ABSTRACT: A device for distributing granular material to the ground, including a dispensing hopper and a flexible delivery tube extending downwardly from the hopper toward the ground, having means including a flexible resilient member and a tubular discharge head for supporting the lower discharge end of the tube in spaced relation to the ground and adjustable to selectively move the tubular head vertically and laterally relative to the ground. The resilient member is operative to permit displacement of the tubular head upon engagement thereof with an obstruction, and to reposition the same, when the obstruction is passed.
CHEMICAL APPLICATOR AND SUPPORT MEANS THEREFOR

The present invention relates to improvements in devices for applying seed or granular chemicals, such as pesticides or fertilizer, to the ground during cultivation thereof. Such devices are disclosed in my prior U.S. Pat. Nos. 2,550,107, 2,852,166 and 2,990,186. An important object of this invention is the provision of an applicator having a flexible material delivery tube and means for supporting the discharge end of the tube for generally vertical and horizontal adjustment relative to the machine on which it is mounted. Another object of this invention is the provision of support means permitting lateral displacement of the discharge end of the delivery tube from a predetermined discharge position relative to the machine, upon engagement of said discharge end with an obstruction in the path of travel thereof and operative to redispense the discharge end of the tube, when the tube passes beyond the obstruction.

To these ends, I provide a generally vertically elongated support rod, means operatively mounting the support rod to the dispensing hopper for generally vertical movements and for generally horizontal movements of its lower end, a rigid tubular discharge head having an upper end for reception of the lower discharge end of the delivery tube and a mounting stem thereon, and a coil spring coupling element secured to the mounting stem and to the lower end of the support rod to dispose the support rod and mounting stem in longitudinally spaced normally aligned relationship. The support rod includes laterally spaced parallel upper and lower rod sections, the lower section being movable laterally about the axis of the upper section, responsive to rotation of the upper section to laterally adjust the discharge head relative to the dispensing hopper.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary view in side elevation of a conventional tractor with the chemical applicator and support means of this invention mounted thereon. FIG. 2 is a view in perspective of the invention. FIG. 3 is an enlarged fragmentary detail, partly in plan and partly in horizontal section, taken substantially on the line 3-3 of FIG. 1; and FIG. 4 is an enlarged fragmentary detail corresponding to a portion of FIG. 1, some parts being broken away and some parts being shown in section.

DETAILED DESCRIPTION

A prime mover in the nature of a conventional farm tractor is shown fragmentarily in FIG. 1, and indicated generally by the numeral 1, the same comprising a frame 2 having an engine 3 mounted thereon and supported in part by front wheels 4, one of which is shown. A cross-sectionally rectangular tubular tool bar 5 extends transversely of the prime mover 1, and supports a plurality of implements such as cultivator shovels 6, by means of platelike members 7 and 8 pivotally connected by parallel arms 9. The member 7 is rigidly secured to the tool bar 5, and the member 8 is secured to an auxiliary support arm 10 from which the cultivator shovels 6 depend. As shown in FIG. 1, the auxiliary support arm is partially supported by means including a ground-engaging wheel 11. Means for raising and lowering the cultivator shovels 6 respectively and from engagement with the ground comprises a fluid pressure operated cylinder 12 pivotally connected to the tractor 1, a cooperating piston-equipped plunger rod 13 pivotally connected at its free end to a crank arm 14 that is mounted on a shaft 15, a bell crank lever 16 secured to the shaft 15, and a lifting link 17 engaged by the bell crank 16 and connected to the lowermost one of the parallel arms 9. Normally, a plurality of laterally spaced pairs of cultivator shovels and support means therefor are carried by the tool bar 5, to simultaneously cultivate a plurality of rows of growing crops. The cultivator shovels 6 and supporting and lifting means therefor, in and of themselves, do not comprise the instant invention, and are shown only for the purpose of illustrating one use of the present invention. Hence, in the interest of brevity, further showing and description of the foregoing equipment is omitted.

A dispensing hopper 18 is provided at its bottom portion 19 with a pair of discharge or outlet fittings 20 and a dispensing rotot 21 that is mounted on a rotary shaft 22 journeled in bearings 23 at opposite ends of the hopper 18. The hopper 18 is similar to that disclosed in the above-mentioned Pat. 2,852,166, reference being had thereto. The dispensing hopper 18 is mounted on a tool bar 24 that extends transversely of the tractor 1, by means of a pair of mounting bars 25 that are bolted or otherwise rigidly secured at their intermediate portions to opposite ends of the hopper 18, the rear end portions of the mounting bars 25 being notched, as indicated at 26, to be seated on the tool bar 24. The mounting bars 25 are rigidly anchored to the tool bar 26 by clamping bars 27 and cooperating clamp hooks 28.

