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(54) IMPROVEMENTS IN OR RELATING TO COMBINE HARVESTERS

(71) We, SPERRY-RAND CORPORATION, a Corporation organised and existing under the laws of the State of Delaware, United States of America, of 1290 Avenue of the Americas, New York, New York 10019, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to combine harvesters of the axial flow type.

One known form of axial flow combine employs threshing means comprising a pair of rotors having rasp bars thereon and mounted within a casing so as to be rotatable in opposite directions for respective coaction with arcuate, stationary concaves. Auger mans are provided on the forward ends of the rotors positively to feed crop material to the inlet end of the threshing compartment or region between the rotors and respective concaves. An elevator is provided on the forward end of the combine and extends upwardly and rearwardly from a header which cuts and consolidates crop material and delivers it to the lower end of the elevator. The elevator moves the crop material upwardly and rearwardly to the lower portions of the auger means which feeds the material to the threshing means in a somewhat undershot manner.

A feed plate extends upwardly and rearwardly from the upper end of the elevator to the forward end of the concaves to guide the crop material from the elevator to the auger means and the forward end of the threshing means. It has been found that when crop material is fed up such a feed plate, there are several undesirable results, especially when the combine is harvesting certain types of crops. One undesirable result is a tendency for the crop material to slide back down the feed plate and thus obstruct the upward delivery movement of oncoming crop material from the elevator and thereby retard the feed function of the elevator. A second undesirable result is that it has been found that there is a limited amount of threshing of the seeds, grains and kernels from the crop material when engaged by the auger means and this threshed material also tends to slide downwardly along the feed plate, whereby a certain amount of such threshed materials falls upon the ground and thus is lost. Another undesirable result is that the grain threshed by the auger will be subject to possible damage if it is permitted to pass through to the threshing means because threshed grain is finer than the crop material for which the threshing mechanism is designed and, therefore, particularly susceptible to damage. A still further undesirable result is caused by the build up of loose crop material at the transition between the feed plate and elevator causing blockage and potential back-feeding down the top of the elevator to the header under some crop conditions.

A typical example of axial flow type combine to which the present invention pertains is disclosed in British Patent Specification No. 1,399,601. In this specification, it will be seen that the elevator delivers crop material to an upwardly and rearwardly extending feed plate which appears to be at an angle approximately 30 degrees relative to a horizontal plane, the feed plate being below the auger means on the forward ends of the rotors. Such combine is not provided with any means to retard or restrict such downward movement of some of the crop material in a back-feeding direction or in providing means to retain grain threshed by the auger means and, therefore, it is the principal object of the present invention to provide means at least to minimise, if not eliminate, such back-feeding tendency and loss of grain threshed by the auger means, as well as to facilitate release of threshed grain before it receives

damaging impact from the threshing mechanism.

According to the present invention an axial flow combine comprises a casing extending longitudinally on the combine and having a generally fore-and-aft extending threshing and separating mechanism mounted therein and comprising rotor means mounted longitudinally and rearwardly from the forward end of, and within, the casing for rotary movement and having rasp bars thereon, a concave supported within the casing coaxially with the rotor means to form in cooperation therewith a threshing mechanism, auger means connected to the forward end of the rotor means, conveyor means connected to the forward end of the casing and extending upwardly and rearwardly from a header at the lower end of the conveyor means towards the auger means, and a feed plate arrangement supported within the casing and extending upwardly and rearwardly therein between the upper rearward end of the conveyor means and the forward end of the concave to guide material for engagement by the auger means to feed the material positively to the threshing mechanism, the feed plate arrangement comprising passage means operable to permit threshed material to pass therethrough and to minimise back feeding of the crop material and grain receiving means disposed beneath the feed plate arrangement to accept threshed material falling through the passage means.

In one embodiment of the invention, the conventional feed plate of a combine is modified by forming therein between opposed side edges thereof and also between the upper and lower edges thereof, a transverseley-extending, rectangular opening or slot, a door-like plate being hingedly connected at one edge to the upper edge of the slot and movable about the axis of the hinge to dispose the plate either within the plane of the stationary feed plate or at an angle thereto to provide a recess which is wedge-shaped in cross section and serves two beneficial purposes namely, (1) if crop material moving up the feed plate by the oncoming material delivered by the elevator tends to slide backward, it will move into the recess and downward moveemnt will be stopped, and (2) such position of the door-like plate referred to above will also provide a transversely-extending slot through which threshed crop material may fall downwardly onto grain receiving means comprising a grain pan, for example.

