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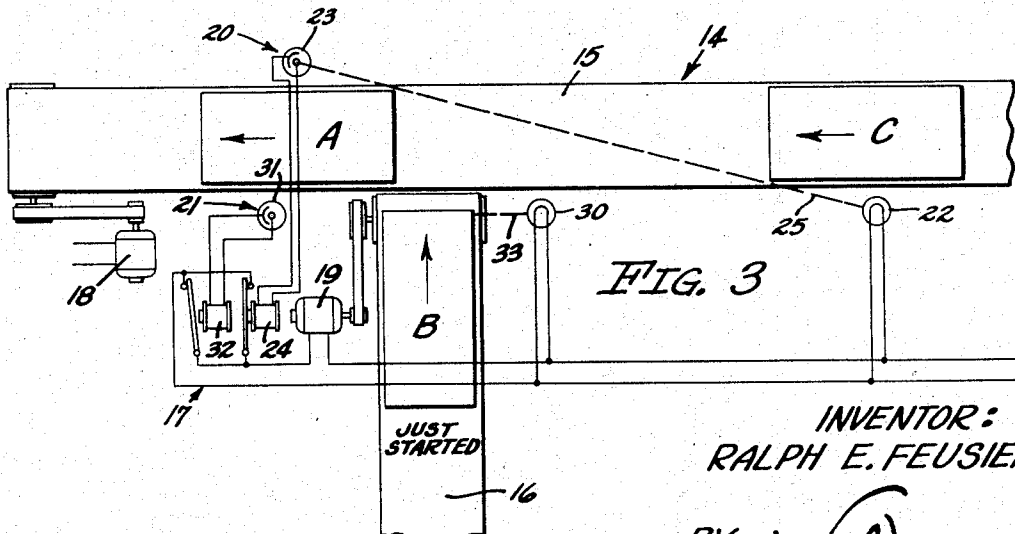
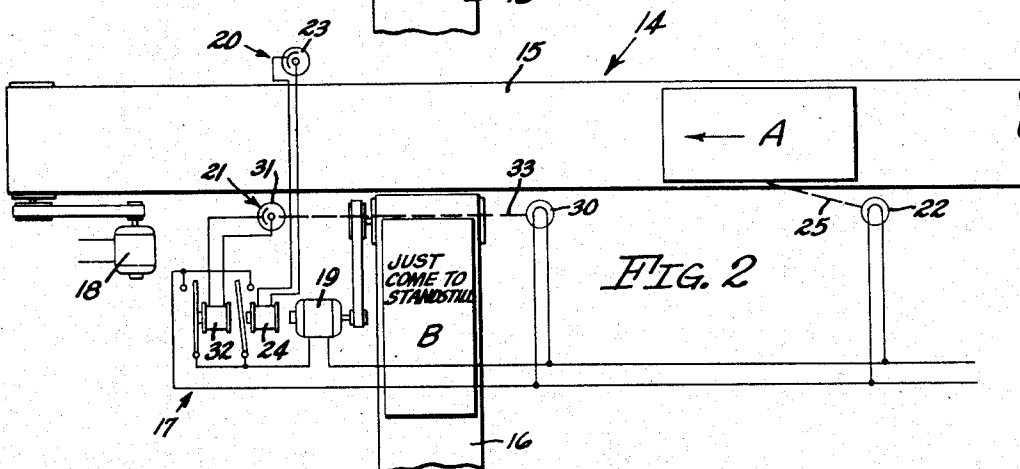
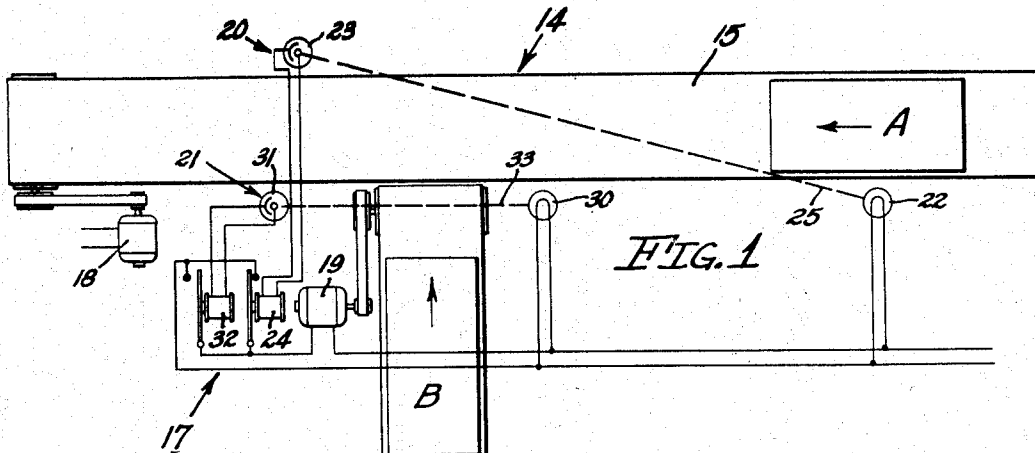
R. E. FEUSIER

