B. A. HUGHES.

MACHINE FOR SIZING AND SEPARATING GRANULAR MATERIAL.

APPLICATION FILED NOV. 8, 1911.

1,039,132.

Patented Sept. 24, 1912.

4 SHEETS—SHEET 1.

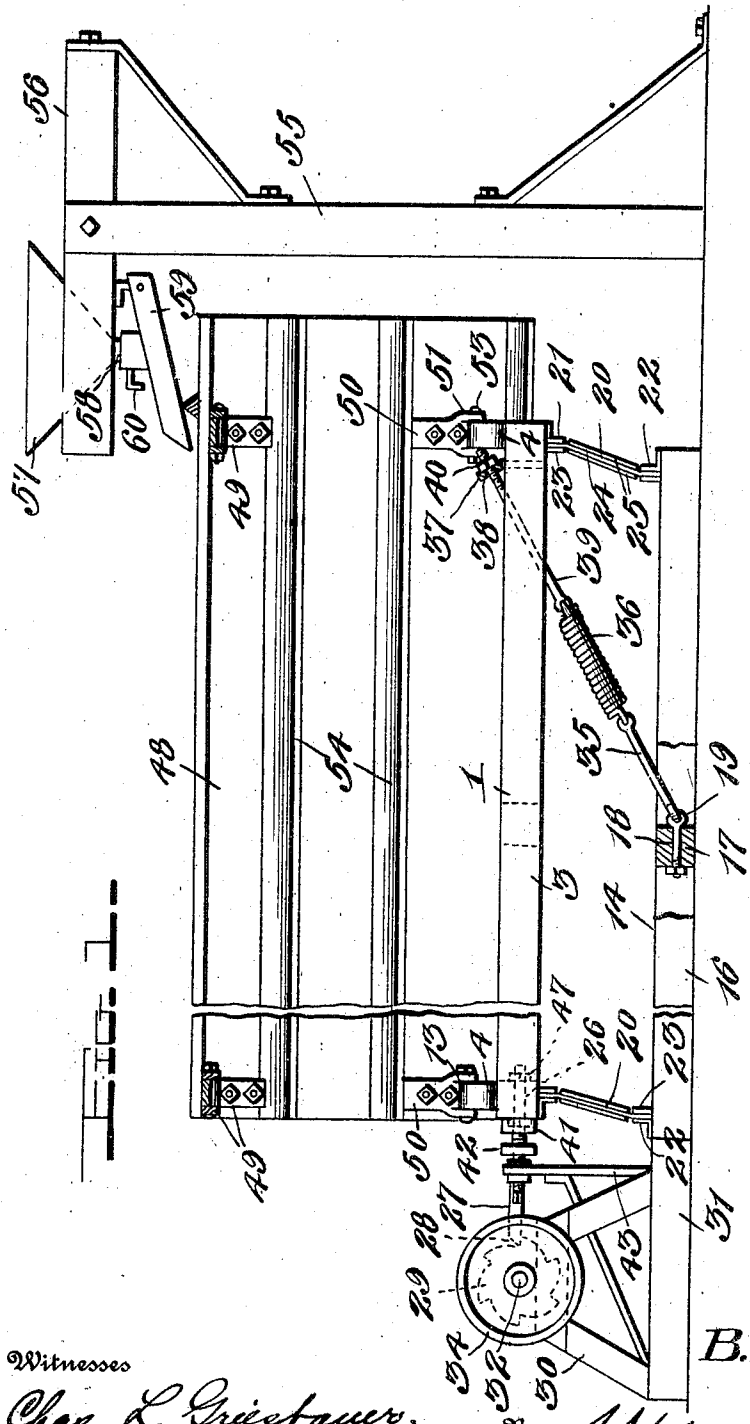

FIG. 1.

Witnesses

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4 SHEETS—SHEET 2.

Fig. 2.

