Sept. 4, 1951 O. Z. WISEMAN 2,566,756

SORTING MACHINE

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Fig. 2.

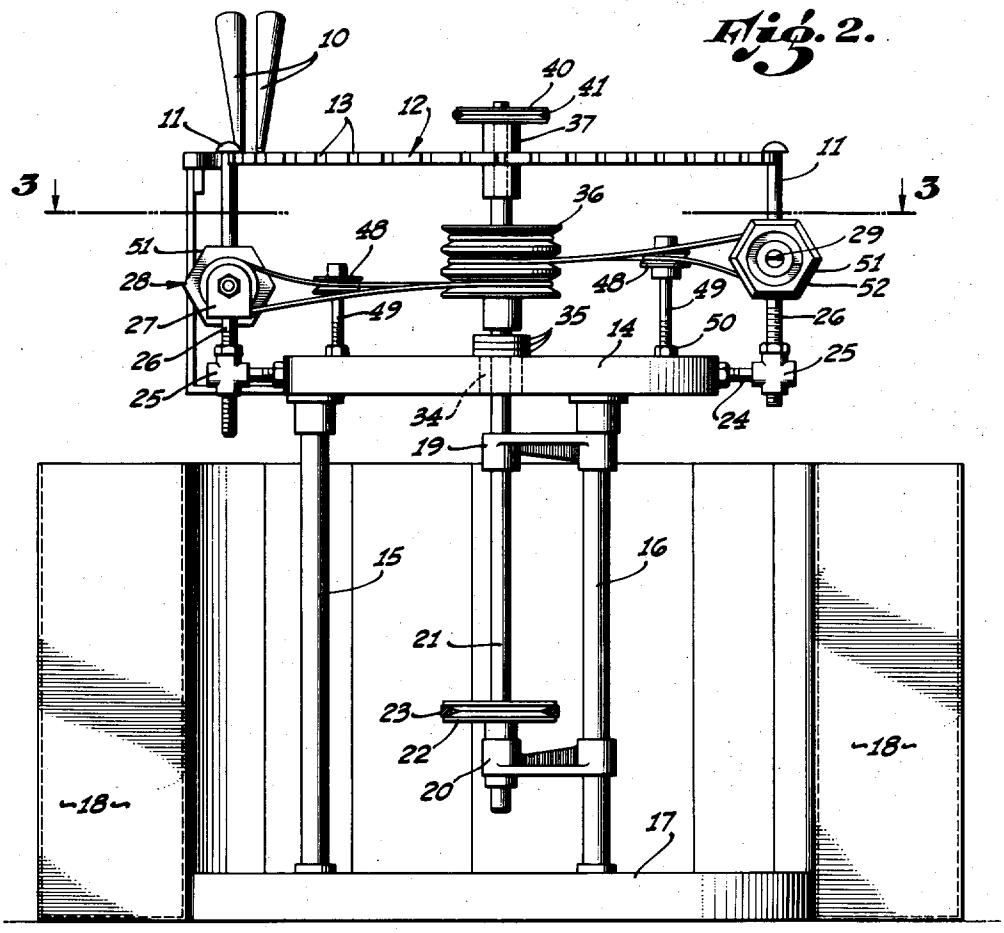
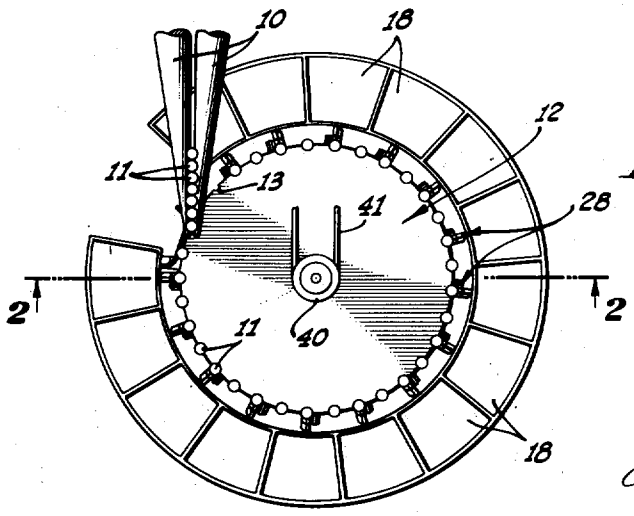


Fig. 1.



