Oct. 7, 1958 P. E. KLEINEBERG ET AL 2,854,900

ARTICLE COUNTING AND COLLECTING MACHINE

Filed Dec. 13, 1956

4 Sheets-Sheet 1

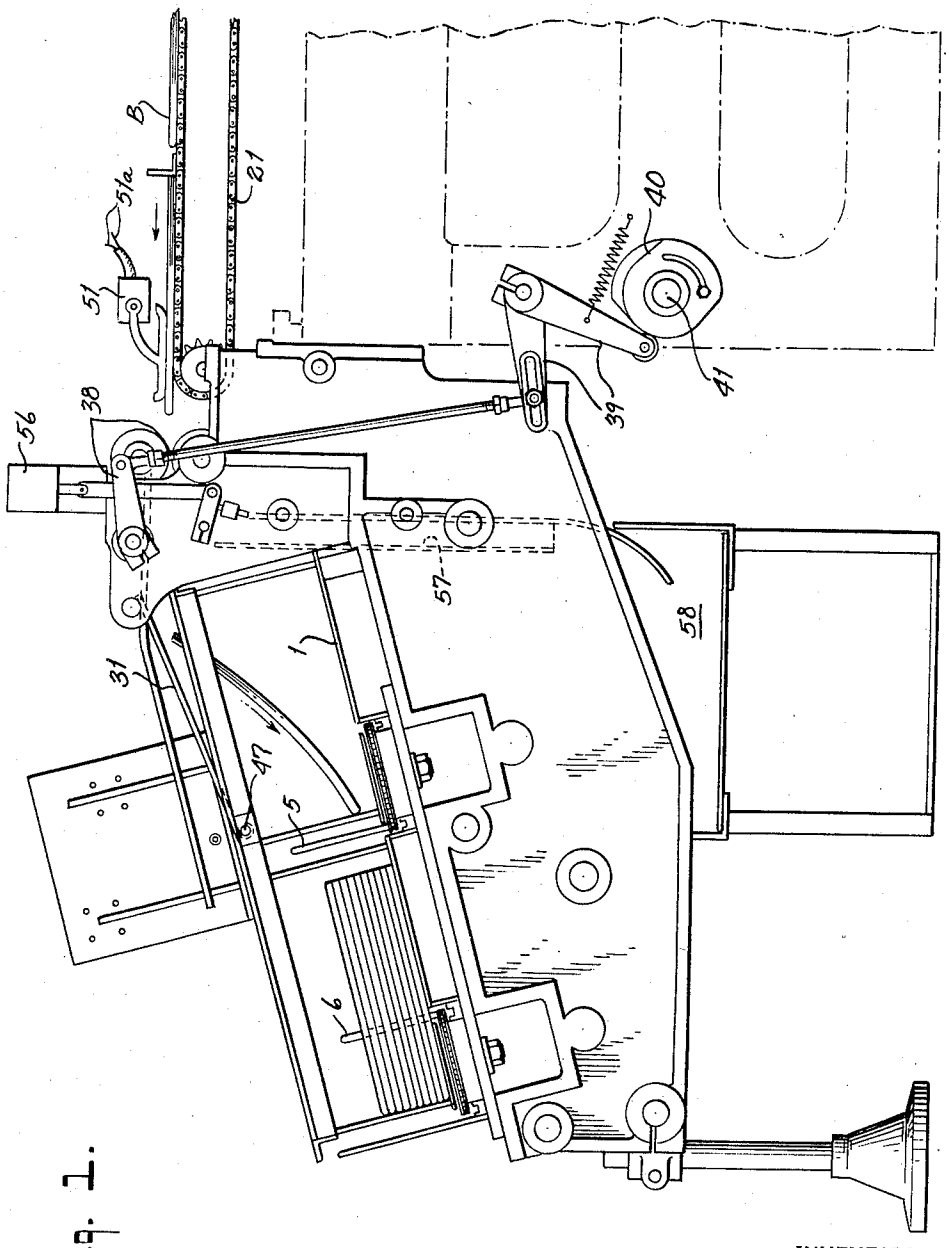



Fig. 1.

