

Dec. 31, 1968

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3,419,221

MATERIAL SPREADING AND MIXING APPARATUS

Filed July 15, 1965

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Fig. 1.

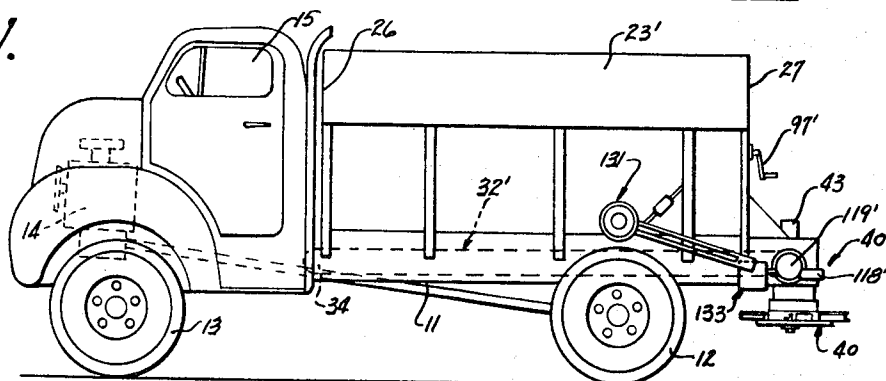


Fig. 2.

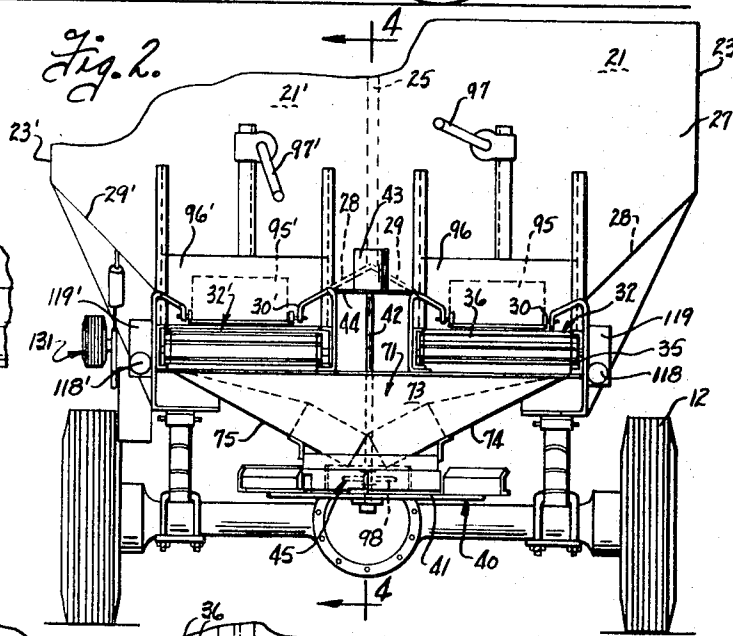


Fig. 4.

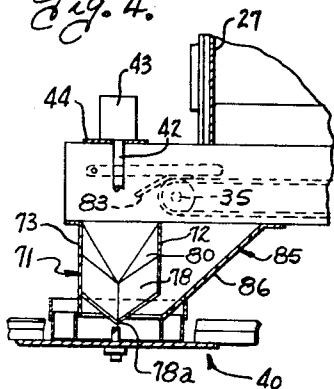
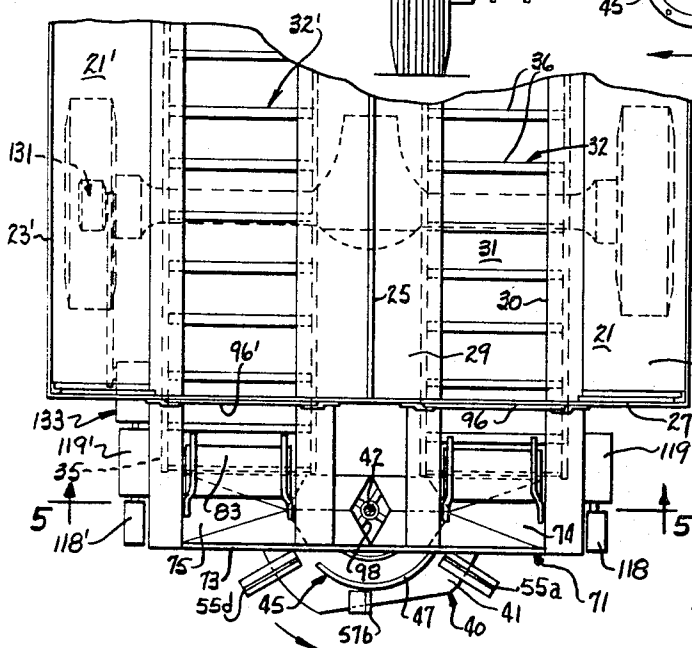


Fig. 3.