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Fig. 3.

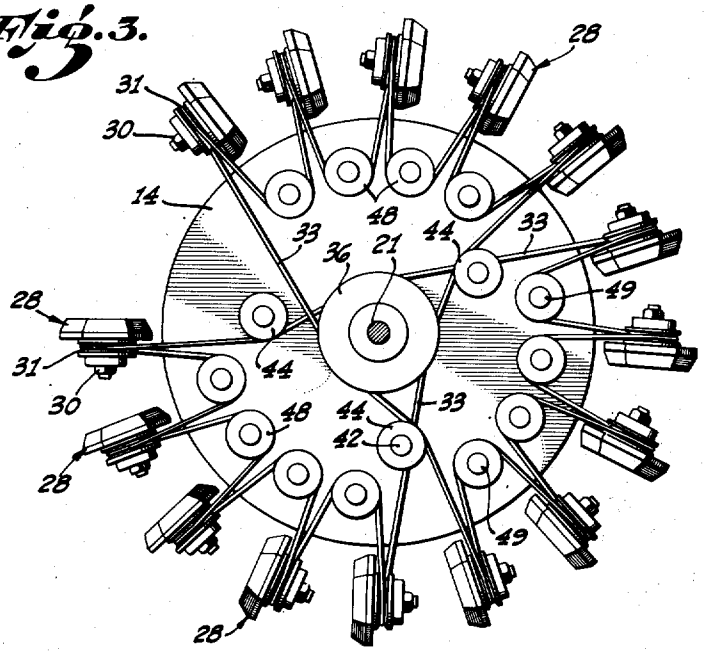
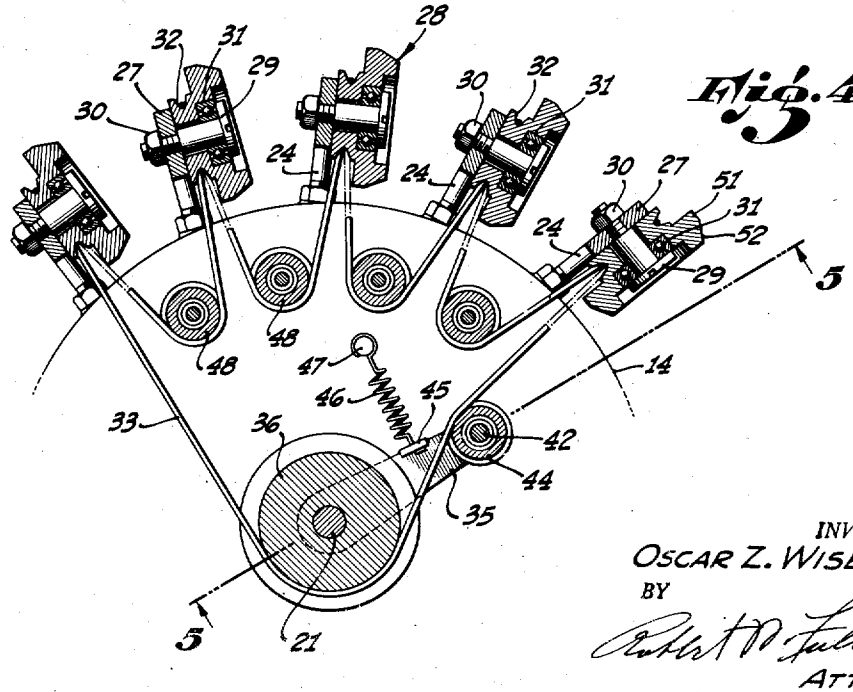


Fig. 4.