INVENTORS
PAUL E. KLEINEBERG
JOSEPH C. ROSEMAN
BY Kenyon & Kenyon
ATTORNEYS

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4 Sheets-Sheet 2

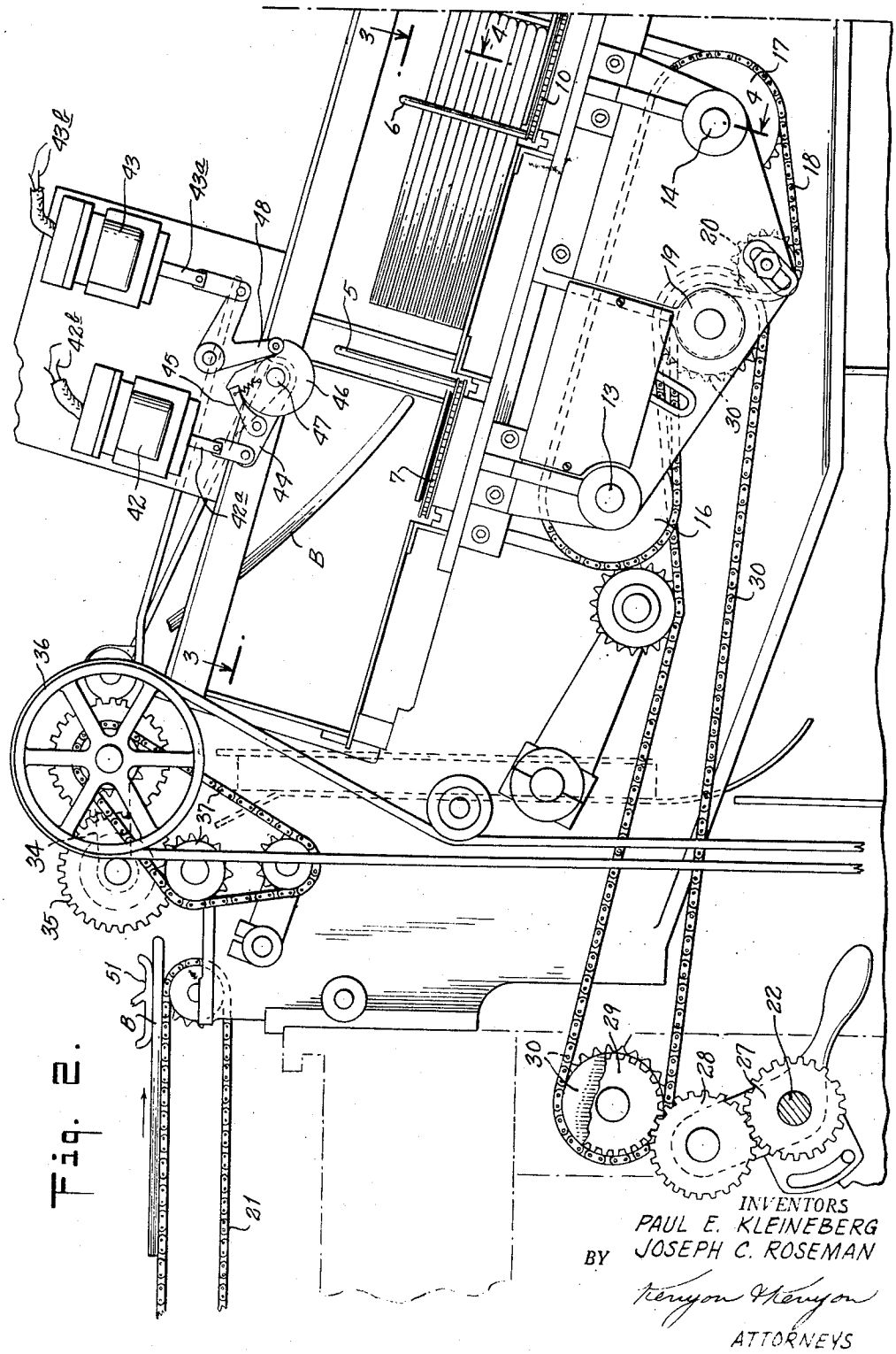


Fig. 2.