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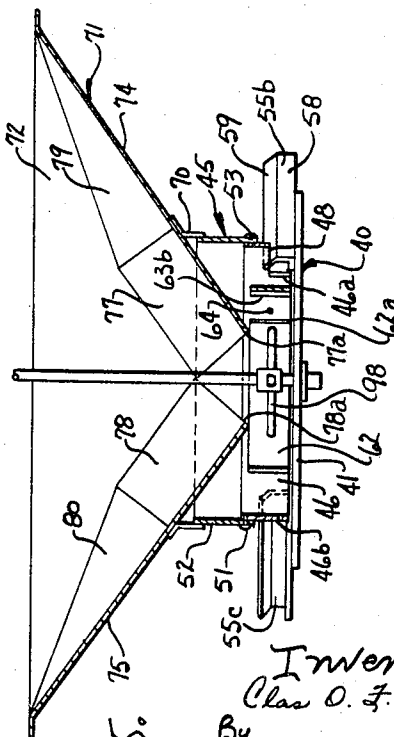
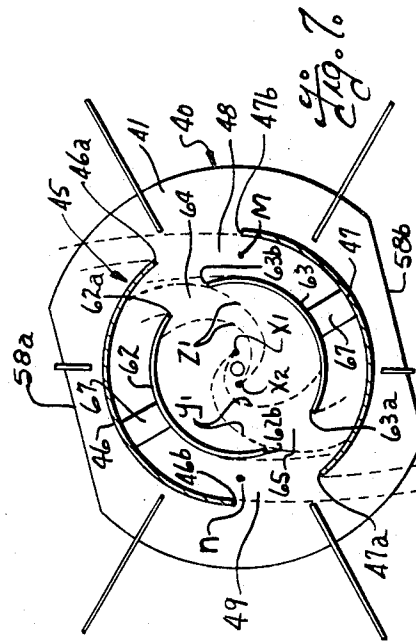
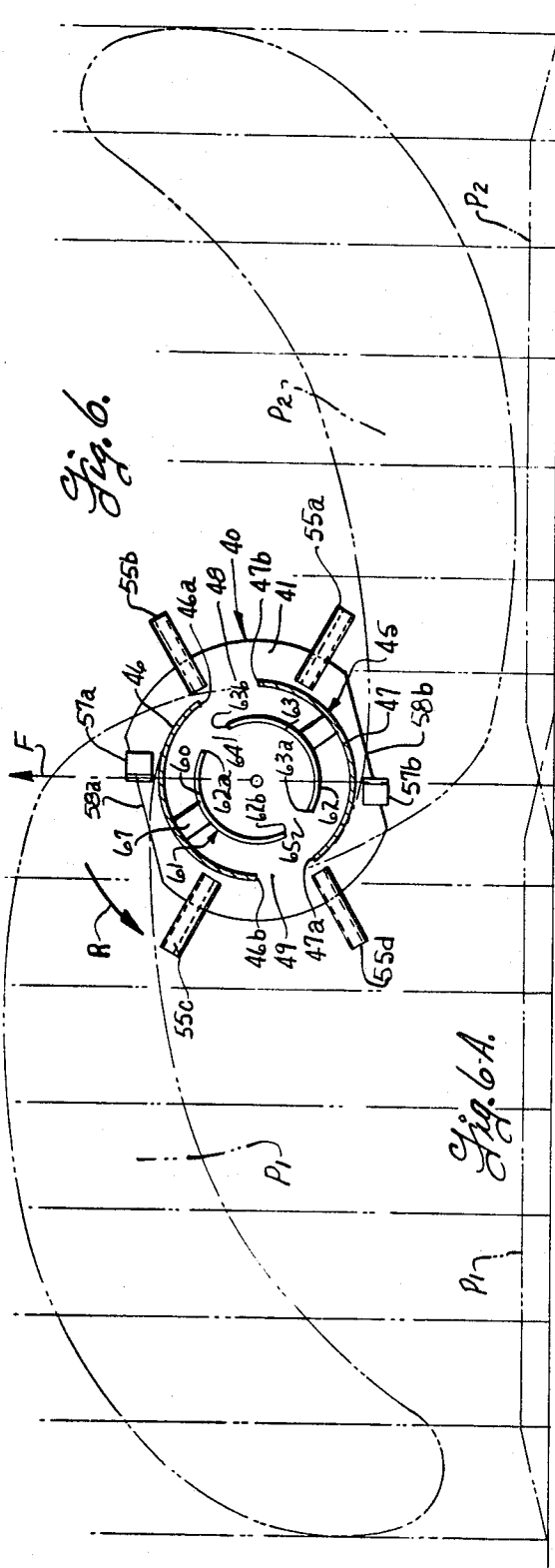
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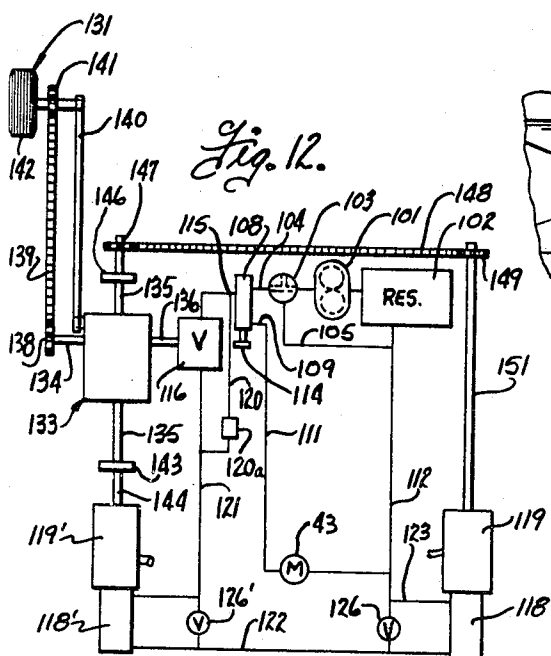
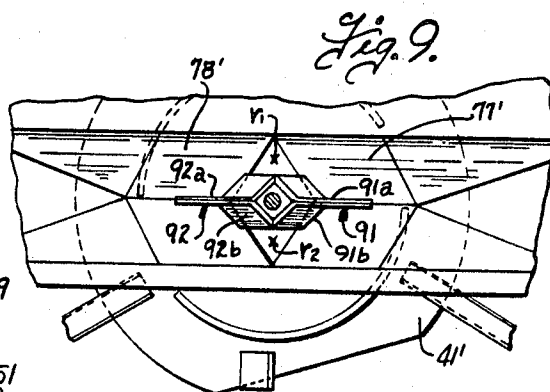
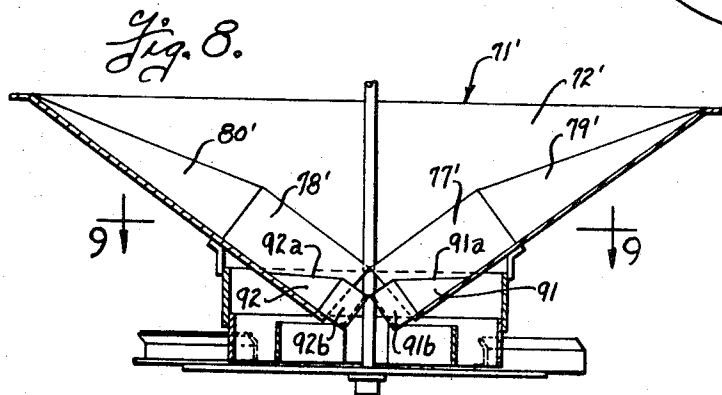
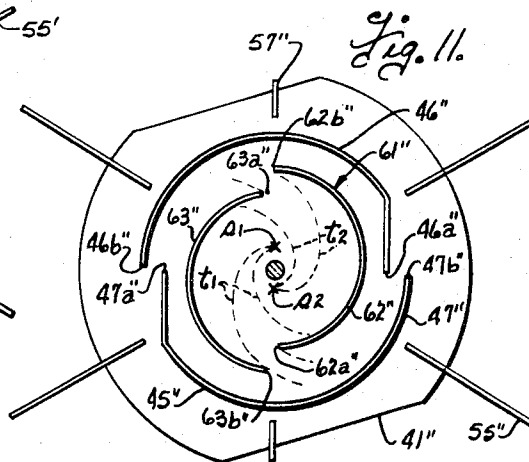
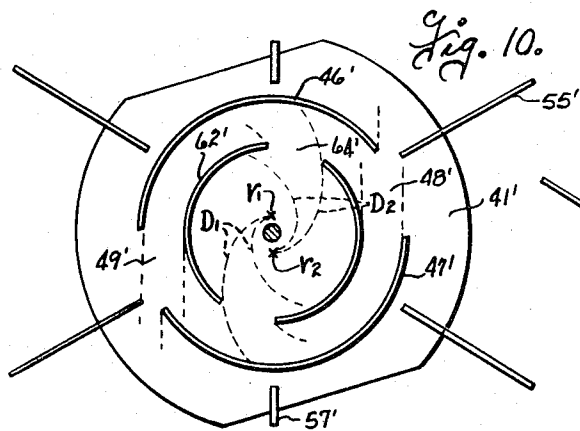
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Fig. 13.

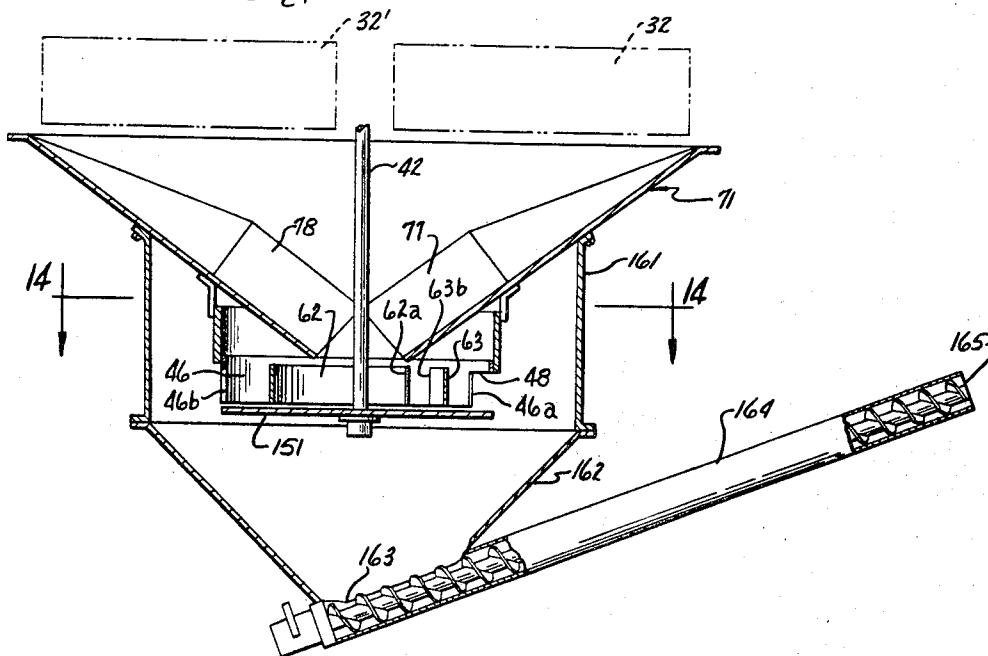
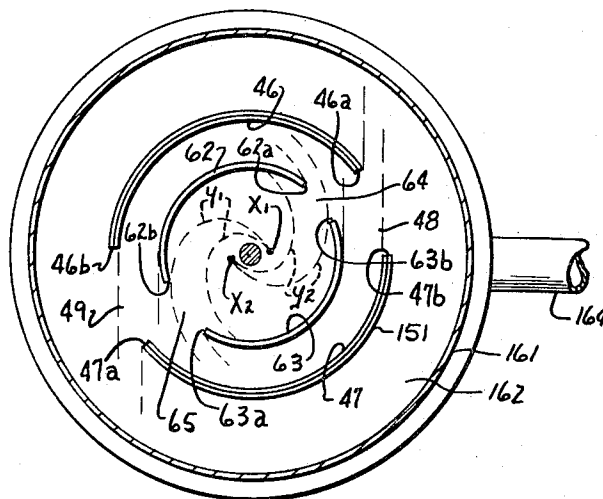


Fig. 14.



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MATERIAL SPREADING AND MIXING APPARATUS

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22 Claims. (Cl. 239—656)

ABSTRACT OF THE DISCLOSURE

An apparatus for spreading and blending particulate materials in which material is fed from a hopper at a controlled rate onto an inner area of a rotary broadcast member and stationary material flow dividers are provided at the upper surface of the broadcast member to divide the material deposited on the broadcast member into separate streams as the material travels outwardly toward the impellers at the outer margin of the broadcast member. Several different particulate materials can be fed into the flow dividers, and the several materials are each divided and delivered to the impellers in separate streams each containing a blended mixture of the several materials. The material feed means is arranged to enable selective feeding of one or the other or both of several different particulate materials to the broadcast member.

This invention relates to an apparatus for spreading materials over an area and for blending plural materials for spreading.