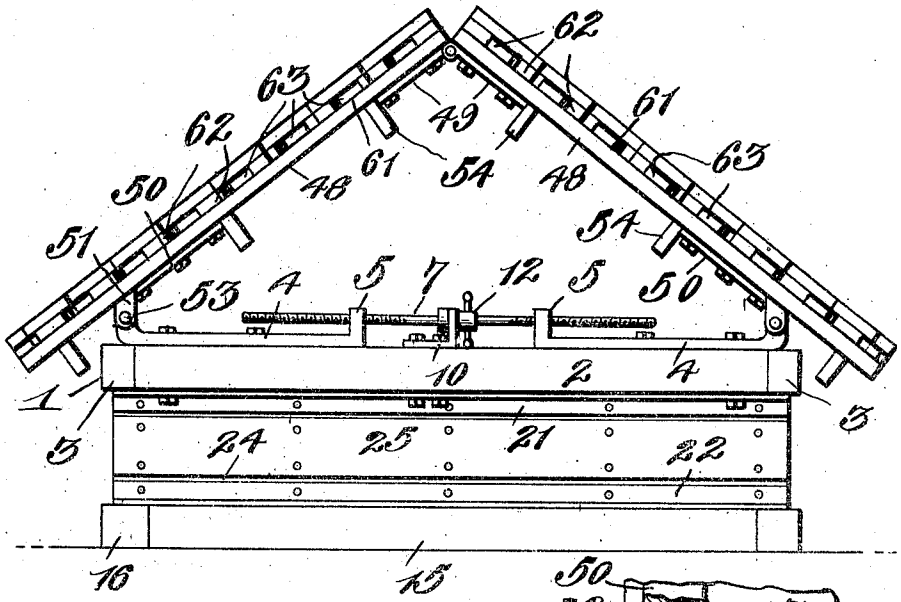
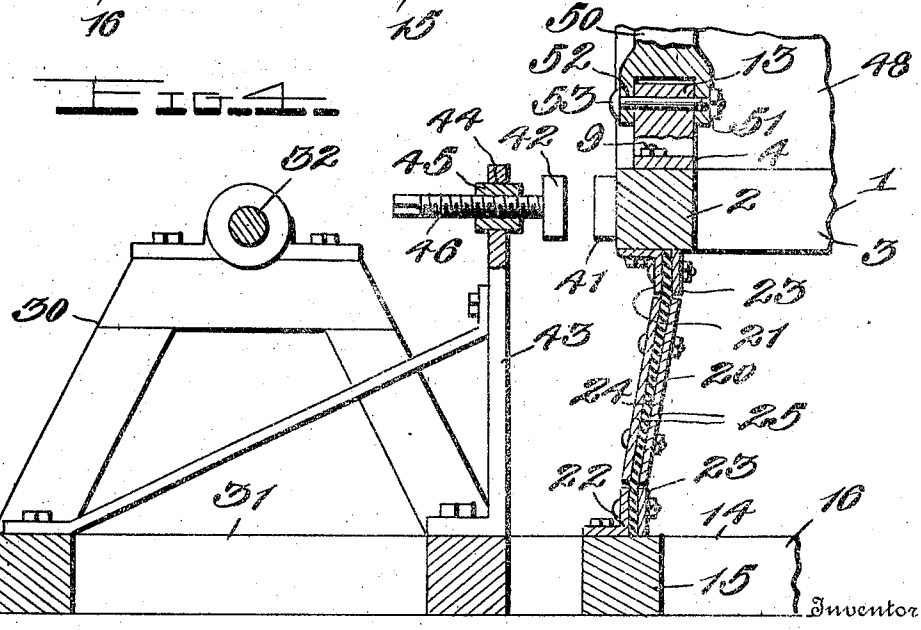


Fig. 4.