INVENTORS
PAUL E. KLEINEBERG
BY JOSEPH C. ROSEMAN
Kenyon & Kenyon
ATTORNEYS

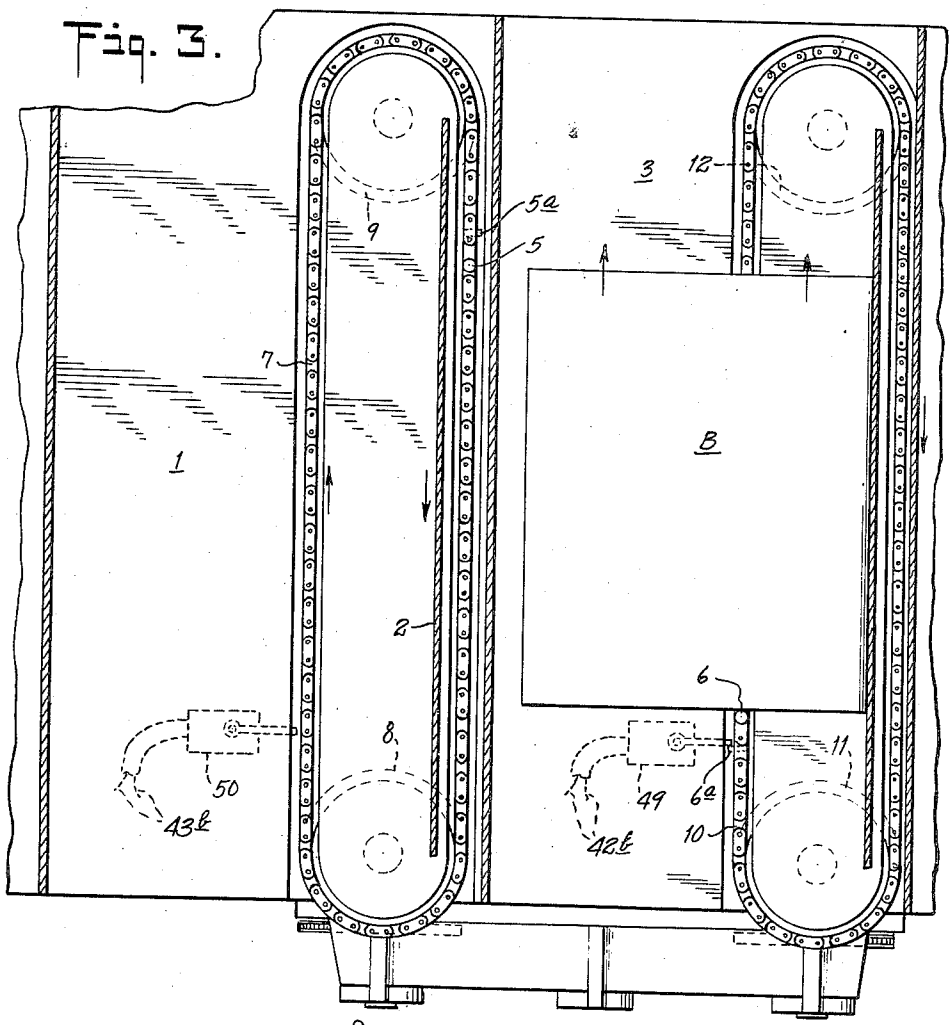
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Fig. 3.



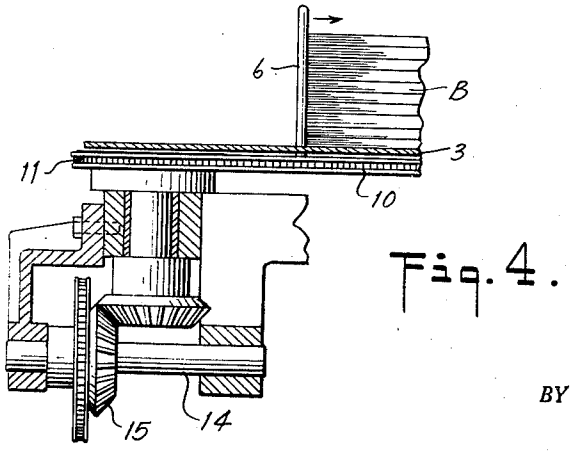




Fig. 4.

INVENTORS
PAUL E. KLEINEBERG
BY JOSEPH C. ROSEMAN
Kenyon & Kenyon
ATTORNEYS

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Fig. 5.