The present invention relates to an apparatus for spreading pulverulent, granular, pelletized or other particulate materials, hereinafter generally referred to as particulate materials, and is particularly adapted for spreading plural materials over an area. The apparatus may, for example, be used for simultaneously spreading several of various different fertilizing materials and soil conditioning materials such as potash fertilizer, phosphate fertilizer, nitrate fertilizer, lime, etc. The apparatus may also be used for spreading other materials such as several of the various different kinds of materials for conditioning of highways and the like, such as sand, sodium chloride, calcium chloride, cinders, etc. In the embodiment illustrated, the apparatus is arranged for simultaneous spreading of two different materials, it being understood that the apparatus could be adapted for the spreading of more than two materials at the same time.

It is frequently necessary, in the conditioning of soils, to apply several different soil conditioning materials, the type and the quantity of materials per acre varying with the different soils and crops to be grown on the soil. At present, it is a general practice to premix several fertilizer materials at mixing plants, and to haul the premixed material to the farm or other place to be spread, and then spread the premixed material. This system has several disadvantages. Since the type and relative proportions of the several fertilizer materials required vary with different soil conditions and the crops to be grown, it is necessary to either custom mix the several materials at the mixing plant according to each user's requirements, or to mix a number of different mixes of relatively different compositions so that the user can select the one which most nearly fits his needs. This premixing requires special equipment to attain uniform mixing of the different materials and, if a number of different premixes are prepared for subsequent sale, it requires the elaborate storage facilities for the different mixes. Further, the different materials to be spread generally have different specific gravities and particle size. The vibration incident to hauling the premixed

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material to the place of distribution, and even while moving over the field when distributing the material, causes significant gravitational separation of the different materials. As a consequence, the initial material spread from each load will contain a relatively greater proportion of the material that tends to gravitationally separate to the bottom of the hopper and the last material distributed from each load will have a relatively greater proportion of the material that tends to gravitationally separate to the top of the hopper.

An important object of this invention is to provide apparatus for spreading plural materials which avoids the necessity of premixing the materials to be spread and also avoids the problem of gravitational separation which occurs in premixed materials during transportation and spreading of the same.

Another object of this invention is to provide an improved apparatus for spreading plural materials and which enables simultaneous spreading of several different materials over the area to be covered.

Another object of this invention is to provide an apparatus for spreading several different materials and which enables ready control of the several amounts of the materials to be spread over a selected area.

Still another object of this invention is to provide an improved broadcast spreader apparatus which achieves more uniform spreading of the material over a wide swath extending to opposite sides of the spreader apparatus as the vehicle moves along a path over the area to be spread.

A more particular object of this invention is to provide a broadcast spreader apparatus which throws the material in two separate streams and in relatively opposite directions from the broadcast spreader and which is so arranged that it substantially equalizes the amount of materials delivered in the separate streams.

Yet another object of this invention is to provide a spreader apparatus in accordance with the foregoing object which is adapted for spreading several materials at the same time and which will spread the several materials in like proportions in the two oppositely directed streams.

A further object of this invention is to provide an improved apparatus which will continuously blend two or more particulate materials in any selected proportions.

A still further object of this invention is to provide an apparatus which is adaptable for continuously blending two or more particulate materials and delivering the same to a common outlet or for blending the materials and broadcast spreading the same.

These, together with other objects and advantages of this invention will be more readily appreciated as the invention becomes better understood by reference to the following detailed description when taken in connection with the accompanying drawings, wherein:

FIG. 1 is a side elevational view of the vehicle having the present invention applied thereto;

FIG. 2 is a fragmentary rear elevational view of the vehicle having the spreader apparatus of the present invention applied thereto;

FIG. 3 is a fragmentary horizontal plan view of the vehicle with the spreader apparatus applied thereto;

FIG. 4 is a fragmentary vertical sectional view taken on the plane 4—4 of FIG. 2;

FIG. 5 is a fragmentary transverse sectional view taken on the plane 5—5 of FIG. 3;

FIG. 6 is a diagrammatic view illustrating the general spread pattern of the spreader apparatus and FIG. 6A is a graph illustrating the desired distribution of material along the spread pattern, and which distribution is closely approximated by the spreader apparatus;

FIG. 7 is a plan view of the broadcast spreader on a

larger scale than FIG. 6 with the flows of material in the spreader illustrated in phantom;

FIG. 8 is a transverse sectional view similar to FIG. 5 and illustrating a modified guide chute construction;

FIG. 9 is a fragmentary sectional view taken on the plane 9—9 of FIG. 8;

FIG. 10 is a plan view of the rotary broadcast spreader for use with the embodiment of FIG. 8 with the flows of material illustrated in phantom;

FIG. 11 is a plan view of a further modified form of broadcast spreader apparatus;

FIG. 12 is a diagrammatic view of the hydraulic control system for the spreader apparatus;

FIG. 13 is a vertical sectional view through an apparatus adapted for blending two or more materials and for delivering the materials to a common discharge; and

FIG. 14 is a sectional view through the blending apparatus taken on the plane 14—14 of FIG. 13.

The spreader apparatus of the present invention is adapted for use with a vehicle for spreading particulate materials from the vehicle as it moves along a path over the area to be covered, and the spreader apparatus can be used with various different types of vehicles including self-propelled vehicles such as trucks and the like and trailing type vehicles which are adapted to be towed by a truck, tractor or the like. As shown herein, the spreader apparatus is applied to a truck-type vehicle having a frame 11, drive wheels 12, steering wheels 13, a drive motor diagrammatically indicated at 14 for driving the vehicle, and driver control station in the cab 15. The truck, as thus far described, is conventional and further detailed description is deemed unnecessary. Alternatively, the vehicle could be in the form of a trailer type vehicle which is merely towed or pushed by another vehicle, if desired.

The spreader apparatus of the present invention is arranged to spread several different particulate materials and the several materials to be spread are not premixed but are instead maintained segregated from each other on the vehicle. For this purpose, plural material storage compartments or hoppers are provided on the vehicle for receiving the different materials to be spread. As shown herein, the vehicle is provided with two storage compartments designated 21 and 21' for use in spreading two different materials, it being understood that additional storage compartments could be provided if desired. The storage compartments may be formed in any suitable manner and, as illustrated, are formed in a V-box having spaced side walls 23 and 23', an intermediate wall 25, and front and rear end walls 26 and 27. Intermediate wall 25 separates the box into the aforementioned hoppers 21 and 21' and these hoppers have downwardly inclined bottom walls 28, 28' and 29, 29'. A feed means is provided for feeding material from the several storage compartments or hoppers to the material spreading apparatus. While it is possible to use a single conveyor which underlies both hoppers or storage compartments, it is preferable to use separate conveyors such as shown at 32 and 32' for individually feeding the different materials to the spreader apparatus. The conveyors 32 and 32' are conveniently of like construction and are herein shown of the endless type entrained over sprockets 34 and 35 adjacent the front and rear of the respective hoppers. The bottom walls 28, 29 and 28', 29' define longitudinally extending openings 30 and 30' therebetween to allow material from the hoppers to pass onto the upper run of the respective conveyors and the conveyors include spaced flights 36 for advancing the material lengthwise of the hoppers to the spreader apparatus adjacent one end. As is conventional, plates or panels 31 underlie the flights on the upper runs of the conveyors to support the material as it is advanced by the conveyors to the ends of the hoppers.

The spreader apparatus for spreading the materials is of the broadcast type and comprises a rotary broadcast member in the form of a generally flat disk 41 mounted as on a shaft 42 for rotation about a generally upright axis. The broadcast member is conveniently rotated by an hydraulic motor 43 and, as best shown in FIGS. 2 and 4, the motor is located above the broadcast member and supported on a mounting plate 44 with the shaft extending downwardly from the motor. Alternatively, the drive motor could be located below the broadcast spreader.

In order to obtain more uniform spreading of the material over a wide swath extending to opposite sides of the spreader apparatus as the vehicle moves along a path, the broadcast spreader apparatus is advantageously arranged to impel the material in two separate streams extending in relatively opposite directions from the broadcast spreader. The broadcast member has impellers for throwing the material outwardly as the disk is rotated and, in accordance with the present invention, a material flow divider means is provided for delivering material to the impellers at approximately diametrically opposite locations on the disk 41 so located with respect to the path of travel of the vehicle as to cause the material to be thrown by the impellers in separate streams extending in relatively opposite directions and generally tangent to the front and rear sides of the disk as diagrammatically illustrated in FIG. 6. In the embodiment of FIGS. 2—7, a material flow divider designated generally by the numeral 45 is disposed above the broadcast member and includes opposed generally U-shaped wall portions 46 and 47 disposed at opposite sides of the axis of rotation of the broadcast member and having their lower edges extending closely adjacent the upper face of the broadcast member inwardly of the outer periphery of the latter. The ends 46a and 46b of the wall portion 46 are spaced from the ends 47b and 47a respectively of the wall portion 47 to define material outlet or discharge openings 48 and 49 therebetween at approximately diametrically opposite locations on the disk. The discharge openings 48 and 49 are located with respect to the direction of movement of the vehicle during spreading, indicated by the arrow designated F in FIG. 6, and the direction of rotation of the disk indicated by the curved arrow R in FIG. 6, so that the material that passes out through the openings 48 and 49 is impelled by the impellers in separate streams extending generally tangentially of the front and rear sides of the disk toward relatively opposite sides of the path of travel of the spreader apparatus, as indicated by the spread patterns P1 and P2 in FIG. 6. The material flowing from the outlet openings 48 and 49 will be carried circumferentially with the impeller vanes through an angle before being thrown off the vanes and the openings 48 and 49 are accordingly angularly spaced in a direction opposite the direction of rotation of the broadcast member from the front and rear sides of the disk, such that the material will be discharged generally tangential to the front and rear sides of the disk, respectively. It has been found that a good spread pattern can be achieved by locating one edge of the openings 48 and 49 defined by the edges 47b and 46b adjacent the plane through the axis of the disk and substantially normal the path of travel of the vehicle with the other edges 46a and 47a angularly spaced in the direction of rotation of the disk from the edges 47b and 46b. For reasons pointed out hereinafter, the edges 47a and 46a of the openings 48 and 49 are advantageously so arranged that only a portion of the material carried by the disk along the wall portion 47 passes out through the opening 48 and, similarly, only a portion of the material carried by the disk along the wall portion 46 passes out through the opening 49. The material which does not pass out through the opening 48 is carried along the wall portion 46 into the other opening 49 and similarly, material which does not pass out through opening 49 is carried along the wall portion 47 to the opening 48. In the preferred embodiment shown, the edges