The door-like plate may be provided with perforations or a pattern of similar openings which extends transversely thereacross, the size of the openings being adequate to permit passage of threshed material of the type being harvested by the combine at any given time. A number of door-like plates which are interchangeable with one another may be provided, the plates having openings of different sizes adapted to different types of crops from the smallest to the largest which normally are harvested by combines of the type embodying the present invention.

A removable bar may be provided at the forward lower edge of the door-like plate which, in conjunction with the plate, affords a shape and area corresponding to that of the opening in the upwardly and rearwardly extending feed plate, whereby when the bar is removed, a slot is provided through which threshed grain may fall onto the grain receiving means. An upwardly and rearwardly extending guide plate has a downwardly-extending flange which coacts with the door-like plate when in a lowered or open position to effect the reception or trapping of any crop material tending to slide downwardly along the feed plate, the flange further cooperating with the lower forward edge of the door-like plate to define a slot through which threshed crop material may drop onto the crop-receiving means.

The door-like plate may be secured in an adjusted position with respect to the opening in the feed plate with which it is associated by maintaining means comprising wings extending downwardly from the feed plate adjacent opposed ends of the slot therein, arcuate slots being formed in the wings for the reception of threaded pins fixed to opposed ends of the door-like plate and disposed within the slots, whereby nuts threaded onto the pins secure the door-like plate in a desired position of adjustment.

An axial flow combine embodying the present invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation of the combine with part thereof broken away to illustrate details with which the present invention is concerned,

Figure 2 is an enlarged fragmentary, partially sectioned, view showing the inlet end of threshing compartment of the combine as seen on line 2—2 of Figure 1,

Figure 3 is an enlarged fragmentary, vertical sectional view showing details of the combine to which the present invention pertains as seen on line 3—3 of Figure 2,

Figure 4 is an enlarged vertical sectional view of a detail of a feed plate arrangement of the combine as seen in the lower right hand portion of Figure 3 and illustrating an adjustable door-like portion thereof in several adjusted positions to illustrate the versatility thereof and also

showing one type of grain discharge opening,

Figure 5 is a view similar to Figure 4 but showing a further type of grain discharge opening comprising a removable extension on the door-like portion of the feed plate arrangement,

Figure 6 is a plan view of the door-like portion of the feed plate arrangement provided with openings therein permitting the passage of grain therethrough and adapted to be substituted for a solid type plate when desired, and

Figure 7 is a fragmentary vertical sectional view of one end of the feed plate arrangement and door-like portion thereof as seen on line 7—7 of Figure 4.

The combine 10 shown in Figure 1 comprises an overall housing 12 which encloses a rigid frame, not shown, supported by a pair of large, traction wheels 14 which are power driven by a diesel engine 16 of substantial horsepower rating. The traction wheels 14 are adjacent the forward end of the combine 10 and, rearwardly thereof, a pair of smaller wheels 18 are mounted, only one of the same being shown in view of the fact that the housing 12 is central of the pairs of wheels 14 and 18 and it is desired that the interior of the housing 12 be illustrated in Figure 1, whereby the nearer wheels 14 and 16 have been omitted. The wheels 18 are adapted to be moved about vertical axes by a steering wheel 20 which is actuated by an operator of the combine while seated upon a seat 22.

A grain bin or tank 24 is supported in the upper portion of the combine 10 and receives grain from elevating means 26. A reciprocatory grain pan 28 is located in the lower portion of the housing 12 and discharges grain onto the lower end of the elevating means 26 which transports the same to the grain bin 24.

Extending forwardly and downwardly from the forward end of the longitudinally-extending housing 12 of the combine is a conventional crop elevator 30 which comprises a plurality of transversely-spaced, endless, flexible belts 32, between which transverse cross bars 34 extend (Figure 3). The belts 32 extend around a lower, forward supporting cylinder or set of sprockets 36 mounted upon a transverse shaft, and the upper end of the elevator 30 has another transverse shaft 38 which extends between opposite sides of the crop elevator 30 to support either a drum or a series of sprockets 40. A driving sprocket 42 is mounted on one end of the shaft 38 for actuation by a sprocket chain, not shown, which derives power from the diesel engine 16.