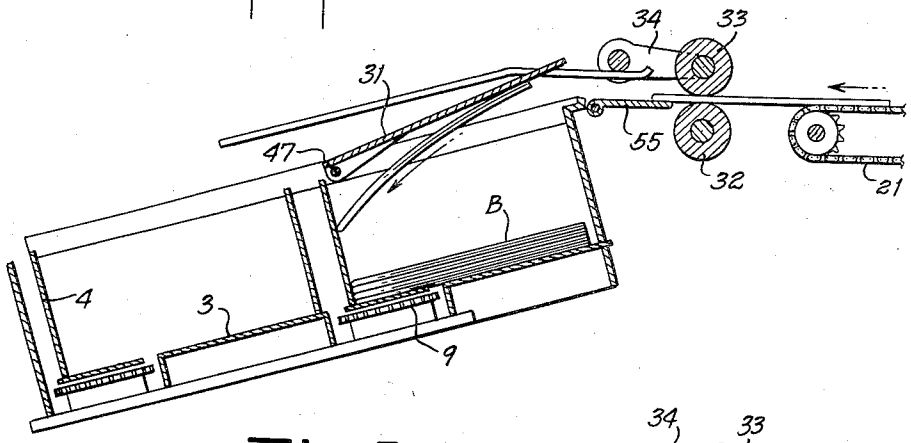
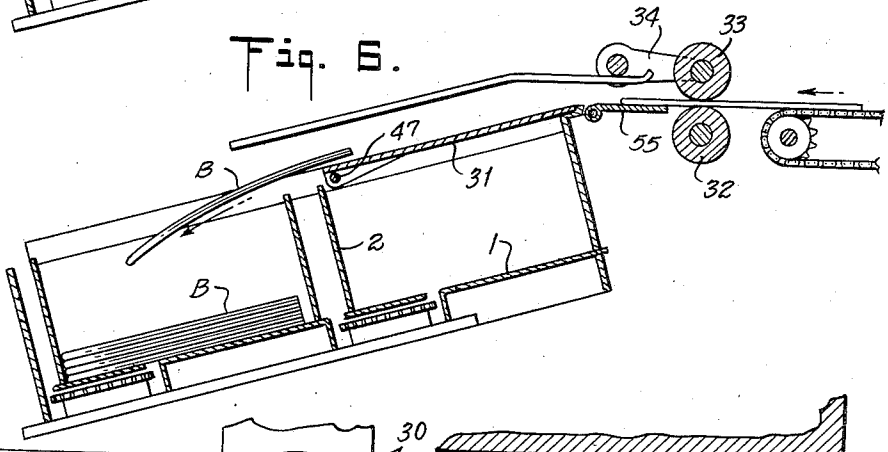



Fig. 6.



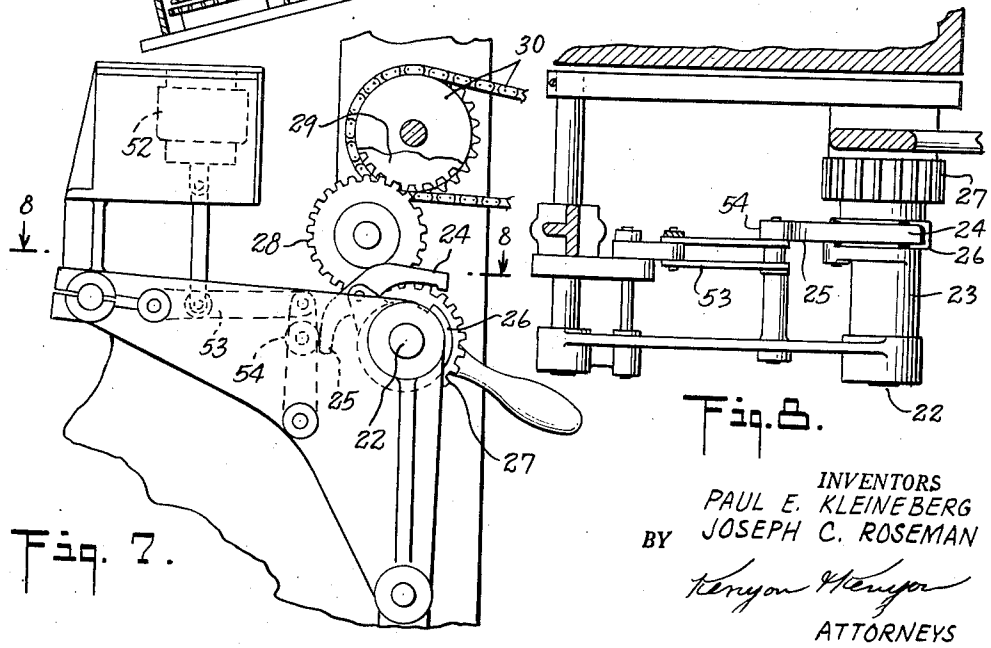




Fig. 8.

Fig. 7.

