

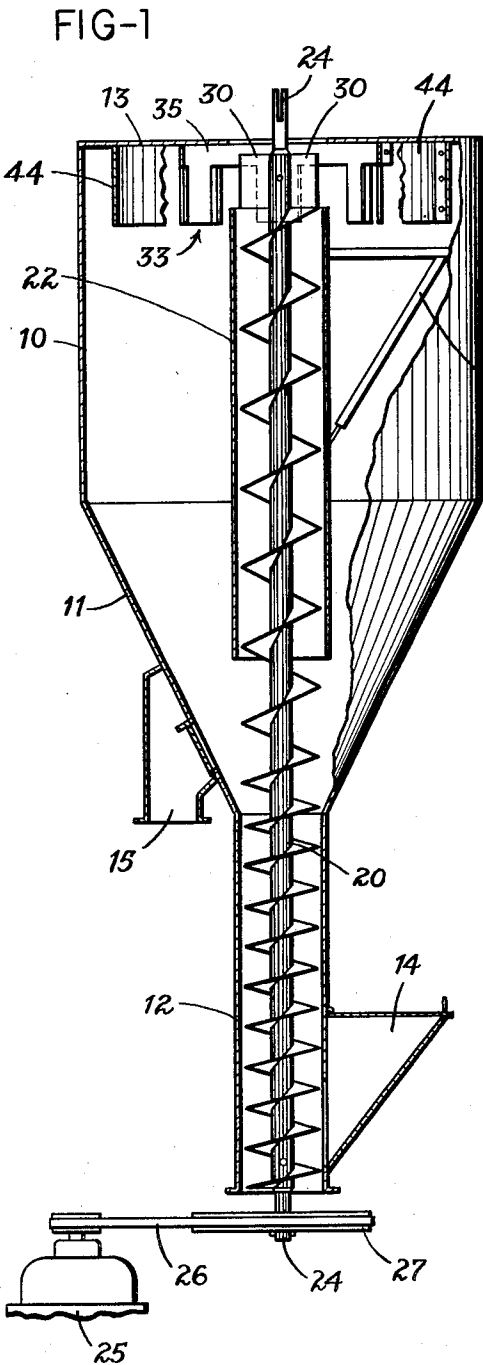
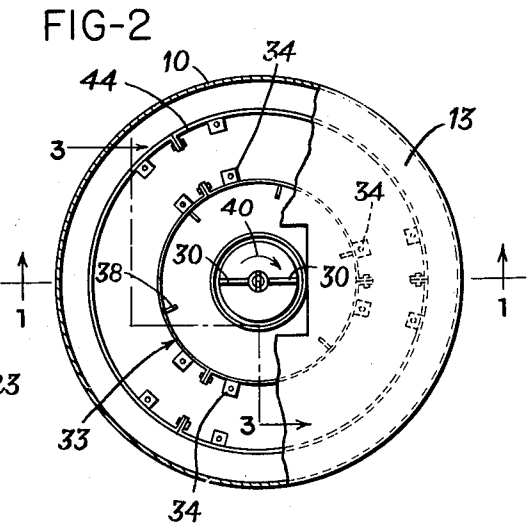
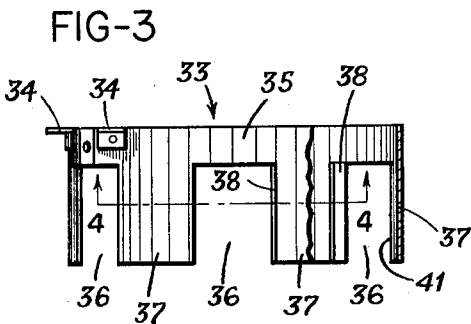
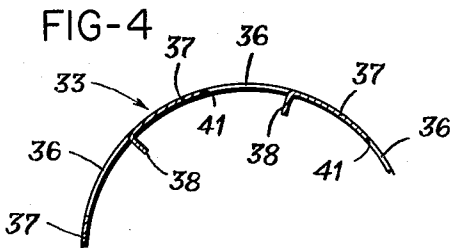
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C. D. FISHER

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MIXER

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INVENTOR
CHESTER DONALD FISHER

BY *Marshall Biebel French & Bugg*
ATTORNEYS

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2,731,248

MIXER

Chester Donald Fisher, Muncy, Pa., assignor to Sprout, Waldron & Company, Muncy, Pa., a corporation of Pennsylvania

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This invention relates to mixing apparatus for powdered or granular materials such as grain and the like, and more particularly to mixers of the vertical type in which the materials to be mixed are carried continuously upwardly through the central part of the mixer by a conveyor such as a screw or worm and are discharged radially into the upper end of the casing for gravity return to the lower part of the casing.