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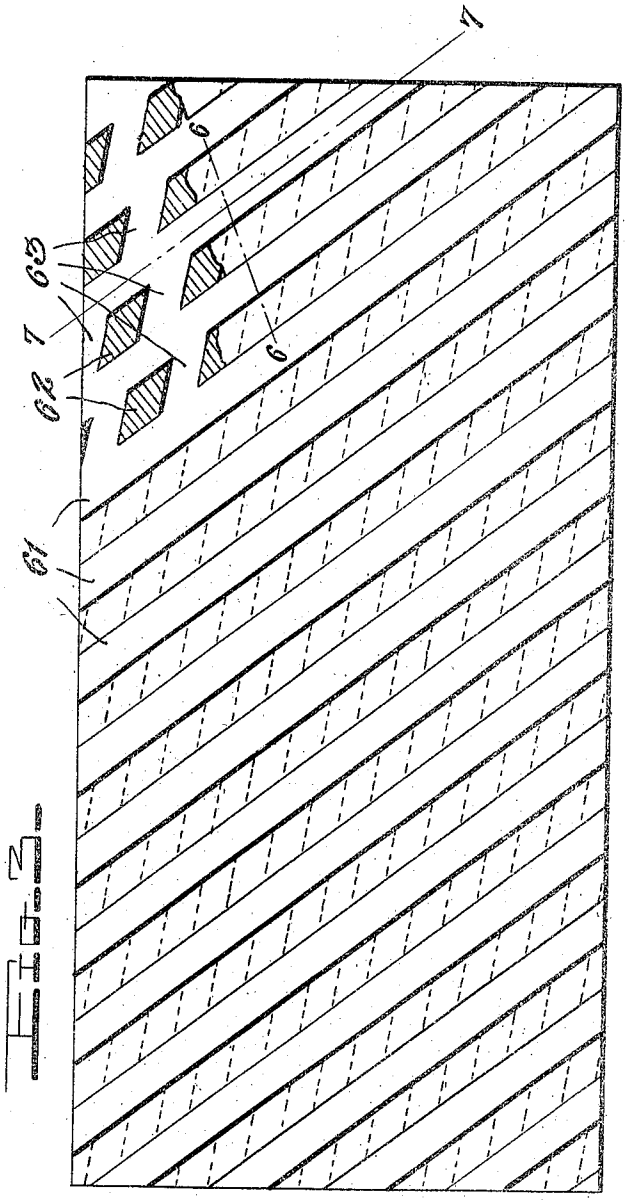

Fig. 2.

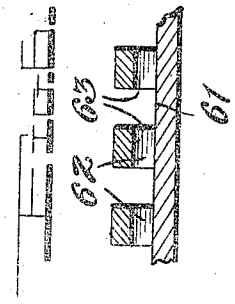

Fig. 3.

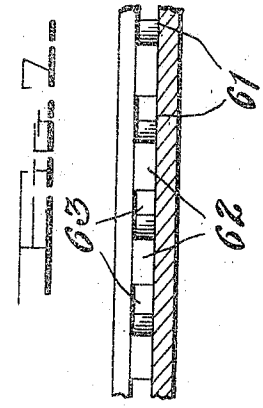

Fig. 4.

Witnesses

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4 SHEETS—SHEET 4.