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SORTING MACHINE

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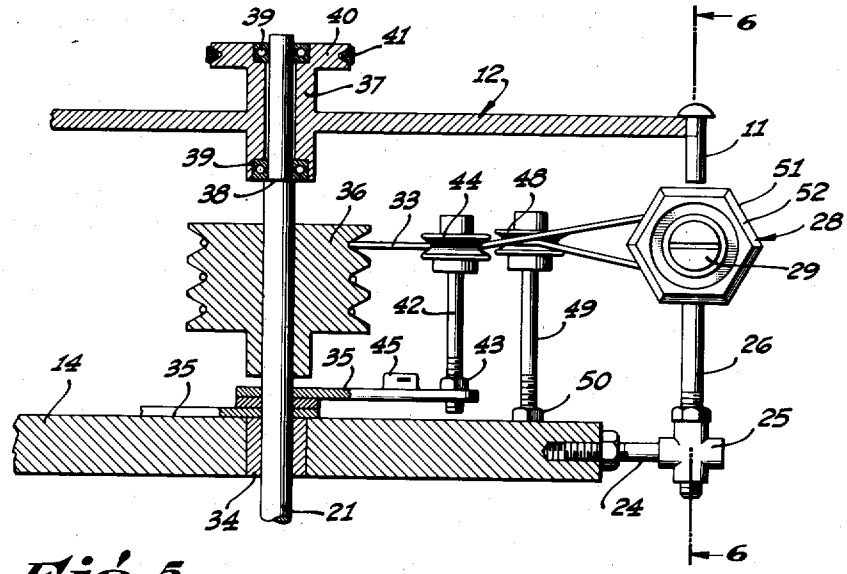


Fig. 5.

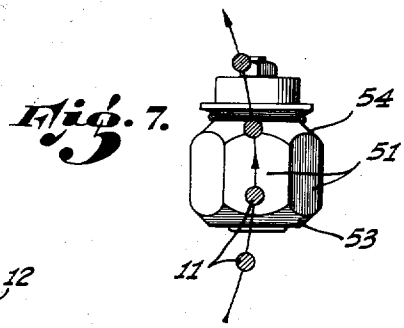


Fig. 7.

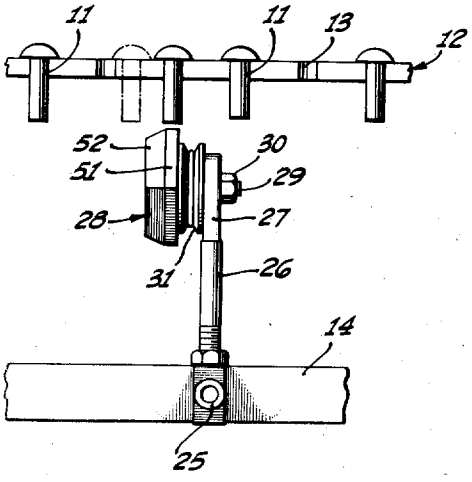


Fig. 6.

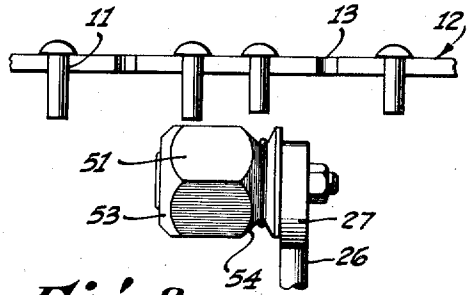


Fig. 8.

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UNITED STATES PATENT OFFICE

2,566,756

SORTING MACHINE

Oscar Z. Wiseman, Altadena, Calif.

Application March 23, 1945, Serial No. 584,399

11 Claims. (Cl. 209—91)

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My invention relates broadly to apparatus for sorting objects such as rivets, bolts, screws, and the like, and more particularly to a device for automatically sorting such objects according to the length of their shanks.

In my co-pending application, Serial No. 513,161, filed December 6, 1943, now abandoned, for a Conveying and Sorting Apparatus, I have disclosed means for sorting rivets and the like according to the thickness of their heads, when presented to the sorting means in uniform position by appropriate conveying machinery. Rivets, bolts, and screws are also classified according to the length of their shanks or stems, and my present invention of means for so sorting them may usefully be incorporated, though not necessarily, with the conveying and positioning means disclosed in my earlier application.

While sundry devices for effecting this type of classification have been known and used in the past, they have been of types so fixed and incorporated in the major framework of the general apparatus as not to be adjustable for fine selectivity, and of inefficient mechanical principle in that their application of force was wholly or largely frictional resulting in force vectors under the influence of which the sorted object might be moved in a direction not desired.

It is therefore a major object of my invention to provide sorting means that are adjustable to give finely determinable selective limits.