47a and 46a are angularly spaced in the direction of rotation of the disk approximately 35° from the other edges 47b and 46b of the openings 48 and 49. The openings 48 and 49 extend above the broadcast member a distance sufficient to accommodate the maximum depth of material on the disk and the material directing casing is shaped in the region above the opening to guide the material down to the disk. As best shown in FIG. 5, the material flow divider wall portions 46 and 47 are connected by a generally annular wall portion 51. The wall portion 51 is preferably mounted for a limited vertical adjustment to enable the lower edges of the wall portions 46 and 47 to extend into close adjacency to the upper face of the broadcast member and, as shown, the wall portion 51 is secured to a generally annular support ring 52, as by fasteners 53 which extend through slots in the ring 52 and into the ring 51. The ring 52 is stationary and is supported in a manner described hereinafter.

As previously described, the material is delivered to the impelling vanes on the broadcast member in two generally diametrically opposite locations which are angularly spaced in a direction opposite the direction of rotation from the front and rear sides of the broadcast member to cause the material to be thrown in two oppositely directed streams. As shown in FIG. 6, the oppositely directed streams designated P1 and P2 extend generally tangential to the front and rear sides of the broadcast member and to the path of movement of the vehicle. The impeller vanes and broadcast members are constructed and arranged so that the two spread patterns substantially achieve the desired uniform distribution of material shown diagrammatically in FIG. 6A. For this purpose, a plurality of elongated main impellers, herein shown four in number and designated 55a-55d, are provided on the broadcast member outwardly of the flow divider 41. The vanes 55a-55d are elongated in a radial direction and are arranged to impel the material from the discharge openings 48 and 49 through a long distance to provide a widespread pattern. The main vanes are each conveniently similarly constructed and, as best shown in FIG. 5, include an upwardly extending wall portion 58 and an upper wall portion 59 inclined forwardly in the direction of rotation of the broadcast member. The upwardly inclined portion 59 of the vanes tends to confine vertical spreading of the material as it is impelled by the vanes to provide a "flat" spread pattern. Generally uniform distribution of the material in the intermediate and far ranges is obtained by spacing the inner ends of the vanes outwardly from the flow divider walls 46 and 47 a distance, for example 5/8 inch, to allow some of the material issuing from the openings to pass by the inner ends of the vanes and pass outwardly to be impelled by the outer ends of the next succeeding vane. In order to enhance the amount of material which is deposited in the close range, one or more auxiliary vanes, herein shown two in number and designated 57a and 57b, are provided on the broadcast member. The auxiliary vanes 57a and 57b are short as compared to the main vanes 55a-55d and impel the material engaged thereby in the close range and partially to the rear of the broadcast member. In addition, the periphery of the broadcast member in the portion adjacent the auxiliary vanes, and indicated at 58a and 58b, is spaced radially inwardly of the periphery of the broadcast member in the region adjacent the main vanes. As shown, this is conveniently achieved by cutting the periphery of the disk in a region between two adjacent main vanes and relatively closer to the trailing side of one main vane than to the lead side of the next adjacent main vane, it being understood that the periphery of the disk could merely be bent down or otherwise cut away in this area to allow the material to pass radially off the broadcast member at a somewhat earlier time. The auxiliary vanes also preferably have their inner ends spaced radially outwardly from the wall portions 46 and 47 of the material directing means,

for the reasons previously described in connection with the main vanes.

The rotary broadcast apparatus is advantageously so arranged that a single broadcast apparatus can be employed for spreading several materials and, alternatively, either one or the other of the materials separately if desired. In the spreader apparatus disclosed employing two outlets for spreading the material in two relatively oppositely directed streams, it is necessary to assure that like amounts of each of the materials pass out through the separate outlet openings 48 and 49. For this purpose, an inner material flow divider designated generally by the numeral 61 is provided for delivering the material to the inside of the outer material flow divider in two separate flows containing substantially like proportions of the several materials to be spread. In the embodiment of FIGS. 2-7, the inner flow divider means includes a flow divider casing disposed in overlying relation to the broadcast member 40 inwardly of the outer flow divider 45. The inner flow divider casing also includes first and second generally U-shaped wall portions 62 and 63 having their lower ends disposed closely adjacent the upper face of the disk 40. The wall portions 62 and 63 are held stationary and, as shown, are supported by brackets 67 on the wall portions 46 and 47 of the outer flow divider. The ends 62a, 62b, and 63a, 63b of the wall portions 62 and 63 are spaced apart to provide flow divider openings 64 and 65 therebetween. The several materials to be spread are deposited on the disk inwardly of the inner flow divider casing and the openings 64 and 65 are constructed and arranged as more specifically described hereinafter relative to the disk areas on which the material is deposited so as to divide the flow of each of the materials delivered to the inner flow divider and pass mixtures of the two materials through each of the openings 64 and 65 to the outer flow divider means.

In the embodiment shown in FIGS. 2-7 a guide chute 71 is arranged to guide the two different materials delivered by the feed conveyors 32 and 32' to separate areas at diametrically opposite sides of the axis of rotation of the disk. The outer flow divider is conveniently supported on the guide chute, as by brackets 70. In general, the chute 71 underlies the outlet of the feed conveyors 32 and 32' and includes front and rear walls 72 and 73 and downwardly converging side walls 74 and 75 for respectively guiding material from the feed conveyors 32 and 32' laterally of the vehicle to a central outlet opening within the inner flow divider casing. For reasons pointed out hereinafter, it is desired to deposit the several materials in definite localized areas on the disk within the inner flow divider and for this purpose, V-shaped material guide panels 77 and 78 are provided on the lower portions of the side walls 74 and 75 of the chute to confine the flow of material into a narrow stream. In this embodiment, the apexes of the V-shaped guide panels 77 and 78 are disposed in a vertical plane through the axis of rotation of the broadcast member 40 and generally perpendicular to the path of movement of the vehicle. As best shown in FIGS. 3 and 5, the apexes 77a and 78a of the V-shaped guide members at the adjacent ends thereof are spaced radially from the axis of rotation substantially equal amounts so as to guide the separate materials onto the disk at diametrically opposite points indicated at X1 and X2 in FIG. 7. Panels 79 and 80 are provided in the upper portion of the guide chute for guiding the material from the respective conveyors laterally into the lower V-shaped guides 77 and 78. In order to facilitate flow of the material down the apex of the V-shaped guides 77 and 78, it is preferable to feed the material from the conveyors 32 and 32' to a point such that the material drops adjacent the plane of the apexes of the V-shaped guides. For this purpose, a flow board indicated at 83 is mounted to overlie the top of the feed conveyors adjacent their outlet ends to receive material therefrom and to guide the material rearwardly to a point

such that it drops adjacent the apex of the respective V-shaped guide.

The guide chutes are preferably narrow in a front-to-rear direction in order to laterally concentrate the streams of material delivered onto the broadcast member. However, a small amount of material is carried around by the conveyors to the underside thereof and is then dropped. A collector chute indicated at 85 in FIG. 4 is accordingly provided forwardly of the main material guide chute previously described, which collector chute underlies the rear ends of the feed conveyors to collect the small amount of material that passes around to the underside of the conveyors. As shown in FIG. 4, the collector chute is formed by rear extensions of the downwardly inclined side walls 74 and 75 and a rear wall 86 which guides the stray material to a point below the main guide chute and inside the flow dividers.

