My invention relates to earth movers, sometimes called "scrapers," of the type employing a main bowl, and usually also having a pusher and a front apron. The front apron moves toward and away from a cutting member at a leading edge of the main bowl to control in part the ingress of excavated material to the main bowl and the discharge of the load from the main bowl onto the ground. If a pusher is used, it assists in the discharging operation. A machine of this general character is shown in my previous patent, Number 2,394,483, issued February 5, 1946. The operation of an earth mover during scraping is attended with various difficulties depending upon the nature of the material being excavated. While some intermediate class soils load and unload fairly easily, others of the clap type are handled with some difficulty and those that are largely sand are handled with considerable difficulty. Even during loading and especially when unloading, the sandy soils tend to run out almost like liquid whereas the heavier clays tend to move as a large, cohesive bulk. Disengaging a layer of clayey soil from the subjacent material sometimes produces irregular digging and chattering of the cutting edge. This leaves a rough surface for subsequent passes. There is no inabiity to separate sand or sandy soil from the subjacent material but it is hard to retain sand during and after excavation.

It is often a requirement in excavating that the excavation be left with a fairly planar surface, especially in work where grades are held to level condition within narrow limits. It is also true in spreading material that the spread layer is usually confined within very small thickness or depth limitations because of specification requirements, particularly for compaction.

It is therefore an object of my invention to provide an earth mover generally an improvement over earth movers at present available.

Another object of my invention is to provide an earth mover which loads better in various soils than presently available equipment and which discharges better in most soils than present equipment.

A further object of the invention is to provide an earth mover having an excavating arrangement especially useful in connection with sandy soils to admit such soils during excavation and to retain them in the machine without excess spillage or loss.

A still further object of the invention is to provide an earth mover having a cutting edge of a reinforced or extra strong nature to resist better the very large excavation or digging forces imposed upon the machine.

A still further object of the invention is to provide an earth mover in which discharge of material from the main bowl is considerably facilitated.

A still further object of the invention is to provide an earth mover having a pusher that is augmented in strength over the normal arrangement.

Other objects together with the foregoing are attained in the embodiment of the invention described in the accompanying drawings in which:

Figure 1 is a diagrammatic plan of an earth mover constructed in accordance with my invention, various parts of the structure being omitted for clarity in showing.

Figure 2 is a cross-section, the plane of which is indicated by the line 2—2 of Figure 1, various portions of the figure being broken away and being shown diagrammatically.

Figure 3 is a view similar to Figure 1 but showing the parts in a different operating position.

Figure 4 is a view in cross-section, the plane of which is indicated by the line 4—4 of Figure 3, various portions being broken away and being shown diagrammatically.

While the earth mover of my invention can be incorporated in various different forms, depending particularly upon the environment in which it is to be utilized and any special conditions under which it is to operate, it has quite successfully been embodied as shown herein.

The arrangement of the earth mover in general is substantially standard, as shown in the mentioned prior patent, and includes a main bowl 6 defined by a bottom panel 7 of a planar contour having a pair of longitudinal side panels 8 and 9 upstanding from the side edges of the panel 7. The side panels 8 and 9 extend forwardly and rearwardly to structure supported on ground engaging wheels 11 and 12 in the customary fashion, there being provided appropriate steering and operating mechanisms, not shown.

The construction of the bottom panel and of the side panels is preferably of metal plates welded together so as to form a main bowl substantially rectangular in cross-section and arranged so that during loading, as shown in Figure 4, the general plane of the bottom panel 7 is substantially parallel to the theoretical plane 13 of the ground being excavated, the direction of advance being toward the left of the figures, as indicated by the arrow 14 in Figure 4, in accordance with the usual custom. The leading edge of the bottom panel 7 is defined as a cutting member 17 preferably including a center section 18 and a pair of side sections 19 and 21. The center section 18 is symmetrical with the longitudinal center line 22 of the earth mover and is preferably a planar plate arranged to extend transversely of the bottom panel 7; that is, perpendicular to the center line 22 and to be downwardly and forwardly incline to terminate in a sharp leading edge 23 for engaging and, when necessary, cutting the material being excavated.