2,304,447

BOX CONVEYER SWITCH

Filed June 8, 1940

4 Sheets-Sheet 1



INVENTOR:
RALPH E. FEUSIER

BY

ATTORNEY

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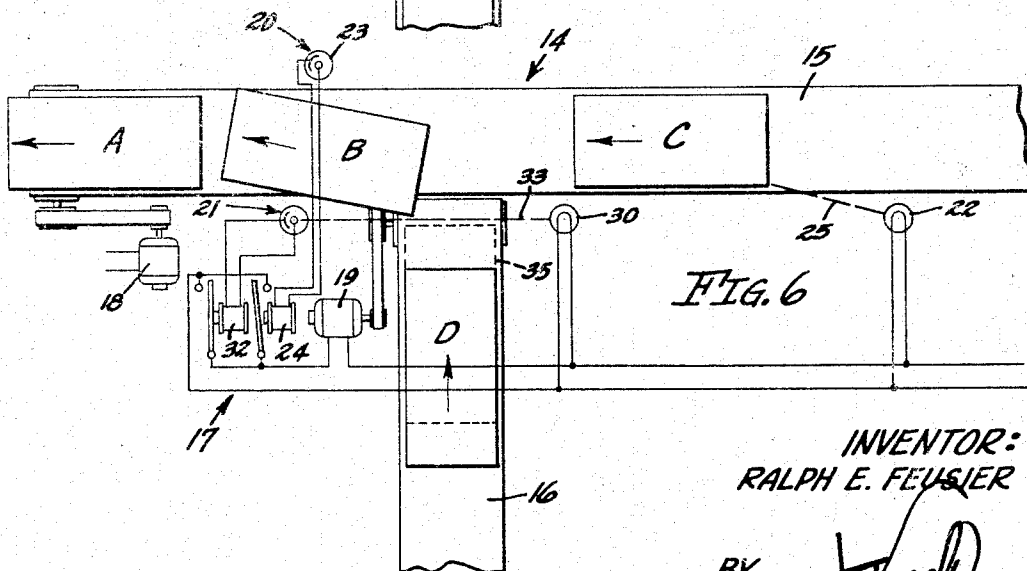
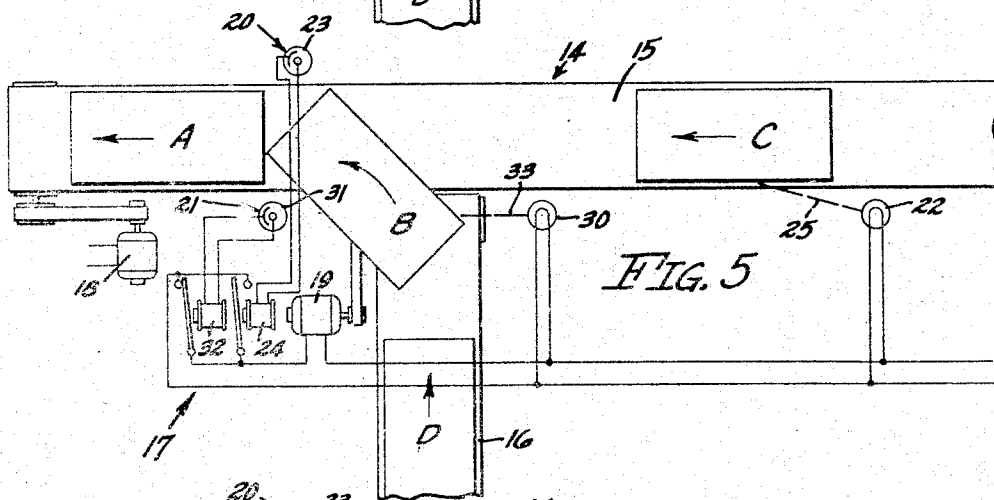
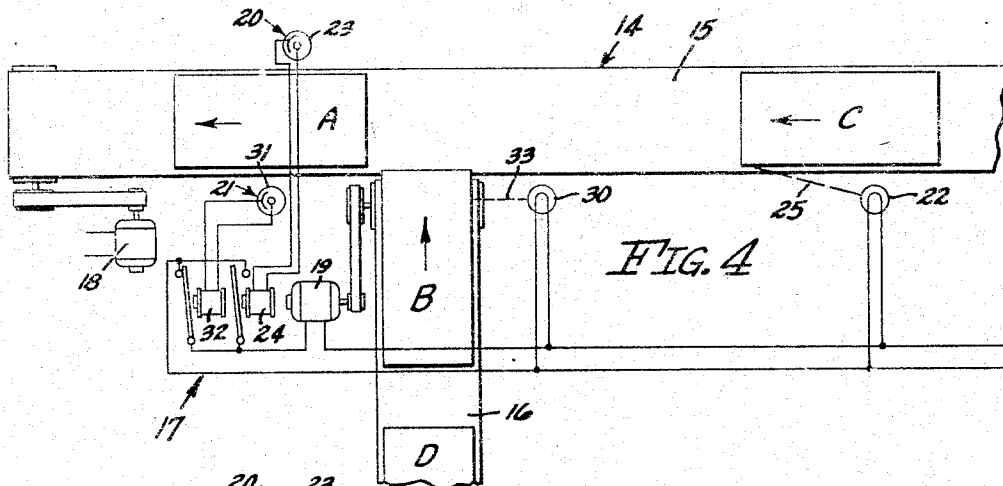
R. E. FEUSIER