The forward end of the frame embodied in the crop elevator 30 supports a forward header 44 of conventional type which cuts the crop material, moves it rearwardly, and a pair of oppositely-spiralled augers 46 consolidates the relatively wide swath of cut material into a much narrower band thereof which is continuously moved upwardly and rearwardly by the crop elevator 30, along the lower surface of the housing of the elevator, for an undershot type of delivery at the upper end of the elevator to a feed plate arrangement 48 which is supported within the housing 12 and is of a composite nature, embodying a number of features of the present invention. From Figures 1 to 5, it will be seen that the feed plate arrangement 48 extends upwardly and rearwardly from the upper end of the crop elevator 30, at an acute angle to the horizontal, to the inlet end of the two rotors 50 and associated concaves 52 which extend generally axial of the housing 12 of the combine 10 and comprise a generally fore-and-aft type of threshing and separating mechanism to which the crop material is forcibly fed by auger means 54 mounted upon the forward ends of respective rotors 50. Each rotor 50 supports a plurality of rasp bars 56 (Figures 2 and 3) which co-act with longitudinally extending bars of the associated arcuate concave 52. It also will be seen from Figure 2, that the two rotors 50 and co-acting concaves 52 are mounted generally parallel to one another with the augers and rotors rotating in opposite rotary directions as shown by the indicating arrows. It is to be understood, however, that the principles of the present invention may be applied to other arrangements of auger, rotor and concave means.

Attention is now directed to Figures 3 to 7 in which details of the feed plate arrangement 48 are best illustrated. The feed plate arrangement 48 comprises an arcuate transverse shield 58 which extends between opposite sides of the housing of the crop elevator 30 and terminates directly below the forward portion of the auger means 54. The upper portion of the shield 58 also is fixed to a rearwardly and downwardly extending additional member 60 which is connected to the forward end of the grain pan 28. This member 60 functions to seal off the area in the vicinity of the front edge of the grain pan 28, and comprises a flexible rubber-fabric material such as tyre carcass fixed between the moving pan and shield 58. It will be seen that the upper end portion of the lower plate 62 of the housing of crop elevator 30 engages the inner surface of the transverse shield 58 so as to permit no leakage of grain or other type of crop product therefrom for discharge onto the ground unless the same slides down the lower plate 62. The upper end of shield 58 engages the lower, forward edge of a

stationary feed plate 64, the upper edge 66 of which is immediately adjacent the forward end of the concaves 52, it being understood that the feed plate 64 extends between opposite sides of the housing 12 of the combine. Hence, it will be seen that the feed plate 64 leads directly to the inlet end of the threshing and separating compartments or regions between the rotors 50 and the respective concaves 52. It also will be seen that the feed plate 64, especially the transverse shield 58, extends upwardly at a substantial angle, whereby it has been found that, especially when threshing certain crop materials which lack structural strength, mass or density, to push the concentration of the material into close proximity of the rotating augers, particularly at the sides and centre section of the threshing means when employing twin rotors, augers and concaves, there is a tendency for portions of the crop material to slide backward, down the incline of the feed plate 64 and shield 58 and along the lower plate 62 of the housing of the crop elevator 30, thereby interfering with the material being continuously mowed upwardly and rearwardly by the elevator 30.

To minimise, or preferably eliminate, such tendency for backward movement of the crop material, the present includes the following improvements.

The feed plate 64 is provided with a transversely-extending opening 68, which is best shown in outline in Figure 2, having a forward, lower edge 70. The opening 68 also has opposed side edges 72, whereby it will be seen that the opening is of ample width to serve two principle objectives; to prevent or substantially minimise the downward, reverse sliding movement of crop material down the feed plate arrangement 48, and to provide means by which threshed crop material separated from the cut crop material incident to being engaged by the auger means 54, for example, may pass onto the forward end of the grain pan 28, exemplary threshed crop material 74, such as grain, being shown diagrammatically in Figure 3. Under circumstances where such threshing has occurred heretofore in similar situations, the grain has moved down the crop elevator 30 and has either impeded the upward movement of crop material or is discharged from the lower end of the elevator onto the ground and thus is wasted.

