May 1, 1945. H. O. NIEDERER ET AL 2,374,948

SORTING DEVICE

Filed Sept. 19, 1942

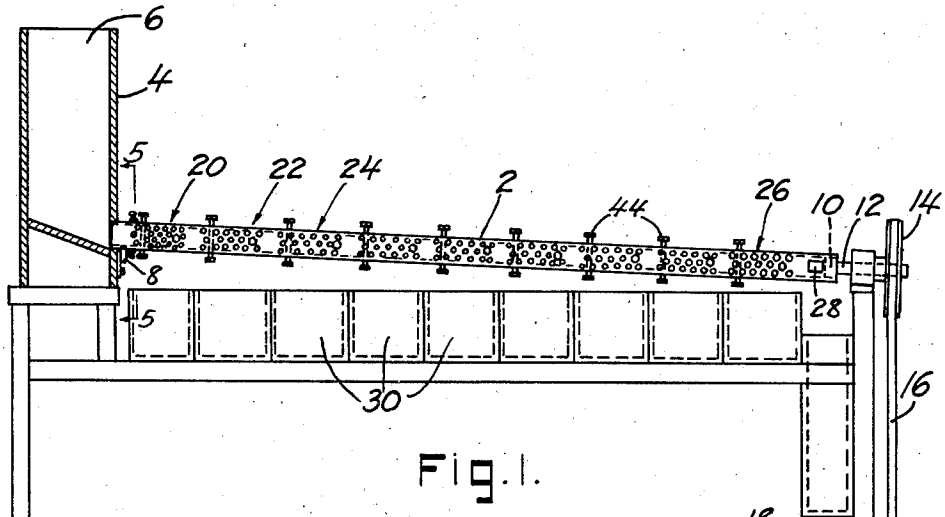


Fig. 1.

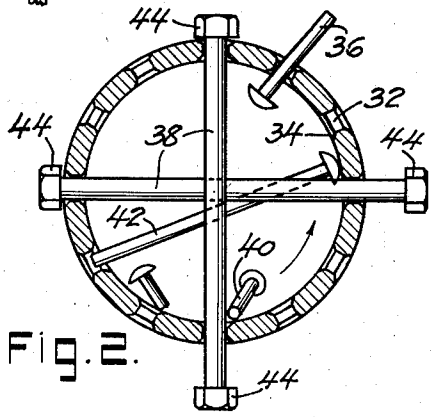


Fig. 2.

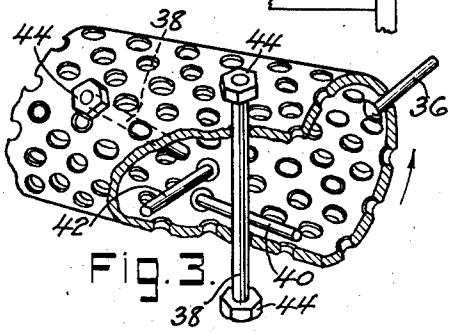


Fig. 3.

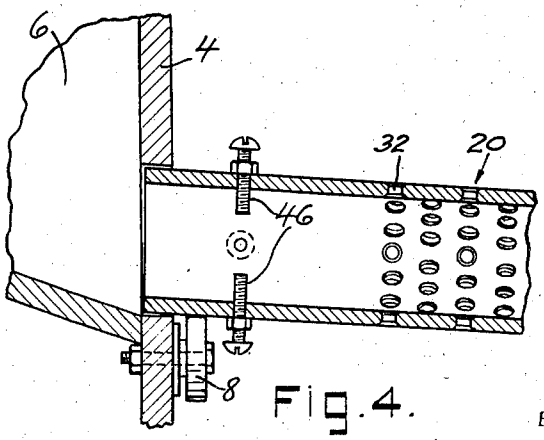


Fig. 4.

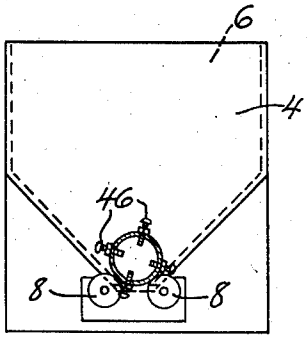


Fig. 5.

INVENTORS
HERBERT O. NIEDERER
OTTO C. NIEDERER
BY Albert Sperry
ATTORNEY

Patented May 1, 1945 2,374,948

UNITED STATES PATENT OFFICE

2,374,948

SORTING DEVICE

Herbert O. Niederer and Otto C. Niederer,
Titusville, N. J.

Application September 19, 1942, Serial No. 459,032

4 Claims. (Cl. 209—86)

Our invention relates to mechanism for use in sorting elongated or headed articles such as rivets, nails, bolts, screws or the like.