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BOX CONVEYER SWITCH

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INVENTOR:
RALPH E. FEUSIER

BY

ATTORNEY

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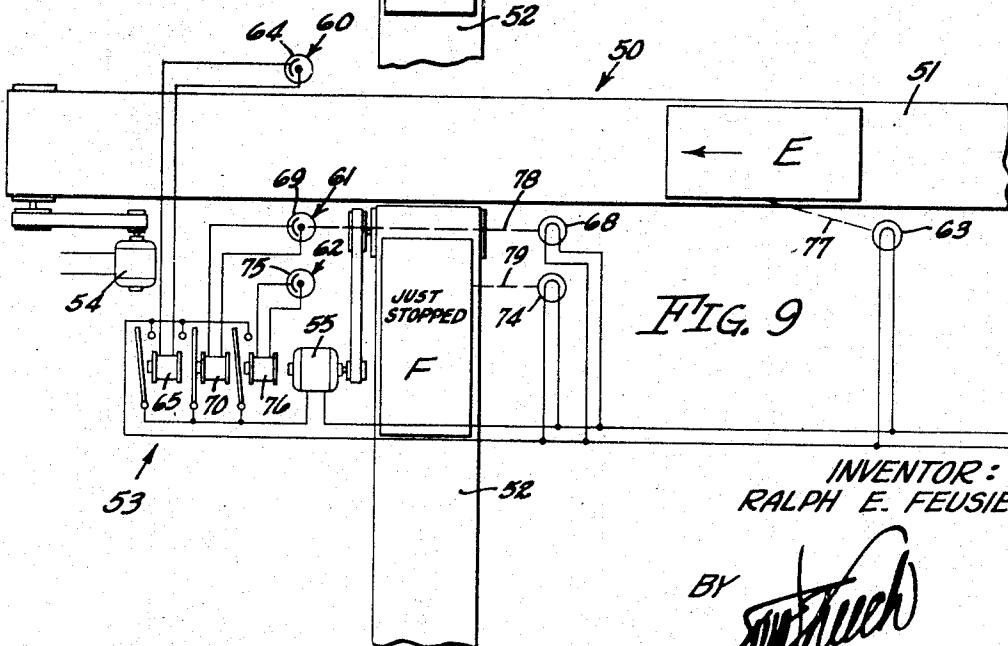
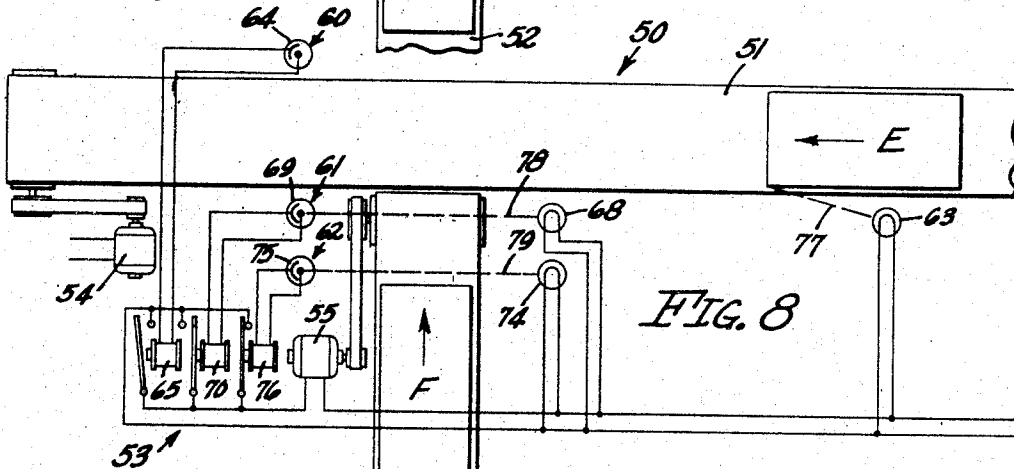
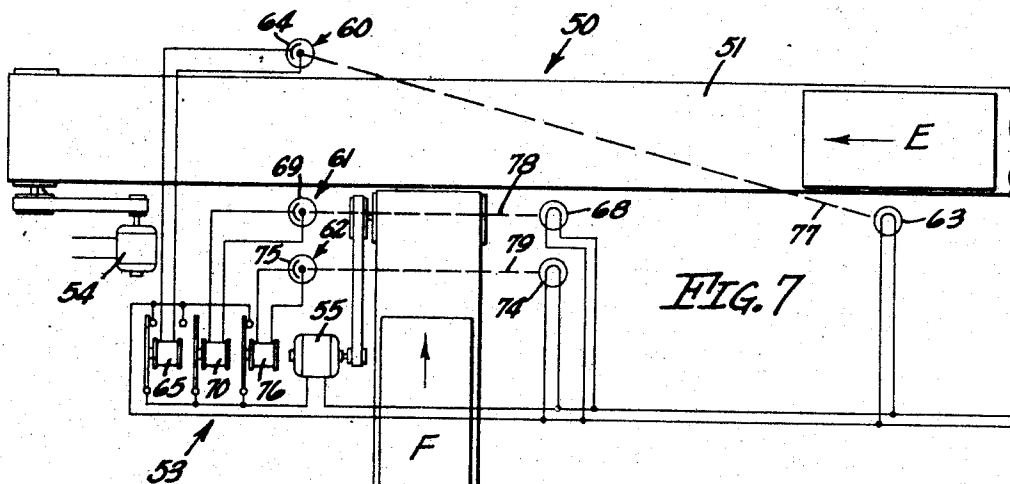
R. E. FEUSIER