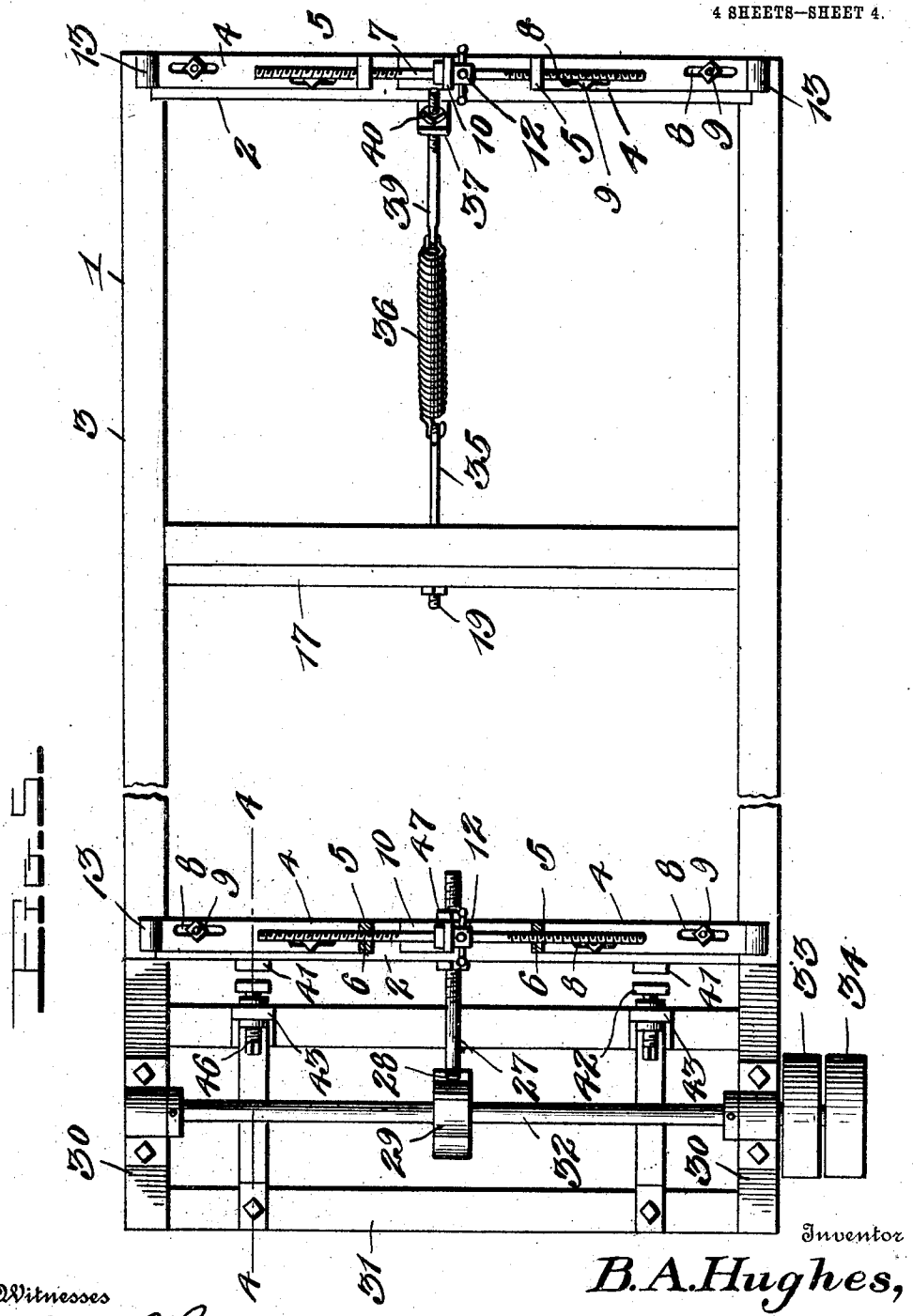

Fig. 5.

Witnesses

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UNITED STATES PATENT OFFICE.

BENJAMIN A. HUGHES, OF COLORADO SPRINGS, COLORADO.

MACHINE FOR SIZING AND SEPARATING GRANULAR MATERIAL.

1,039,132. Specification of Letters Patent. Patented Sept. 24, 1912.

Application filed November 8, 1911. Serial No. 659,158.

To all whom it may concern:

Be it known that I, BENJAMIN A. HUGHES, a citizen of the United States, residing at Colorado Springs, in the county of El Paso and State of Colorado, have invented certain new and useful Improvements in Machines for Sizing and Separating Granular Material, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to machines for sizing and separating granular material and has for its object to produce a machine of this character which is simple in construction, durable and efficient in operation and one which may be manufactured cheaply.

A further object of the invention is to produce a machine of this character provided with a pair of hingedly connected and adjustable riffle decks, said decks being adapted to be adjusted at different inclinations.

A still further object of the invention is to construct a machine of this character with a new and novel arrangement of toggle connection between the reciprocating upper frame and stationary lower frame.

With the above and other objects in view, this invention resides in the novel features of construction, combination and arrangement of parts as will be hereinafter more fully described, claimed, and illustrated in the accompanying drawings, in which,

Figure 1 is a side elevation of a machine embodying this invention, with parts removed in order to show the end and interior parts of the machine. Fig. 2 is an end elevation of the machine proper. Fig. 3 is a top plan view of one of the riffle decks, lines being indicated thereon in order to show the direction of the material across the same when the machine is operated. Fig. 4 is a sectional view along the line 4—4 of Fig. 5 and in addition showing the connecting parts of the riffle deck of the framework of the machine. Fig. 5 is a plan view with the riffle decks removed. Fig. 6 is a section along the line 6—6 of Fig. 3. Fig. 7 is a section along the line 7—7 of Fig. 3.

Similar reference characters refer to similar parts throughout the drawings.

