

E. E. GRAY.

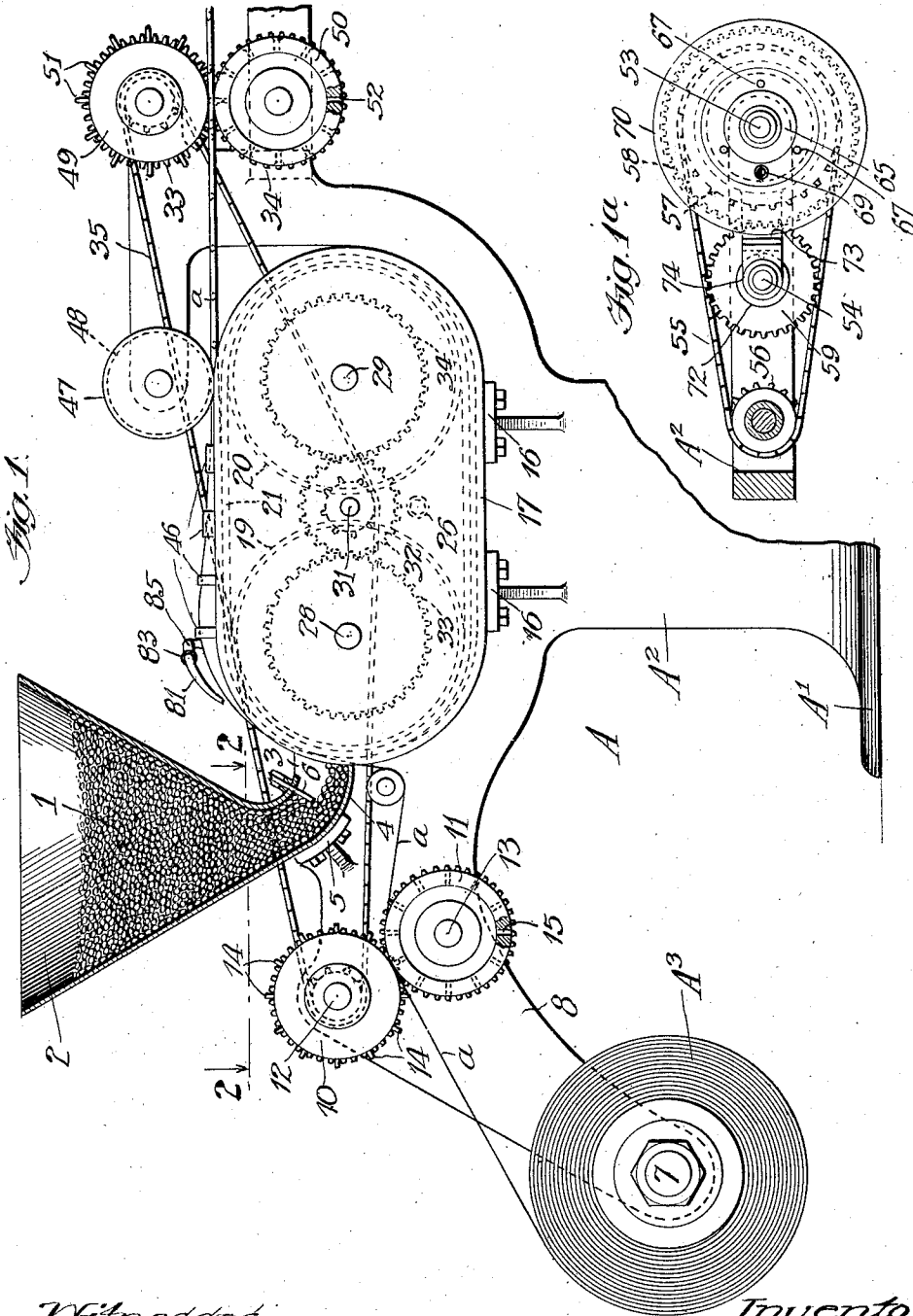
MACHINE FOR AND METHOD OF FORMING SEEDTAPE.

APPLICATION FILED MAY 27, 1916. RENEWED APR. 27, 1920.

1,364,050.

Patented Dec. 28, 1920.

3 SHEETS—SHEET 1.



Witnesses  
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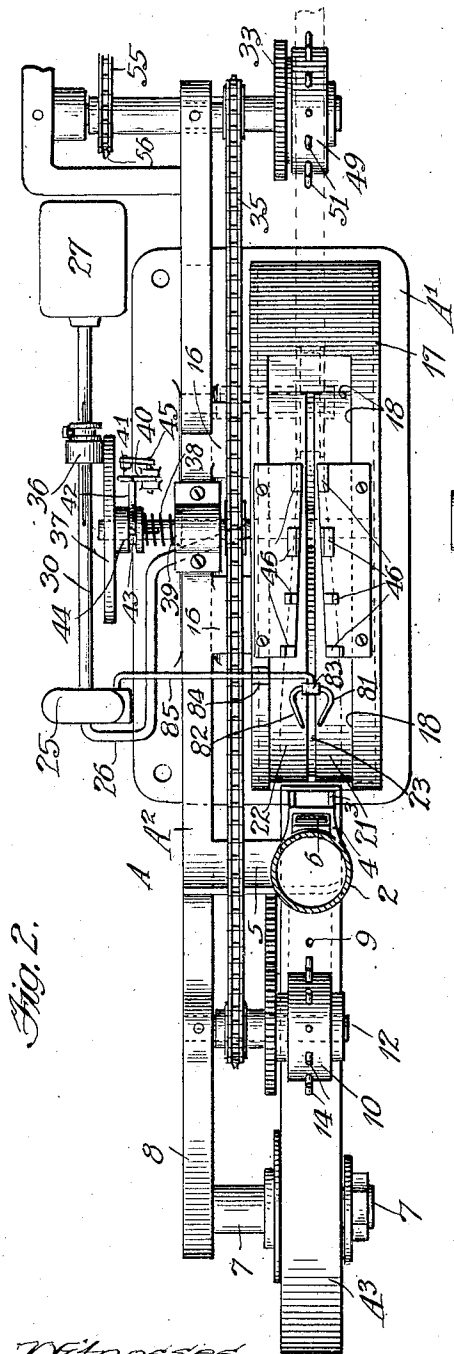


Fig. 2.

