This invention relates to apparatus for throwing discrete substances.

The invention refers more particularly to apparatus of the type now employed extensively for throwing discrete materials, such as sugar, grain and the like, from one position to another—as in the bulk loading of a ship’s hold or in establishing a stock-pile. For purposes of this apparatus, hereinafter referred to as the type described’ may be found in my United States patent specifications Nos. 671,985, Patent No. 2,920,766, and 770,209, Patent No. 2,979,183, the most essential feature being an endless thrower-belt passing around spaced, parallel, horizontally-disposed end rollers, the upper or working surface of the thrower-belt being constrained to move in an accurate path by pressure exerted by narrow, intermediate deflector wheels arranged between the end rollers and bearing on the marginal portions at either side of the belt.

The discrete substance or material to be thrown is directed down onto the surface of the thrower-belt so that, when the latter is driven at high speed, the substance or material will be forcibly projected in a concentrated stream. The apparatus may be in the form of a mobile machine or it may be a housing suspended, through a turntable device from the lower end of a telescopic conduit for location in a ship’s hold. In the latter case, the dual purposes of loading and trimming may be accomplished by providing a hinged gate or flap in the housing to direct the sugar or other material to either arm of a bifurcated chute, one arm feeding the material to the thrower-belt, while the other extends to the rear of the housing and is adapted to direct the material directly downwards for trimming purposes. These alternative loading and trimming functions are illustrated in the machine described in my United States patent specification No. 770,209.

In small-capacity machines of this type, it is possible to use a comparatively narrow belt, but larger machines, such as that shown in my United States patent specification No. 671,985, may use a wide belt of desired width to give a very large capacity or throwing rate, this being possible by the provision of division discs on the shaft of the deflector wheels, these division discs acting firstly to prevent undesirable bulging of the belt and secondly to divide the stream of feed material into laterally-spaced “ compartments” to assist in maintaining a constant, concentric delivery stream.

While my machines of these types have proved very efficient in general operation in connection with the throwing of sugar, wheat and many other materials, it will be appreciated that there is no limit to the desirable degree of efficiency for any purpose and that even greater efficiency than at present achieved is necessary or at least desirable for the most effective handling of certain materials, such as barley and rice. Accordingly, my present invention has been devised with this as its principal object, the feature of the invention being the provision of an improved construction of endless thrower-belt.

Notably, the invention resides in apparatus of the type described, characterized in that the endless thrower-belt has a series of transverse ribs of flat-top, saw-tooth profile, preferably formed integrally therewith, and against which the beforementioned division-discs bear. These ribs may extend between the marginal portions of the belt contacted by the deflector wheels, the marginal portions being plain or devoid of ribs or other projections, while the thickness of the thrower-belt in the marginal portions may be equal to the thickness of the belt in the highest portion of each rib. Preferably, the ribs are defined by and between regularly-spaced transverse grooves in the thrower-belt between the marginal portions thereof, each groove having a vertical rear face and upward-inclined lower face constituting respectively the front face of one rib and the rear face of the rib next in front relative to the direction of motion of the belt.

In the drawings:

FIG. 1 is a partly broken-away side elevational view of one form of loading and trimming apparatus for use in a ship’s hold, incorporating the invention;

FIG. 2 is a partly broken-away front elevational view of the apparatus shown in FIG. 1;

FIG. 3 is a side elevational view of portion of the thrower-belt of the apparatus, made in accordance with the present invention;

FIG. 4 is a perspective view, showing the upper or working surface of portion of the thrower-belt, and

FIG. 5 is a perspective view of one of the discs of the deflector-wheel shaft of the apparatus shown in FIG. 1.

The apparatus shown in the drawings includes a housing 10 built up of a pair of sheet metal side plates 11 and other plates and angle irons welded together. Into an opening at the top of the housing 10 there is fitted one arm 12 of a bifurcated chute 13, the other arm 14 of the chute 13 leading to the rear of the housing 10 for trimming purposes. Within the chute 13, there is provided a hinged gate or flap (indicated in broken outline at 15 in FIG. 1) adapted to be moved by an hydraulically-operated mechanism 16 to either the trimming position indicated in FIG. 1 in which the material is directed down the arm 14 of the chute 13 or to a loading position in which the flap 15 is vertical to allow the material to pass down the arm 12 of the chute 13.

Secured within the upper end of the chute 13 is a lower conduit 17 shaped to develop downwardly from square to rectangular cross-section and adapted to be connected in a well-known manner, through turn-table means, to the lower end of a telescopic substantially vertical conduit for sugar or the like.

Within the housing 10, an electric motor 18 is pivotedally mounted in adjustable manner upon a motor mounting frame 19 and has a drive pulley 20 connected through belts 21 to a pulley 22 on a rear transverse shaft 23 rotatably mounted in a fixed position between the side plates 11 in rear of the arm 12 of the chute 13. A driver roller (not shown) is fixedly mounted on the shaft 23 and is connected by an endless thrower-belt 24 to an identical front roller 25 fixedly mounted on a front shaft 26. The ends of the shaft 26 are carried in longitudinally-adjustable bearings in upper arms 27 of bell-crank 28 which are pivoted at 29 to the side plates 11 of the housing 10. The lower arms 30 of the bell-crank 28 are interconnected by a rod 31 adapted to be moved by an hydraulic ram and cylinder 32. Thus the front roller 25 may be pivotally raised or lowered by the cylinder 32 or may be longitudinally adjusted along the bell-crank arm 27 to give adequate adjustment of the angle of throw of the discrete material by the thrower-belt 24.