It is also an object to provide an adjustability adaptable to sorting various classes of objects that may differ in their standards of classification by length.

Another object of my invention is to provide sorting means having an appreciable degree of adjustability in the horizontal plane, so that the machine as a whole may be readily modified to accommodate articles requiring such modification.

A further object is the provision of sorting means which may selectively be made inoperative, either in individual classifications or in closely related groups of classifications without interfering with the adjustment of other classifications which it may be desired to maintain in operating condition.

It is also an object of my invention to provide sorting means which propel the objects to be sorted by means of a sharp blow rather than by a frictional resistance in their path of travel.

A still further object is to provide that the propelling force be directed in the direction in which it is desired to move the materials to be

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sorted with a minimization of accidental vectors of force that might move the materials in undesired directions.

These and other objects of my invention will become apparent from the following description of preferred and modified forms thereof, and from the accompanying drawings illustrating those forms, in which:

Fig. 1 is a plan view of my improved sorting apparatus showing its relationship to the conveying apparatus described in my co-pending application hereinbefore referred to;

Fig. 2 is a sectional elevation along line 2—2 of Fig. 1, showing the complete apparatus;

Fig. 3 is a horizontal sectional view along line 3—3 of Fig. 2, with the elements therein shown, for convenience, as if mounted in one plane, and showing the general assembly of the driving mechanism;

Fig. 4 is an enlarged horizontal section of one of the unit drive groups showing in detail my preferred construction of the sorting or knock-off cams and the means of driving them;

Fig. 5 is an elevational view partly in cross-section along line 5—5 of Fig. 4, showing the method of mounting the carrier disc and a knock-off cam with its driving mechanism in relation to the fixed parts of the machine;

Fig. 6 is an elevation taken along line 6—6 of Fig. 5;

Fig. 7 is a plan view of an alternative embodiment of my knock-off cam; and

Fig. 8 is an elevation of the same embodiment and part of a carrier disc.

When in the following description I refer to rivets, it will be understood that this term is used for brevity as an example of the type of object that may be sorted and that my invention may also be applied to the sorting of articles of similar shape such as, for example, bolts or screws.

Referring now to the drawings and particularly to Figs. 1 and 2 thereof, the numeral 10 designates a set of tapered conveyor rollers positioned to deliver a plurality of rivets 11 to carrier means, such as a disc 12, which may have on its periphery a plurality of notches 13, each adapted to receive and carry a rivet, as described in my co-pending application, Serial No. 513,161. These rivets are suspended in the notches 13 by their heads, with their shanks projecting below the disc to levels varying with their length, and it is the function of the hereinafter described mechanism to sort them according to their length of shank and to move them into receptacles

specific to their sorted classification. For this purpose I prefer to provide, as the general framing and support member of my mechanism, a round plate 14 which may be mounted in fixed position upon support posts 15 and 16 on a base 17. Around the base 17 are positioned a plurality of receiving bins 18, not necessarily integral with the base or with each other, as it may be desirable to use them as individual transportable containers. One of the support posts 16 serves also to support journal boxes 19 and 20, which by means of appropriate bearings (not shown) rotatably support and guide a vertical shaft 21. A drive pulley 22 is keyed to the lower portion of shaft 21 and is connected by a belt 23 to driving means (not shown) which may for convenience be the drive of the adjacent conveying apparatus.

Around the periphery of plate 14 and threadedly mounted thereon as shown in general in Fig. 2 and in greater detail in Figs. 4 and 5, I provide a plurality of stud bolts 24, one for each of the receiving bins 18, and each positioned substantially centrally above the opening of its respective bin. Each stud bolt 4 supports, by means of a threaded T fitting 25, a vertical post 26, the upper end of which is broadened to form a flat-bearing plate 27, as best shown in Fig. 2. Each bearing plate 27 supports a knock-off edge cam 28, rotatably mounted thereon by means of a slotted and threaded axle pin 29, nut 30 and roller bearings 31, as shown in detail in Fig. 4. To provide driving means for the cams 28, each cam is extended and grooved on the side adjacent the bearing plate 27 to form a grooved pulley 32 adapted to be engaged by a round belt 33.

