its length and is provided with sucker means adapted to move in an arc downwardly in proximity to and rearwardly from the lower portion of the rear end of said hopper and adapted to withdraw a single one of said sheets downwardly from said hopper each time said sucker tube thus passes in proximity to said hopper and thereafter to release said withdrawn sheet, a counting device adapted to count singly each of said withdrawn sheets successively one-by-one before they are released by the sucker means of said sucker device, and controlling means adapted to prevent the operation of said counting device when no sheet is withdrawn by the sucker means of said sucker device.

25. In a sheet counting mechanism, in combination, supply means adapted to hold a supply of sheets to be counted and to expose a marginal face area of one of the outermost of said sheets, a rotary sheet-withdrawing sucker device having an orbitally revolving sucker tube which moves transversely of its length and is provided with sucker means adapted to move in proximity to the exposed marginal face area of said outermost sheet and adapted to withdraw a single one of said sheets from said supply means each time said sucker tube thus passes in proximity to the exposed marginal face area of the then outermost sheet and thereafter to release said withdrawn sheet, a counting device adapted to count singly each of said withdrawn sheets successively one-by-one before they are released by the sucker means of said sucker device, and controlling means adapted to prevent the operation of said counting device when no sheet is withdrawn by the sucker means of said sucker device.

26. In a sheet counting mechanism, in combination, supply means adapted to hold a supply of sheets to be counted and to expose a marginal face area of one of the outermost of said sheets, a rotary sheet-withdrawing sucker device having an orbitally revolving sucker tube which moves transversely of its length and is provided with sucker means adapted to move in proximity to the exposed marginal face area of said outermost sheet and adapted to withdraw a single one of said sheets from said supply means each time said sucker tube thus passes in proximity to the exposed marginal face area of the then outermost sheet and thereafter to release said withdrawn sheet, a counting device adapted to count singly each of said withdrawn sheets successively one-by-one before they are released by the sucker means of said sucker device, a vacuum-operated air motor adapted to operate said counting device, vacuumizing means adapted to apply sheet-holding vacuumizing suction to said sucker device and to apply operating vacuumizing suction to said vacuum air motor, and controlling means adapted to prevent the operation of said counting device when no sheet is withdrawn by the sucker means of said sucker device.

27. In a sheet counting mechanism, in combination, supply means adapted to hold a supply of sheets to be counted and to expose a marginal face area of one of the outermost of said sheets, a rotary sheet-withdrawing sucker device having an orbitally revolving sucker tube which moves transversely of its length and is provided with sucker means adapted to move in proximity to the exposed marginal face area of said outermost sheet and adapted to withdraw a single one of said sheets from said supply means each time said sucker tube thus passes in proximity to the exposed marginal face area of the then outermost sheet and thereafter to release said withdrawn sheet, a counting device adapted to count singly each of said withdrawn sheets successively one-by-one before they are released by the sucker means of said sucker device, and controlling means adapted to prevent the operation of said counting device when no sheet is withdrawn by the sucker means of said sucker device, said controlling means comprising a vacuum-operated air motor adapted to have operating suction applied thereto from one of said sucker tubes only when the latter is carrying a withdrawn sheet and thus adapted to operate said counting device in coordinated timed relation with the sheet-withdrawing operation of said sucker device.

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