As a distinction from usual practice, the side sections 19 and 21 are not linear continuations of the center section 18 but rather each of them is made up of an individual, planar plate arranged so that at its inner portion it merges smoothly with the plate 18. At its outer portion each side plate is disposed considerably further forward, as it extends outwardly, than the central plate.

The points of junction of the plates 19 and 21 with the side plates 8 and 9, respectively, are at locations considerably forward of the central section 18. The various plates, being separate, are installed and replaced individually. The general inclination of the side plates 19 and 21 is downwardly and forwardly so that they, together with the central plate 18, terminate in cutting edges ending in a plane substantially parallel to the plane of the bottom panel 7.

The inclined side sections 19 and 21 serve as reinforcing gussets for the central portion of the cutting edge 18 and provide a structure which is extremely rigid as a beam to resist forces acting in the direction of the plane of the bottom; that is, generally in the direction of forces encountered during digging and excavating. This is particularly important since it has become the practice in
hard digging and loading to supplement the ordinary tractive power of the scraper for which it is designed, with additional loading thrust furnished by a pusher tractor. Virtually all of the augmented force is imposed upon the cutting member. The present construction affords extra rigidity for this use. Since the various cutting member portions are contained between two parallel planes and since the side portions are not out of the transverse planes of the central portion 18, they do not produce an irregular or non-planar cut at any point in the width of the main bowl during normal excavation, except possibly when the structure is first lowering into and beginning an excavation and upon lifting out of an excavation. In the normal cutting operation, as shown in Figure 4, the forwardly extended side sections 19 and 21 do not interfere with a cut uniformly deep in a transverse direction. Furthermore, when the machine is used for spreading the cutting member 17 is available as a planar spreading device for the width of the machine.

To cooperate with the cutting edge so formed, to assist in movement of the material during excavation to load the main bowl, and to assist in discharging the load from the main bowl, I provide a special pusher 31. This comprises many parts which are substantially standard such as a push element 32 connected to any suitable sort of operating structure, not shown, and incorporates primarily a central, generally planar portion 33 fabricated of a metal plate mounted for rectilinear translation within the bowl 6 and having a part of its weight, at least, supported on rollers 34, for example, running on the upper edges of the side panels 8 and 9. The transverse central plane 33 of the pusher is somewhat inclined in the vertical direction so that its transversely straight leading edge 36, in the forward position of the pusher, indicated by the dotted lines in Figure 3, is in direct vertical registry with the central portion 18 of the cutting edge.

So that the sides likewise register, in the forward position of the pusher, with the leading edge of the main bowl 6, I provide a pair of side portions 38 and 39 merging smoothly with the central portion 33 and extending nearly to the side panels 8 and 9. These side sections are generally planar and have their planes inclined forwardly and downwardly as well as outwardly and forwardly so that they act as extra reinforcements for the bowl constructed by the pusher 31 to the entire area of the bottom panel. When material is being loaded it is turned by the side portions 38 and 39 and directed inwardly and upwardly to assist in "boiling" of the material for proper distribution.

Cooperating with the pusher and the main bowl is a front apron 41 including a central plate 42 preferably planar and, in its lower position, inclined somewhat to the vertical. The apron is supported in any convenient way; for example, by a pair of side arms 43 and 44 extending rearwardly to pivots 46 and 47 on the side panels 8 and 9 so that the front apron swings approximately or exactly in an arc toward and away from the cutting member 17. Included in the front apron 41 is a lip 48 conveniently fabricated of a planar plate of metal inclined downwardly and rearwardly toward the cutting member 17 and having a central zone 51 terminating in a transverse edge adapted to lie closely adjacent the leading part of the central section of the cutting member 17—sufficiently closely so as to constitute an adequate closure for carrying sand.