2,304,447

BOX CONVEYER SWITCH

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4 Sheets-Sheet 3



INVENTOR:
RALPH E. FEUSIER

BY

ATTORNEY

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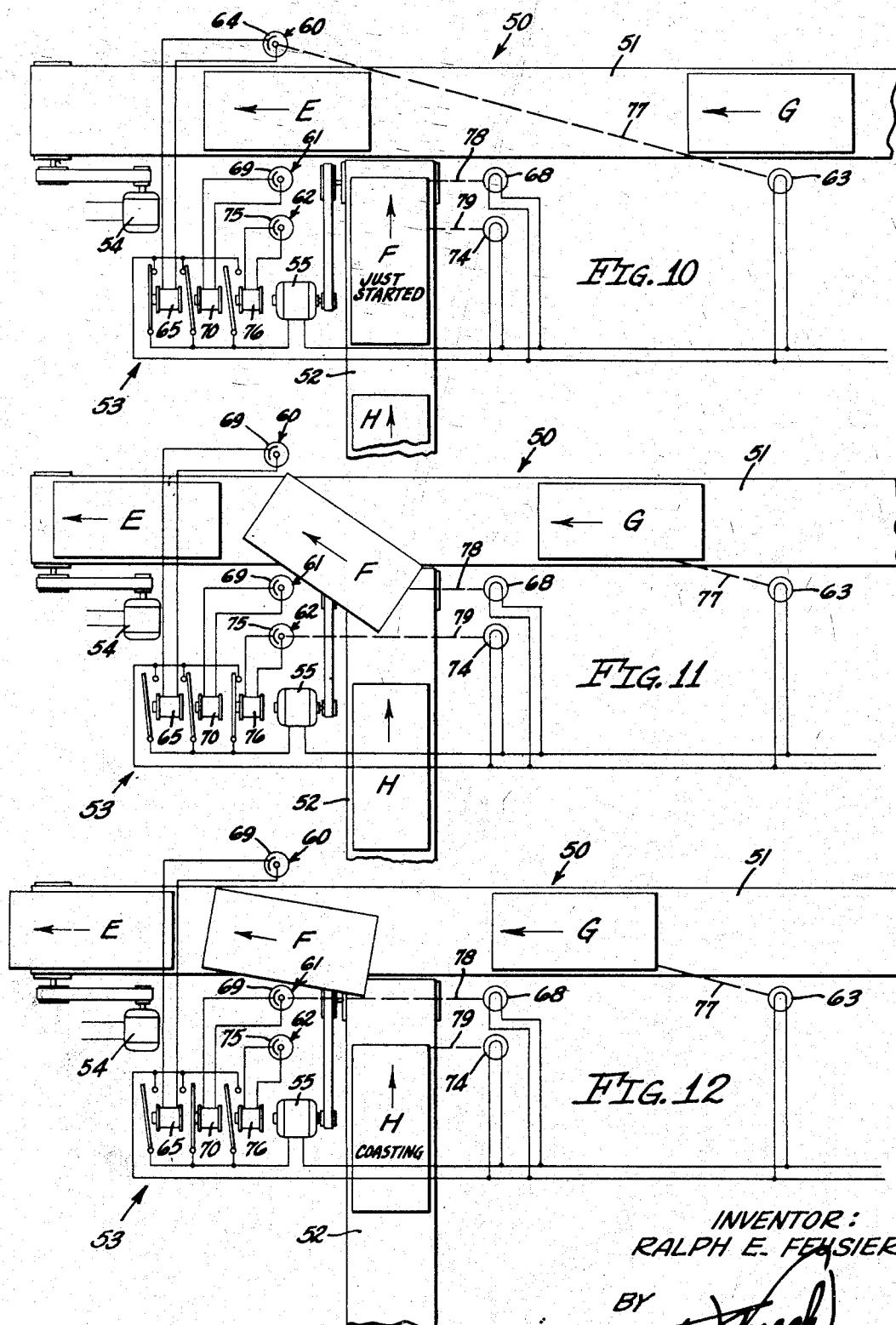
R. E. FEUSIER

2,304,447

BOX CONVEYER SWITCH

Filed June 8, 1940

4 Sheets-Sheet 4



INVENTOR:
RALPH E. FEUSIER

BY

ATTORNEY

UNITED STATES PATENT OFFICE

2,304,447

BOX CONVEYER SWITCH

Ralph E. Feusler, Dunedin, Fla., assignor to Food Machinery Corporation, San Jose, Calif., a corporation of Delaware

Application June 8, 1940, Serial No. 339,510

10 Claims. (Cl. 198—21)

This invention relates to the control of the travel of articles such as boxes and it is particularly useful in controlling the operation of power box conveyers.