The tool bar 24 is supported from the tractor 1 by a pair of laterally spaced forwardly projecting mounting arms 29, one of which is shown, the mounting arms 29 being bolted or otherwise rigidly secured to opposite sides of the tractor frame 2. Preferably, the tool bar 24 is of a length to support a plurality of dispensing hoppers 18 in laterally spaced relationship, each hopper 18 being adapted to supply granular chemical to the ground in or adjacent the path of travel of each pair of cultivator shovels 6. Preferably, the tool bar 24 is braced laterally outwardly of the support arms 29, by brace members 30 and 31 fragmentarily shown in FIG. 1.

A pair of flexible delivery tubes 32 have upper ends suitably connected to the outlet fittings 20, and extend downwardly therefrom toward the ground. The lower ends of the tubes 32 are releasably received one each in the upper end of a different one of a pair of rigid tubular heads 33 having curved lower end portions 34. The heads 33 are preferably made from rigid metallic tubing, the delivery tubes 32 being of any suitable flexible material, such as synthetic plastics.

The tubular members or heads 33 are supported from the mounting bars 25 by a pair of generally vertically disposed elongated support rods 35 each comprising an upper rod portion 36, a lower rod portion 37 laterally offset from the upper rod portion 36, and an angular dog leg portion 38 interconnecting the upper and lower rod portions 36 and 37 respectively. The hopper mounting bars 25 project forwardly from the hopper 18 and have their front ends angularly outwardly bent to provide out-turned ears 39 that cooperate with adjacent portions of their mounting bars 25 to define intermediate bearers 40 for vertical sliding reception of respective ones of the upper rod portions 36. A pair of L-shaped clamping bolts 41 each partially encompasses a different one of the upper support rod portions 36 opposite an adjacent inside corner 40, each clamping bolt 41 comprising a screw-threaded end portion 42 that extends through an opening 43 in a respective mounting bar 25, and an angularly displaced headed end portion 44 that extends loosely through an opening 45 in an adjacent one of the ears 39, see FIG. 3. The threaded end portion 42 of each clamping bolt 40 is provided with a clamping nut 42' which, when tightened on the threaded portion 42, moves the clamping bolt 41 in a direction to rigidly clamp the adjacent upper support rod portion 36 in its adjacent inside corner 40 of its respective mounting bar 25. With this arrangement, each support rod 35 may be raised or lowered, or rotated on the axis of its respective upper rod portion 36, and releasably locked in any desired set position relative to the hopper 18.

Each of the discharge heads 33 is provided with a rigid mounting stem 46 having a screw threaded upper end portion 47 disposed in laterally spaced generally parallel relation with the upper end portion of its respective discharge head 33, and a lower end portion 48 welded or otherwise rigidly anchored to its adjacent tubular discharge head 33. Interconnecting
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means between each stem 46 and the lower end portion of its respective support rod 35 comprises a resilient coupling member in the nature of a coil spring 49 having opposite open ends, the lower end portion of each spring 49 being screw threaded on the threaded port 47 of a respective mounting stem 46. The lower ends of the lower rod portions 37 are screw threaded, as indicated at 50, to threadedly receive the upper end portions of the springs 49. The convolutions of the springs 49 are wound in a manner to cause each convolution to be yieldingly urged into engagement with adjacent convolutions, to provide normally closed springs. The springs 49 are also of such diameter relative to the stems 46 and support rods 35 that the threaded portions 47 and 50 respectively are tightly received in the opposite end portions of the springs 49. It will be further noted, with reference to FIG. 4, that the springs 49 are of such axial length as to dispose the adjacent thread end portions 47 and 50 in substantial axially spaced apart relationship, whereby to permit the springs 49 to be easily bent or flexed between the stem and rod ends 47 and 50. The tight winding of the convolutions of the springs 49 enables the springs to resume an axially straight condition when flexing or bending force applied thereto is released.

When the dispensing hopper 18 and parts carried thereby are mounted on the tool bar 24, the support rods 35 are vertically adjusted and rotated relative to the support bars 25 to dispose the discharge end portions 34 of the discharge heads 33 at desired heights above the ground and in desired spaced apart relationship from each other. The clamping nuts 42' are then tightened to hold the discharge heads 33 in their set positions. During operation of the dispensing hopper 18 and forward movement of the mover or tractor 1, should either dispensing head 33 strike an obstacle in the field, the adjacent spring 49 will bend or flex sufficiently to permit the engaged discharge head 33 to pass over or around the obstacle after which the affected spring 49 will immediately assume its axially straight condition and automatically redispose its adjacent discharge head 33 in its set delivery position.

1. In a device for distributing granular material:
   a. a dispensing hopper;
   b. means for mounting said hopper on a prime mover;
   c. a flexible delivery tube having an upper inlet end operatively connected to said hopper for conducting material from said hopper to the ground and having a lower discharge end portion; and
   d. means for supporting said discharge end portion in an operative position in predetermined upwardly spaced relation to the ground and including:
      1. a generally vertically elongated rigid support rod comprising, an upper rod portion, a lower rod portion laterally offset from said upper rod portion, and an intermediate angular dog leg portion connecting said upper and lower rod portions;
      2. means releasably securing said support rod at its upper rod portion to said hopper for vertical and rotary movements of said support rod on the axis of said upper portion to move said lower end of the rod relative to said hopper;
      3. a tube-engaging head at the discharge end portion of said tube; and
      4. interconnecting means including a flexible resilient coupling member between said head and the lower end of said support rod, said coupling member being flexibly in all directions transversely of the axis of said support rod lower portion and flexing responsive to engagement of said head by an obstruction during movement of said device over a field to carry the head over the obstruction and to reposition the head responsive to disengagement of the head from said obstruction.