Mixers of this type have proved quite satisfactory from the standpoint of producing thorough mixing where the materials to be mixed are powdered or are otherwise of appropriate uniform particle size, as for example in the case of mixed grains for poultry or stock feed which are ground to appropriate uniform size. However, when the mix contains materials of different particle sizes, difficulty has been encountered in obtaining uniform mixing of the coarse and fine ingredients of the mix. For example, many stock feeds now include mixtures of ground corn or other grain together with pelleted food concentrates, with the latter being used in pellet form with maximum dimensions as large as $\frac{3}{8}$ inch while much of the grain constituent may be of such small particle size as to be capable of passage through 8 or 10 mesh screens. When it is attempted to mix materials of such widely different particle sizes in an ordinary vertical mixer, the normal action of the mixer has been found on many occasions to cause a tendency to separation or stratification of the materials rather than the desired intermixing.

It is accordingly a primary object of the present invention to provide a vertical mixer as outlined above which is so constructed and arranged that it will operate effectively with mixes of granular materials of materially different particle sizes and give thorough intermixing to substantially uniform consistency.

Another object is to provide a vertical mixer especially adapted for handling dry materials which will operate equally efficiently both with materials of approximately the same particle size and also with dry materials of comparatively widely different particle sizes and weights, and which will also in either case produce thorough and uniform intermixing with economical power requirements.

A further object of the invention is to provide a vertical mixer in which thorough intermixing of materials of different particle sizes is produced by the cooperative action of a conveyor screw and one or more baffles at the discharge end of the screw which causes distribution of the materials to be mixed throughout the interior of the mixer casing in such manner that effectively uniform mixing of both large and small particles is obtained.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawing and the appended claims.

In the drawing—

Fig. 1 is a view in vertical section showing a mixer constructed in accordance with the invention;

Fig. 2 is a top view of the mixer with portions of the top plate broken away;

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Fig. 3 is a detail view in side elevation showing the serrated baffle unit at the upper end of the casing; and

Fig. 4 is a fragmentary section on the line 4—4 of Fig. 3.

Referring to the drawing, which illustrates a preferred embodiment of the invention, the main casing of the mixer includes a cylindrical upper portion 10, and a tapering or funnel portion 11 connecting the portion 10 with a cylindrical lower portion 12 of substantially smaller diameter. A charging hopper 14 for the material to be mixed connects as shown with the lower end of the casing portion 12, and the discharge spout for the mixed materials is indicated at 15. A conveyor screw or worm 20 extends vertically through the casing, with its lower end fitting within the part 12 of the casing, and the upper portion of the screw is enclosed within a pipe 22 approximately equal in diameter to the casing part 12 and secured as by brackets 23 in the casing. The screw 20 is adapted at each end 24 for connection to a suitable drive, such as the motor 25, belt 26 and pulley 27.

The pipe 22 terminates within the funnel portion 11 of the casing and above the casing part 12, leaving a space in the casing part 11 surrounding the screw 20 as shown so that the materials within the casing are funneled by the sloping wall of the casing part 11 against the screw to be picked up and lifted through the pipe 22 to the top of the casing. The pipe 22 terminates below the cover plate 13 to provide a discharge opening for the screw, and radially extending paddles 30 are mounted on the shaft of the screw above the highest flight for rotation with the screw to throw or fling the lifted material radially outwardly into the surrounding upper portion of the casing.

This mixer as thus far described will give highly satisfactory results from the standpoint of uniform mixing when the materials to be mixed are of approximately the same particle size. However, if the materials to be mixed are of relatively different particle sizes, as in the illustrative example of mixed grain and pelleted food concentrates noted above, there is a tendency for the material thrown out from the screw to drop and form a funnel shaped pile such that the coarser particles roll down and inwardly towards the center of the casing while the finer particles compact along the outer wall, and the desired uniform mixing is not obtained even after prolonged operation of the apparatus.

In accordance with the present invention, this undesirable result is prevented, and the desired uniform mixing is obtained, by the provision of a baffle unit approximately midway between the discharge end of the screw and the outer wall of the casing which is discontinuous and is of such construction that it intercepts approximately half of the discharged material and causes it to drop near the center of the casing while permitting the remainder of the material to pass radially therebeyond towards the outer wall of the casing. In addition, the baffle unit is so constructed that the baffle portions alternate at sufficient frequency with through passages as to cause an effective averaging of the intercepted material with the freely discharged material around the entire circumference of the mixer.