In controlling power box conveyers, it is desirable to stop these when certain conditions exist requiring this, but it is generally undesirable to stop such a conveyer when a box is being discharged therefrom.

It is accordingly an object of this invention to provide a means for controlling a power box conveyor for stopping the latter, but which is adapted to continue the operation of the conveyor after the stop means has been actuated until any box which is in the process of being discharged from the conveyor at the time the stop means was actuated has been discharged from said conveyor, and to then stop said conveyor.

This invention has special utility in controlling one of two power box conveyers which are combined in an intersection, so as to prevent the jamming of boxes in said intersection. For illustrative purposes, therefore, the invention will be described as embodied in means for controlling the movement of boxes through such an intersection.

It is another object of this invention to provide such a power box conveyor control which will prevent the jamming of boxes at an intersection into which said conveyor delivers boxes.

Conveyor controls previously developed have required that a considerable measure of force be exerted by boxes on said conveyor in order to control said conveyor. These former controls were relatively less suitable for use with empty boxes than with full boxes.

It is an object of the present invention to provide a conveyor control which operates with equal facility on empty boxes and on loaded boxes.

Many conveyor controls previously devised have effected this control in response to contact with the boxes, which thus had a tendency to mar up and damage the boxes.

A still further object of this invention, therefore, is to provide a power box conveyor control which does not mark up or wear the material of the boxes passing along said conveyor through said control.

The manner of accomplishing the foregoing objects, as well as further objects and advantages, will be made manifest in the following description taken in connection with the accompanying drawings, in which:

Figs. 1 to 6 inclusive are diagrammatic plan

views of a power box conveyor intersection incorporating a preferred embodiment of the invention, and illustrating various situations met with in the operation of the invention.

Figs. 7 to 12 inclusive are diagrammatic plan views of a power box conveyor intersection incorporating a modified form of the invention and illustrate various situations met with in the operation thereof.

Fig. 1 illustrates a situation in the operation of said preferred embodiment of the invention, in which boxes on each of two conveyers are approaching an intersection between the latter in such relation that one of said conveyers will be automatically stopped to prevent the box thereon interfering with the passage of the box on the other conveyor through said intersection.

Fig. 2 shows a situation which follows that illustrated in Fig. 1 and in which the controlled conveyor has just come to a standstill.

Fig. 3 illustrates a situation which follows that illustrated in Fig. 2 and wherein the controlled conveyor has just been started as the box on the other conveyor has reached such a point in passing through said intersection that it will not interfere with the delivery of the foremost box from the controlled conveyor into said intersection.

Fig. 4 illustrates a situation which just follows that shown in Fig. 3 and in which the aforesaid box on the controlled conveyor is entering said intersection at the rear of the box which has just passed through said intersection as aforesaid and in which another box is approaching said intersection on said other conveyor.

Fig. 5 is a view illustrating a situation which follows shortly that illustrated in Fig. 4 and shows the turning of a box being delivered from a controlled conveyor so as to extend into the space in the intersection between the two boxes aforementioned on said other conveyor.

Fig. 6 is a view illustrating a situation which follows shortly after that shown in Fig. 5 and in which the box being fed from the controlled conveyor into the space in the intersection between two other boxes has just reached a point at which it co-operates with the box following it to actuate the controls of the invention to stop the controlled conveyor so that the latter will remain stopped until all of the boxes aforementioned have passed through said intersection.

Fig. 7 illustrates a situation met with in the operation of the modified form of the invention shown in Figs. 7 to 12 inclusive, in which a box on each of two conveyers forming an intersec-

Mon is approaching said intersection, there being no boxes in said intersection.

Fig. 8 illustrates a situation just following that shown in Fig. 7, in which a box on one of said conveyers which operates continuously actuates the control apparatus so that the box on the other of said conveyers which is controlled will, after proceeding a slight distance farther, actuate the control apparatus to stop said controlled conveyer.

Fig. 9 illustrates a situation which just follows that shown in Fig. 8 wherein the controlled conveyer has just been stopped.

Fig. 10 is a view illustrating a situation shortly following that shown in Fig. 9 and wherein the controlled conveyer has just been started.

Fig. 11 is a view illustrating a situation shortly following that shown in Fig. 10 and wherein a box is being fed from the controlled conveyer onto the continuously operating conveyer.

Fig. 12 is a view illustrating a situation following closely that shown in Fig. 11 and wherein the box being delivered from said controlled conveyer has passed entirely from the latter onto the continuously moving conveyer.

Referring specifically to the preferred embodiment of the invention illustrated in Figs. 1 to 6 inclusive, this is seen to comprise a conveyer intersection 14 which includes a primary conveyer 15, a secondary conveyer 16 and a control mechanism 17. The primary conveyer is continuously driven by a motor 18 while the secondary conveyer 16 is intermittently driven by a motor 19.

The motor 19 is controlled in its operation by the control mechanism 17 which includes a primary photo-electric control device 20 and a secondary photo-electric control device 21. The control device 20 includes a source of light 22, a photo-electric cell 23 and a magnetic switch 24, the latter being normally closed and being opened when a beam of light 25 projected across the conveyer 15 by the source of light 22 is broken as by a box travelling on the conveyer 15.

