This invention relates to improvements in bunch forming and spacing apparatus. It is disclosed herein and referred to as apparatus useful at the end of envelope making machines or allied machines such as for folding writing paper sheets to package with envelopes. It is common practice to bunch the envelopes and bunch the sheets and box them together in counted bunches. The new apparatus is particularly useful as a help in such work. But the principle of the same invention is obviously adapted for analogous operations and has a scope implied by the title given to the invention.

The nearest prior art now known to applicant is shown in Patent #1,385,741 of 1921 on a Packing machine. It was found on a preliminary search of prior patents to determine the scope of this invention just before filing this application. Applicant does not know of any prior use corresponding to said patent. In this prior patent the bunching operation is carried on with shingles. Its mode of operation may be contrasted with applicant's to see the nature of the improvements.

According to a main feature of improvement the new apparatus will give its bunching effect at exceedingly high speeds. Thus in a high speed envelope making or paper folding machine the new bunch forming and spacing apparatus can take the envelopes or paper as fast as they come off the customary machines, and do the work of bunching and spacing. Other features will be better understood from examination of the detailed disclosure of the apparatus as built and used in one form.

In the drawings:

Fig. 1 is a somewhat diagrammatic view indicating the delivery end of a machine for folding paper with the structure of this invention added to operate with that kind of a known machine;

Figs. 2 and 3 are plan views showing two extreme positions of a movable tray embodying two bottom portions in relation to a stationary bunch forming chute, the boundary walls of the chute being shown in section. The showing of Fig. 3 has been moved to the right for convenience in making this view. It should be imagined as having the chute walls 7 of Fig. 3 directly below those of Fig. 2.

Fig. 4 is a view mostly in section showing a suitable form of mechanism to give the movable tray timed movements.

Fig. 5 is a diagram indicating an electric circuit and magnet operated means for parts indicated in Figs. 1 and 4.

Referring to Fig. 1, A represents the delivery belt conveyor of a machine for folding sheets of writing paper. The usual conveyor is made of narrow spaced bands. They pass around the rear metal roller 1 with spaces between them. An electric contact brush 2 bears on the roller between the bands. As each folded sheet enters under the brush it breaks the contact. This successive contact breaking, operates a counter as will be explained. Successive sheets are projected from the conveyor for delivery into the top of a chute 3. The structure and mechanism related to this chute, particularly its bottom tray part, embodies the main features of the invention.

The chute 3 is provided with a deep bottom 4 and a shallow bottom 5 carried by the same frame 6 formed like a tray. The chute has skeleton walls 7 which may be obviously adjustable for different dimensions of sheets. The deep bottom is shown in its position to function as the chute bottom in Fig. 1. The shallow bottom 5 is out of operating position in Fig. 1. The plan of two bottoms 4 and 5 is seen with relation to the other walls of the chute which are in skeleton form in Figs. 2 and 3. Below the chute is a "take away" conveyor 8 on which the finished bunches are dropped intermittently from the deep bottom 4 of the chute. This conveyor has any suitable drive not shown, to space the bunches as they are taken away for packing.

The frame or tray 6 carrying the two bottoms 4 and 5 is mounted to slide in grooves merely indicated in Fig. 1. It has an automatic cycle from the full to the dotted and back to the full line position, merely indicated in Fig. 1. This is accomplished by one full rotation of wheel 9 carrying pivotal arm 10 shown with its connected links 11 and 12, and with arm 11 pivoted on fixed pin 13. The one full rotation is given automatically as each bunch of sheets is completed according to the counting device. The wheel 9, as will be explained, is held stationary while a bunch of sheets is being completed on bottom 4.

The make and break contact operated by successive sheets operates a magnet 14 to operate a ratchet device 15, Fig. 5. The ratchet device carries a switch contact 16. So if the ratchet wheel is made with a number of teeth, 12 for example, corresponding to the number of sheets wanted in a completed bunch, the contact 16 closes the circuit for the second magnet 17 in a clutch, see Fig. 4. On being energized magnet 17 pulls lever 18, to move a clutch member 19, keyed
on shaft 20, and glides it against clutch spring 21 for dogs 22 to engage between the two clutch members 19 and 23. The member 23 is constantly driven by gear 24 integral with it and loose on shaft 20. The member 23 drives the other member 19 keyed to shaft 20. As the keyed member 19 is pulled over to engage the driving member 23, a dog 25 on the hub of member 19 is pulled out of a recess lock 26 in stationary block 27. Shaft 20 can then rotate once. The timing is such that magnet 17 is deenergized before the one rotation of shaft 20 is completed. So that clutch spring 21 separates the clutch members 19 and 23 and one is again locked into the recession 25 as dog 25 returns to aligned position. When the clutch rotates once the shaft 20 and crank wheel 9 rotate once. This gives the cycle of movements to the two bottoms 4 and 5 with relation to the chute 3 of Fig. 1.