In the manufacture of aeroplanes, many thousands of rivets of different sizes, shapes and types are used. These rivets are small and difficult to handle and as a result many are dropped or spilled by the operators and fall upon the floor. They are then swept up and have to be sorted out in order that they may be re-used. The sorting operation is extremely tedious and expensive to perform but is very necessary, particularly at the present time when aluminum rivets for aircraft manufacture are in great demand and difficult to obtain.

In many other instances mixed accumulations of rivets, bolts, nails, screws and the like have to be sorted out for use.

In accordance with our invention simple mechanism is provided which serves to sort such accumulations and to divide them into different sizes or classes. This classification is not always complete although it does separate those rivets having a head diameter of one size from those having a head diameter of another size. Moreover, in most instances rivets having different types of head are found to have different head diameter and therefore in practice the sorting of rivets as to head type is effected with a surprising degree of accuracy.

In any event if further sorting of rivets is required to separate those of different length for example, the pre-sorted rivets obtained from our device may be passed through one or more devices such as that shown and described in the co-pending application of Edward E. Garlits, Jr., Serial No. 450,929, filed July 14, 1942.

Devices embodying our invention may be constructed in various ways but in general they embody an inclined tube having a plurality of circular holes of predetermined diameter therein to permit rivets or other objects of predetermined smaller diameter to pass therethrough while other larger rivets or objects pass on through the tube. The smaller rivets are thus separated from the larger rivets and by forming the tube or tubes with a number of successive sections each having holes of slightly larger diameter than those in the preceding section the rivets may be rapidly classified with a high degree of accuracy.

We have also discovered that the accuracy with which rivets are sorted and the number of rivets which can be sorted in a given time is materially increased if the diameter of the tube through which the rivets are passed is limited and means are provided for turning the rivets so that they extend across rather than lengthwise of the tube.

One of the objects of our invention is to provide a novel device for sorting mixed accumulations of objects such as rivets and embodying an inclined tube having circular holes therein through which objects of predetermined diameter may pass.

A further object of our invention is to provide a rivet sorter or the like which embodies a perforated tube of relatively small diameter as compared with the length of the longest rivets in the accumulation to be sorted.

Another object of our invention is to provide a rivet sorter or the like which embodies a perforated tube and means for turning the rivets within the tube so that they extend across rather than lengthwise of the tube.

Other objects of our invention are to provide novel feeding means for supplying rivets or the like to a tube and to provide a construction which is simple and economical to produce and operate, which requires no skilled labor for the manipulation thereof and which has the ability to sort a large number of rivets or other objects in a given period of time.

These and other objects and features of our invention will appear from the following description thereof in which reference is made to the figures of the accompanying drawing, wherein:

Fig. 1 is a side elevation of a preferred form of rivet sorter embodying our invention,

Fig. 2 is an enlarged vertical sectional view through the sorting tube of the device shown in Fig. 1,

Fig. 3 is a perspective of a portion of the sorting tube shown in Fig. 1 with part broken away,

Fig. 4 is a vertical sectional view through a portion of the hopper and sorting tube of the device shown in Fig. 1, and

Fig. 5 is a vertical sectional view of the device shown in Fig. 1 taken on the line 5—5 thereof.

In that form of our invention chosen for purposes of illustration and shown in the figures of the drawing, the rivet sorter is provided with a tube 2 located in an inclined position with the upper end of the tube extending into an opening in the wall 4 of the hopper 6. The end of the tube 2 is open to receive rivets from the hopper and is substantially flush with the inner surface of the wall 4. This construction is found to overcome the tendency of rivets to jam between the rotating tube and the adjacent surfaces of the hopper so that the tube rotates smoothly and easily without injury to the rivets being sorted.

The upper end of the tube 2 rests upon rollers 8 whereas the lower end of the tube is provided with a plug 10 to which a shaft 12 is secured. A pulley 14 is fixed on the shaft 12 and driven by a belt 16 from a motor 18 provided with a reduction gear so that the tube rotates relatively slowly.

The tube 2 is provided with a number of groups of radially extending holes which are circular in form and of predetermined diameters corresponding to the diameters of the heads of the rivets or other objects in the mixed accumulations to be sorted. The holes of each group are all of the same diameter but the holes of different groups are of progressively greater diameter in passing from the upper end of the tube to the lower end thereof. Thus the holes of group 20 are the smallest, those of group 22 are somewhat larger than those of group 20 and those of group 24 are still larger. The holes of the last group 26 are of sufficient diameter to pass the largest rivets in the accumulations to be sorted and the plug 10 in the end of the tube is provided with openings 28 for discharging any unusual rivets or foreign objects which are too large to pass through any of the holes of the tube. Separate receptacles 30 are located beneath each group of holes and beneath the plug 10 to receive the rivets discharged by each group of holes and thus collect the different sizes of rivets.