The control device 21 includes a source of light 30, a photo-electric cell 31, and a magnetic switch 32, the latter being normally open and being closed whenever a beam of light 33 projected across the conveyer 16 by the source of light 30 against the photo-electric cell 31 is broken as by a box travelling on the secondary conveyer 16. The switches 24 and 32 are disposed in the circuit of the motor 19. The light sources 22 and 30 are illuminated continuously.

If desired, the motor 19 may of course receive its current through a main magnetic switch subject to control by the switches 24 and 32. In such a case, the starting and stopping of motor 19 would be controlled by the switches 24 and 32 no differently than when these switches are placed directly in the main supply circuit of the motor as shown.

The intersection 14 with its control mechanism 17 operates as follows:

The conveyer 15 is driven continuously by the motor 18 and the object of the control mechanism is to stop the conveyer 16 whenever any boxes about to be discharged thereby onto the conveyer 16 will interfere with any boxes carried on the latter.

Fig. 1 shows a box A on conveyer 15 approaching the intersection of the latter with conveyer 16. Box A is just about to intercept light beam 25, and when it does intercept this light beam it will throw out switch 24 and thus break the power circuit of the motor 19, causing the conveyer

16 to coast to a stop. Fig. 1 shows a box B travelling on conveyer 16, this box being located a slightly greater distance from the light beam 33 than the distance which conveyer 16 will coast when coming to a stop after the circuit of the motor 19 has been interrupted.

Fig. 2 illustrates the situation following normal operation of the intersection 14 after the situation shown in Fig. 1. Here we see the beam 25 has been broken and remains broken by box A, thus interrupting the circuit of the motor 19 and causing the conveyer 16 to coast to a standstill. This stopping of the conveyer 16 has just been completed with the boxes A and B in the positions shown in Fig. 2. It is seen that box B has stopped just short of interrupting light beam 33. If the box B had been close enough to light beam 33 at the time box A first interrupted light beam 25, so that the coasting of the conveyer 16 incidental to its stopping carried box B through light beam 33 thus interrupting the latter, switch 32 would have been closed so as to again start conveyer 16 and this conveyer would have been kept operating by the interception of light beam 33 by the box B until the latter had been completely discharged onto conveyer 15.

As box A travels along the conveyer 15 from the position in which it is shown in Fig. 2, it continues to intercept the light beam 25 until just before it reaches the position in which it is shown in Fig. 3, where it moves out of line of this beam and permits the latter to be re-established. This throws in the switch 24, which reenergizes the motor 19 and starts the conveyer 16.

Fig. 3 illustrates box B after being moved by this so as to intercept the light beam 33. As already described, the intercepting of the light beam 33 by a box on the conveyer 16 causes this conveyer to continue in operation until the box intercepting light beam 33 has passed entirely through the line of this beam. This means that this box must be entirely discharged from the conveyer 16 before the beam 33 is re-established. In order to illustrate the most difficult situations met with by the invention, Fig. 3 shows a box C approaching on the conveyer 15 and just about to intercept the light beam 25 at a time when the conveyer 16 has just been started, so that box B is intercepting the light beam 33 at the time the light beam 25 is first intercepted.

Fig. 4 shows how box A has travelled far enough along on the conveyer 15 to be out of the way of box B when the latter is discharged from the conveyer 16 into the path of boxes carried on the conveyer 15. In other words, box B is discharged onto the conveyer 16 behind box A, and turns on the conveyer 16 as shown in Fig. 5, aided by guide rails (not shown) which are placed alongside the intersection of the two conveyers in a manner well known in the art, and box B is thus guided into place on the conveyer 15 behind box A, further steps in this process being illustrated in Figs. 5 and 6.

In Fig. 4, a box D is shown on the conveyer 16 following box B. In order for the intersection 14 to operate properly, the only restriction which it is necessary to observe in placing the boxes on the conveyers, is to space the boxes on conveyer 16 by a distance at least as great as the distance box D is spaced from box B. This spacing is necessary so that if the conveyer 16 is stopped by the re-establishment of light beam 33 at a time when light beam 25 is interrupted as by box C, then the coasting of the conveyer 16 to a stop will not carry the box D far enough

to intercept the light beam 33. The ultimate position in which the box D comes to a halt with the stopping of the conveyer 16 is shown in Fig. 6 by broken lines 35. Box D will remain in this position until box C has passed along the conveyer 15 out of the line of the light beam 25 so as to be out of the way of box D when the latter is discharged onto the conveyer 15 by the starting of the conveyer 16. When the latter action takes place, boxes C and D will be in the same relation as boxes A and B in Fig. 4.

It will thus be seen that this invention provides a control for stopping conveyer 16 which, when actuated, stops this conveyer, except that if said actuation takes place at the time a box is being discharged from said conveyer, said conveyer will continue in operation until the discharge of said box is completed before said conveyer will respond to said stopping means. It is also to be noted that when the means for stopping the conveyer 16 remain actuated, as by the interception of the light beam 25, these stop means become effective to stop conveyer 16 just as soon as the discharge of the box from the conveyer 16 is completed. This function of the invention is not only very useful in the control of the conveyer 16, when the latter is included in a conveyer intersection, but it has value in many other situations requiring the control of a power box conveyer where it is desirable to stop such conveyer at intervals, yet not at a time when a box is in the process of being discharged from said conveyer.