The upper part of the thrower-belt 24 is depressed between the drive roller and front roller 25 by a pair of deflector wheels 33 secured to a transverse shaft 34 rotatably mounted between the side plates 11, these deflector wheels 33 bearing upon the marginal or side portions of the thrower-belt 24.

The thrower-belt 24 is of novel design, being shown more particularly in FIGS. 3 and 4, and it will be seen
that it is of uniform thickness except for the provision of regularly spaced grooves 35 extending between such portions of its edge as are contacted by the deflector wheels 33, these grooves being 36 being plain and of uniform thickness. Each groove 35 has a vertical face 37 with the lower extremity thereof connected back to the top face of the belt by an inclined face 38, the upward inclination of the face 38 being in the intended direction of motion of the belt 24, as indicated by the arrows 39 in FIGS. 3 and 4. The thrower-belt 24 may be of conventional fabriccored or other known construction, faced or enveloped in rubber or the like, the grooves 35 being molded integrally therewith.

Thus, when considered in longitudinal section, the thrower-belt 24 has regularly spaced ribs or flat-tooth teeth 40 between and defined by the grooves 35, each rib being of flat-top saw-tooth profile and having a short vertical face 37, an upwardly-inclined face 38 and a normally upper and horizontal top face 41, the width of the latter being, for example, about two-thirds the width of the groove 35, while the depth of the vertical face 37 may be about one-half the width of the top face 41. It will be appreciated that the flat-tops of the said teeth present a substantial surface to the rims of the aforementioned division-discs and, consequently, serve to resist deterioration of the belt on account of friction between said discs and said belt.

The deflector wheel shaft 34 also has secured thereon three disc-assemblies 42, one of which is shown in detail in FIG. 5, the three being arranged in equally-spaced manner along the shaft 34 and extending back into the arm 12 of the chute 13, slots 43 being provided in the latter for this purpose.

Each disc-assembly 42 includes a central, hollow cylindrical hub 44 having welded theretoabut a plain, centrally-opened inner disc 45 which may suitably have a thickness of about three-eighths inches. An outer disc 46, of lesser thickness than the disc 45—such as one-eighth inch—has a central aperture to closely accommodate the inner disc 45 and is welded thereon. The outer disc is of slightly lesser overall diameter than the deflector wheels 33 and it has a series of equally-spaced, radial corrugations, as shown in FIG. 5 extending from its outer periphery to the periphery of the inner disc 45 where the corrugations may be of reduced or zero deformity.

The general operation of the overall apparatus is similar to that of the previous machines and will be readily apparent from the description and drawings, the discrete material being thrown in a concentrated stream from the front of the apparatus by the thrower-belt 24. At the same time, the radially-corrugated discs 46 exert on the particles of material a frictional force in the direction of the belt, this thrust acting to grip and throw the particles against the belt, with the result that they are more efficiently gripped by the belt and projected from the apparatus.

The principal features of this invention is the provision of the novel form of thrower-belt 24 as previously described, and I have found that belts having this shape and configuration are most effective in giving a better propelling action than previously. While it is preferred that the marginal portions of the belt be plain and devoid of raised ribs, it will be appreciated that the deflector wheels would operate satisfactorily over the ribs if they were extended flush with the edges of the belt.

However, it will be appreciated that the particular exemplary form of belt hereinbefore described may be subject to other modifications of constructional detail and design. For example, the front face of each rib need not be truly vertical but could slope somewhat in either direction, and the upper and rear faces of each rib could be arcuate or of other equivalent shape, if so desired. Such modifications will be readily apparent and are deemed to reside within the scope and ambit of my invention, as defined by the appended claims.

The disc-assemblies illustrated herein are described in greater detail and claimed in my copending patent application Ser. No. 862,689 filed concurrently herewith. I claim:

1. Apparatus for throwing granular substances, comprising, in combination, a housing having an opening for the ejection of a granular substance, an endless thrower-belt, said thrower-belt comprising two substantially flat marginal portions of uniform thickness and a central portion extending between and integral with said marginal portions, said central portion comprising a plurality of transverse rib sections of flat-top, saw-tooth profile extending at regularly spaced intervals in the direction of the belt, each rib having a front face, a top face extending rearwardly at a right angle to the front face and an inclined face extending downwardly at an acute angle from the top face, said inclined face and the front face of a succeeding rib section forming a transverse groove in said central portion, the thickness of said rib section through said top face being equal to the thickness of said marginal portions, means rotating and supporting said thrower-belt within said housing with the central portion of the thrower-belt facing said opening, a chute arm located within said casing for feeding said granular substance to said thrower-belt, a transverse shaft rotatably mounted in said housing, a pair of deflector wheels secured to said shaft and bearing upon said marginal portions of said thrower-belt, and a plurality of disc assemblies secured to said shaft and located between said deflector wheels, said disc assemblies extending through slots formed in said chute arm and bearing against said central portion of the thrower-belt.

2. Apparatus for throwing granular substances, comprising, in combination, a housing having an opening for the ejection of a granular substance, an endless thrower-belt, said thrower-belt comprising two substantially flat marginal portions of uniform thickness and a central portion extending between and integral with said marginal portions, said central portion comprising a plurality of transverse rib sections of flat-top, saw-tooth profile extending at spaced intervals in the direction of the belt, means rotating and supporting said thrower-belt within said housing with the central portion of the thrower-belt adjacent said opening, a chute arm located within said casing for feeding said granular substance to said thrower-belt, a transverse shaft rotatably mounted in said housing, a pair of deflector wheels secured to said shaft and bearing upon said marginal portions of said thrower-belt and a plurality of disc assemblies secured to said shaft and located between said deflector wheels, said disc assemblies extending through slots formed in said chute arm and bearing against said central portion of the thrower-belt.

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