Stud bolts 24 may or may not be mounted radially in plate 14, but each is preferably mounted so that the working face of the cam 28 carried thereby lies in a vertical plane radial to plate 14. The advantage of this construction will be appreciated when the operation of the cams is considered. As illustrated in the plan view of Fig. 1, and in Figs. 6 and 8, in which the views are radial to the carrier disc 12, the cams are mounted in a circle directly below the notches 13 on disc 12. As it is the function of the cams to knock the rivets out of their lodgment in the notches 13 and into bins 18, it is highly desirable to have the cams apply their force radially so that the rivets will be accurately aimed toward the bins in which they are intended to fall.

It will also be seen, particularly by reference to Fig. 2, that the threaded and locked construction of stud bolts 24 and vertical posts 26 provides for the adjustment of these elements so as to permit the accurate positioning of the cams 28 within a horizontal and vertical range of considerable extent. The horizontal adjustment, effected by stud bolts 24, allows the use of discs of varying diameters or of deeper or shallower notches 13, as may be found desirable in sorting objects of varying shapes and sizes, and the vertical adjustment, effected by vertical posts 26 is of primary importance in setting the mechanism for the sorting of objects according to their length.

In order to drive the series of cams 28 adjusted to different heights, I have provided driving means which also have vertical adjustability. Referring now to Figs. 2 and 5, it will be seen that shaft 21 extends upwardly through a bearing 34 in plate 14 and carries in upward succession above plate 14 a plurality of free arms 35, which may be supported by plate 14 and by each other, a pulley 36 keyed to shaft 21 and having a plurality of grooves in its driving surface, and disc 12 hereinbefore mentioned. Disc 12 carries centrally a journal box 37 which is supported on shaft 21 by a shoulder 38 in the upper portion of said shaft, and is freely rotatable on said shaft by means of bearings 39. The upper portion of journal box 37 carries in fixed relative position a grooved pulley 40 adapted to receive and be driven by a V-belt 41 which may receive its power from the driving means of the adjacent conveying apparatus.

It will be seen that shaft 21 driven by belt 23, and disc 12 driven by belt 41, although both driven by means connected with the adjacent conveying apparatus, are rotatable independently of each other and at independent speeds controlled by the proportionment of their respective pulleys and the driving means to which they are connected. It is desirable to have disc 12 rotate in synchronization with the conveying means in order to receive the rivets as they are delivered to it, while shaft 21, although acting as a support for disc 12, may rotate independently at any speed required by its function as a driving means, which will be presently explained.

Referring now to Fig. 3, it will be seen that the knock-off cams 28 are divided into a plurality of groups, each of which is driven as an entirety by a belt 33 engaged in one of the grooves of pulley 36. Fig. 4 shows the driving means connecting pulley 36 to one of these groups, and Fig. 5 shows the same means in its relation to a single one of the cams. The purpose of this grouping with each group driven by its individual belt 33 is to to enable the cams to be set individually at desired heights, as shown in Fig. 2, without the necessity of driving each cam individually from shaft 21.

Free arms 35 are equal in number to the groups into which cams 28 are divided, and each arm supports a vertical shaft 42, threadedly engaged therein and adjustably fastened thereto by a lock nut 43, as shown in Fig. 5. Mounted by suitable bearing means on each shaft 42 is an idler pulley 44. Each arm 35 also carries a lug 45 engaging one end of a spring 46, the other end of which is fastened to a post 47 set in plate 14, as shown in Figs. 4 and 5. Belt 33 is engaged by idler pulley 44 and spring 46 serves to maintain tension thereon.

A further series of idler pulleys 48 is mounted on shafts 49 adjustably threaded into plate 14 and locked thereto by nuts 50. As shown in Figs. 3 and 4, pulleys 48 are divided in groups corresponding to the groupings of cams 28, each group of pulleys containing one less pulley than the number of cams in the corresponding group. Belt 33 for each group of cams and idler pulley engages a groove on pulley 36 at substantially a mean height for the group of cams and derives its driving force therefrom, thence engaging its respective idler pulley 44 and being maintained in tension thereby, thence engaging pulley 32 on the first of the cams 28 of its group, then back to the first of idler pulleys 48 of its group, thence outwardly again to the next cam 28 and inwardly to the next idler pulley 48, and so on until it has traversed the circuit of all the cams in the group and returns to pulley 36. It will be seen that the adjustability in height of idler pulleys 44 and 48 to correspond approximately with the height of the adjacent cams 28 permits a single belt 33 to take a rising and descending course without undesirable side friction on any one pulley.