Referring now to Figs. 7 to 12 inclusive, the modified form of the invention is there diagrammatically illustrated as embodied in a conveyer intersection 50 which includes a primary conveyer 51, a secondary conveyer 52, and a control mechanism 53 for the latter. The primary conveyer 51 has a motor 54 for driving the same and the secondary conveyer 52 has a motor 55, the operation of which is controlled by the control mechanism 53.

The control mechanism 53 includes a primary photo-electric control device 60, a secondary photo-electric control device 61, a tertiary photo-electric control device 62. The control device 60 includes a source of light 63, a photo-electric cell 64 and a magnetic switch 65 which is normally closed. The control device 61 includes a source of light 68, a photo-electric cell 69 and a magnetic switch 70 which is normally open. The control device 62 includes a source of light 74, a photo-electric cell 75, and a magnetic switch 76 which is normally closed. The switches 65, 70, and 76 are placed in the circuit supplying current to the motor 55. If desired, the motor 55 might be supplied current through a master magnetic switch (not shown) but which would be controlled by switches 65, 70, and 76 to start and stop the motor 55 no differently in effect than this motor is adapted to be started and stopped by the switches 65, 70, and 76 with the latter directly in the main power circuit of the motor as shown in the drawings.

The source of light 63 directs a beam of light 77 across the conveyer 51 against the photo-electric cell 64 which extends substantially along the same path as the beam of light 25 in the intersection 14. The source of light 68 directs a beam of light 78 across the conveyer 52 against the photo-electric cell 69, the path of this beam being the same as that followed by the beam 33 in the intersection 14.

The intersection 50 is constructed and operates

like the switch 14 described hereinabove, except for the addition thereto of the control device 62. The source of light 74 of this device directs a beam of light 79 across the conveyer 52 against the photo-electric cell 75, the path of this beam being spaced from the path of the beam 78, in a direction away from the conveyer 51, a distance slightly in excess of the distance the conveyer 52 will coast after the power of the motor 55 is shut off and before the conveyer comes to a complete stop.

The principal purpose of having the control device 62 incorporated into the control mechanism 53 is to eliminate unnecessary stopping of the secondary conveyer as occurs in the intersection 14 when the light beam 25 is intercepted by a box on the conveyer 15 when there is no box on the conveyer 16 close enough to the discharge end thereof to interfere with the passage through the intersection of the box interrupting the beam 25 even though the conveyer 16 were to continue operating. In other words, the purpose of the control mechanism 62 in the intersection 50 is to permit the conveyer 52 to continue operating in spite of the beam 77 being interrupted, and in spite of the fact that the beam 78 is not interrupted, until a box on this conveyer approaches close enough to the discharge end thereof so that it becomes necessary to stop it.

Fig. 7 shows a box E travelling on the conveyer 51 approaching the beam 77 and a box F on the conveyer 52 approaching the beam 79.

In Fig. 8 we see the box E intercepting the beam 77, while box F has not yet reached the point where it intercepts beam 79. The interception of beam 77 opens the normally closed switch 65 and as the beam 78 is unbroken and the switch 70 controlled thereby normally open, the conveyer continues to be run solely by a current going through the switch 76. As soon as the box F intercepts the beam 79, therefore, the switch 76 is opened and the motor 55 de-energized, thus causing the conveyer 52 to coast to a stop with box F positioned as shown in Fig. 9 where it is seen that this box is stopped short of intercepting the light beam 78.

From the position in which it is shown in Fig. 9, the box E continues leftward along the conveyer 51 until it moves out of the line of the light beam 77 as shown in Fig. 10. Assuming that no box is following box E on the conveyer 51 close enough to intercept the light beam 77 before box E moves out of the line of this beam, the restoration of the light beam 77 will throw in the switch 65, which will cause the motor 55 to be energized and the conveyer 52 started. Only a very slight travel of this conveyer is necessary to move the box F from the position in which it is shown in Fig. 9 until it crosses the path of the light beam 78 as shown in Fig. 10. In the latter figure, box G is shown as following box E on the conveyer 51 at a distance which is great enough to permit the light beam 77 to be restored for only a brief interval. This restoration, however, is sufficient to advance the box F to where it breaks the light beam 78 and closes the switch 70. From this point, the conveyer 52 of course must continue to run until the box F has been discharged entirely past the line of the beam 78.

Figs. 11 and 12 illustrate the turning of box F onto conveyer 51 as it is discharged from the conveyer 52. It is to be noted that in Fig. 10 a box H, travelling on the conveyer 52 is spaced from a box F a distance similar to that which

box D is spaced from box B on the conveyer 16 of intersection 14, the reason for this spacing being necessary in the conveyer 50 for exactly the same reason as it is necessary in intersection 14 as pointed out hereinabove. That is, if box H were spaced a lesser distance from box F, box H would be carried far enough by the coasting of the conveyer 52, after the latter is stopped by box F moving out of the path of light beam 78, for box H to break light beam 78. This would of course cause box H to collide with box G, which collisions it is a principal object of the invention to avoid. Thus, the necessity for spacing the boxes on the secondary conveyer of each of the intersections embodying my invention and disclosed herein.