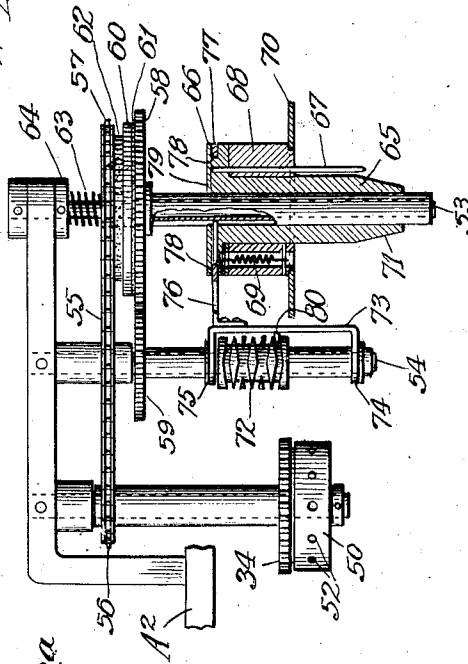


Fig. 2a.

Witnesses  
Martin H. Olsen.

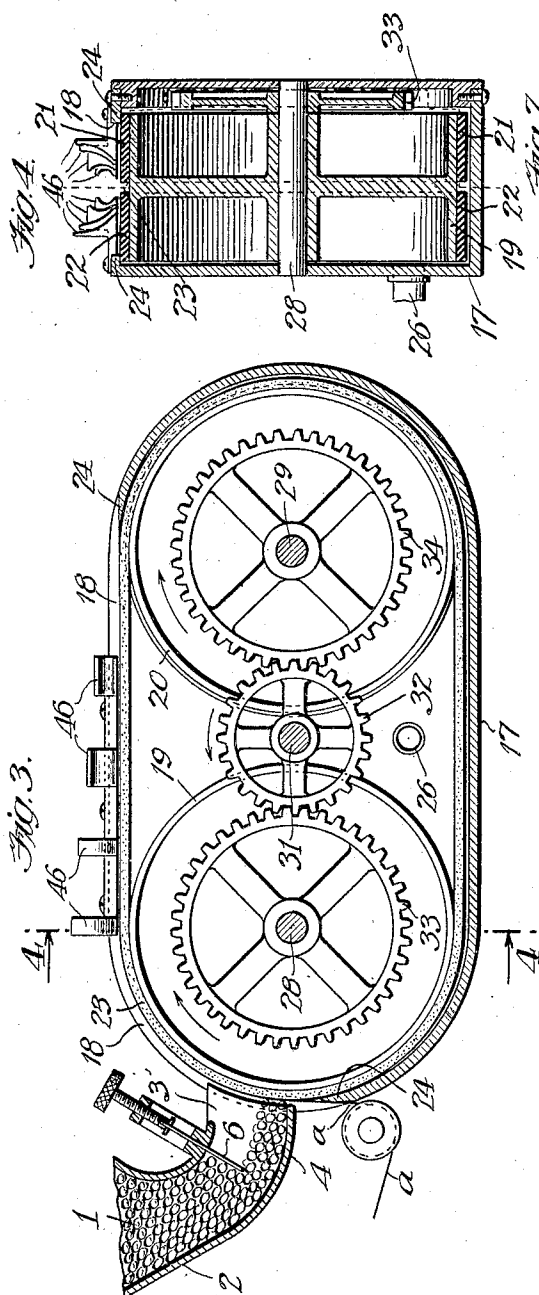
Edna A. Olson.

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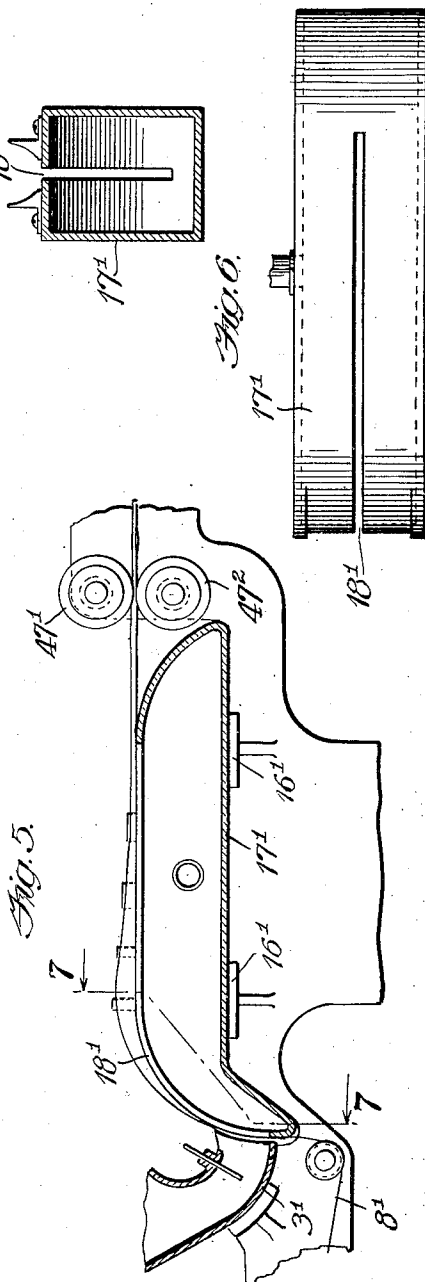
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3 SHEETS—SHEET 3.



Witnesses  
Martin H. Olsen.  
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Att.

# UNITED STATES PATENT OFFICE.

EDWARD E. GRAY, OF PLANO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO  
AMERICAN SEEDTAPE COMPANY, OF NEWARK, NEW JERSEY, A CORPORATION  
OF NEW JERSEY.

## MACHINE FOR AND METHOD OF FORMING SEEDTAPE.

1,364,050.

Specification of Letters Patent.

Patented Dec. 28, 1920.

Application filed May 27, 1916, Serial No. 100,228. Renewed April 27, 1920. Serial No. 377,015.

*To all whom it may concern:*

Be it known that I, EDWARD E. GRAY, a citizen of the United States, and resident of Plano, in the county of Kendall and State of Illinois, have invented new and useful Machines for and Methods of Forming Seed-tape, of which the following is a specification.