INVENTORS
PAUL E. KLEINEBERG
BY JOSEPH C. ROSEMAN
Kenyon & Kenyon
ATTORNEYS

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# ARTICLE COUNTING AND COLLECTING MACHINE

Paul E. Kleineberg, Easton, and Joseph C. Roseman, Bethlehem, Pa., assignors to T. W. & C. B. Sheridan Co., New York, N. Y., a corporation of New York

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7 Claims. (Cl. 93—93)

This invention relates to an article counting and collecting machine which was developed for the purpose of handling boks although it may be used for other articles.

Using books as an example, in the hook binding industry books are delivered by machinery in rapid succession or, in other words, in the form of a continuous flow of travelling interspaced books. These must be collected in stacks containing a predetermined number of books and this requires a counting and collecting machine. Incidentally, the term books is used to embrace magazines or periodicals which must be produced rapidly in large numbers.

One of the objects of the present invention is to provide a counting and collecting machine which may be constructed simply and strongly, which reliably collects and counts articles, and which may be serviced easily. In the case of books in particular an object is to provide a stacking and counting machine having a long service life, which is reliable, and which is capable of operating continuously under the high-speed conditions connected with the production of books such as magazines and periodicals enjoying large circulations.

Generally speaking, this new machine incorporates two containers each having a collecting zone for the articles. An ejector is provided each container for removing the articles collected in its collecting zone, and means are provided for causing each of these ejectors to travel continuously 180° out of phase with respect to the other ejector. The path of travel is in the form of a loop permitting continuous motion of the ejector, and this looped path has a portion passing through the collecting zone of the container with which it is associated.

Controllable means feed the continuous flow of travelling interspaced articles, such as books, to either one or the other of the two collecting zones of the two containers. In other words, it is possible to feed the flow selectively to either of the containers. The control of this feeding means is effected by means activated by the start of either of the ejectors through its collecting zone. Thus, as soon as the articles collected in one zone begin to be ejected by the ejector of that zone, the flow of articles to that zone is terminated and directed without interruption to the other collecting zone.

The count is determined by the time it takes either ejector to travel from the location where it starts through its collecting zone, through the zone and back to its starting position. In other words, the travelling speeds of the ejectors determine the count, it being understood that normally the two ejectors are positively interlocked so that they travel at the same speed, the lengths of their travelling paths normally being equal to each other.

Because of this operation the new machine eliminates the need for stepping relays and their necessary activators in the form of article operated trigger switches, photoelectric cells, and other complicated electrical systems such as have heretofore been used. Rugged construction, simplicity, and easy maintenance by an ordinary mechanic are thus made possible.



A specific example of the new machine in its book stacking and counting form is illustrated by the accompanying drawings in which:

Fig. 1 is an elevation showing the side of the machine from which the stacks of books are alternately discharged by the ejector;

Fig. 2 is an elevation showing the opposite side of the machine on a scale larger than that of Fig. 1;

Fig. 3 is a top view or plan showing the collecting zones of the two containers with the ejectors in operation, this view being taken on the line 3—3 of Fig. 2;

Fig. 4 is a cross section of details and is taken on the line 4—4 in Fig. 2;

Fig. 5 shows the containers of Fig. 1 and illustrates the feeding to the right-hand one of these containers;

Fig. 6 is like Fig. 5 but shows the feed to the left-hand container, it being understood that these directional references are related to Figs. 5 and 6 and not necessarily to the machine itself;

Fig. 7 is an elevation showing certain outer elements eliminated from the lower left-hand portion of Fig. 2 for the purpose of showing inner elements in Fig. 2; and

Fig. 8 is a horizontal section taken on the line 8—8 in Fig. 7.

Referring to these drawings, it can be seen that in this instance the two containers are located end to end and slant downwardly. The upper one is made up primarily of a bottom wall 1 and an end wall 2, the other device having a corresponding bottom wall 3 and end wall 4. The walls 1 and 2, and 3 and 4, are at right angles to each other, and the bottom walls 1 and 3 slant downwardly. Thus the containers may be considered to be hoppers and when the books B are horizontally dropped into either hopper the books gravitationally slide down the bottom walls to the end walls so that the books stack. The described angularity, of course, establishes the collecting zone occupied by the books.

It can be seen that the containers may be made very simply. In the commercial version of the machine other walls would normally be provided for the sake of safety and appearance.

These upper and lower hoppers or containers each have the described ejector in the form of upstanding pins 5 and 6 respectively. The looped paths of travel are effected by mounting the pin 5 on a sprocket chain 7 located below the bottom wall 1 and guided by sprocket wheels 8 and 9 which are, of course, also journaled below this wall 1. The arrangement is such that the chain 7 travels transversely with respect to the wall 1 and loops around or encircles the end wall 2 so that the ejector pin 5, connected to and upstanding from the chain 7, makes its ejecting pass through the collecting zone of the upper container 1 and returns behind the wall 2 and free from this zone.