When particulate material is deposited on a rotating disk at a point radially offset from the axis, the particles will tend to travel outwardly and in the direction of the rotating disk along a curve generally similar to a logarithmic spiral. All particles dropped even on the same point, however, will not travel along an identical curve, due to differences in weight, particle size, particle shape and further dependent upon whether the particles are in direct contact with the disk or are riding on other material which contacts the disk. In general, material deposited at a point such as X1 in FIG. 7 will pass outwardly in a spiral flow indicated generally by the phantom lines Y1 and, similarly, material deposited at a second point X2 will pass outwardly and in the direction of the rotating disk in a flow pattern indicated at Z1. The openings 64 and 65 in the flow divider are angularly and radially related to the points X2 and X1 respectively such that only a portion of the material deposited at X2 passes out through the opening 64 and the other portion is carried along the wall 62 to the opening 65. Similarly, the opening 65 is located with relation to the point X1 so that only a portion of the material deposited at X1 passes out through the opening 65 and the remaining portion is carried around the wall 63 to the opening 64. Preferably, the openings 64 and 65 are positioned with relation to the locations X2 and X1 respectively such that a substantial portion of the material deposited at these locations spirals outwardly as indicated at Y1 and Z1 in FIG. 7 and through the openings 64 and 65 without contacting the walls 62 and 63.

One end 63a of the wall 63 is positioned to extend into the spiral stream Y1 and guide a portion of that material around to the other opening 64 and, similarly, one end 62a of the wall 62 is positioned to extend into the spiral stream Z1 and guide a portion of that stream to the opening 65. In this manner, the separate materials deposited at X2 and X1 are divided and portions of each discharged through both openings 64 and 65 to provide mixed streams issuing from the inner flow divider. It is preferable to so arrange the openings 64 and 65 that approximately one-half of each of the materials passes out through the openings. However, as previously described, the outlet openings 48 and 49 in the outer material flow divider 45 are also arranged so that only a portion of the material on the disk as it passes each outlet opening 48 and 49 passes through that opening and the other portion of the material is carried around on the disk to the next outlet opening. This arrangement substantially compensates for any deviation in the desired 50-50 division of material passing from the inner flow divider openings 64 and 65. As shown in FIGS. 6 and 7, the edges 46a and 47a and the edges 46b and 47a are circumferentially spaced apart. The material moving along the wall portions 46 and 47 tends to move generally tangent to these wall portions as it moves across the respective openings 49 and 48 and the lead edges 46a and 47a of the walls 46 and 47 are arranged to extend to a point which preferably bisects the generally tangent flow of material at the outlet open-

ings 48 and 49. As shown in FIG. 7, the lead edges 46a and 47a of the walls 46 and 47 are respectively located along lines tangent to points indicated at M and N in FIG. 7, which points preferably approximately bisect the space between the outer and inner flow dividers at the ends 47b and 46b of the openings 64 and 65. The radial spacing between the wall portions of the inner and outer flow dividers, in the region adjacent the openings 64 and 65, is preferably selected so that, even when the spreader apparatus is operated to distribute material at relatively low rates, the material being spread is sufficient to substantially cover the disk between the walls of the inner and outer flow dividers. Accordingly, locating the edges 47a and 46a along tangent lines that bisect the space between the inner and outer flow dividers will approximately bisect the streams of material carried on the disk as it passes the openings 48 and 49. Centrifugal force will tend to cause the material to build up somewhat higher adjacent the radially outer wall portions 46 and 47 than adjacent the flow divider wall portions 62 and 63. However, this effect is significant only at very low distribution rates in which the material being distributed is not sufficient to at least cover the disk between the inner and outer wall portions. At such very low distribution rates, somewhat more than half of the material carried on the disk will pass out through the respective openings 48 and 49 and somewhat less than half of the material will be carried around to the next opening. However, the amount of carry-over need not be exactly fifty percent and this carry-over, so long as it is substantial, will substantially compensate for deviations in the desired 50-50 division of the materials achieved in the inner flow divider. At higher distribution rates, the material being spread has a substantial depth as it passes between the wall portions of the inner and outer flow dividers and centrifugal build-up of material along the wall portions of the outer flow divider is not significant. As will be seen, the material which is carried over from one of the outlet openings such as 48 along the wall 46 will mix with the material discharged from the opening 64 in the inner flow divider and this mixed material is carried to the next opening 49. In order to assure mixing of the material carried over from the outer flow divider with the material emerging from the openings in the inner material flow divider, the outer flow divider openings 48 and 49 are angularly related to the outlet openings 64 and 65 of the inner flow divider such that the material from the inner flow divider openings does not pass directly through the outlet openings 48 and 49 but instead strikes the wall portions 46 and 47 to be carried to the next succeeding outlet opening.

A modified form of material guide chute and broadcast apparatus is illustrated in FIGS. 8-10. The guide chute is generally similar to the guide chute 71 and like numerals followed by the postscript ' are used to designate corresponding parts. In this embodiment, the guide chute is additionally arranged so as to divide each of the separate flows of material passing down the V-shaped portions 77' and 78' and to deposit approximately one-half of each of the two materials at one point indicated at r1 and the other half of each of the materials at an opposite point indicated at r2 in FIGS. 9 and 10. For this purpose, vertically disposed divider plates 91 and 92 are provided in the lower V-shaped portions 77' and 78' of the chute for dividing each of the materials flowing down each of the V-shaped guide portions into two streams. The upper edges 91a and 92a of the divider plates are preferably located below the upper ends of the V-shaped portions 77' and 78' to allow the material to form a stable stream in the V-shaped portions before it engages the divider walls. In addition, these upper edges are preferably inclined downwardly slightly as shown in FIG. 8 to avoid collecting material on the upper edges. The divider walls have laterally extending portions 91b and 92b at their lower ends which diverge relative to a vertical plane through the apexes of the V-shaped guide members 77'

and 78' so as to direct the divided streams of material laterally to the points *r1* and *r2* on the disk 41'. As will be seen from FIGS. 9 and 10, the points *r1* and *r2* are disposed in a plane generally paralleling the front-to-rear center line of the vehicle.

The rotary broadcast apparatus in the embodiment of FIGS. 8-10 is similar to that described in connection with FIGS. 2-7 and like numerals followed by the postscript ' are used to designate corresponding parts. However, since the points *r1* and *r2* on which the material is deposited are different than in the previous embodiment, it is necessary to angularly locate the openings 64' and 65' in the inner flow divider accordingly. As shown in FIG. 10, the openings 64' and 65' are related to the spiral paths of flow of the material deposited on the points *r2* and *r1* respectively so as to allow a portion of each material to pass through the openings and to carry the other portion of the material to the next opening in a manner similar to that described in connection with the embodiment of FIGS. 2-7. The outer flow divider wall portions 46' and 47' extend crosswise of the openings 64' and 65' and have their ends spaced apart to define outlet openings 48' and 49' at approximately diametrically opposite sides of the disk 41' to be impelled by the vanes 55' and 57' in the manner described in connection with the preceding embodiment.

The rotary broadcast apparatus illustrated in the embodiment of FIG. 11 is also generally similar to that described in connection with FIGS. 2-7 and like numerals followed by the postscript '' are used to designate corresponding parts. In this embodiment, the broadcast apparatus includes the disk 41'' having vanes 55'' and 57'', an outer flow divider 45'', and an inner flow divider 61''. As in the first embodiment, the inner flow divider includes first and second generally U-shaped wall portions designated 62'' and 63''. However, in this embodiment the ends 62a'' and 62b'' are radially spaced from the adjacent ends 63b'' and 63a''. This is conveniently achieved by using generally semicylindrical wall portions which are radially offset from the spinner axis, as best shown in FIG. 11. The openings formed between the ends of the wall portions 62'' and 63'' are related to the points *s1* and *s2* at which material is deposited on the spinner so as to achieve the aforescribed division of the materials as they flow outwardly and circumferentially along paths *r1* and *r2* from the points *s1* and *s2*.

The outer material flow divider 45'' includes U-shaped portions 46'' and 47'' generally similar to those previously described. However, in this embodiment, the lead ends 64a'' and 47a'' on the respective wall portions extend to a point closely adjacent the trailing ends 47b'' and 46b'' of the adjacent wall portions but offset radially inwardly thereof a distance such as to divide the material carried on the disk between the outer flow divider walls and the inner flow divider walls. The construction and operation of the broadcast apparatus in FIG. 11 is otherwise similar to that previously described in connection with FIGS. 2-7.