This invention relates to machines for and methods of forming seedtape.

For convenience in planting, to avoid the waste of seeds due to planting an excessive number of seeds, as is almost universally the case where seeds are dropped by hand, and to eliminate the work incident to thinning out or removing superfluous plants after the plants have attained some size, so that they will not crowd and impair the growth and development of each other, seeds of various kinds are, at the present time, incased in a continuous envelop of suitable light paper, or the like, said paper being of such texture that it will readily disintegrate when subjected to moisture, as the moisture of the soil in which the seeds are planted, thus permitting the seeds to germinate and grow in the usual way.

A primary object of the invention is to provide improved and simplified means, in a machine of this general type, for depositing the seeds contained in a receptacle or hopper upon the tape material preliminary to folding said tape material to inclose said seeds.

A further object of the invention is to dispense with the use of glue for securing the tape material in folded position so as to retain the seeds within the envelop formed thereby.

Still further objects of the invention are to provide improved and simplified means for driving the machine, whereby it may be quickly and conveniently started and stopped, as when it is desired to remove a roll of tape from the machine and to start a new roll; and to provide an improved reeling device for forming the tape into rolls when finished.

To effect these various objects, a machine embodying my invention and suitable for practising my improved method comprises the various features, combinations of features and details of construction hereinafter described and claimed.

In the accompanying drawings, in which my invention is fully illustrated,

Figures 1 and 1<sup>a</sup> together constitute a side elevation of my improved machine, parts thereof being shown in section to expose other parts concealed thereby,

Figs. 2 and 2<sup>a</sup> together constitute a top plan view of my improved machine, the seed hopper being shown in section on the line 2—2 of Fig. 1,

Fig. 3 is an enlarged view of the casing forming the suction chamber, and associated parts of my improved machine, whereby the tape material is subjected to suction during a period of its travel,

Fig. 4 is a sectional view thereof on the line 4—4 of Fig. 3,

Fig. 5 is a fragmentary, sectional, side view of a machine for forming seed tape embodying my invention in modified form,

Fig. 6 is a top plan view of the casing forming the suction chamber of the machine shown in Fig. 5, and

Fig. 7 is a section on the line 7—7 of Fig. 5.

Referring now to the drawings, A designates, as a whole, the frame of my improved machine, comprising a supporting base A' and an upright member A<sup>2</sup> made in the form of a web upon which the different parts of the machine are mounted.

The seeds upon which the machine is designed to operate, designated 1, are contained in a hopper or receptacle 2, the lower end of which is shaped to form a lateral extension 3, the bottom of which is inclined as shown at 4, the weight of the seeds contained in said hopper operating to force the seeds toward the open discharge side of said extension 3. As shown, said hopper 2 is mounted upon and supported by bracket 5 which projects laterally from the upright frame member A<sup>2</sup>.

The passage of the seeds from the hopper 2 to the lateral extension 3 thereof is controlled by means of a sliding gate 6, whereby the depth of the layer of seeds at the discharge end of the lateral extension of said hopper may be controlled as desired.

The tape material, preferably thin, light paper, or the like, indicated at *a*, is drawn, in the form of a continuous web, from a suitable source of supply, as from a roll A<sup>3</sup>

adapted to be rotatably mounted on an arbor 7 secured in an arm or bracket 8 which extends frontward and downward at the front end of the upright frame member A<sup>2</sup>.

5 In its passage through the machine, said tape material is guided across and into close proximity to the open or discharge side of the lateral extension 3 of the hopper, the relation being such that the seeds contained  
10 in said lateral extension of the hopper will rest in contact with said strip of tape material.

As the tape material *a* passes across the discharge opening of the hopper, seeds are  
15 caused to adhere to the surface of said tape material at predetermined, spaced intervals in the following manner:—Before said tape material *a* passes across the discharge opening of said hopper, small holes or perforations 9 are formed therein at intervals cor-  
20 responding to the desired spacing of the seeds on said tape material. Said perforations in said tape material may be formed before it is wound into the roll A<sup>3</sup>, but I preferably provide perforating means as a part of my improved machine, located between the roll A<sup>3</sup> and the discharge end of the hopper. As shown, said perforating means consists of perforating wheels 10 and  
25 11 rotatably mounted in studs 12 and 13 secured in the upright frame member A<sup>2</sup>, between which the tape material passes, one of said perforating wheels, as shown the wheel 10, being provided with what may be  
30 called projecting pins 14 which are adapted to enter holes 15 formed in the perforating wheel 11 and which will cooperate to form holes in the strip of tape material as it passes between said perforating wheels.

40 As said strip of tape material passes across the discharge opening from said hopper, it is subjected on its outside to a suction which, acting through the holes or perforations 9 therein, will cause a seed or seeds  
45 to adhere to said tape at each of said openings or perforations, the suction being also continued for a considerable time after said tape material with the seeds adhering thereto, passes the discharge end of said hopper  
50 and during the time that the tape material is being folded as will presently be described.

While my invention contemplates any desired or approved means for thus subjecting  
55 said strip of tape material to suction, what I now consider to be the preferable means for this purpose are shown in Figs. 1-4 of the drawings, which are as follows:—Mounted in fixed position on the frame of the machine,  
60 as on brackets 16 which project laterally from the upright frame member A<sup>2</sup>, is a casing 17, which is closed excepting for an opening 18 formed in the top and in the side thereof adjacent to the discharge opening of  
65 the hopper. Rotatably mounted within said

casing are flat-faced wheels 19 and 20 adjusted to which are belts 21 and 22, the aggregate widths of said belts being less than the width of said wheels and which, in operation, are spaced apart, forming a cen-  
70 tral opening 23 between said belts. At their outer edges, the wheels 19 and 20 and the belts 21 and 22 run under inwardly projecting shoulders 24 formed at the edges of the opening 18 in said casing 17, the size of  
75 the wheels 19 and 20 and the thickness of the belts 21 and 22 being such that the outer surface of said belts will run into close proximity to said shoulders 24 throughout the length of said opening 18.

In its passage through the machine, the tape material *a* runs in the opening 18 in the casing 17 and rests in contact with the belts 21 and 22 throughout the length of said slotted opening 18, the relation being  
80 such that throughout the length of said slotted opening, the holes or perforations 9 in said tape material will communicate directly with the slot or opening 23 between the belts 21 and 22.