Several alternatives may be employed with respect to the transverse opening 68. One of these is shown in Figures 2, 3 and 6, wherein a door-like plate 76 is illustrated which is provided with a plurality of holes 79 which are of adequate size to permit the ready passage of threshed crop material therethrough in accordance with the size of the seeds, grains or kernels of the crop material being threshed. Accordingly, it is preferred that a plurality of the plates 76 be available, respectively having holes 79 of different sizes corresponding to the crop material being threshed. The upper, rearward edge of the plate 76 is pivotally supported by a transverse pivot shaft 78 which extends between a pair of wings 80 which are fixed to and extend downwardly from the lower surface of the feed plate 64 respectively adjacent opposed ends of the transverse opening 68 in the plate 64. The opposed ends of the door-like plate 76 have downwardly turned end members 82 thereon which are apertured for purposes of receiving bolts 84 which pass through arcuate slots 86 and have nuts 88 threaded thereon, whereby upon tightening the nuts 88, a desired angular position of the door-like plate 76 with respect to the opening 68 in feed plate 64 may be maintained for the following purposes.

From Figures 4 and 5 in particular, it will be seen that the forward lower edge of door-like plate 76 has a removable angle bar 90 connected to a perpendicular flange 92 which extends along the lower, forward edge of the plate 76, whereby one flange 94 is coextensive with the flange 92 and is removably connectible thereto by a plurality of bolts 96. The other flange 98 of angle bar 90 actually forms a continuation of the plate 76 as can be best seen in Figure 5. The combined width of the plate 76 and flange 98 of angle bar 90, considered in a direction perpendicular to the axis of the pivot shaft 78, preferably is slightly greater than the corresponding width of the transverse opening 68, whereby when the door-like plate 76 is disposed in the closed position with respect to opening 68 as seen in Figure 3, the terminal edge of flange 98 will engage the lower edge 70 of the opening 68. Accordingly, if the plate 76 is of the type shown in Figure 6, any threshed product material which slides down the plate 64 will pass through the openings 79 and fall onto the grain pan 28.

It also is contemplated within the purview of the present invention that an imperforate plate 76^1 may be employed, as illustrated in Figure 4 in full lines in the closed position, and in phantom in the open position. When the angle bar 90 is removed, the lower portion 100 of transverse opening 68, adjacent the lower edge 70 of the opening 68, is open and thereby forms a relatively narrow slot through which the grain or other threshed product 74 may fall.

A further transverse flange 102 may be provided which extends substantially perpendicular to the lower surface of the feed plate 64 immediately adjacent the lower

edge 70 of transverse opening 68, the flange preferably having a perpendicular terminal edge to strengthen and rigidify the flange. The flange 102 has several important functions, one of these being to form a wall of a recess 104 which otherwise is defined by the door-like plate 76 when the latter is disposed in a selected open position such as shown in exemplary manner in Figure 5. The recess 104 is capable of receiving at least a limited amount of threshed crop material which may tend otherwise to slide down the feed plate 64, opposite the desired feeding direction thereof, and the reception of such material in the recess 104 serves to minimise or prevent such backward, downward movement of the material, especially under circumstances where there is limited bulk of the material to ensure continuous upward and rearward feeding movement of the material along the feed plate 64.

A second function of the transverse flange 102 is to cooperate with the terminal edge of the other flange 98 of angle bar 90, when provided, and provide a space through which threshed crop material may fall onto the grain pan 28. Accordingly, it will be seen that different positions of the door-like plate 76 with respect to the transverse flange 102 will provide passage slots of different widths, as desired to suit the type of crop material being threshed.

From the foregoing it will be seen that the present invention provides means for either substantially minimising or eliminating the tendency for threshed crop material to slide backward from the intended feeding direction thereof when moving the feed plate 64 by providing angular adjustment of the door-like plate 76 relative to the transverse opening 68 in the feed plate 64 to form the recess 104 which operates to receive a certain amount of downwardly sliding material and halt such action, and providing possibilities of forming a build-up of said material and thereby prevent any downward movement of additional material, particularly until such time as oncoming masses of the crop material will tend to move the material which has accumulated in the recess 104 upwardly to the inlet of the threshing and separating compartment of the combine. In addition, material which is threshed by the action of the augers 54, or otherwise, prior to the crop material being engaged by the threshing rotor and concave means, is permitted to fall onto the grain pan by passage either through the openings 79 in the door-like plate 76 and/or the transverse slot 100 which is provided with the angle bar 90 is removed, or the slot between flange 102 and the terminal edge of flange 98 of angle bar 90 when the door-like plate 76 has been moved to an open position.