The lower hopper arrangement is substantially a duplicate having a corresponding chain 10 and sprocket wheels 11 and 12.

Both sprocket wheels 8 and 11 are connected by right angle gearing with horizontal shafts 13 and 14 respectively. Fig. 4 shows the right angle gearing 15 between the sprocket wheel 11 and shaft 14 and it is to be understood that the same kind of gearing is used in the other instance.

Sprocket wheels 16 and 17 are mounted on the shafts 13 and 14 respectively and interconnected by a sprocket chain 18. Thus the chains 7 and 10 are synchronized with respect to each other, the arrangement being such that, as previously described, the ejector pins 5 and 6 are 180° out of phase with each other. The chain 18 is engaged by a driving sprocket wheel 19 and a chain tightening sprocket wheel 20 keeps the chain 18 tight so as to as-

sure accurate and positive synchronization between the travel of the chains 7 and 10.

Normally a machine of this character is incorporated with other machines as for example with the conveyor delivering books from a covering machine, edge trimmer or the like. Accordingly the books B are shown as being delivered to the new machine by an endless conveyor 21 which may be part of another machine such as generally indicated by broken lines in Fig. 1. Such a machine would ordinarily have some means for powering it so the present machine is shown as being powered by a shaft 22 which it may be assumed is driven by the motor which drives the machine delivering the books. It is to be further understood that this shaft 22 turns through one complete revolution for each book delivered by the conveyor 21.

As shown by Figs. 7 and 8 this shaft 22 has a collar 23 mounted on it, so that the shaft and collar turn together and this collar carries a pawl 24 having a tripping end 25. This pawl in turn engages a notched cam wheel 26 which turns freely on the shaft 22 and is connected to a gear 27 which meshes with an intermediate gear 28 which in turn meshes with a driving gear 29 connecting with the sprocket wheel 19 by way of a sprocket chain and wheel drive 30. As long as the pawl 24 engages the notched cam wheel 26 the shaft 22 positively drives the ejectors through their respective circuits in synchronism with the delivery of the books by the conveyor 21.

It can be seen that the above provides a means for feeding the continuous flow of travelling interspaced books. This flow must be controlled to send the books to either one or the other of the previously described containers or hoppers.

Such control is effected by use of a deflector 31. When this deflector is in its up position as shown by Fig. 5 the books are fed to the upper one of the hoppers, and when this deflector 31 is in its lower position, shown by Fig. 6, the books are deflected to the other or lower hopper. The books have momentum enough to travel over the deflector 31 to the lower hopper because speed-up rollers 32 and 33 are used to engage and accelerate the travelling speed of the books leaving the conveyor 21. The lower rollers 32, of this speed-up or accelerating device, are fixed while the upper rollers 33 are mounted on arms 34 so that they may be lifted to clear the advancing edges of the oncoming books. As shown by Fig. 2 both rollers 32 and 33 are driven. The drive is through gears 35 which permits swinging action of the arms 34, and a belt and pulley drive 36 which powers the one of the gears 35 concentric with the swinging axis of the arms 34. This drive 36 is powered by a suitable high-speed motor, not shown. The lower rollers 32 are driven by a chain and sprocket drive 37.

The lifting action of the upper rollers 33 is effected by a lever and link connection 38 operated by a lever system 39 which is actuated by a rotary cam 40 mounted on a shaft 41 on which the previously described gear 29 and sprocket 30 are also mounted on the other side of the machine. Thus this roller lifting action is synchronized with the other elements.

Control of the selective feeding action is effected by operating the deflector 31 by means of electric solenoids 42 and 43. The armature shaft 42*a* of the solenoid 42 rotates a lever 44 which through a pawl 45 rotates a notched cam wheel 46, the latter being fixed to a shaft 47 on which the deflector 31 is mounted. Thus energization of the solenoid 42 lifts the deflector 31 to the position shown by Fig. 5. The solenoid's armature 42*a* is spring biased downwardly but after initial lifting a trigger 48 engages the notched cam wheel 46 and prevents the latter from returning. Return of the deflector 31 to the position shown by Fig. 6 is effected upon energization of the solenoid 43 because the latter's armature shaft 43*a* is connected to trip the trigger 48. The deflector 31 is strongly made and has considerable weight so that it is normally biased to its Fig. 6 position by gravity.