Suction is adapted to be maintained within the casing 17 by means of a suitable fan or blower, indicated at 25, the suction opening of which is connected with the chamber formed by the casing 17, by a suction pipe  
85 26. Said fan or blower 25 is driven continuously from any suitable source of power as by a motor 27, which, as shown, is connected directly to said fan or blower.

As shown, the wheels 19 and 20 are se-  
90 cured to rotate with shafts 28 and 29, which, together with the perforating wheels 10 and 11 are driven by means of suitable driving connection with the motor shaft 30. As shown, said driving connections comprise  
95 a main driving shaft 31 which is driven directly from the motor shaft 30, a pinion 32 secured to which meshes with gear wheels 33 and 34 secured to rotate with the shafts 28 and 29, respectively, said pinions and gear wheels being preferably located inside  
100 of the casing 17, which comprises a removable side to provide for access to the chamber formed by said casing for assembling the parts contained therein and for other de-  
105 sired purposes. The perforating wheels 10 and 11 and corresponding wheels at the opposite side of the casing 17, presently to be described, are driven from said shaft 31 by means of a chain belt 35 adjusted to sprocket  
110 wheels secured to rotate with the driving shaft 31 and with one of each set of perforating wheels, the members of each set of perforating wheels being connected so as to rotate together with the same peripheral  
115 speed by intermeshing gears secured to rotate with the wheels of each set of said perforating wheels.

Also, to provide for operating the ma-  
120 chine at different rates of speed to adapt it  
125 130

for use with different kinds of seeds, the driving shaft 31 is driven by means of a friction pulley 36 on the motor shaft 30, which is designed to contact with the face of a friction disk 37 mounted to rotate with the driving shaft 31, said friction pulley being adjustable endwise on the motor shaft 30 to cause it to engage the face of the friction disk at a greater or less distance from its center, whereby the rate of rotation of the friction shaft and thus the speed of the machine may be varied—either increased or decreased as it may be desired to meet the requirements of any particular case.

Also, to provide for stopping the machine when desired without stopping the fan or blower 25 or in any way interfering with its operation, the friction disk 37 is mounted on the driving shaft 31 so as to be movable endwise thereon toward and from the friction pulley 36, said friction disk being maintained yielding in contact with the friction pulley 36 by means of a coiled spring 38 inserted between the hub of said friction disk and a collar 39 secured to the driving shaft 31. The friction disk 37 is adapted to be retracted against the force of the spring 38 to disengage it from the friction pulley 36 by any suitable means, preferable means for the purpose consisting of a bell-crank lever 40, which may be pivoted to the base A' of the machine frame or other suitable support, formed on the end of the upright arm 41 of which is a yoke 42 which embraces the sides of a hub on the friction disk 37, pins 43 secured in which engage a circumferential slot 44 formed in the hub of the friction disk 37. The other arm 45 of the bell-crank lever 40 is so positioned that said lever may be conveniently manipulated by the foot of the operator to retract the friction disk and thus stop the machine.

During the time that the seeds 1 are held on the tape material *a* by the suction within the chamber formed by the casing 17—that is while they are passing over the belts 21 and 22, they are subjected to the action of folding devices whereby the edges thereof are turned upwardly and inwardly so as to overlap and inclose the seeds held on said tape material. As shown, said folding devices consist of a series of spaced plates 46, secured to the casing 17 and arranged in pairs at opposite sides of the central opening 23 between the belts 21 and 22, whereby the longitudinal section of said tape material *a* in which the perforations 9 are formed and to which the seeds 1 adhere, will always extend over and cover the space 23 between said belts, thus at all times maintaining the suction on said tape material and holding the same from lateral displacement under the action of said folding guides. As shown, there are four sets or pairs of said

folding plates or guides 46, the adjacent ends or edges of the first or front set of said plates or guides being curved to impart a substantially trough-shape to said tape material, and succeeding sets or pairs of said plates being arranged successively closer together and being provided in their adjacent edges with notches of successively shorter radius, whereby the edges of said strip of tape material will be turned in upon the central portion thereof and will overlap each other. After passing through the folding plates or guides, said tape material will form what may be described as a flat tube in which the seeds will be inclosed. While I consider the form of folding device shown to be preferable, I do not desire to limit myself thereto, as my invention contemplates the use of any desired or approved form of folding device.

From the folding devices, by which a flat tubular shape has been imparted to said tape material, as aforesaid, said tape material passes beneath a pressure roll 47, mounted on a stud secured in the upright frame member A<sup>2</sup>, and which runs in close proximity to the belts 21 and 22 directly above the rear belt wheel 20, which will operate to flatten and set the folds of said tape material. To prevent crushing of the seeds inclosed within the folds of said tape material, said pressure roll 47 is provided with a circumferential groove 48 of sufficient width and depth to permit the passage therethrough, without crushing, of the seeds contained within said folded tape material.

To effect the object of the invention as it relates to dispensing with glue for securing the folds of the tape material together, I provide means for punching holes through the folded tape material, intermediate the seeds contained therein, using for the purpose a blunt punch or punches which will not cut the paper but will form what may be described as burred holes in the folds of said tape material and will operate to force the burred edges of the holes in the overlying folds through the holes formed in the lower folds, which will operate, in an obvious manner, to secure and hold the folds of said tape material together in folded position with a sufficiently strong connection to permit said seed tape to be handled in the usual way without breaking the connection between said folds, particularly when the burred edges of said holes have been flattened and crushed together, as they will be in the process of winding the finished seed tape into rolls preparatory to packing the same into boxes or cartons for sale and use, as presently described. As shown, the means for thus punching holes through the folded tape material are sub-

stantially similar to the perforating wheels 10 and 11, comprising wheels 49 and 50 between which the folded seed tape passes. One of said wheels, as shown the wheel 49, is provided with projecting pins or punches 51, the ends of which are blunt or rounded, and the wheel 50, is provided with holes 52 adapted to loosely receive the pins or punches 51. Said punch wheels are driven from the driving shaft 31 by means of the chain belt 35 which is adjusted to a sprocket wheel secured to rotate with the punch wheel 49, and by the gears 33 and 34 secured to rotate with said punch wheels, respectively, all substantially in the same manner as the perforating wheels 10 and 11 are driven, the relation being such that said punch wheels shall rotate at the same peripheral speed as each other and also as the other driven parts operating on said tape material. Also, in order that the punches or pins 51 shall not injure the seeds contained in the seed tape, the punch wheels are so adjusted axially that the pins or punches 51 will penetrate the folds of the tape material between the seeds inclosed therein.