My preferred form of knock-off cam 28 is best illustrated in Figs. 4 and 6. The cam may appropriately be hexagonal, as shown, with six flat cam surfaces 51, as the difference in radius between the circumscribed and inscribed circles of a hexagon conveniently permits the shank of a rivet to move into the zone between the circles so as to be above a flat surface and then to make contact with the following extruding angle of the cam. However, it will readily be seen that the cam, depending upon its size, might have fewer than six sides, or more, and still permit the above-described movement and contact.

Furthermore, to facilitate the free movement of a rivet into the zone between the circumscribed and inscribed circles of the cam, I prefer to place a chamfer 52 on the edge of the cam face opposed to the direction of movement of the approaching rivet. By means of this chamfer a substantial number of rivets will enter the inter-circle zone before making contact with the cam and will receive a push directed upwardly and outwardly. I have found it desirable to extend the chamfer somewhat beyond the inscribed circle of the cam, thus assuring that the longest rivets that are likely to be presented to it will strike upon it rather than upon the side-face of the cam and that the push given to the rivets will thereby be upward and substantially in the direction in which it is desired to move the rivets. I have found that many of the rivets striking the chamfer at one of the angles of the cam will ride momentarily upon its face and travel across it to become opposed to the working face of the cam at the next succeeding flat surface and to be engaged by the next succeeding ridge of the cam, by which they are propelled in the desired direction.

As an alternative to the chamfered construction of the cam shown in Figs. 4 and 6, I may use the form of cam shown in Figs. 7 and 8, in which a cam substantially of the shape of a convex-faced nut has a plurality of flat surfaces 51 on its working face and conical ends 53 and 54, conical end 53 taking the place of chamfer 52 and receiving and guiding the ends of the rivets that strike it, and conical end 54 acting as one side of grooved pulley 32.

In order to allow the rivets to ride upon the chamfer or cone of my cams and to enter the inter-circle zone and to receive a strong propulsion from the angular ridges of the cams, I have found it desirable to drive the cams at a peripheral speed greatly in excess of the peripheral speed of the disc 12. In practice, I have found that with a 14½ inch disc rotating at 15 R. P. M., a 2" cam rotating at 350 R. P. M. gave good results, but it will be understood that this speed ratio is only an example, and that greater or lesser ratios may be found desirable according to the weight and type of the objects to be sorted.

In operation, the first cam in the circle, counting from the point at which the rivets are received by disc 12, is so adjusted in height that the shanks of the longest rivets which it is desired to permit to pass this cam will just clear the angular ridges of the cam, and is laterally adjusted so that the center of the cam is positioned approximately vertically under the path of travel of the rivet shanks. This lateral adjustment is maintained throughout the sequence of cams. It will be clear that all rivets of more than a certain length will contact either the side face or the working face of the cam and

be dislodged from the disc 12 and knocked in to the first bin. Those rivets which clear the first cam proceed to the second cam which is adjusted to a slightly higher level and which knocks into the adjacent bin all rivets that it contacts. The remaining rivets proceed to the next cam which again is set a little higher, and so on around the circle of cams. The final cam may be set so high as to catch even broken stemmed rivets that extend below the disc.

As the difference in radius of the inscribed and circumscribed circles of a 2" hexagon is 0.134 inch or a little more than ⅛ inch, it will be clear that if the cams are of 2" diameter and if fifteen such cams as shown in Fig. 3 are successively set at ⅛" increasing elevation, they will short all rivets, for example, from 2 inches in shank length to ½ inch, with the first cam knocking off all rivets longer than 2 inches and the last cam set to knock off all rivets shorter than ½ inch, and furthermore after the first cam is passed no rivet will strike the side face of any cam, but all will either strike upon the chamfer or cone of the cams and be given opportunity to ride upon such chamfer or cone into the succeeding flat portion of the cam, or they will enter directly onto the flat portion, in either event receiving from the next succeeding angular ridge an upward and radially outward thrust directly towards the appropriate bin.