The solenoid 42 is powered through lines 42*b* with a suitable electric power source through a normally open electric limit switch 49 which is positioned for actuation by a projection 6*a* carried along with the pin 6. The arrangement of these parts is such that the limit switch 49 is closed just as the ejector pin 6 engages the books and starts to eject or push them along the bottom wall 3 of the lower container or hopper. This momentarily energizes the solenoid 42 and cocks the cam wheel 46 with the deflector 31 in its Fig. 5 position. This now causes the books to feed to the upper hopper while the books are being ejected from the lower hopper.

The solenoid 43 connects through power lines 43*b* with a suitable power source also through a controlling limit switch 50. This switch is located so that a projection 5*a* associated with the ejector pin 5 momentarily closes the switch 50, which is normally open, just as the ejector pin 5 reaches the start of its travel through the book collecting zone of the upper hopper. This momentarily energizes the solenoid 43 and trips the trigger 48 so that the deflector 31 falls to its Fig. 6 position and the books are delivered to the lower hopper while the upper hopper is being cleared of its stacked collection of books.

Now it becomes apparent that for any given ratio between the train of gears 27, 28 and 29 a predetermined number of books accumulate in either hopper at which time its ejector pin starts to push out the collected stack while at the same time the feed is diverted to the other hopper. The number counted depends on the time it takes the one or the other of the pins 5 to complete its circuit and this in turn depends on the mentioned gear ratio. Therefore, the gears 27, 28 and 29 are mounted so that they may be replaced by other gears of different sizes.

In the book binding art it is not uncommon for a book to be removed from the flow being carried along. Should this happen in the case of the present machine a miscount will result.

The above possible trouble is guarded against by the use of a calipering limit switch 51 located to feel the conveyor 21 continuously. In the event a book is missing this switch 51 through lines 51*a* momentarily energizes an electric solenoid 52. Through a suitable link and lever system 53 this throws a camming roller 54 in the path of the pawl 24 so as to trip the latter from the notch in the cam wheel 26. This then permits the shaft 22 to turn through one revolution before the pawl 24 can re-engage which it does automatically. This momentary halt in the drive of the two chains 7 and 10 compensates for the missing book and prevents a miscount.

In some instances the machine must handle books delivered two at a time and in such a case the same action occurs because the machine is calibrated, by proper gearing, to in effect count two at a time. This would, of course, leave a surplus book but this may be removed in the usual fashion by a deflector 55 actuated by a solenoid 56. The details of this arrangement are not shown but may follow conventional machines of this kind. Such surplus books would go down a chute 57 to a container 58.

The foregoing describes only the parts required to disclose the present invention. Good engineering would involve other parts. For example, the described electrical system normally would include relays and protective devices. The commercial form of the machine would, of course, involve details of a mechanical nature which are not required to understand the invention.

It is to be noted that the machine is entirely mechanical excepting for the limit switches 49 and 50 which must be actuated only at very infrequent intervals as compared to once for each book passed. The calipering switch 51, of course, does not operate unless a book is missing. Those parts which do operate con-

tinuously are all of a mechanical nature which may be made very strong and simply.

We claim:

1. An article counting and collecting machine including at least one container having a collecting zone for the articles, an ejector for removing the articles from said zone, means for causing said ejector to travel continuously through a looped path having a portion passing through said zone but said path otherwise being free from said zone, means for feeding the articles successively to said zone, and means for interrupting said feeding while said ejector travels through said collecting zone, the travelling speed of said ejector determining the number of articles collected in said zone, said zone being defined by an end wall and a bottom wall which declines towards said end wall so that the articles collect thereagainst, and said ejector projecting upwardly through said bottom wall, the latter having a passage for said ejector, and said looped path encircling said end wall, the first-named means comprising an endless sprocket chain and sprocket wheels guiding said chain below said bottom wall so that said chain defines said looped path, said ejector being connected to said chain and projecting therefrom to travel through said passage to engage and push the collected articles from said zone, and means for rotating said chain continuously but at variable speeds predetermined to cause said ejector to travel through said path free from said zone for time periods permitting said feeding means to feed predetermined numbers of the articles to said zone.