From the punch wheels 49 and 50, the finished seed tape passes to the winding device or reel by means of which it is wound into rolls or coils, which, as fast as they are formed, are removed from said winding device or reel and packed in boxes or cartons for sale and use. As shown, the construction of said winding device or reel is as follows:—Rotatably mounted in suitable bearings formed in bearing bosses on the upright frame member A<sup>2</sup> are shafts 53 and 54, of which the shaft 53 is driven by means of a chain belt 55 adjusted to sprocket wheels 56 and 57, one of which is driven by means of a suitable friction device and the relation being such that said winding device will be driven at such a rate of speed that, normally, it will tend to wind the tape faster than said tape travels through the machine, thus permitting said winding device to automatically adjust or accommodate itself to the feed of the machine as the size of the roll being formed varies, the take up of said roll becoming greater as its size increases. Obviously, also, said friction device will maintain the said tape under desired tension while it is being wound into rolls. The shaft 54 is driven from the shaft 53 by means of gears 58 and 59 secured to said shafts, respectively, so as to rotate therewith.

As shown, the friction device for driving the shaft 53 comprises a glass disk 60 secured to one side of the gear wheel 58 secured to said shaft, a thin felt cushion 61 being preferably interposed between said glass disk 60 and gear wheel 58, and secured to the side of the sprocket wheel 57 adjacent to said glass disk is a felt pad 62, which is

adapted to be held in frictional engagement with said glass disk by means of a spring 63 inserted between a collar 64 secured to the shaft 53 and the side of said sprocket wheel 57 opposite to that to which said felt pad 62 is secured.

Splined to the shaft 53 is sleeve 65 formed at the inner end of which is a head 66 secured in which are pins 67, which extend parallel with the axis of the shaft 53, and are spaced a short distance from the surface of the sleeve 65, and on which the finished tape is wound directly. Slidably fitted to the sleeve 65 is a collar 68, which is held yieldingly in contact with the head 66 on said sleeve by means of springs 69, the ends of which are connected to rigid parts of said head and collar. Said springs are made of such length relative to their points of attachment to said head and collar that they will always be under tension. As shown, the springs 69 are positioned in holes formed through said collar 68 parallel with its axis. The pins 67 are slidably fitted to holes formed through said collar 68 and are of such length that, when said collar 68 is in contact with the head 66 on said sleeve, said pins will project, at the front side of said collar, a sufficient distance to permit a roll of tape of desired size to be wound thereon.

The finished tape is wound directly upon the pins 67 and while it is being wound into rolls or coils, is supported by a disk 70 secured to the front end of the collar 68. The pins 67 will operate, in an obvious manner, to impart rotation to the collar 68 with the shaft 53.

The sleeve 65 is somewhat longer than the pins 67 and its front end, which projects beyond the ends of said pins, is tapered or leveled, as shown at 71.

The function of the pins 67 is, primarily, to provide convenient means for engaging the end of the seed tape with the sleeve 65 when the roll is started, this being effected by inserting the end of said seed tape between one of said pins and said sleeve and then turning said end back to loop it around said pin.

The function of the collar 68 and disk 70 is to facilitate the removal of the finished rolls of said tape from the sleeve 65, or more properly, from the pins 67, this being effected by drawing the collar 68, carrying the disk 70, frontward to force the finished roll off from said pins. Said collar is then released, whereupon the springs 69 will return it to its operative position in contact with the head 66.

The machine is stopped after the formation of each roll and remains idle during the time said rolls are being removed and the end of the tape engaged with a pin 67 for the start of a new roll.

To provide for winding the seed tape in

coiled layers back and forth on said pins 67, means are provided for imparting a traverse to the sleeve 65. As shown, the means for thus imparting a traverse to said sleeve are as follows:—Formed on or secured to rotate with the shaft 54 is a screw 72 comprising right and left hand threads, the ends of which are connected or run into each other. Supported adjacent to said screws 72 so as to be freely movable transversely of the machine, is a carriage pivotally mounted on which is a shoe adapted to engage the screw threads of the screw 72. As shown, said carriage consists of a plate 73 which extends over the screw 72 and is supported upon and connected to the shaft 54 by means of the downwardly turned ends 74 and 75 thereof, said downwardly turned ends being provided with suitable bearings slidably fitted to said shaft. The distance between the downwardly turned ends 74 and 75 of said traverse plate 73 is sufficiently greater than the length of the screw 72 to provide for movement of said plate 73 under the influence of said screw 72. The traverse plate 73 is connected to the sleeve 65 by means of a plate 76 which extends upwardly therefrom and formed at the upper end of which is a ring 77 which is confined in a groove 78 formed in the head 66 at the inner end of said sleeve 65. To provide for engaging the ring 77 with the groove 78, one side of said groove is formed by a collar 79 removably secured, as by a set screw, to the sleeve 65.

Pivoted to the traverse plate 73 is a shoe 80 which engages the screw threads of the screw 72, said shoe being elongated and so shaped that it will follow the screw threads of said screw and will pass freely from one section to the other thereof.

To provide for detaching surplus seeds which may be caused to adhere to the tape material by the suction in the casing 17 and returning such detached seeds into the lateral extension 3 of the hopper 2, I provide a nozzle or nozzles adapted for discharging a jet or jets of air along the exposed surface of the tape material, to which the seeds adhere, as it passes above the discharge opening from said hopper, said air jets being directed into the open discharge end of said hopper, whereby the seeds detached will be returned to said hopper. As shown, there are two nozzles 81 and 82 at the ends of a bifurcated tube 83 which is rigidly supported in a bracket 84 on the casing 17 of the suction chamber, preferably in such manner that it may be adjusted bodily endwise and secured in any desired adjusted position, as by a set screw, whereby the operative force of the air jets from the nozzles 81 and 82 on the seeds may be regulated. The pipe or tube 83 is connected with the discharge side of the fan or blower 25 by means of a flexible hose 85. In practice, only a

portion of the air discharged from the blower 25 will be discharged through the pipe 83, as otherwise air jets of excessive strength would be produced.