A baffle unit found satisfactory as fulfilling these conditions is indicated at 33 in the drawing and includes a cylindrical upper portion 35 secured to the top plate 13 by brackets 34, and it extends downwardly to a level somewhat below the upper end of the pipe 22, for example a distance of approximately $2\frac{1}{4}$ inches in the case of a baffle which is 30 inches in diameter for a mixer wherein the upper casing portion 10 is 60 inches in diameter. The baffle 33 may be formed of continuous tubing or may be fabricated from segments of sheet materials bolted or otherwise secured together in cylindrical shape, and its lower edge is serrated to pro-

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vide a plurality of open spaces 36 alternating with solid baffle members 37. For preferred results these spaces and solid portions are of approximately equal angular dimensions and thus alternate equally around the circumference of the mixer. For example, in a baffle and mixer of the above dimensions, satisfactory results have been obtained with a total of six openings 36 alternating with the same number of solid baffle portions 37, and with the spaces 36 extending from the lower end of the baffle to a distance of approximately 6¾ inches above the upper end of the pipe 22, leaving a continuous baffle portion approximately 3 inches in height above the spaces 36.

It has been found desirable to form an intumed radial flange or lip 38 along the far edge of each baffle portion 37 with relation to the direction of rotation of the screw 20 and paddles 30. Thus referring to Figs. 2 and 4, with the directions of rotation of the paddles indicated by the arrow 40, it will be seen that the flanges 38 lie along the far edges of the baffle portions 37 as distinguished from the near edges 41 which are first encountered by discharged materials during rotation of the screw. The flanges 38 thus provide a sharp cutoff between the intercepted and the free thrown materials whereas if they were not present, some of the materials striking the far edge of each solid baffle portion might be deflected more or less tangentially through the adjacent opening 36. In a baffle member of the dimensions given above, satisfactory results have been obtained with each flange 38 having a radial dimension of approximately two inches.

With this baffle constructed and mounted as described, in the operation of the mixer the solid materials lifted by the screw to the top of pipe 22 will be flung radially outwardly by the rotating paddles 30 with sufficient force to carry to the outside wall of the casing. However, the solid baffle portions 37 will intercept approximately 50% of this discharged material while the remainder thereof passes through the openings 36. Since the baffle 33 is open along its lower end, the intercepted materials will drop near the center of the mixer, while the materials passing through the baffle openings 36 will strike either the outer wall of the casing and thus drop near the outer portion of the casing. This resulting averaging of the discharged material across the radius and around the circumference of the casing has been found to give highly effective and uniform intermixing of even materials of as widely different particle sizes as noted above, and particularly where such uniform intermixing has not been obtained in the absence of the baffle unit 33.

It has also been found desirable under some conditions to employ an additional baffle located outwardly of baffle 33 and of circumferentially continuous construction, as shown at 44 in Fig. 1, for example a baffle 44 of the same axial length as baffle 33 and of a 51-inch diameter in a casing of the 60-inch diameter stated. When such a continuous baffle is used without the baffle 33, it does not appear to improve the mixing conditions, since the materials discharged from the screw tend to fall in such manner as to form a cone located inwardly of the casing wall, and the coarser materials then roll down the outside of the cone to collect near the outer wall of the casing. However, when the two baffles are both used, they cause the falling materials to form inner and outer cones such that the desired uniform mixing is obtained.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A mixer especially adapted for effecting uniform mixing of granular materials of different particle size

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comprising a generally vertical casing, vertical conveyor means mounted within said casing to lift the materials therein to be mixed from the lower end to the upper end of said casing, rotary means cooperating with said conveyor means at the upper end thereof to cause said lifted materials to be discharged radially outwardly into the surrounding open portion of the casing, means forming a plurality of baffle members located at positions intermediate the discharge end of said conveyor means and the wall of said casing in the path of said radially discharged materials, said baffle members being angularly spaced and having an aggregate circumferential dimension of approximately one-half the total circumference of said baffle means to effect interception of approximately one-half of said discharged materials while permitting the remainder thereof to pass radially therebeyond, said baffle members being open along the lower edges thereof to cause said intercepted materials to drop within the inner portion of said casing, and each said baffle member having an intumed and generally radially arranged flange along the far edge thereof with respect to the direction of rotation of said rotary means to provide a relatively sharp cutoff between said intercepted materials and said materials passing beyond said baffle members.

2. A mixer especially adapted for effecting uniform mixing of granular materials of different particle size comprising a generally vertical casing, a conveyor screw mounted for rotation within approximately the center of said casing to lift the materials therein to be mixed from the lower end to the upper end of said casing, an impeller mounted for rotation at the upper end of said screw for causing said lifted materials to be discharged radially outwardly into the surrounding open portion of said casing, and means forming a plurality of baffle members located radially between said impeller means and the wall of said casing in the path of said radially discharged materials, said baffle members being located at positions intermediate the outer wall of said casing and said impeller and being angularly spaced and open along the lower edges thereof to cause materials intercepted thereby to drop within the inner portion of said casing while permitting the remainder of said materials to pass therebeyond and thereby to drop in the outer portion of said casing for thorough mixing.