2. An article counting and collecting machine including at least one container having a collecting zone for the articles, an ejector for removing the articles from said zone, means for causing said ejector to travel continuously through a looped path having a portion passing through said zone but said path otherwise being free from said zone, means for feeding the articles successively to said zone, and means for interrupting said feeding while said ejector travels through said collecting zone, the travelling speed of said ejector determining the number of articles collected in said zone, said zone being defined by an end wall and a bottom wall which declines towards said end wall so that the articles collect thereagainst, and said ejector projecting upwardly through said bottom wall, the latter having a passage for said ejector, and said looped path encircling said end wall, the first-named means comprising an endless sprocket chain and sprocket wheels guiding said chain below said bottom wall so that said chain defines said looped path, said ejector being connected to said chain and projecting therefrom to travel through said passage to engage and push the collected articles from said zone, and means for rotating said chain continuously but at variable speeds predetermined to cause said ejector to travel through said path free from said zone for time periods permitting said feeding means to feed predetermined numbers of the articles to said zone, said feeding interrupting means comprising a deflector for diverting the articles fed by said feeding means away from said container, and means for activating said deflector when said ejector starts to travel through said zone and while travelling therethrough.

3. An article counting and collecting machine including at least one container having a collecting zone for the articles, an ejector for removing the articles from said zone, means for causing said ejector to travel continuously through a looped path having a portion passing through said zone but said path otherwise being free from said zone, means for feeding the articles successively to said zone, and means for interrupting said feeding while said ejector travels through said collecting zone, the travelling speed of said ejector determining the number of articles collected in said zone, and means for varying the travelling speed of said ejector to vary the number of articles which collect in said zone while said ejector is travelling free therefrom.



4. An article counting and collecting machine including at least one container having a collecting zone for the articles, an ejector for removing the articles from said zone, means for causing said ejector to travel continuously through a looped path having a portion passing through said zone but said path otherwise being free from said zone, means for feeding the articles successively to said zone, and means for interrupting said feeding while said ejector travels through said collecting zone, the travelling speed of said ejector determining the number of articles collected in said zone, said machine having means for detecting the absence of an article in the successive feeding action of said feeding means, means for interrupting the otherwise continuous travel of said ejector for a time interval compensating for said missing article, and means for activating said travel interrupting means in response to the absence of an article in the successive feeding action of said feeding machine.

5. A book counting and stacking machine including two hoppers each having a bottom wall and an end wall and arranged adjacently end to end with said bottom walls declining towards said end walls, controllable means for feeding a flow of interspaced travelling books to one or the other of said hoppers so that the books fall therein and slide flatly down to said end walls to stack one on another at a location against said end walls, a book stack pusher for each of said hoppers, means for causing each of said pushers to travel continuously and mutually synchronously 180° out of phase with the other pusher through a looped path encircling said end wall of this pusher's said hopper with a portion of said path passing through said location where said books stack therein, and means responsive to the start of each said pusher's travel through its said stacking location for controlling said feeding means to cause the latter to feed said flow to the other of said hoppers, and means for varying the travelling speed of said pushers to vary the number of books stacked prior to action of said pushers.

6. A book counting and stacking machine including two hoppers each having a bottom wall and an end wall and arranged adjacently end to end with said bottom walls declining towards said end walls, controllable means for feeding a flow of interspaced travelling books to one or the other of said hoppers so that the books fall therein and slide flatly down to said end walls to stack one on another at a location against said end walls, a book stack pusher for each of said hoppers, means for causing each of said pushers to travel continuously and mutually synchronously 180° out of phase with the other pusher through a looped path encircling said end wall of this pusher's said hopper with a portion of said path passing through said location where said books stack therein, and means responsive to the start of each said pusher's travel through its said stacking location for controlling said feeding means to cause the latter to feed said flow to the other of said hoppers, and means for detecting missing books in said flow and for varying the normal travel time of said pushers to compensate therefor.

7. A book counting and stacking machine including two hoppers each having a bottom wall and an end wall and arranged adjacently end to end with said bottom walls declining towards said end walls, controllable means for feeding a flow of interspaced travelling books to one or the other of said hoppers so that the books fall therein and slide flatly down to said end walls to stack one on another at a location against said end walls, a book stack pusher for each of said hoppers, means for causing each of said pushers to travel continuously and mutually synchronously 180° out of phase with the other pusher through a looped patch encircling said end wall of this pusher's said hopper with a portion of said path passing through said location where said books stack therein, and means responsive to the start of each said pusher's travel

through its said stacking location for controlling said feeding means to cause the latter to feed said flow to the other of said hoppers, and means for varying the travelling speed of said pushers to vary the number of books stacked prior to action of said pushers, and means for detecting missing books in said flow and for varying the normal travel time of said pushers to compensate therefor.



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