Referring to the drawings, the numeral 1 designates, in general, the deck supporting frame, the same consisting of end sills 2 and side sills 3. Mounted for sliding movement upon each end sill 2 are a pair of oppositely disposed plates 4, each of which is provided at its inner end with an upwardly extending flange 5, said flanges being formed with alined threaded openings 6, and in which are threaded the opposite ends of screw bolts 7. The threaded ends of said bolts are oppositely threaded, as clearly shown in Fig. 5 of the drawings.

The plates 4 are each provided with a pair of off-set slots 8 and through which pass bolts 9, said bolts being also passed through suitable openings formed in the end sills 2, whereby the plates 4 may be adjusted toward or away from each other. It will be noted that the intermediate portion of the screw bolts 7 are not threaded and are supported at this point by a right angle bracket 10, said bracket being provided with an aperture 11 and in which the bolt 7 is rotatably mounted.

Rigidly secured to the unthreaded portion of the bolt 7 and adjacent the right angle bracket 10 is a hand wheel 12, which, when operated, will rotate the threaded bolt 7 to adjust the plates 4, as desired. The outer ends of the plates 4 are so bent as to form eyes 13, the purpose of which will be hereinafter described.

The bottom or supporting frame 14 is formed in a manner similar to the frame 1 and is of substantially the same width and consists of end sills 15 and side sills 16. Intermediate the end sills 15 is a transversely arranged brace 17, the same having its opposite ends suitably connected to the side sills 16. The brace 17 is provided at its center with a horizontally arranged opening 18 and in which is clamped the eye bolt 19. The frame 1 is flexibly supported above the frame 14 by toggle joints 20, said joints being arranged between the end sills 2 of the upper frame and end sills 15 of the lower frame, said joints being connected at their upper and lower ends to the sills 2 and 15, respectively.

Secured to the under sides of the sills 2 is an angle strip 21, said strip being of the same width as the end sills 2. Similar strips 22 are mounted and secured upon the upper faces of the end sills 15 of the lower frame 14. Bolted to the inner faces of the strips 21 and 22 are vertical clamping plates 23. Strips 24, preferably formed from rubber belting, are provided and have their upper edges clamped between the angle plates 21 and the vertical plates 23 and their lower

edges clamped between the angle plates 22 and vertical plates 23. The strips of belting 24 are substantially the same length as the upper and lower sills 2 and 15, respectively. To prevent buckling and at the same time to allow a free hinge action between the upper and lower frames are a pair of metallic plates 25, said plates being bolted to that portion of the strip 24 between the angle plates 21 and 22. It will, of course, be understood that both strips 24 are provided with the plates 25.

Passing through an opening 26 formed in one of the end sills 2 of the upper frame is a cam rod 27, the inner end of which is threaded for engagement with the threads formed in the opening 26 and by which the cam rod 27 may be adjusted to regulate the longitudinal movement of the frame 1. The outer end of the cam bolt 27 is beveled as at 28 and is adapted to be reciprocated by a cam wheel 29, said came wheel being supported adjacent the frame 1 by a supporting frame 30. The base 31 of the frame 30 is bolted or otherwise suitably secured to the frame 14 by which the same is anchored in its relative operative position to the upper frame 1.

The cam wheel 29 is rigidly secured to a transversely arranged shaft 32 and to one end of which is connected a fixed belt pulley 33 and a loose pulley 34, both of which being of the usual construction and operating in a manner to drive the cam wheel 29 by the belt which passes around the pulley 33 or idler 34, as desired.

Pivotally connected to the eye bolt 19 is the lower end of a link 35, the upper end of which is attached to the lower terminal of a coil spring 36. Secured to the inner face of one of the sills 2 of the upper frame and intermediate its ends is an angle plate 37, the same being provided with a screw threaded opening 38 and through which is threaded the threaded upper end of a bolt 39, the lower or inner end of which is attached to the upper terminal of the coil spring 36. A nut 40 is mounted upon the outer threaded end of the bolt 39, which when operated regulates the tension of the spring 36.

Mounted upon the sill 2 of the upper frame and upon the upper face thereof are a pair of buffers 41, said buffers acting in conjunction with a pair of bumpers 42, said bumpers being adjustably mounted near the upper ends of bumping posts 43. Each bumping post 43 is formed near its upper end with openings 44 and in which are inserted internally screw threaded bushings 45. The bumpers 42 have projecting from their outer faces screw threaded shanks 46, the extreme outer ends of which are square whereby the same may be operated upon by a wrench or suitable tool to obtain the proper adjustment of same.