The perforating wheels 10 and 11, the pressure roll 47, the punch wheels 49 and 50, and the winding or reeling mechanism will cooperate to feed the tape material through the machine. My invention, however, contemplates the use of a separate feed mechanism, if desired.

As a modification of my improved machine, I contemplate dispensing with the wheels 19 and 20 and the belts 21 and 22 adjusted thereto, and forming the suction slot in the casing of the suction chamber directly in the front and top sides of said casing.

This modification is shown in Figs. 5 to 7, inclusive, of the drawings, in which A<sup>4</sup> 85 designates the frame of the machine, a' the tape material, 3' the lateral extension at the lower end of the hopper, 17' the casing forming the suction chamber, said casing being mounted on bracket 16' on the frame 90 A<sup>4</sup>, in substantially the same manner as the casing 17 is mounted on the brackets 16 in the form of the device shown in Figs. 1 to 4.

In said modified form of my improved machine, the tape material, having been 95 perforated, is guided across and in close proximity to the discharge opening from the hopper and over the front end and top of said casing 17', said casing being provided with a suction slot 18' through which 100 the perforations in said tape material will be subjected to suction from within the casing 17'.

Said modified form of machine will also comprise means mounted on said casing 17' 105 for folding the tape material while subjected to the suction of the suction chamber formed by the casing 17', pressure means for flattening and setting the folds of the tape material punching means and winding 110 ing means, all of which may be of any usual or desired construction. As regards the folding, punching and winding means I contemplate means similar to the corresponding parts of the preferred form of 115 machine heretofore described. As regards the pressure means for flattening and setting the folds of the tape material without crushing or injuring the seeds, I prefer to substitute for the grooved pressure roll 120 47, two opposed rolls 47' and 47<sup>2</sup> between which the folded tape material, with the seeds inclosed therein, passes. To avoid crushing the seeds, said pressure rolls 47' and 47<sup>2</sup> are made of soft rubber provided 125 with suitable metal bearing bushings which will yield as the seeds pass between them, thus subjecting the tape material to desired pressure without crushing or otherwise injuring the seeds.

Seed tape, such as my improved machine is designed for making, forms the subject-matter of a separate application for U. S. Letters Patent filed by me in the Patent Office concurrently herewith, Serial No. 100,227, filed May 27, 1916, to which reference is made for a description thereof.

In carrying out the novel method with the aid of the apparatus above described, the strip of package forming material or tape A is withdrawn continuously from the supply A<sup>3</sup>, said tape being either previously perforated or perforated by suitable perforating means, one form of which has been described. The perforated strip is then drawn past the supply of seeds while suction operates through the perforations to select seeds from the supply and the seeds thus selected and retained at the perforations are secured in permanent position on the strip either while the suction still operates or immediately thereafter. Obviously, the carrying out of the novel method is not dependent upon the specific form of machine hereinabove described and shown in the drawings attached hereto. For example, the method may also be practised in its broadest form by means of the apparatus shown and described in applicant's allowed application Serial No. 257,670 which is a renewal of applicant's original corresponding application Serial No. 101,003 filed May 31, 1916.

I claim:—

1. In a machine for forming seed tape, the combination of means for depositing seeds upon perforated tape material, and means for subjecting said tape material to suction whereby seeds deposited thereon will be caused to adhere to the perforations in said tape material.

2. In a machine for forming seed tape, the combination of means for depositing seeds upon perforated tape material, means for folding said tape material, and means for subjecting said tape material to suction whereby seeds deposited thereon will be caused to adhere to the perforations in said tape material, said suction being continued during the folding of said tape material.

3. In a machine for forming seed tape, the combination of means for depositing seeds upon perforated tape material, means for folding said tape material, means for subjecting said tape material to suction whereby seeds deposited thereon will be caused to adhere to the perforations in said tape material, said suction being continued during the folding of said tape material, and means for securing said tape material in folded position.

4. In a machine for forming seed tape, the combination of means for depositing seeds upon perforated tape material, means for folding said tape material, means for subjecting said tape material to suction

whereby seeds deposited thereon will be caused to adhere to the perforations in said tape material, said suction being continued during the folding of said tape material, and means for securing said tape material in folded position, said means comprising a punch adapted for punching holes through the folds of said tape material and to force the edges of the holes in overlying folds through the holes in underlying folds, substantially as described.

5. In a machine for forming seed tape, the combination of a seed receptacle, means for guiding perforated tape material into contact with seeds contained in said seed receptacle, and means for subjecting said tape material to suction whereby seeds which come into contact therewith will be caused to adhere to the perforations in said tape material.

6. In a machine for forming seed tape, the combination of a seed receptacle, means for guiding perforated tape material into contact with seeds contained in said seed receptacle, means for folding said tape material, and means for subjecting said tape material to suction whereby seeds which come into contact therewith will be caused to adhere to the perforations in said tape material, said suction being continued during the folding of said tape material.

7. In a machine for forming seed tape, the combination of a seed receptacle, means for guiding perforated tape material into contact with seeds contained in said seed receptacle, means for folding said tape material, means for subjecting said tape material to suction whereby seeds which come into contact therewith will be caused to adhere to the perforations in said tape material, said suction being continued during the folding of said tape material, and means for securing said tape material in folded position.

8. In a machine for forming seed tape, the combination of a seed receptacle, means for guiding perforated tape material into contact with seeds contained in said seed receptacle, means for folding said tape material, means for subjecting said tape material to suction whereby seeds will be caused to adhere to the perforations in said tape material, said suction being continued during the folding of said tape material, and means for securing said tape material in folded position, said means comprising a punch adapted for punching holes through the folds of said tape material and to force the edges of the holes in overlying folds through the holes in underlying folds.

9. In a machine for forming seed tape, the combination of a seed receptacle, means for guiding perforated tape material into contact with seeds contained in said seed receptacle, means for folding said tape material, means for subjecting said tape

material to suction whereby seeds will be caused to adhere to the perforations in said tape material, said suction being continued during the folding of said tape material, and means for securing said tape material in folded position, said means comprising a punch adapted for punching burred holes through the folds of said tape material.