In many applications, such as in the spreading of fertilizers as well as in the spreading of road conditioning materials, it is desirable to correlate the amount of material spread with the vehicle speed so as to maintain a uniform amount of material spread along a path independent of vehicle speed. A conveyor drive apparatus, preferably of the type disclosed in the copending application of Burl A. Wilder, Eskil W. Swenson and Clas O. F. Fyrk, Ser. No. 448,108, filed Apr. 14, 1965, now abandoned, and refiled on Jan. 21, 1966, as a continuation-in-part application Ser. No. 522,078, and now Patent No. 3,344,993, is advantageously employed to drive the spreader apparatus. However, the present apparatus is designed for spreading plural materials and, in some applications, it is desirable to spread only one or the other of the materials. An improved drive is accordingly provided which will enable driving of either one or both

of the conveyors at a speed correlative with the vehicle speed. A control circuit is diagrammatically illustrated in FIG. 12 and, as shown, includes a pump 101 having its inlet connected to a reservoir 102 and its outlet connected through a manually operated valve 103 which is selectively movable between a position as shown in FIG. 12 delivering fluid to a control line 104 and a second position delivering fluid to a by-pass line 105 leading to the reservoir. An adjustable valve 108, preferably of the pressure compensated flow control type, has its inlet connected to the line 104 and a controlled outlet 109 connected through a line 111 to the hydraulic drive motor 43 for the broadcast member, the motor being connected through a return line 112 to the reservoir. The pressure compensated flow control valve can be of any of several commercially available types and has an adjustable orifice between the inlet 104 and outlet 109 controlled as by a knob 114 and a pressure operated valve mechanism for controlling flow to the controlled outlet 109 and responsive to the pressure differential across the orifice to maintain a preselected pressure drop thereacross and hence to maintain a flow through the controlled outlet 109 determined by the setting of the adjustable orifice and substantially independent of the inlet and outlet pressures in the system. In this manner, the speed of the broadcast member can be preset and accurately maintained at that speed, substantially independent of the speed of the vehicle and pump. The pressure compensated valve also has a by-pass outlet 115 which, as shown, is conveniently connected to a feed conveyor control valve 116. The feed conveyors 32 and 32' are preferably driven by separate hydraulic motors 118 and 118' which are preferably connected in series with each other and to the valve 116 as by conduits 121 and 122 and return conduit 123. In this manner, a single valve is operable to control both conveyors. Alternatively, separate valves could be employed for the separate hydraulic motors 118 and 118', if desired. In order to enable selective operation of either one or the other of the hydraulic motors and conveyors, by-pass valves 126 and 126' are provided for respectively bypassing the hydraulic motors 118 and 118'. In order to simplify illustration, the by-pass valves are shown adjacent the respective motors 118 and 118', it being understood that the valves could be located at any convenient location and may, for example, be located in the vehicle cab.

As disclosed in the aforementioned application of Wilder et al., the control means for maintaining a preselected ratio between the speed of the conveyor and the speed of the truck includes a first sensing means responsive to the speed of the truck, a second sensing means responsive to the speed of the conveyor and a third means responsive to the first and second sensing means for maintaining a preselected ratio between the speed of the truck and the speed of the conveyor by adjusting the flow control valve 116. In order to simplify the apparatus for spreading multiple materials, a single sensing means indicated at 131 is provided for sensing the speed of the truck and a second sensing means is provided and so arranged to sense the speed of rotation of whichever conveyor is in operation. A third sensing means 133 is responsive to the first and second sensing means and operates the valve 116. The third sensing means 133 can conveniently be in the form of a mechanical differential having one input shaft 134, a second input shaft 135, herein shown extending from opposite sides of the differential 133, and an output shaft 136 which is rotated in a direction and magnitude corresponding to the difference in the speeds of the shafts 134 and 135. Input shaft 134 is connected through a sprocket 138, chain 139 and sprocket 141 to a sensing wheel 142 mounted on the end of an arm 140 for engagement with the vehicle wheel. One end of the shaft 135 is connected, as through a one-way clutch 143, to a shaft 144 driven by one of the conveyor drive speed reducers 119' and the other end of the shaft 135 is connected, as through a one-way clutch

146, sprocket 147, chain 148 and sprocket 149, to a shaft 151 driven by the other conveyor speed reducer 119. The one-way clutches 143 and 146 are of conventional construction and are so arranged as to establish a driving connection from the shaft 144 to the shaft 135 when the shaft 144 is rotated in a direction to advance the conveyor 32', and the clutch 146 is arranged so as to establish a driving connection to the shaft 135 when the other conveyor 32 is driven. With this arrangement, the shaft 135 is driven whenever either one or the other or both of the conveyors are driven.

The aforescribed conveyor drive will operate one or both conveyors at a speed correlative with the speed of the vehicle to maintain the amount of material spread along a path uniform, independent of vehicle speed. Provision is made for adjusting the relative amounts of the several materials to be spread and, while this can be achieved by changing the relative speeds at which the conveyors are operated, it is conveniently accomplished by using adjustable flow control gates. As best shown in FIG. 2, the end walls 27 of the compartments 21 and 21' are provided with discharge openings 95 and 95' and gates 96 and 96' to regulate the effective size of the discharge openings. In this manner, the amounts of each material to be spread along the path can be selectively and independently preset. An adjustable valve 120a connected by a line 120 to by-pass the valve 116 is advantageously provided to enable operation of the conveyors when the vehicle is stopped, as for discharging the contents of the hoppers 32 and 32'. One or more arms indicated at 98 are advantageously provided on the shaft 42 inside the inner flow divider, to break any lumps of material that may be fed to the spreader.

From the foregoing it is thought that the construction and operation of the device as a spreader apparatus will be readily understood. Both conveyors 32 and 32' can be operated simultaneously to feed materials into the guide chute 71, which guide chute deposits the several materials on diametrically opposite locations on the disk, inwardly of the inner flow divider. The openings in the flow divider are so arranged with respect to the locations on which the material is deposited that only a portion of each material passes out through each opening and the other portion is carried around by the inner flow divider walls to the other openings. Similarly the outlet openings in the outer flow divider means are so arranged that only a portion of the material carried between the outer flow divider and the inner flow divider passes out through the outlet openings 48 and 49 and the other portion is carried around to the other outlet opening. The aforescribed carry-over of material in each the inner and outer flow dividers divides each of the materials several times before it is fed into the broadcast spreader and delivers the material in two mixed streams to the impellers on the broadcast disk.

On the other hand, if only one material is deposited on the impeller disk, that material will be initially divided by the inner flow divider into two streams which are discharged through openings 64 and 65 into the outer flow divider. The outer flow divider also divides the material passing the ports 48 and 49 and allows approximately one-half the material to pass through each port with the other half carrying over to the other port. Thus, even when only one material is deposited on the disk, that material will be delivered in like quantities to the two ports 48 and 49 for spreading by the impeller vanes.

The outlet openings 48 and 49 and the material directing means are so arranged as to be on approximately diametrically opposite sides of the disk and angularly spaced in a direction opposite the direction of rotation of the disk from the front and rear sides of the disk so that the material is impelled by the vanes in two separate streams and at relatively opposite directions from the broadcast apparatus. In order to achieve substantially uniform distribution of the material over the spread pattern,

the inner ends of the vanes on the broadcast disk are spaced outwardly somewhat from the material directing means in the area adjacent the outlet openings so that a portion of the material issuing from the outlet openings can pass by the inner ends of the vanes to be impelled by the next succeeding vane. In addition, auxiliary vanes, relatively shorter than the main impeller vanes, are provided to increase the amount of material distributed in the close range adjacent the broadcast apparatus.

The apparatus previously described is also adapted for use in blending several materials for spreading by a different spreader apparatus. As shown in FIGS. 13 and 14, the apparatus of FIGS. 2-7 is converted for use in blending the several particulate materials and for conveying the blended materials to a common outlet for spreading by another spreader apparatus (not shown). Such a convertible mixing and spreading apparatus is disclosed and claimed in the applicant's copending application Ser. No. 690,361, filed Dec. 13, 1967. In the embodiment of FIGS. 13 and 14, the guide chute 71, the inner flow divider walls 62 and 63 and the outer flow divider walls 46 and 47 are the same as that shown and described in connection with FIGS. 2-7 and like numerals are used to designate the same parts. As previously described, material is delivered into the chute 71 by the several material feed conveyors 32 and 32' from their respective hoppers. In this embodiment, disk 151 replaces disk 41 and is mounted on the shaft for rotation therewith. The disk 151 preferably does not have spreader vanes and, advantageously, extends outwardly only to a diameter adjacent the outer flow divider walls 46 and 47. As in the embodiment of FIGS. 2-7, material is deposited at angularly spaced locations X1 and X2 and spirals outwardly along flow paths Y1 and Y2.

The openings 64 and 65 are angularly disposed relative to the locations X2 and X1 so that portions of the flows Y2 and Y1 respectively spiral out through the openings 64 and 65, and the ends 62a and 63a of the walls 62 and 63 respectively extend into the streams Y2 and Y1 to guide a portion of each stream to the other openings 65 and 64. The walls 46 and 47 are positioned to guide the material from openings 64 and 65 around to the outlet openings 49 and 48 respectively. The end 46a of the wall 46 is arranged to extend into the path of the material on the disk between wall portions 47 and 63 so that one portion of that material passes through opening 48 and the other portion is guided by wall 46 to the opening 49. Similarly, the end 47a of wall 47 guides a portion of the material between the wall portions 46 and 62 around to the opening 48. The inner flow divider thus divides the streams Y1 and Y2 and delivers mixed streams to the outer flow divider and the outer flow divider again divides the mixed streams and delivers portions of the divided mixed streams to both outlets 48 and 49. This produces a uniform blending of the several materials as they are fed to the apparatus by the conveyors 32 and 32'.