WHAT WE CLAIM IS:—

1. An axial flow combine harvester comprising a casing extending longitudinally on the combine and having a generally fore-and-aft extending threshing and separating mechanism mounted therein and comprising rotor means mounted longitudinally and rearwardly from the forward end of, and within, the casing for rotary movement and having rasp bars thereon, a concave supported within the casing coaxially with the rotor means to form in cooperation therewith a threshing mechanism, auger means connected to the forward end of the rotor means, conveyor means connected to the forward end of the casing and extending upwardly and rearwardly from a header at the lower end of the conveyor means towards the auger means, and a feed plate arrangement supported within the casing and extending upwardly and rearwardly therein between the upper rearward end of the conveyor means and the forward end of the concave to guide crop material for engagement by the auger means to feed material positively to the threshing mechanism, the feed plate arrangement comprising passage means operable to permit threshed material to pass therethrough and to minimise back feeding of the crop material, and grain receiving means disposed beneath the feed plate arrangement to accept threshed material falling through the passage means.

2. A combine according to claim 1, in which the feed plate arrangement comprises a plate extending from the centre of the arrangement towards respective sides of the casing and having a series of openings therein.

3. A combine according to claim 1 or 2, in which the feed plate arrangement comprises an upwardly and rearwardly extending plate supported transversely between opposed sides of the casing and having a transversely-extending opening therein, and a door-like plate extending across the opening and movably supported relative thereto adjustably to form a passage opening between the door-like plate and one edge of the transverse opening to permit passage of threshed grain therethrough.

4. A combine according to claim 3, in which the door-like plate has a pattern of holes therein of sufficient size to pass threshed crop material therethrough.

5. A combine according to claim 3 or 4, in which the door-like plate is hingedly connected along the upper rearward edge thereof relative to the upper edge of the transversely extending opening and is adjustable about the hinge to provide a variable discharge slot through which crop material

threshed by the auger means or otherwise may pass to the grain receiving means.

6. A combine according to claim 5 and further including a flange extending downwardly from the lower edge of the transversely-extending opening and cooperating with said door-like plate when the lower forward edge thereof is lowered to form a recess trap adapted to receive crop material and at least minimise any tendency for crop material to slide down the feed plate arrangement, as well as to provide a passage for any threshed crop material.

7. A combine according to claim 6 and further including a bar extending across and removably attached to the forward lower edge of the door-like plate and comprising an extension of that edge to extend to the forward lower edge of the transversely-extending opening when the door-like plate is in the closed position relative to the opening, the bar, when removed, decreasing the size of the door-like plate and thereby providing a further slot between one edge of the discharge slot and the plate through which threshed crop material may pass when the door-like plate is in the closed position.

8. A combine according to any of claims 5 to 7 and further including wing members connected to the upwardly and rearwardly extending plate adjacent the opposed ends of the transversely-extending opening therein, the wing members being engaged respectively by the opposed ends of the door-like plate when pivotally moved downwardly to form the discharge slot, maintaining means being provided between the wing members and door-like plate operable to maintain the door-like plate in a desired adjusted position relative to the transversely-extending opening.

9. A combine according to claim 8, in which the maintaining means comprise arcuate slots in the wing members and threaded bolts carried by transverse members on opposed ends of the door-like plate adjustably movable within the slots, and nuts on the bolts operable to secure the door-like plate in a desired adjusted position.

10. An axial flow combine substantially as herein particularly described with reference to Figures 1, 2, 3, 6 and 7, or as modified by Figure 4 or Figure 5 of the accompanying drawings.

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Chartered Patent Agents.