10. In a machine for forming seed tape, the combination of a seed receptacle, means for perforating tape material, means for guiding said perforated tape material into contact with seeds contained in said seed receptacle, and means for subjecting said tape material to suction whereby seeds which come into contact therewith will be caused to adhere to the perforations therein.

11. In a machine for forming seed tape, the combination of a seed receptacle, means for perforating tape material, means for guiding said perforated tape material into contact with seeds contained in said seed receptacle, means for folding said tape material to inclose the seeds adhering thereto, and means for subjecting said tape material to suction whereby seeds which come into contact therewith will be caused to adhere to the perforations in said tape material, said suction being continued during the folding operation.

12. In a machine for forming seed tape, the combination of a seed receptacle, means for perforating tape material, means for guiding said perforated tape material into contact with seeds contained in said seed receptacle, means for folding said tape material to inclose the seeds adhering thereto, means for subjecting said tape material to suction whereby seeds which come into contact therewith will be caused to adhere to the perforations in said tape material, said suction being continued during the folding operation, and means for securing said tape material in folded position.

13. In a machine for forming seed tape, the combination of a seed receptacle, means for perforating tape material, means for guiding said perforated tape material into contact with seeds contained in said seed receptacle, means for folding said tape material to inclose the seeds adhering thereto, means for subjecting said tape material to suction whereby seeds which come into contact therewith will be caused to adhere to the perforations in said tape material, said suction being continued during the folding operation, and punching means for securing said tape material in a folded position.

14. In a machine for forming seed tape, the combination of a seed receptacle provided with a discharge opening, a hollow casing, a side of which extends into close proximity to the discharge opening of said seed receptacle, means for guiding perforated tape material across the discharge

opening of said seed receptacle and over said casing, said casing being provided with a slot adapted to be closed by the tape material passing over said casing with the perforations in said tape material in communication with said slot, and suction means applied to the chamber formed by said casing, whereby said tape material will be subjected to suction adapted to cause seeds coming in contact therewith to adhere to the perforations in said tape material throughout the length of the slot in said casing.

15. In a machine for forming seed tape, the combination of a seed receptacle provided with a discharge opening, a hollow casing a side of which extends into close proximity to the discharge opening of said seed receptacle, means for guiding perforated tape material across the discharge opening of said seed receptacle and over said casing, said casing being provided with a slot adapted to be closed by the tape material passing over said casing with the perforations in said tape material being in communication with said slot, suction means applied to the chamber formed by said casing whereby said tape material will be subjected to suction adapted to cause the seeds coming in contact therewith to adhere to the perforations in said tape material throughout the length of the slot in said casing, and means for folding said tape material to inclose the seeds adhering thereto while said tape material is subjected to suction.

16. In a machine for forming seed tape, the combination of a seed receptacle provided with a discharge opening, a hollow casing a side of which extends into close proximity to the discharge opening of said seed receptacle, wheels rotatably mounted within said casing, a slotted belt adjusted to said wheels, said casing being provided with an opening through which a section of said belt will be exposed and said belt operating to close said opening but for the slot therein, means for guiding perforated tape material across the discharge opening of said seed receptacle and in contact with the section of said belt exposed through the opening in said casing with the perforations therein in communication with the slot in said belt, and suction means applied to the chamber formed by said casing whereby said tape material will be subjected to suction adapted to cause seeds coming in contact therewith to adhere to the perforations in said tape material substantially throughout the exposed length of said belt.

17. In a machine for forming seed tape, the combination of a seed receptacle provided with a discharge opening, a hollow casing a side of which extends into close proximity to the discharge opening of said

seed receptacle, wheels rotatably mounted within said casing, a slotted belt adjusted to said wheels, said casing, being provided with an opening through which a section of  
 5 said belt will be exposed and said belt operating to close said opening but for the slot therein, means for guiding perforated tape material across the discharge opening of said seed receptacle and in contact with the  
 10 section of said belt exposed through the opening in said casing with the perforations therein in communication with the slot in said belt, suction means applied to the chamber formed by said casing whereby  
 15 said tape material will be subjected to suction adapted to cause seeds coming in contact therewith to adhere to the perforations in said tape material substantially throughout the exposed length of said belt, and  
 20 means for holding said tape material to inclose the seeds adhering thereto while said tape material is subjected to suction.

18. In a machine for forming seed tape, the combination of a seed receptacle provided  
 25 with a discharge opening, a hollow casing a side of which extends into close proximity to the discharge opening of said seed receptacle, wheels rotatably mounted within said casing, a slotted belt adjusted to said  
 30 wheels, said casing being provided with an opening through which a section of said belt will be exposed and said belt operating to close said opening but for the slot therein, means for guiding perforated tape material across the discharge opening of said  
 35 seed receptacle and in contact with the section of said belt exposed through the opening in said casing with the perforations therein in communication with the slot in  
 40 said belt, suction means applied to the chamber formed by said casing whereby said tape material will be subjected to suction adapted to cause seeds coming in contact therewith to adhere to the perforations in said tape  
 45 material substantially throughout the exposed length of said belt, means for folding said tape material to inclose the seeds adhering thereto while said tape material is subjected to suction, and means for securing said tape material in folded position.

19. In a machine for forming seed tape, the combination of a seed receptacle, means for guiding a tape material into contact with the seed, means for holding seed on  
 55 said tape material, means for folding said material around the seed and means for winding the tape on a receiver.

20. In a machine for forming seed tape, the combination of a seed receptacle, means  
 60 for guiding a tape material into contact with the seed, means for holding seed on said tape material, means for folding said material around the seed, and a spool for receiving the tape, said spool adapted to be  
 65 rotated and to be moved transversely.

21. In a machine for forming seed tape, the combination of a seed receptacle, means for guiding a tape material into contact with the seed, means for holding seed on said tape material, means for folding said material around the seed, a spool rotatable and  
 70 endwise movable for receiving the tape, a head on said spool, a collar biased to contact with said head, and pins mounted in said head and adapted to slide in said collar  
 75 and to extend over and apart from said spool to have a portion of the tape inserted therebetween.

22. In a machine for forming seed tape, the combination of a seed receptacle, means  
 80 for guiding a tape material into contact with the seed, means for holding seed on said tape material, means for folding said material around the seed, means for receiving the tape, a source of power for driving  
 85 said machine, and members biased to contact and to move relatively for transmitting a part of said power and for varying the speed of various parts of said machine.