As shown in Figs. 2 and 3 the internal diameter of the tube 2 is relatively small. The internal diameter should not be more than about three times the length of the longest rivets in the accumulations and in practice we prefer to use tubes having an internal diameter only slightly greater than the longest rivets normally found in the accumulations.

By using a tube of relatively small diameter the rivets are caused to engage the inner surface of the tube at such an angle that they slip readily into the holes in the tube so as to be gauged thereby. Furthermore, as shown in Fig. 2 the inner surface of the tube adjacent the holes 32 therein may be countersunk as shown at 34 to aid in directing the rivets into the holes. If the head or largest diameter portion of the rivet or object being sorted does not exceed the diameter of the hole into which it passes the rivet will fall through the hole and be discharged into the receptacle 30 located beneath that group of holes. On the other hand, if the shank of a rivet slides into a hole and the head of the rivet is too large to pass through the hole, the rivet will be held against discharge and carried upward with the tube as the tube rotates. When the hole through which the rivet extends reaches an upper position, the rivet will be inverted, as shown at 36 in Figs. 2 and 3, and drop back into the tube so that it may pass on down the tube to the next group of holes. In this way each of the rivets is repeatedly gauged for head size or diameter and is only discharged when it reaches that group of holes corresponding in size to the head of that particular rivet.

In order to overcome the tendency of elongated objects such as rivets to assume positions parallel to the longitudinal axis of the rotating tube, means are provided for turning or deflecting the rivets as the tube rotates. The rivets are thus caused to extend across the tube rather than lengthwise thereof and are positioned so that they will readily enter the radially extending holes in the tube. The means employed for this purpose project inward from the inner surface of the tube and preferably extend diametrically across the tube in position to engage the rivets and turn them into substantially crosswise positions as the tube rotates. As shown in Figs. 2 and 3 bolts 38 extend diametrically across the tube 2 at numerous points along the tube so that a rivet, such as that shown at 40 in Fig. 3 will be engaged by the bolt 38 and will be turned crosswise of the tube into the position of the bolt 42 in which the end of the rivet is positioned to enter one of the holes in the tube. With this construction it is possible to sort elongated objects which are many times longer than the diameter of the holes and to gauge the objects in terms of their diameter without reference to the length of the object.

The bolts 38 preferably are somewhat longer than the diameter of the tube and are provided with heads 44 on opposite ends thereof so that the bolts are held by the tube but are free to drop back and forth as the tube rotates. The bolts 38 thus serve also as means for displacing or dislodging any rivets which may tend to become jammed or stuck in the tube and aid in the distribution and movements of the rivets through the tube.

It is also found to be advantageous to arrange the holes 32 in staggered relation as shown in Figs. 2 and 4 so that there are no circumferentially extending areas of the tube which have no holes therein and a rivet which passes between two longitudinally aligned holes when the tube rotates will be directed into a hole staggered with respect to those between which the rivet passed. In this way the device serves to insure repeated opportunities for each rivet to be gauged as it passes through each section of the tube.

In order to aid in the proper admission and distribution of the rivets in the upper end of the tube where they are received from the hopper, members 46 are located about the tube and project inwardly in advance of the first group of holes 20. Clogging of the rivets is thereby prevented and they are caused to pass along the tube in a loose distributed manner, which insures relatively free movement and tumbling of the rivets within the tube.

In operating devices embodying our invention we prefer to avoid rotation of the tube at such speeds that the action of centrifugal force will prevent proper tumbling and re-arrangement or movement of the rivets within the tube. For this reason the tube should not be rotated so that the surface thereof travels more than about 40 linear feet per minute and preferably travels only about 15 linear feet per minute.

The speed of rotation of the tube and the angle at which the tube is inclined as well as the diameter of the tube and the diameter of the gauging holes, in the tube, may of course be varied considerably depending upon the variety and size of the rivets or objects to be sorted. In a typical installation in which our invention has been used most effectively, the tube employed was 6 feet in length and had an inside diameter of $1\frac{9}{16}$ inches. The length of the longest rivets in the mixed accumulations was 1½ inches. The tube was inclined at an angle of 5° and rotated at a speed of 27 R. P. M. The diameter of the rivets varied from the smallest rivets, the heads of which were only .174 inch in diameter to the largest rivets which had a head .386 inch in diameter. The holes in the tube were arranged in nine groups corresponding to the standard head sizes of the rivets in the accumulations to be sorted, and in each instance were .005 inch larger in diameter than the head size of the rivet they were designed to select.