The lip 48 also includes side zones 52 and 53 terminating in trailing edges, in the lower position of the front apron lying closely adjacent the side sections 19 and 21. Preferably the trailing edges of zones 52 and 53, when seen vertically, are at such an angle as to extend diagonally across the side sections 19 and 21 from the inner lower corner thereof to the outer upper corner thereof, as illustrated in Figure 1. Since the trailing edge of the front apron is relatively thin while the cutting member 17 is relatively thick, in a vertical direction, the intersections and meeting faces described can readily be attained.

One of the advantages of the arrangement is particularly shown in comparing Figures 1 and 3. When the front apron is closed entirely as shown in Figure 1, the main bowl is sealed and material can neither enter it nor escape from it. When the front apron has been slightly opened, as shown in Figures 3 and 4, from the vertical aspect (which is the direction of the gravitational component of discharge) there is a relatively large central opening with diminishing side openings. In the case of sandy soils, particularly, this assists in laying an even window during spreading without having the material flow laterally substantially beyond the width of the main bowl. Also in loading there is permitted a relatively large flow through the central portion of the opening but adjacent the sides, the flow is diminished and is gradually closed off. While this may tend to diminish the influx of material at the sides, it is especially effective in preventing a simultaneous lateral outflow which presently occurs with ordinary constructions during loading. The net result therefore in precluding the present loss at the sides and in augmenting the central influx is to afford at least as great a rate of loading as is now possible and in most instances a greatly increased rate of loading. Furthermore, the material flowing into the main bowl, once excavated, is retained.

In loading the clayey soils the relatively wide central opening is adequate to afford rapid influx of material. The side sections 19 and 21 rather than ramming into the earth, like chisels, instead afford an action (because of their angularity to the direction of advance) more nearly akin to a sliding, slicing cut—not a straight shear but rather a shear having a large component parallel to the cutting edge. This acts in clay or like material to facilitate the separation of the layer to be excavated from the underlying material. The peeled or sliced material is turned or directed not only rearwardly into the main bowl in the usual fashion, but some is directed upwardly and away from the sides of the bowl so facilitating the loading operation. Material entering the bowl is turned by the side sections 19 and 21 toward the center of the bowl thereby creating a heaped effect in the loaded material. The side sections 19 and 21 act as moldboards to turn and also set in to the bottom of the bowl as it rides up over their surfaces thus giving accelerated loading of the central portion of the bowl. The accelerated central loading gives a heaped load without spilling over the sides. In conventional machines material is spilled over the sides until a desirable heaped load is obtained. For materials from sand to clay and of various intermediate characteristics, the scraper operation is generally improved both in loading and in unloading. The fabrication of the parts however is no more difficult than usual, in fact is somewhat easier because of the additional bracing and strength provided by the location and disposition of the cutting member, the more favorable shape of the front apron and the better beam construction of the pusher.

What is claimed is:

An earth mover comprising a main bowl including a substantially horizontal, planar bottom panel and a pair of longitudinally extending, substantially vertical side panels upstanding from the side edges of said bottom panel; a cutting member at the leading edge of said bottom panel and including a central section extending transversely of and fixed with respect to said bottom panel and inclined forwardly and downwardly therefrom, said cutting member also including a pair of side sections fixed with respect to and joining said central section, and extending forwardly and outwardly therefrom to join the associated one of said side panels and inclined forwardly and downwardly from said bottom panel; a pusher, means for mounting said pusher for movement...
in said main bowl over said bottom panel between a rearward position and a forward position, said pusher including a central portion and a pair of side portions each joining said central portion, said central and side portions being contoured to be substantially in vertical registry with said central section and said side sections respectively in said forward position of said pusher; a front apron; and means for pivotally mounting said front apron on said side panels for movement between a first position away from said cutting member and a second position adjacent said cutting member; said front apron including a transversely extending central zone and a pair of side zones each joining said central zone, said central zone and said side zones being contoured to be substantially in abutment with said central section and said side sections respectively, when said front apron is in said second position.