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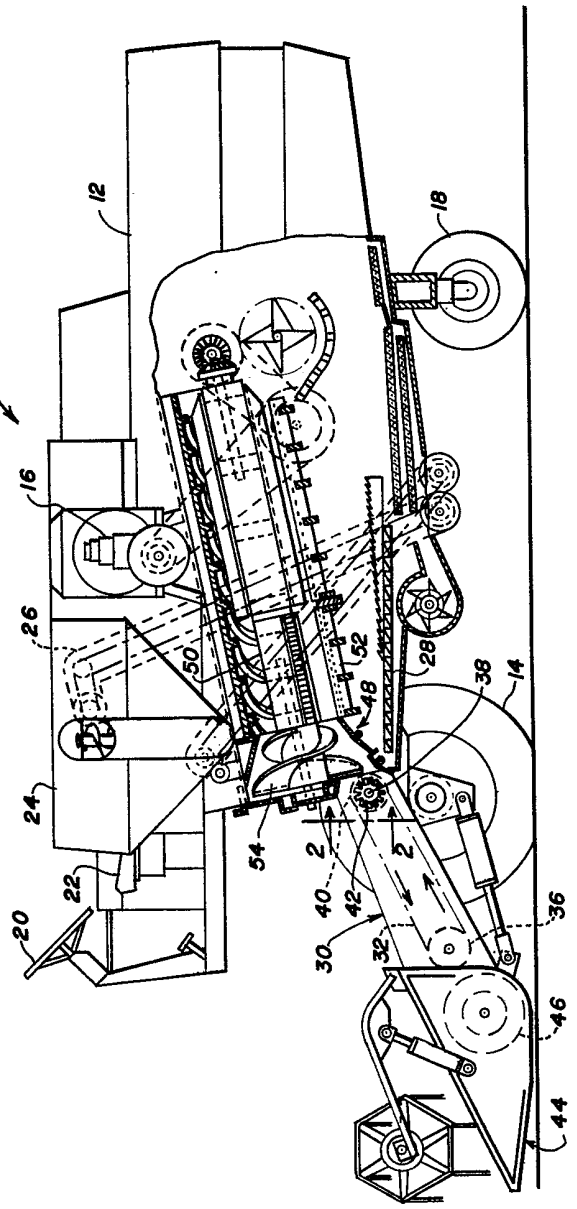
1559999 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig. 1