With this construction it was possible to sort mixed accumulations of rivets at the rate of 27 lbs. per hour with a remarkable degree of accuracy. In fact, the device separated those rivets

having round heads from those rivets having flat heads or brazier heads since rivets of different head type were found to vary also in head diameter. It is also found that the diameter of the shank of the rivet generally is so related to the head size that the only further sorting of the rivets obtained from our device that may be required for complete classification thereof is a sorting for length of the shank. The accuracy of sorting or gauging of rivets by our device is most surprising, since only from 1 to 2% of the rivets in each of the receptacles is found to be improperly classified.

Sorting of the rivets to separate those of one length from those of another for complete classification thereof may be effected by any suitable means such as the device shown and described in the copending application referred to above.

In forming the tube and in order that the inner surface thereof may be counter-sunk adjacent the holes, it is preferable to drill or punch the holes in a flat sheet and to counter-sink the surface about the holes. The sheet may then be formed into a tube with the counter-sunk surfaces on the interior thereof. The meeting edges of the tube may then be brazed, welded or merely clamped together to present a smooth continuous inner surface to be engaged by the rivets. Counter-sinking of the tube about the outer extremities of the holes has also been found to be desirable since the rivets then are released more readily when they slide back into the tube after the shank has projected through a hole too small to allow the head to pass therethrough. This operation also may be performed most readily before the sheet is formed into a tube.

Instead of providing the tube with means which extend diametrically across the tube for turning the rivets cross-wise therein, other inwardly extending projections or means may be formed thereon or located within the tube for engagement with the rivets to turn them within the tube as the tube rotates. Similarly it will be apparent that any desired number of groups of holes may be employed and the rivets or objects collected in the last receptacle may be passed through another tube or sorting device to classify the larger objects.

These and other modifications and changes may be made in the form, construction and arrangement of the elements used in the practice of our invention, and in view thereof the embodiment of the invention shown in the drawing is intended to be illustrative only and is not intended to limit the scope of the following claims.

We claim:

1. A device for sorting mixed accumulations of elongated objects such as rivets or the like, comprising a tube presenting a lower surface located in an inclined position and formed with a plurality of circular holes extending radially through the walls of the tube and of different predetermined diameters corresponding to the diameters of the heads of rivets in the accumulations to be sorted, said holes being arranged in groups throughout successive lengths of the tube with those holes of smallest diameter occupying a length of the tube located above a length of the tube occupied by those holes of larger diameter, means for rotating said tube about its longitudinal axis to cause rivets introduced into the upper end of said tube to pass downward along said tube and to be discharged through those holes to which they correspond, and means located within a length of said tube occupied by a group of holes and engageable by the rivets on rotation of the tube for deflecting the rivets so that they extend in directions transverse to the longitudinal axis of the tube rather than parallel thereto and are positioned so that they may pass through said holes.

2. A device for sorting mixed accumulations of elongated objects such as rivets or the like, comprising a tube presenting a lower surface located in an inclined position and formed with a plurality of circular holes extending radially through the walls of the tube and of different predetermined diameters corresponding to the diameters of the heads of rivets in the accumulations to be sorted, said holes being arranged in groups throughout successive lengths of the tube with those holes of smallest diameter occupying a length of the tube located above a length of the tube occupied by those holes of larger diameter, means for rotating said tube about its longitudinal axis to cause rivets introduced into the upper end of said tube to pass downward along said tube and to be discharged through those holes to which they correspond, and members extending inward from the inner surface of the tube within a length of the tube occupied by a group of holes and engageable by the rivets on rotation of the tube for deflecting the rivets so that they extend in directions transverse to the longitudinal axis of the tube rather than parallel thereto and are positioned so that they may pass through said holes.

3. A device for sorting mixed accumulations of elongated objects such as rivets or the like, comprising a tube presenting a lower surface located in an inclined position and formed with a plurality of circular holes extending radially through the walls of the tube and of different predetermined diameters corresponding to the diameters of the heads of rivets in the accumulations to be sorted, said holes being arranged in groups throughout successive lengths of the tube with those holes of smallest diameter occupying a length of the tube located above a length of the tube occupied by those holes of larger diameter, means for rotating said tube about its longitudinal axis to cause rivets introduced into the upper end of said tube to pass downward along said tube and to be discharged through those holes to which they correspond, and members extending diametrically across the tube within a length thereof occupied by a group of holes and engageable by the rivets on rotation of the tube for deflecting the rivets so that they extend in directions transverse to the longitudinal axis of the tube rather than parallel thereto and are positioned so that they may pass through said holes.

4. A rivet sorter of the character defined by claim 2 in which the members that extend inward from the inner surface of the tube for deflecting the rivets, are also movable relative to the tube on rotation thereof to displace the rivets and aid in preventing clogging of the rivets within the tube.

HERBERT O. NIEDERER.
OTTO C. NIEDERER.