The cam bolt 27 is adjustable in the manner as hereinbefore described and is held in its adjusted position by clamping nuts 47 arranged upon the inner and outer faces of the sill 2. This arrangement of the cam bolt 27 permits the adjustment of the same to take up the wear due to constant use and caused by the contact of the cam wheel 29 with the beveled edge 28 thereof. A like object is gained by the arrangement and adjustment of the bumpers 42.

Supported above the frame 1 are a pair of inclined riffle decks 48, the upper edges of which are connected by strap hinges 49, said hinges being secured to the under surface of each deck. The riffle decks 48 are pivotally connected to the frame 1 by plates 50, said plates corresponding in number to the plates 4, mounted upon the end sills 2 of the frame 1. The plates 50 are each provided at their lower ends with oppositely disposed ears 51, said ears being provided with perforations 52 through which pivot bolts 53 are passed when said perforations register with the eyes 13 formed upon the outer ends of the plates 4. The riffle decks 48 are each provided upon their under surface with a plurality of longitudinally arranged truss bars 54. The deck riffles 48 are each of a sufficient width to have their lower edges projected slightly beyond the side sills of the upper and lower frames so that the material passing thereover will clear the same.

An upright 55 is mounted adjacent the ends of the frames and said upright is provided at its upper end with a supporting frame 56, one end of said frame being arranged directly over and near one end of the meeting upper edges of the riffle decks 48. Mounted in the frame 56 is a hopper 57, said hopper being provided with a neck 58, said neck leading to a spout 59. Mounted in the neck is a regulating valve 60, whereby the flow of material from the hopper 57 to the baffle decks may be regulated or flow cut off entirely.

The riffle decks, in this instance, differ from the usual separators and sizers inasmuch as the same comprise solid backs in lieu of the usual screen mesh separators. The deck backs 61 are formed preferably from wood and have arranged on their inner or deck faces a plurality of diagonally arranged and alined diamond-shaped teeth 62, each tooth being spaced a sufficient distance apart to provide a space between each tooth to permit the material to be sized or separated to travel in a direction across the decks diagonally opposite to the line of arrangement of the teeth. Arranged between each line of teeth are a series of channels 63. It will be noted by arranging the teeth in this manner that the upper apex of each tooth 62 is positioned so that the material falling therefrom will be projected upon the succeeding tooth at a point between its up-

per and lower apexes, so that the fine and coarse material will be graded or separated and the finer material which is naturally light will be directed toward the upper apex of each tooth and the coarser material being heavier will drop toward the lower apex of each tooth, and from thence into the channels 63 as the material travels in a substantially diagonal direction across each riffle deck. The coarse material will pass from one tooth to the other in a diagonal direction toward the lower edge of the riffle deck and from the channels to a suitable receptacle arranged for their reception. The finer material also travels in a diagonal direction across the decks and is acted upon by the teeth in such a manner as to be projected on the end of the riffle deck at the end opposite from its point of flow. This action and travel of the material is caused by the continued reciprocation of the frame 1 which consequently causes the longitudinal reciprocation of said decks, the end thrust caused by the reciprocation of these parts causing the material to flow or be projected in a rearward direction upon the forward and quick movement of the frame and decks, during which movement the finer material will in effect "jump" from the upper inclined plane of each tooth to the other and the coarser material to have the same action to a certain extent from the upper inclined plane of one tooth to the side inclined plane of the succeeding tooth, thus sizing the fine and coarse material, it being, of course, understood that certain of the fine material will pass with the coarse material to a certain distance in a downward and diagonal direction until somewhat below the longitudinal center of the deck riffles.

The general construction of the decks is as follows:—The decks are first finished smooth with a plane surface, and can be of metal, or tongued and grooved boards closely fitted together. This surface is then covered with linoleum or some other suitable material. After the cover is secured to the decks, lines are drawn across the same and preferably in a transverse direction of about 55° with the longitudinal direction of the decks. These lines should preferably be about one inch apart to form a means for alining the diamond shaped blocks or riffle teeth on the decks, and on top of these blocks is placed and fastened a thin strip of wood, which forms a solid back for the same. As only two faces of these diamond blocks are used in the operation of the machine, they can readily be made from sheet metal, and if desired integrally with the strip placed thereon to strengthen them.