23. In a machine for forming seed tape, 90 the combination of a seed receptacle, means for guiding a tape material into contact with the seed, means for holding seed on said tape material, means for folding said material around the seed, means for receiving the  
 95 tape, a power shaft, a friction wheel thereon, a friction disk on a shaft for driving part of said machine, a spring for holding said wheel and said disk yieldingly in contact, and means to retract said friction disk  
 100 against said spring.

24. In a machine for forming seed tape, the combination of means for depositing seeds upon perforated tape material, and means for causing said seeds to adhere to  
 105 the perforations in said tape material.

25. In a machine for forming seed tape, the combination of means for depositing seeds upon perforated tape material, means for folding said tape material, and means  
 110 for causing said seeds deposited thereon to adhere to the perforations in said tape material, said second means being effective during the folding of said tape material.

26. In a machine for forming seed tape, 115 the combination of means for depositing seeds upon perforated tape material, means for folding said tape material, means for causing said seeds deposited thereon to adhere to the perforations in said tape material, said second means being effective during the folding of said tape material, and means for securing said tape material in folded position.

27. In a machine for forming seed tape, 125 the combination of means for depositing seeds upon tape material, means for folding said tape material, and means for securing said tape material in folded position, said means comprising a punch adapted for  
 130

punching holes through the folds of said tape material, and to force the edges of the holes in interlocking relation.

28. In a machine for forming seed tape, the combination of means for depositing seeds upon tape material, means for folding said tape material, means for causing seeds deposited thereon to adhere to said tape material, and means for securing said tape material in folded position, said means comprising a punch adapted for punching holes through the folds of said tape material, and to force the edges of the holes in interlocking relation.

29. Apparatus of the character described comprising pneumatic means for selecting seeds from a source of supply and for maintaining them in definite arrangement on a traveling tape or strip, in combination with means arranged to receive the tape and to secure the seeds permanently in place thereon.

30. Apparatus of the character described, comprising means for perforating tape, and pneumatic means for positioning seeds on said tape at the perforations, in combination with tape-folding means arranged to receive and to operate upon the tape and associated seeds at a point of substantially horizontal tape travel.

31. The method of making seed tape which comprises bringing a perforated carrier tape or strip into operative proximity on one side to seeds, applying suction to the other side of the tape to position seeds on the tape at the perforations, and then permanently securing the seeds in position on the tape.

32. The method of making seed tape which comprises moving a perforated carrier tape longitudinally in operative proximity on one side to a supply of seeds, applying suction to the other side of the moving tape, whereby seeds are affixed to the tape at the perforations, and then shaping the tape to secure the seeds permanently in position.

33. The method of making seed tape which comprises moving a carrier tape or strip longitudinally, pneumatically selecting seeds from a source of supply and placing them in predetermined arrangement upon the moving tape, pneumatically maintaining the seeds in position on the tape until the tape reaches a predetermined point in its travel, and then permanently securing the seeds on the tape.

34. The method of making seed tape which comprises bringing a carrier tape or strip into operative proximity on one side to seeds, applying suction to the other side of the tape to position seeds on the tape, and then permanently securing the seeds in position on the tape.

35. The method of making seed tape which comprises moving a carrier tape longi-

tudinally in operative proximity on one side to a supply of seeds, applying suction to the other side of the moving tape, whereby seeds are affixed to the tape, and then shaping the tape to secure the seeds permanently in position.

36. The method of making seed tape which comprises moving a carrier tape or strip longitudinally, selecting seeds from a source of supply and placing them in predetermined arrangement upon the moving tape, maintaining the seeds in position on the tape until the tape reaches a predetermined point in its travel, and then permanently securing the seeds on the tape.

37. The method of making seed tape which comprises perforating a carrier tape or strip, bringing the strip into operative proximity on one side to seeds, applying suction to the other side of the tape to position seeds on the tape at the perforations, and then permanently securing the seeds in position on the tape.

38. The method of making seed tape which comprises perforating a paper tape or strip, moving the perforated strip into contact on one side with a supply of seeds while applying suction to the other side, whereby seeds become affixed to the tape at the perforations, and folding the tape with its associated seeds to secure the seeds permanently in position, the aforesaid operations being conducted simultaneously on different portions of the tape and in a continuous manner.

39. The method of making seed tape which comprises moving a perforated strip into contact on one side with a supply of seeds while applying suction to the other side, whereby seeds become affixed to the tape and folding the tape with its associated seeds to secure the seeds permanently in position, the aforesaid operations being conducted simultaneously on different portions of the tape and in a continuous manner.

40. The method of making seed tape which comprises perforating a paper tape or a strip, moving the perforated strip into contact on one side with a supply of seeds while applying suction to the other side, whereby seeds become affixed to the tape at the perforations, and folding the tape with its associated seeds in a fixed folder to secure the seeds permanently in position, the aforesaid operations being conducted simultaneously on different portions of the tape and in a continuous manner.

41. The method of making seed tape which comprises bringing a perforated carrier tape or strip into operative proximity on one side to seeds, applying suction to the other side of the tape to position seeds on the tape at the perforations, and then permanently securing the seeds in position on the tape without the use of adhesive.

42. The method of making seed tape which

comprises moving a perforated carrier tape longitudinally in operative proximity on one side to a supply of seeds, applying suction to the other side of the moving tape, whereby  
5 seeds are affixed to the tape at the perforations, and then shaping the tape to secure the seeds permanently in position without the use of adhesive.

43. The method of making seed tape which  
10 comprises bringing a carrier tape or strip into operative proximity to seeds, positioning the seeds temporarily on the tape and then permanently securing the seeds in position on the tape.

15 44. Apparatus of the character described comprising, in combination, means for feed-

ing suitably perforated tape longitudinally, means for applying suction to one side of the tape, means for presenting seeds to the opposite side of the tape while it is under suc- 20 tion, and means for thereafter treating the tape to secure the seeds positioned on the tape by the suction.

In testimony, that I claim the foregoing as my invention, I affix my signature in the 25 presence of two subscribing witnesses this 17 day of May, A. D. 1916.

EDWARD E. GRAY.

Witnesses:

J. A. PARKS,  
E. G. PINKERTON.