With the above described structure in mind the full operation can now be clearly understood.

Referring to Fig. 1; assume that the desired work is to continually take the sheets B delivered from the folding machine, put them up into counted bunches of twelve, and carry succeeding bunches to a packing station with the bunches spaced apart for rapid handling in the packing operation.

When twelve sheets are counted and bunched as in Fig. 1 at B, the deep bottom 4 and the shallow bottom 5 are simultaneously moved to the left. The bunch of twelve sheets is dropped onto the take-away conveyor 3 from bottom 4 as it moves to the left. Simultaneously other sheets are starting the next bunch on the shallow bottom 5. As a continuous movement and following these two operations the shallow bottom 5 will drop its bunch starting pile onto the deep bottom 4. Then this cycle of movement stops until the counting mechanism starts another identical cycle at the end of the count for each succeeding bunch of 12. The take-away conveyor 3 is driven at a speed to make any desired spacing between bunches as desired. As viewed in Fig. 1 the top flight of conveyor 3 moves away from the back wall 1, the latter being shown. The front wall is cut away enough to permit removal of the bunch.

In Fig. 1; the belt A, the rolls A' indicate usual practice for the device being the delivery end. Rolls A' merely hold the work in contact with the belt. A spring S' indicates a means to guide the paper as it leaves the belt so it will drop properly into chute 3 at high speed. It is to be understood that the frame or tray 5 is guided in suitable grooves indicated 51 in a frame on the apparatus. This frame is not shown in any detail as a full showing would tend to confuse the drawings. Shaft 20 is mounted in bearings of the clutch box C as in Fig. 4 and this box is supported by frame parts a piece of which is indicated at F. It so happens that an old form of sheet folding machine to which the invention in the example described has been added has room enough; room under the end conveyor to mount the apparatus as described. It is an apparatus which is easily applied as an addition or accessory to other apparatus. And it is understood that the addition will vary to suit the style of machine to which it is applied for the bunch forming and spacing purpose.

It will be seen that when bottom 5 goes into sheet receiving relation to the chute walls 7, as in Fig. 2, the bottom 4 goes out of such relation, and the bunch is stripped off to fall on conveyor 8. Conversely when the parts go into the relation of Fig. 2 the few sheets accumulated on bottom 5 are stripped off to fall on bottom 4. And it will be understood also that while belt A of Fig. 1 will be continually running at high speed with counted sheets on it, the count as stated will be correct. It is only necessary to get the apparatus started right and it will follow that every count of twelve, see ratchet wheel 15 in Fig. 5, will trip the clutch of Fig. 4 to give the operation stated. The apparatus will start right after one bunch is delivered to the chute. The accumulation of more than twelve between bottom 4 and counter fingers 2 will not matter. In fact it is the speed of this sort of delivery that makes the two bottomed chute and its manner of operating particularly useful. The number of the count for the bunch is readily changed as desired by changing the ratchet wheel 15 and giving it teeth corresponding to count desired.

Sometimes, depending on the nature of the articles or sheets being bunched, it is useful to have a device to push the bunched sheets B downwardly when they are about to be dropped on conveyor 3. The reason for this is that if the articles are of light-weight the bunch may not fall fast enough to get the upper sheets started past the level of bottom 4 before it returns. The motion of the tray 3 is rapid. The device for pushing the bunch down from the top is indicated in Fig. 1. It consists of one or more pieces of thin spring wire, each one folded back on itself as indicated. Such a device may be fastened on the bottom 5, on their under side. It may be assumed that such one device is fastened as shown in Fig. 1 at point 29 under each finger. The one indicated in Fig. 1 will make the structure and operation clear. The spring device 30 here shown has the rear end of its top portion fastened to bottom 5 as stated. The spring extends to the left, is bent back on itself and the lower portion at its rear end is provided with a depending flange 31. As bottom 5 is moved to the left, flange 31 is engaged by a stationary stop 32. The latter may be fastened in position on the wall portions 7 to extend out at the sides in the path of flange 3. Flange 3 engaged by stop 32 holds against the stop. But bottom 5 continues to move the rest of the spring device 30 after such engagement. The device is caused to bend out and wipe down against the top sheet of the bunch of sheets B and give it a spring push downwardly. This gets the sheets B down by the movement of bottom 5 with the device 30 on its bottom side to prepare for the return of bottom 4. The action of device 30, when both ends of the hair pin like structure is held as stated, is to tip the forward end downwardly for the patter action on top of bunched sheets B.