The size and number of the teeth may be varied to suit different classes of work.

Upon rotary movement being imparted to the shaft 32, the cam wheel 29 is caused to rotate which, in turn, operates the cam bolt 27 to vibrate or reciprocate the upper frame 1, the end thrust of said frame being regulated by the adjustment of the cam bolt 27, said frame being returned with a jerk by the coil spring 37 for further action by the cam wheel, the toggle joints to a certain extent imparting in addition to the longitudinal movement a slight upward movement to the frame 1 and riffle decks 48, which action dislodges the material and at the same time projects the same in a rearward direction or in a direction opposite to the end thrust.

By providing the plates 25 upon the belting 24, the same is braced or reinforced at its entire width and length between the upper and lower brackets 21 and 22, respectively, which will not only prevent buckling of the belting 24 but will prevent any lateral movement of the upper frame and deck riffle and at the same time provide a durable and sensitive toggle arrangement between the upper and lower frames.

The inclination of the riffle decks may be adjusted upon operation of the handle wheel 12 to suit different classes of work as in the process of sizing or separating cereals or grains the travel would necessarily have to be retarded to some extent to allow perfect separation, and in this instance the inclination of the decks will necessarily be greater than in cases where crushed ore is being separated or sized, the process being naturally quicker.

It is a well known fact that finer graded material will adhere or will be frictionally held upon the surface where the coarser material will immediately pass thereover and the dislodging of the fine material is greatly enhanced upon the buffers 41 coming in contact with the bumpers 42.

The machine is particularly adapted for sizing and classifying crushed ore, grain, sand, and, in fact, any granular material in its dried condition, the different uses being governed by the size and spacing of the teeth 62 and channels 63.

Having thus described my invention, what I claim as new and desire to secure by Letters-Patent is:—

1. In a device of the class described, the combination of a reciprocating frame, a supporting frame, flexible connections between said frames, a pair of inclined riffle decks mounted upon the reciprocating frame, said decks being hingedly connected at their upper edges, plates slidably mounted on the reciprocating frame, said decks being pivotally connected near their lower edges to said plates, means for adjusting said plates to change the inclination of the decks, and means for reciprocating the first mentioned frame.

2. In a device of the class described, the

combination with upper and lower frames, of toggle joints connecting said frames at each of their ends, said toggle joints consisting of flexible belting, the upper edge of said belting being connected to the upper frame and the lower edge of the same being connected to the lower frame, and plates clamped to said belting whereby buckling of the same is prevented.

3. A device of the class described comprising a reciprocating frame, a pair of inclined riffle decks mounted upon said frame and adapted to reciprocate therewith, said riffle decks having solid backs, a plurality of diagonally alined teeth arranged in spaced relation formed upon said backs, a hopper supported above the upper edges of said riffle decks, and means for reciprocating said decks and imparting a slight upward movement thereto whereby material fed from the hopper is caused to travel in a direction diagonal to the line of teeth to separate or classify the fine and coarse material.

4. A device of the class described comprising a reciprocating frame, a supporting frame, a flexible connection arranged between said frames, a pair of inclined riffle decks mounted upon the reciprocating frame and being hingedly connected at their upper edges and pivotally connected near their lower edges to the reciprocating frame, means for changing the angles of said riffle decks, each riffle deck being provided with a plurality of diagonally arranged and spaced teeth, channels arranged between each line of teeth whereby when material is passed over said decks certain of the material will pass from tooth to tooth and certain other of the material will pass into the channel, and means for reciprocating said decks.

5. A device of the class described comprising in combination, a supporting frame, another frame flexibly connected to the first mentioned frame, a plurality of decks hingedly connected and angularly disposed over the last mentioned frame, adjusting devices for tipping said decks to various angular positions, buffers on said last mentioned frame, holders disposed on the first mentioned frame, adjustable buffers disposed in said holders, said last mentioned buffers being alined with the buffers on said second mentioned frame, and means for reciprocating said second mentioned frame.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

BENJAMIN A. HUGHES.

Witnesses:
GERTRUDE HERREN,
HARRY A. SCURR.