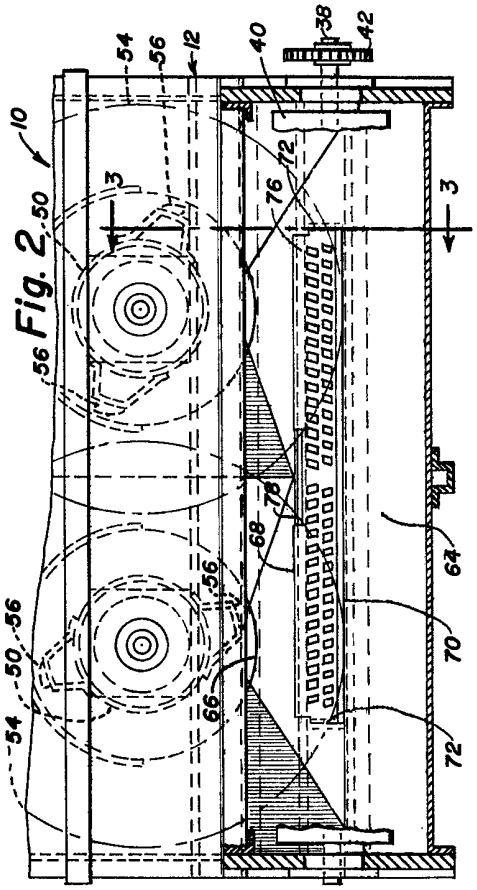


Fig. 2

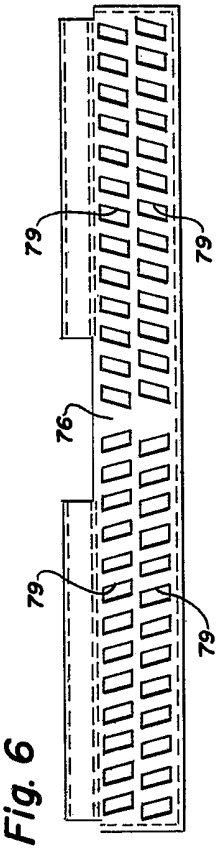


Fig. 6

Fig. 3

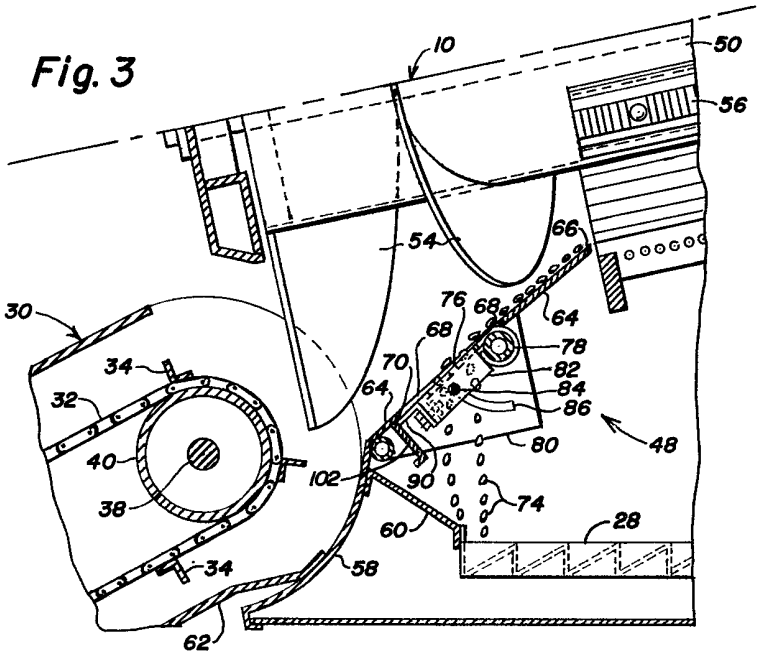

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Fig. 7

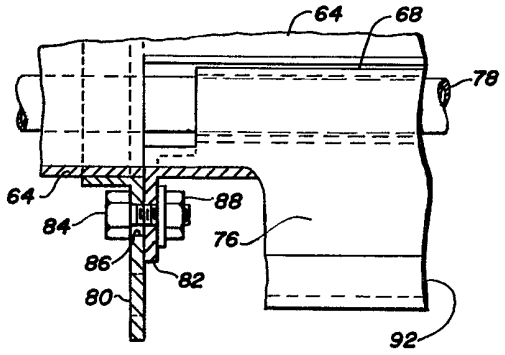
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Fig. 4

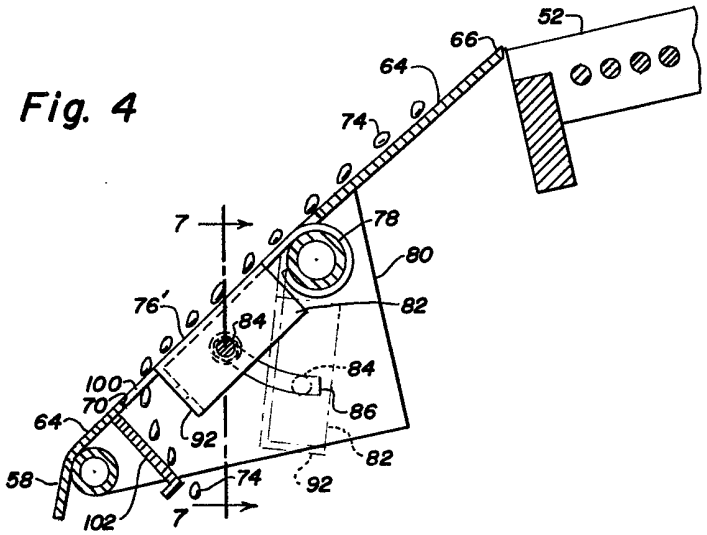
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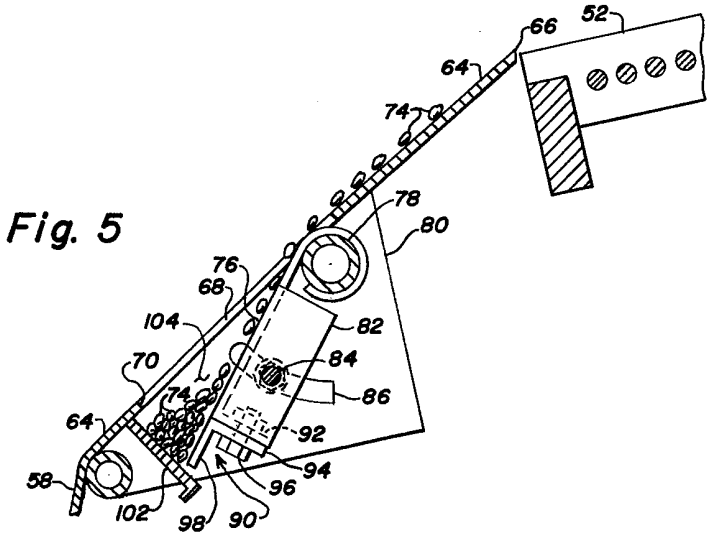
Fig. 5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