What I claim is:

1. In a box conveyer intersection control, the combination of: a primary conveyer for boxes; a secondary conveyer for boxes forming an intersection with said primary conveyer so that said conveyers move boxes through a common intersectional area; control means responsive to the approach of a box on said primary conveyer within a given distance from said area to stop said secondary conveyer, provided no box on said secondary conveyer is at that moment positioned opposite a given point adjacent the discharge end of said secondary conveyer; and means operative, when a second box is located on said secondary conveyer, opposite said point at the time said first mentioned box approaches said area as aforesaid, to cause said secondary conveyer to continue operation until said second box has been delivered from said secondary conveyer onto said primary conveyer and to then stop said secondary conveyer.

2. In a box conveyer intersection control, the combination of: a primary conveyer; a secondary conveyer positioned for feeding boxes onto said primary conveyer; light controlled means responsive to a box moving beyond a given point on said primary conveyer toward the intersection thereof with said secondary conveyer so as to stop said secondary conveyer with the exception stated hereinafter; and means for rendering said first aforementioned means inoperative to stop said secondary conveyer while a box is being discharged from said secondary conveyer onto said primary conveyer.

3. In a box conveyer intersection control, the combination of: a primary conveyer; a secondary conveyer positioned for feeding boxes onto said primary conveyer; light controlled means responsive to a box moving on said primary conveyer toward the intersection thereof with said secondary conveyer to stop said secondary conveyer; and means for rendering said first aforementioned means inoperative if the latter is caused to function while a box is being discharged from said secondary conveyer onto said primary conveyer, said second control means being adapted, after the discharge of said box from said secondary conveyer onto said primary conveyer, and provided said first control means at that time remains actuated by a box on said primary conveyer, to cause said secondary conveyer to be stopped.

4. In combination: a primary conveyer; a secondary conveyer adapted to form an intersection with and deliver boxes onto said primary conveyer; means for forming a beam of light crossing the path of boxes carried on said primary conveyer; primary photo-electric control means responsive to interruptions of said beam to stop

said secondary conveyer, with the exception stated hereinafter; a light source directing a light beam across said secondary conveyer within an area adjacent the discharge end of the latter; secondary photo-electric means responsive to said last mentioned light beam to render interruptions of said first mentioned light beam effective in stopping said secondary conveyer, the interruption of said light beam over said secondary conveyer rendering said primary photo-electric means inoperative to stop said secondary conveyer.

5. In a box conveyer intersection control, the combination of: a primary conveyer; a secondary conveyer positioned for feeding boxes onto said primary conveyer, there being two control points 1 and 2 located along said secondary conveyer, point 2 being closer to said intersection than point 1; control means X responsive to the approach of a box on said primary conveyer within a given distance from said intersection to stop said secondary conveyer, with the exception stated hereinafter; control means Y responsive to the presence of a box at point 1 on said secondary conveyer to cause said secondary conveyer to be stopped by actuation of control means X; and control means Z responsive to the presence of a box on said secondary conveyer at point 2 to cause said secondary conveyer to continue in operation until said last mentioned box has passed beyond point 2, said control means X being inoperative to stop said secondary conveyer when no box is disposed on said secondary conveyer opposite point 1.

6. A combination as in claim 5, in which each of the three control means recited therein comprises a light source and a photo-electric means responsive to a beam of light projected by said light source, said beam of control means X extending diagonally across said primary conveyer and said beams of control means Y and control means Z extending across said secondary conveyer at points 1 and 2 respectively.

7. In combination: a conveyer for carrying boxes; means adapted, when actuated, to stop said conveyer, with the exception to be noted hereinafter; and check means rendering said first mentioned means inoperative to stop said conveyer when said stop means is actuated while a box is being discharged from said conveyer but permitting said stop means to be effective to stop the conveyer when said stop means is actuated when a box is not being so discharged.

8. In combination: a conveyer for carrying boxes; means adapted, when actuated, to stop said conveyer, with the exception to be noted hereinafter; check means rendering said first mentioned means inoperative to stop said conveyer while a box is being discharged from said conveyer but causing said stop means to be effective, if actuated whenever a box is not being so discharged; and means rendering said stop means ineffective to perform its function aforesaid until a box on said conveyer has approached within a given distance of said check means.

9. In combination: a conveyer for carrying boxes; means adapted, when actuated, to stop said conveyer, with the exception to be noted hereinafter; and check means responsive to the physical presence of a box on said conveyer within a given discharge zone of said conveyer to render said first mentioned means, when the latter is actuated, inoperative to stop said conveyer, but permitting said stop means to be effective

to stop said conveyer if said stop means is actuated whenever said zone is empty of boxes.

10. In combination: a conveyer for carrying boxes; means adapted, when actuated, to stop said conveyer, with the exception to be noted hereinafter; check means responsive to the physical presence of a box on said conveyer within a given zone of said conveyer to render said first

mentioned means inoperative to stop said conveyer, but causing said stop means to be effective if said stop means is actuated whenever said zone is empty of boxes; and means rendering said stop means ineffective to perform its function aforesaid until a box traveling on said conveyer has approached within a given distance of said zone.

RALPH E. FEUSIER.