The blended material from the outlets 48 and 49 is collected by a housing or shroud 161 conveniently detachably mounted on the chute 71 and extending around the blending apparatus outwardly of the disk 151. The housing is preferably formed with a hopper-like bottom 162 which conveys the material to a bottom outlet 163 and a means such as a screw conveyor 164 is advantageously provided for elevating and conveying the blended material to a discharge outlet 165. With this arrangement, the vehicle can be employed to transport the several separated materials to the point of use such as a farm, and the apparatus then used to fill a hopper on a separate spreader device with mixed materials. As previously described, the conveyors 32 and 32' can be operated when the vehicle is stopped under the control of valve 119, and the gates 96 and 96' adjusted to deliver the several materials in the desired proportions. The blending apparatus operates to intimately mix the several mate-

rials in the proportions fed thereto and to deliver the blended materials to a common outlet.

While the several embodiments disclosed illustrate two material feed conveyors for feeding two different materials into the blending apparatus, it is apparent that additional materials can be simultaneously mixed by feeding the additional materials into the guide chute in such a manner that the materials are deposited on the disk at one or both of the two locations indicated above. The blending apparatus shown in FIGS. 13 and 14 can of course be reconverted for use as a spreader by removing the housing 161 and disk 151 and attaching the previously described spreader disk 41 to the shaft 42.

I claim:

1. A broadcast type spreader apparatus for spreading material as it is advanced along a path, said spreader apparatus including a rotary broadcast member having an upper face and means for rotating the broadcast member about a generally vertical axis, a stationary material flow divider means open at the bottom thereof and overlying the upper face of the broadcast member inwardly of the outer periphery of the broadcast member and defining two outlet openings at approximately diametrically opposite locations on the broadcast member, means for feeding material at a controlled rate onto the upper face of the broadcast member inside the material flow divider means for flow out through the two openings in separate streams, said broadcast member having a plurality of main impellers at circumferentially spaced locations thereon and extending outwardly from said material flow divider means for impelling material from said two openings in first and second spread patterns respectively generally tangential to the forward and rear sides of the broadcast member toward opposite sides of the path as the spreader is advanced along the path, said broadcast member having at least one peripheral portion spaced radially inwardly of the outer periphery of the broadcast member and located intermediate two adjacent main impellers, and an auxiliary impeller in said one peripheral portion having a radial extent which is short as compared to said main impellers.

2. In a broadcast type spreader apparatus for spreading material as it is advanced along a path, said spreader apparatus including a rotary broadcast member having an upper face and means for rotating the same about a generally vertical axis, a stationary material flow divider means having first and second wall portions disposed at opposite sides of said vertical axis and extending adjacent the upper face of the broadcast member inwardly of the outer periphery thereof to define inner and outer areas on the upper face of the broadcast member, the wall portions having the ends thereof spaced apart to define two outlet openings at approximately diametrically opposite locations on the broadcast member, means for feeding material at a controlled rate into the flow divider means and onto the inner area of the broadcast member for flow out through the two openings in separate streams, said broadcast member having a plurality of main impellers at circumferentially spaced locations thereon and extending outwardly from said flow divider means for impelling material from the two openings in relatively opposite directions generally tangential to the forward and rear sides of the broadcast member as the spreader apparatus is moved along the path, said broadcast member having at least one peripheral portion spaced radially inwardly of the outer periphery of the broadcast member and located intermediate two adjacent main impellers, and an auxiliary impeller in said one peripheral portion having a radial extent which is short as compared to said main impellers.

3. The combination of claim 2 wherein said main impellers have their radially inner ends spaced outwardly from said outlet openings in said wall portions.

4. A broadcast type spreader apparatus for use with a vehicle for spreading material as the vehicle moves along a path, said vehicle having a hopper for receiving material

to be spread, said spreader apparatus including a rotary broadcast disk and means for rotating the same about a generally vertical axis, a stationary material flow divider means including a generally annular wall having its lower end extending closely adjacent the top of the disk inwardly of the periphery thereof and defining inner and outer areas on the disk, said wall having two outlet openings at approximately diametrically opposite locations on the disk, means for feeding material at a controlled rate into the flow divider means and onto the inner area of the disk for flow out through the two outlet openings in separate streams, and impeller means on the disk outwardly of the annular wall for impelling material from the two openings in relatively opposite directions from the broadcast disk to opposite sides of said path, said openings being angularly spaced in a direction opposite the direction of rotation of the disk from the forward and rear sides of the disk such that the two streams are impelled by the impellers generally tangent to the forward and rear sides of the disk toward opposite sides of the path of movement of the vehicle, said impellers including a plurality of vanes at spaced locations around the disk, certain of said vanes being main impeller vanes, at least one other of said vanes being substantially shorter than said main vanes, said disk having a portion adjacent said one vane and intermediate two angularly adjacent main vanes which is space radially inwardly from the portions of said disk adjacent the main vanes.

5. An apparatus for spreading at least two different particulate materials comprising a rotary disk having means for rotating the same about a generally vertical axis, a stationary inner flow divider means defining first and second angularly spaced outlet openings, means for feeding two different particulate materials into said inner flow divider means for flow through said two outlet openings, a stationary outer flow divider means defining two generally U-shaped wall portions having their lower edges extending closely adjacent the upper face of said disk and spaced outwardly of said inner flow divider means, said wall portions having their ends spaced apart to define third and fourth outlet openings at approximately diametrically opposite locations on the disk, one of said wall portions being disposed crosswise of the path of flow of material from said second opening to guide the material therefrom toward said third opening and the other of said wall portions being disposed crosswise of the path of flow of material from said first opening to guide material therefrom toward said fourth opening, said one wall portion having one end thereof extending into the path of flow of the material carried on the disk between the inner and outer flow divider means as it passes said fourth opening to guide a portion of that material to said third opening, and said other wall portion having one end thereof extending into the path of flow of the material carried on the disk between the inner and outer flow divider means as it passes said third opening to guide a portion of that material to said fourth opening, and impeller means on said disk outwardly of said outer flow divider means for impelling material from said third and fourth outlet openings in relatively opposite directions from the spreading apparatus.

6. An apparatus for blending at least two different particulate materials comprising, a rotary disk having means for rotating the same about a generally vertical axis, means for depositing two different particulate materials on the disk at first and second angularly spaced locations, a stationary inner flow divider means defining first and second wall portions disposed at opposite sides of said axis and having their lower edges extending closely adjacent the upper face of the disk outwardly of said two locations, said first and second wall portions having their ends spaced apart to define first and second openings, the material deposited at said first and second locations traveling outwardly and in the direction of rotation of the disk respectively toward said first and second openings,

said first wall portion having one end extending into the path of travel of the material deposited at said first location for guiding a portion of that material to said second opening and said second wall portion having one end extending into the path of travel of the material from said second location to guide a portion of that material to said first opening, a stationary outer flow divider means including third and fourth wall portions disposed at opposite sides of said axis and having their lower edges extending closely adjacent the upper face of the disk outwardly of said inner flow divider means, said third and fourth wall portions having their ends spaced apart to define third and fourth openings, said third wall portion being disposed crosswise of the path of flow of material from said second opening to guide the material therefrom toward said third opening and said fourth wall portion being disposed crosswise of the path of flow of material from said first opening to guide material therefrom toward said fourth opening.

7. An apparatus for blending at least two different particulate materials comprising, a rotary disk having means for rotating the same about a generally vertical axis, means for depositing two different particulate materials on the disk at first and second angularly spaced locations, a stationary inner flow divider means defining first and second wall portions disposed at opposite sides of said axis and having their lower edges extending closely adjacent the upper face of the disk outwardly of said two locations, said first and second wall portions having their ends spaced apart to define first and second openings, the material deposited at said first and second locations traveling outwardly and in the direction of rotation of the disk respectively toward said first and second openings, said first wall portion having one end extending into the path of travel of the material deposited at said first location for guiding a portion of that material to said second opening and said second wall portion having one end extending into the path of travel of the material from said second location to guide a portion of that material to said first opening, a stationary outer flow divider means including third and fourth wall portions disposed at opposite sides of said axis and having their lower edges extending closely adjacent the upper face of the disk outwardly of said inner flow divider means, said third and fourth wall portions having their ends spaced apart to define third and fourth openings, said third wall portion being disposed crosswise of the path of flow of material from said second opening to guide the material therefrom toward said third opening and said fourth wall portion being disposed crosswise of the path of flow of material from said first opening to guide material therefrom toward said fourth opening, said third wall portion having one end thereof extending into the path of flow of the material carried on the disk between the inner and outer flow divider means as it passes said fourth opening to guide a portion of that material to said third opening, and fourth wall portion having one end thereof extending into the path of flow of the material carried on the disk between the inner and outer flow divider means as it passes said third opening to guide a portion of that material to said fourth opening.

8. The combination of claim 7 wherein first and second openings are angularly offset in the direction of rotation of said disk from said first and second locations respectively such that a substantial portion of the material from said first and second locations passes out in a spiral path through said first and second openings without contacting said first and second wall portions.

9. The apparatus of claim 7 wherein the material depositing means deposits one material at said first location and a different material at said second location.

10. The apparatus of claim 7 wherein the material depositing means deposits two different particulate materials at each said first and said second locations.

11. The apparatus of claim 7 wherein said third and

fourth outlet openings are at approximately diametrically opposite locations on the disk, and impeller means on said disk outwardly of said outer flow divider means for impelling material from said third and fourth outlet openings.