As previously stated herein, the cams may be of shapes other than hexagonal, and by the use of shapes of greater or lesser ratio of the radii of their inscribed and circumscribed circles, and of greater or lesser size, and at appropriate speeds and vertical and horizontal adjustment, my invention makes possible the sorting of a wide variety of objects with an accuracy not hitherto possible.

Having now described and shown preferred and modified forms of my invention, I wish it to be understood that I do not wish to be limited to the particular forms or arrangement of parts herein described, which are merely illustrative of the broad principles of my invention as defined in the appended claims. It is to be further understood that whenever in the appended claims I refer to rivets, I mean to embrace by that term all articles of the type having a head or thickened portion by which they may be suspended and a shank or lengthened portion by the length of which they may be classified.

I claim:

1. In a sortting machine of the class described, the combination of: a shaft; a disc supported by said shaft and rotatable thereon, said disc being adapted to receive rivets and the like and to carry them around to knock-off points; notches on the perimeter of said disc adapted to suspend said rivets by the heads thereof; drive means for rotating said disc independently of said shaft; knock-off means below said disc comprising a plurality of supporting members adjustably stationed in vertical and horizontal relationship to the perimeter of said disc and an edge cam carried rotatably by each of said supporting members and positioned thereby to rotate in a plane radial to said disc, said cams having a working edge of regular polygonic form and being spaced at successively decreasing vertical intervals below said disc so as to be adapted to knock off rivets of successively decreasing lengths and being further adapted to being divided into groups having successively higher means group levels; means connecting each of said groups of

cams to said shafts in driven relationship thereto for rotating the cams; and tension means on each of said connecting means, said tension means being releasable whereby any of said connecting means and the groups of cams driven thereby may selectively be made inoperative.

2. In a sorting machine of the class described, the combination of: carrier means adapted to receive rivets and the like and to carry them to knock-off points; a shaft; driven means for rotating said shaft; additional drive means for driving said carrier means independently of said shaft; knock-off means below said carrier means comprising a plurality of supporting members adjustably stationed in vertical and horizontal relationship to the carrier means and an edge cam carried rotatably by each of said supporting members and positioned thereby to rotate in a plane at right angles to the path of travel of said carrier means, said edge cams having a working edge of regular polygonic form and being spaced at successively decreasing vertical intervals below said carrier means so as to be adapted to knock off rivets of successively decreasing lengths, and being further adapted to being divided into groups having successively higher means group levels; means connecting each of said groups of cams to said shaft in driven relationship thereto for rotating the cams; and tension means on each of said connecting means, said tension means being releasable whereby any of said connecting means and the groups of cams driven thereby may selectively be made inoperative.

3. In a sorting machine of the class described having carrier means for carrying rivets and the like to knock-off points: an edge cam positioned below said carrier means for knocking off rivets from the carrier, characterized by having a working edge of regular polygonic form and having a difference in radius of the inscribed and circumscribed circles of the polygon greater than the differential in length between the classifications of the rivets to be sorted thereby, and having one side of said working edge cut away to form a face at an intermediate angle between said working edge and the adjacent side-face, said intermediately angled face extending to a point on the adjacent side-face within the inscribed circle of the polygon, said cam being positioned to rotate in a plane at a right angle to the direction of travel of the rivets and to receive and strike the shanks of rivets longer than a desired classification within the circumscribed circle of the polygon at a point substantially vertically above the center of rotation.

4. In a sorting machine of the class described having carrier means for carrying rivets and the like to knock-off points: an edge cam positioned below said carrier means for knocking off rivets from the carrier, characterized by having a working edge of regular polygonic form, and having a difference in radius of the inscribed and circumscribed circles of the polygon greater than the differential in length between the classifications of the rivets to be sorted thereby, said cam being positioned to rotate in a plane at a right angle to the direction of travel of the rivets, and to receive and strike the shanks of rivets longer than a desired classification within the circumscribed circle of the polygon at a point substantially vertically above the center of rotation.

5. In a sorting machine of the class described having carrier means for carrying rivets and the like to knock-off points: an edge cam positioned

below said carrier means for knocking off rivets from the carrier, characterized by having a working edge of regular polygonic form, and having one side of said working edge cut away to form a face at an intermediate angle between said working edge and the adjacent side-face, said intermediately angled face extending to a point on the adjacent side-face within the inscribed circle of the polygon, said cam being positioned by its supporting member to rotate in a plane at a right angle to the direction of travel of the rivets and to receive and strike the shanks of rivets longer than a desired classification within the circumscribed circle of the polygon at a point substantially vertically above the center of rotation.