2. In a device for distributing granular material:
   a. a dispensing hopper;
   b. means for mounting said hopper on a prime mover;
   c. a flexible delivery tube having an upper inlet end operatively connected to said hopper for conducting material from said hopper to the ground and having a lower discharge end portion; and
   d. means for supporting said discharge end portion in an operative position in predetermined upwardly spaced relation to the ground and including:
      1. a generally vertically elongated rigid support rod;
      2. means releasably securing said support rod intermediate its ends to said hopper for vertical and horizontal movements of the lower end of the rod relative to said hopper;
      3. a tube-engaging rigid tubular head having a generally vertical upper end portion for reception of the discharge end of said delivery tube and a lower discharge end angularly disposed relative to said upper end portion thereof; and
      4. interconnecting means including a flexible resilient coil spring between said head and the lower end of said support rod and a rigid stem secured to the tubular member and having a generally vertical upper end portion disposed in laterally spaced relation to the upper end portion of said tubular member, said spring having opposite upper and lower ends secured to the support rod and stem respectively, said support rod and stem being maintained in longitudinally spaced relationship by said spring, said spring flexing responsive to engagement of said head by an obstruction during movement of said device over a field to carry the head over the obstruction and to reposition the head responsive to disengagement of the head from said obstruction.

3. The device for distributing granular material defined in claim 1, in which each of the convolutions of said spring are yieldingly biased into engagement with adjacent convolutions, said spring having open opposite ends, said rod and stem having screw threads on their adjacent end portions for screw-threaded reception of the ends of said spring.

4. The device for distributing granular material defined in claim 1, in which said means releasably securing said support rod intermediate said hopper includes a mounting bar having an angular bent end portion providing an inside corner for reception of said support rod, said end portion and the bar adjacent said end portion each having an opening therethrough, an L-shaped clamp element having a screw-threaded end portion extending through one of said openings and an opposite end portion loosely received in the other of said openings, and a clamping nut screw-threaded on said threaded portion, said clamp element partially encompassing said support rod opposite said inside corner, whereby, when said clamping nut is loosened, said support rod may be vertically moved relative to said mounting bar and rotated on the axis of said upper end portion of the support rod to impart generally lateral movements to said lower end portion of the support rod and said tube engaging head.

5. The device for distributing granular material defined in claim 1, in which said means releasably securing said support rod intermediate said hopper includes a latching arrangement comprising a latch member pivotally connected to said hopper for interconnection by said spring, said latch member including a catching element provided at the pivot rising end of the latch member for engaging with a corresponding projection of the support rod, a spring between said latch member and said projection for biasing said latch member and said projection into engagement, means for releasing said latch member to pivot said latch member in a direction away from said pivot rising end of said latch member, and means for re-engaging said latch member with said projection for locking said latch member against movement therefrom.

6. The device for distributing granular material defined in claim 1, in which said means releasably securing said support rod intermediate said hopper includes a clamping arrangement comprising a clamping member for engaging the inside diameter of said support rod, a proximate end of said clamping member extending beyond a pivot rising end of said support rod for engaging with a projection on said pivot rising end of the support rod, a pivot support point for said clamping member, a separation pivot therein communicating with said pivot support point being pivotally connected to said hopper, a clamping member pivotally connected to said pivot point and capable of engaging and disengaging said support rod, and means for biasing said clamping member away from said pivot rising end of the support rod when said clamping member is disengaged from said support rod.

7. The device for distributing granular material defined in claim 1, in which said means releasably securing said support rod intermediate said hopper includes a securing arrangement comprising a securing member pivotally connected to said hopper for engaging a projection on said pivot rising end of the support rod, a pivot support point for said securing member, a pivot therein communicating with said pivot support point being pivotally connected to said hopper, a securing member pivotally connected to said pivot point and capable of engaging and disengaging said support rod, and means for biasing said securing member away from said pivot rising end of the support rod when said securing member is disengaged from said support rod.

8. The device for distributing granular material defined in claim 1, in which said means releasably securing said support rod intermediate said hopper includes a means for engaging said support rod comprising a securing member pivotally connected to said hopper for engaging a projection on said pivot rising end of the support rod, and said means including means for biasing said securing member away from said pivot rising end of said support rod when said securing member is disengaged from said support rod.

9. The device for distributing granular material defined in claim 1, in which said means releasably securing said support rod intermediate said hopper includes a means for engaging said support rod comprising a securing member pivotally connected to said hopper for engaging a projection on said pivot rising end of the support rod, and said means including means for biasing said securing member away from said pivot rising end of said support rod when said securing member is disengaged from said support rod.