3. A mixer especially adapted for effecting uniform mixing of granular materials of different particle size comprising a generally vertical casing, a conveyor screw mounted for rotation within approximately the center of said casing to lift the materials therein to be mixed from the lower end to the upper end of said casing, an impeller mounted for rotation at the upper end of said screw for causing said lifted materials to be discharged radially outwardly into the surrounding open portion of said casing, and means forming a plurality of baffle members located radially between said impeller means and the wall of said casing in the path of said radially discharged materials, said baffle members being located at positions intermediate the outer wall of said casing and said impeller and being angularly spaced and having an aggregate circumferential dimension of approximately one-half the total circumference of said baffle means to effect interception of approximately one-half of said discharged materials while permitting the remainder thereof to pass therebeyond and thereby to drop in the outer portion of said casing for thorough mixing.

4. A mixer especially adapted for effecting uniform mixing of granular materials of different particle size comprising a generally vertical casing, a conveyor screw mounted for rotation within approximately the center of said casing to lift the materials therein to be mixed from the lower end to the upper end of said casing, an impeller mounted for rotation at the upper end of said screw for causing said lifted materials to be discharged

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radially outwardly into the surrounding open portion of said casing, means forming a plurality of baffle members located radially between said impeller means and the wall of said casing in the path of said radially discharged materials, said baffle members being located at positions intermediate the outer wall of said casing and said impeller and being angularly spaced and open along the lower edges thereof to cause materials intercepted thereby to drop within the inner portion of said casing while permitting the remainder of said materials to pass therebeyond and thereby to drop in the outer portion of said casing for thorough mixing, and each said baffle member having an inturned and generally radially arranged flange along the far edge thereof with respect to the direction of rotation of said screw to provide a relatively sharp cutoff between said intercepted materials and said materials passing beyond said baffle members.

5. A mixer especially adapted for effecting uniform mixing of granular materials of different particle size comprising a generally vertical casing, means for continuously elevating the materials within said casing from the lower portion of said casing to the upper portion thereof, means in said upper portion of said casing for discharging said elevated materials radially outwardly within said casing with sufficient force to reach the surrounding outer wall of said casing, rotary means in said upper portion of said casing for causing said elevated materials to be thrown radially outwardly within said casing with sufficient force to reach the surrounding wall of said casing, a baffle surrounding said rotary means and spaced approximately equidistant the center and outer wall of said casing, said baffle having a serrated lower edge providing open spaces therethrough alternating with solid baffle portions for intercepting a predetermined limited portion of said thrown materials while permitting the remainder thereof to pass radially beyond said baffle, each said solid baffle portion having a radially inturned flange along one vertical edge thereof, and each said flange being located on the far side of the associated said baffle portion with relation to the direction of rotation of said rotary means.

6. A mixer especially adapted for effecting uniform mixing of granular materials of different particle size comprising a generally vertical casing, means for continuously elevating the materials within said casing from the lower part of said casing to the upper part therefor and for discharging said elevated materials radially outwardly with sufficient force to reach the outer wall of said upper portion of said casing, baffle means located at a position intermediate said outer wall and the dis-

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charge point of said materials in the radial path of said discharged materials, said baffle means being circumferentially discontinuous to intercept a predetermined limited portion of said discharged materials while permitting the remainder thereof to pass radially therebeyond and being open along the lower edge thereof to cause said intercepted materials to drop in the inner portion of said casing, and additional baffle means located radially outwardly of said discontinuous baffle means and intermediate said discontinuous baffle means and the wall of said casing, said additional baffle means being circumferentially continuous to intercept said discharged materials passing radially beyond said discontinuous baffle means and to cause said materials to drop in an area radially inwardly of the outer wall of said casing.

7. A mixer especially adapted for effecting uniform mixing of granular materials of different particle size comprising a generally vertical casing, means for continuously elevating the materials within said casing from the lower portion of said casing to the upper portion thereof, means in said upper portion of said casing for discharging said elevated materials radially outwardly within said casing with sufficient force to reach the surrounding outer wall of said casing, a baffle surrounding said discharging means at a position approximately equidistant the center of said casing and said outer wall thereof, said baffle having a serrated lower edge providing open spaces therethrough alternating with solid baffle portions for intercepting a predetermined limited portion of said discharged materials while permitting the remainder thereof to pass radially beyond said baffle and being open along the lower edge thereof to cause said intercepted materials to drop in the lower portion of said casing, and an additional baffle located radially outwardly of said serrated baffle at a position intermediate said serrated baffle and the wall of said casing, said additional baffle being circumferentially continuous to intercept said discharged materials passing beyond said serrated baffle and to cause said materials to drop in an area radially inwardly of said casing wall.

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