6. In a machine for sorting rivets and the like, the combination of: carrier means for carrying rivets and the like to knock-off points; a plurality of rotatable knock-off means positioned at successively decreasing vertical intervals below said carrier means and adapted to being divided into groups having successively higher mean group levels; a drive shaft; a plurality of belts each connecting said drive shaft to one of said groups of knock-off means, whereby each group is driven individually by means appropriate to its group level; and means individual to each group of cams for releasing the tension on the belt of that group whereby that group may selectively be made inoperative.

7. In a machine for sorting rivets and the like, the combination of: a circular carrier plate with means on its peripheral edge for carrying rivets and the like to knock-off points; drive means for rotating said plate; a plurality of rotatable knock-off means positioned around said carrier plate at successively decreasing vertical intervals below said plate and adapted to being divided into groups having successively higher mean group levels; a drive shaft; a plurality of belts each connecting said drive shaft to one of said groups of knock-off means, whereby each group is driven individually by means appropriate to its group level; and individual tension means for each group of knock-off means for tensioning the belt for said group, each said tension means being separately releasable to release the tension on said belt whereby said groups may be selectively made inoperative.

8. In a sorting machine of the class described having carrier means for carrying rivets and the like to knock-off points: an edge cam positioned below said carrier means for knocking off rivets from the carrier, characterized by having a working edge of polygonic form, and having a difference in radius of the inscribed and circumscribed circles of the polygon greater than the differential in length between the classifications of the rivets to be sorted thereby, said cam being positioned to receive and strike the shanks of rivets longer than a desired classification within the circumscribed circle of the polygon at a point substantially vertically above the center of rotation.

9. In a sorting machine of the class described, the combination of: carrier means adapted to receive rivets and the like and to carry them to knock-off points; a shaft; means for rotating said shaft; means for driving said carrier means independently of said shaft; knock-off means below said carrier means comprising a plurality of supporting members adjustably stationed in vertical and horizontal relationship to the carrier means and an edge cam carried rotatably by each of said supporting members and positioned there-

by to rotate adjacent the path of travel of said carrier means, said edge cams having a working edge of polygonic form and being spaced at successively decreasing vertical intervals below said carrier means so as to knock off rivets of successively decreasing lengths, and being adapted to being divided into groups having successively higher mean group levels; means connecting each of said groups of cams to said shaft in driven relationship thereto for rotating the cams; and control means operatively associated with each of said connecting means, said control means being releasable whereby any of said connecting means and the groups of cams driven thereby may selectively be made inoperative.

10. In a sorting machine of the class described, the combination of: carrier means adapted to receive rivets and the like and to carry them to knock-off points; a shaft, drive means for rotating said shaft; additional drive means for driving said carrier means independently of said shaft; knock-off means below said carrier means comprising a plurality of supporting members adjustably stationed in vertical and horizontal relationship to the carrier means and an edge cam carried rotatably by each of said supporting members and positioned thereby to rotate in a plane at right angles to the path of travel of said carrier means, said edge cams having a working edge of regular polygonic form and being spaced at successively decreasing vertical intervals below said carrier means so as to be adapted to knock off rivets of successively decreasing lengths; means connecting said cams to said shaft in driven relationship thereto for rotating the cams; and means for selectively rendering said cams inoperative.

11. In a sorting machine of the class described, the combination of: carrier means adapted to receive rivets and the like and to carry them to knock-off points; a shaft; drive means for rotating said shaft; means for driving said carrier means independently of said shaft; knock-off means below said carrier means comprising a plurality of supporting members adjustably stationed in vertical and horizontal relationship to the carrier means and an edge cam carried rotatably by each of said supporting members and positioned thereby to rotate adjacent the path of travel of said carrier means, said edge cams having a working edge of polygonic form and being spaced at successively decreasing vertical intervals below said carrier means so as to be adapted to knock off rivets of successively decreasing lengths; means connecting said cams to said shaft in driven relationship thereto for rotating the cams; and means for selectively rendering said cams inoperative.

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