12. An apparatus for blending at least two different particulate materials comprising a rotary disk having means for rotating the same about a generally vertical axis, a stationary outer flow divider means defining first and second generally U-shaped wall portions disposed in opposed relation at opposite sides of said vertical axis and having their lower ends extending closely adjacent the upper face of the disk, said first and second wall portions having their ends spaced apart to define first and second outlet openings angularly spaced apart, a stationary inner flow divider means defining third and fourth wall portions disposed at opposite sides of said axis and having their lower ends extending closely adjacent the upper face of the disk inwardly of said outer flow divider means, means for depositing two different particulate materials onto the disk inwardly of said inner flow divider means at first and second angularly spaced locations, said third and fourth wall portions having the ends thereof spaced apart to define third and fourth outlet openings respectively angularly spaced in the direction of rotation of the disk from said first and second locations.

13. In a broadcast type spreader apparatus for spreading material at a controlled rate as it is advanced along a path, the combination comprising hopper means for receiving a quantity of particulate material, a rotary broadcast member having a central area on the upper face thereof and mounted for rotation about a generally upright axis, impeller means on said broadcast member outwardly of said central area, means for feeding material at said controlled rate from said hopper means and for depositing the material on said central area of the broadcast member in first and second zones at relatively opposite sides of said axis, means for rotating said impeller means about said axis to cause the material deposited on said central area to travel outwardly from said zones and in the direction of rotation of the broadcast member, material flow divider means including two stationary generally U-shaped wall portions disposed at opposite sides of said axis and having their lower edges extending closely adjacent said central area of said broadcast member inwardly of said impeller means, the wall portions having the ends thereof spaced apart to define a first outlet opening having a preselected angular and radial spaced relation to said first zone and a second outlet opening having substantially the same preselected angular and radial spaced relation to said second zone, said flow divider means also including an outer flow divider defining two stationary generally U-shaped outer wall portions disposed at opposite sides of said axis and having their lower edges extending closely adjacent said central area of the broadcast member outwardly of said first mentioned wall portions and inwardly of said impeller means, said two outer wall portions having their ends spaced apart to define third and fourth openings angularly offset from the first and second openings.

14. In a broadcast type spreader apparatus for spreading material at a controlled rate as it is advanced along a path, the combination comprising hopper means for receiving a quantity of particulate material, a rotary broadcast member having a central area on the upper face thereof and mounted for rotation about a generally upright axis, impeller means on said broadcast member outwardly of said central area, means for feeding material at said controlled rate from said hopper means and for depositing the material on said central area of the broadcast member in first and second zones at relatively opposite sides of said axis, means for rotating said impeller means about said axis to cause the material deposited on said central area to travel outwardly from said zones and in the direction of rotation of the broadcast member, material flow

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divider means including two stationary generally U-shaped wall portions disposed at opposite sides of said axis and having their lower edges extending adjacent said central area of said broadcast member inwardly of said impeller means, the wall portions having the ends thereof spaced apart to define a first outlet opening having a preselected angular and radial spaced relation to said first zone and a second outlet opening having substantially the same preselected angular and radial spaced relation to said second zone, said flow divider means also including an outer flow divider having two stationary generally U-shaped outer wall portions spaced outwardly from said first-mentioned flow divider means, said two outer wall portions having their ends spaced apart to define third and fourth outlet openings respectively angularly offset in a direction opposite the direction of rotation of said broadcast member from said first and second openings whereby at least a major portion of the material issuing from the first and second openings is guided by said two outer wall portions toward said fourth and third outlet openings respectively, said outer wall portions having the edge thereof which extends opposite the direction of rotation of the broadcast member located to extend into the path of flow of material as it passes the respective one of the third and fourth openings to guide a substantial portion of that material toward the other of the third and fourth openings.

15. A spreader apparatus in accordance with claim 14 wherein said hopper means includes means for separately storing at least two different materials and said means for feeding material is operative to simultaneously feed said two different materials onto said central area of said broadcast member to be blended and spread.

16. A spreader apparatus according to claim 14 wherein said third and fourth openings are located at relatively opposite sides of said path of travel.

17. In a broadcast spreader apparatus for spreading material at a controlled rate as it is advanced along a path, the combination comprising, hopper means for receiving a quantity of particulate material, a rotary broadcast member mounted for rotation about a generally upright axis, flow divider means including an inner stationary wall means disposed generally coaxially of said axis and an outer stationary wall means spaced radially outwardly from said inner wall means, means for feeding material at said controlled rate from said hopper means into said flow divider means, said inner and outer wall means having their lower edges extending adjacent the upper surface of said broadcast member, said outer wall means including several arcuate wall portions each having lead and trail ends, the lead and trail ends of adjacent wall portions being angularly spaced apart to define outlet openings therebetween, said inner wall means having means for dividing the material fed into said flow divider means into several streams corresponding in number to said outlet openings and for directing the separate streams into the space between said inner and outer wall means at locations adjacent said arcuate wall portions whereby said streams are guided by the arcuate wall portions toward the next adjacent outlet opening, said arcuate wall portions each having the lead ends thereof disposed along a line tangent to a point located between the inner and outer wall means at the trail end of the respective adjacent wall portion.

18. In a broadcast spreader apparatus for spreading material at a controlled rate as it is advanced along a path, the combination comprising hopper means for receiving a quantity of particulate material, a rotary broadcast member having a central area on the upper face thereof and mounted for rotation about a generally upright axis, a stationary outer flow divider means defining first and second generally U-shaped wall portions disposed in opposed relation at opposite sides of said vertical axis and having their lower ends extending adjacent the upper face of the broadcast member, said first and second wall portions having their ends spaced apart to define first and second outlet openings angularly spaced apart, a stationary inner flow divider means defining third and

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fourth wall portions disposed at opposite sides of said axis and having their lower ends extending adjacent the upper face of said broadcast member inwardly of said outer flow divider means, means for feeding material at a controlled rate from said hopper means onto the broadcast member inwardly of said inner flow divider means, said third and fourth wall portions having the ends thereof spaced apart to define third and fourth outlet openings for passing material in two streams from the inner flow divider means to the outer flow divider means.

19. A spreader apparatus according to claim 18 wherein said hopper means includes at least two hoppers for two different particulate materials and said means for feeding material is operative to simultaneously feed material from said two hoppers onto said broadcast member inwardly of said inner flow divider means.

20. A spreader apparatus including a vehicle having means defining at least first and second hoppers for receiving two different particulate materials to be spread, spinner type spreader means for spreading material over a wide band as the vehicle moves along a path, first and second separate material feed means for respectively feeding material from said first and second hoppers onto said spreader means, drive means operatively connected to said first and second feed means, said drive means including control means selectively operable to effect driving of said first feed means or said second feed means or both said first and second feed means simultaneously to enable selective spreading of said first or said second or both materials, said drive means including hydraulic motor means for driving said feed means, conduit means connected to the hydraulic motor means, pump means connected to the conduit means to supply fluid under pressure thereto, means in the conduit means including valve means for regulating the rate of flow of fluid through the conduit means to control the speed of the hydraulic motor means, valve operating means for adjusting said valve means to maintain a preselected ratio between the speed of the feed means and the speed of the vehicle, said valve operating means including a first means for sensing the speed of the vehicle over the ground and a second sensing means for sensing the speed of whichever one of the feed means is driven, and means actuated by said first and second sensing means for adjusting the valve means when said speeds vary from the preselected ratio to modify the speed of the hydraulic motor means until said preselected ratio is achieved.

21. A spreader apparatus including a vehicle having means defining first and second hoppers for receiving two different particulate materials to be spread, spreader means for spreading the material as the vehicle moves along a path, first and second separate material feed means for respectively feeding material from said first and second hoppers onto said spreader means, drive means including first and second hydraulic drive motors respectively connected to said first and second feed means, conduit means connected to said first and second hydraulic motor means, pump means connected to the conduit means to supply fluid under pressure thereto, control means adjustable to regulate the rate of flow of fluid from the pump means through the conduit means to control the speed of the hydraulic motor means, operating means for adjusting the control means to maintain a preselected ratio between the speed of the feed means and the speed of the vehicle, said operating means including a first means for sensing the speed of the vehicle over the ground and a second sensing means for sensing the speed of whichever one of the feed means is driven and a third means actuated by the first and second sensing means for adjusting the control means to modify the speed of the hydraulic motor means when the speeds vary from the preselected ratio to modify the speed of the hydraulic motor means until said preselected ratio is achieved, said conduit means including selectively operable means for passing fluid to either said first hydraulic motor means or said second hy-

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draulic motor means or both said first and said second hydraulic motor means to effect selective driving of said first feed means or said second feed means or both said first and second feed means simultaneously.

22. A spreader apparatus according to claim 21 wherein said first and second hydraulic motor means are connected by said conduit means in series with each other so that fluid can pass serially from one hydraulic motor means to the other, and said selectively operable means includes first and second by-pass valves connected to enable selective by-passing of said first and second hydraulic motor means.

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