The principles of the apparatus disclosed in one convenient form can obviously be applied also in various other forms. The application results in carrying on bunching with a minimum and exceedingly high speed machines. Envelope and paper folding machines are commonly operated at exceedingly high speeds. Whereas heretofore the product has been counted and bunched automatically, the bunches have not been separated in the same size for the action. That is one bunch might be offset slightly, or a count might indicate where separation should be made. The general plan has been to run all the bunches together in a substantially continuous pack. In the new way of carrying on the bunching operations, there is an advantage in the ease with which the packing operations can be done. The bunches
are in substantially spaced relation and can be handled faster and easier at the packing station.

I claim the invention with the scope pointed out by the following claims:

1. A bunch forming and spacing apparatus comprising a delivery belt arranged for continuous travel, a generally stationary chute above the belt to receive and guide the vertical drop of successive sheets delivered by another machine, two vertically spaced movable bottoms for the chute one a substantial distance below the other, the lower one positioned for successive sheets to form in the chute as a counted bunch, the higher one positioned for a few sheets to form a smaller bunch when the lower one is removed to drop the counted bunch, a counter controlled mechanism for moving simultaneously, the lower bottom out of and the higher bottom into, their bottom functioning positions with respect to the chute, whereby when a bunch of predetermined number has accumulated on the lower bottom, such bunch may be dropped on said belt while a succeeding bunch starts forming on the higher bottom, said counter controlled mechanism being operable to return simultaneously, the lower bottom into and the higher bottom out of, said functioning positions whereby the sheets accumulated on the higher bottom are dropped to the lower bottom on which the counted bunch may be completed, all constructed and arranged to take rapid delivery of sheets from a high speed machine for bunch forming and spacing purposes.

2. A sub-combination for forming bunches of sheets, a vertical chute adapted to take rapid delivery of successive sheets from an automatic machine, two vertically spaced bottoms for said chute one a substantial distance below and offset from the other, means connecting said two bottoms for shifting them periodically and simultaneously crosswise of the chute, one out of and one into bottom forming position with respect to the chute, all constructed and arranged to start forming a bunch on the higher bottom, finish it on the lower bottom, and deposit a finished bunch from the chute, in conjunction with rapid running machines delivering sheets to said chute.

3. Automatic bunching apparatus for sheets comprising, a chute having two movable bottom walls, spaced apart longitudinally of the chute more than the thickness of a bunch to be formed, and a mouth to feed the chute with sheets, positioned above the higher of said two bottom walls, a frame carrying both bottom walls for simultaneously moving one across the chute into bottom wall position and the other away from such position, whereby first one and then the other is in position for forming bunches on it as sheets are fed into the mouth of the chute and a finished bunch may be removed from the end of the chute opposite its mouth while a bunch is being started on the higher of the two bottom walls.

4. The combination of a chute adapted as a receptacle to receive sheets from an automatic machine, a movable bottom wall on which sheets may be accumulated as a bunch, means to remove and return said bottom so as to drop a finished bunch, said means carrying a second and substantially higher bottom wall and operable to insert the latter in the chute temporarily while the finished bunch is being dropped, the bottoms being positioned for the temporary one to drop sheets accumulated on it to the other one when the latter is returned to position, and automatic intermittently operated mechanism adapted to be controlled from a sheet counting device to accomplish the relative movements of said two chute bottoms to the chute and to each other for the purpose described.

5. In apparatus for the purpose described, a bunch forming chute having two horizontally and vertically offset bottoms between which a counted bunch may be formed, means to alternately and simultaneously move said bottoms into functioning position and out again with relation to the chute in receiving position, counter controlled means to do so when a full bunch is resting on the lower bottom, all adapted for the upper bottom to accumulate a partial bunch while the lower bottom is dumping a full bunch and to deposit the partial bunch upon the lower bottom when the latter is returned to receiving position, and means to time said cycle of movements for one operation as each full counted bunch is completed on the lower bottom.

6. The structure of claim 5 with a pattern device to engage the top of the full bunch and help it drop at the beginning of the bunch dropping operation.

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