The present invention relates in general to a mechanism for automatically feeding and distributing articles, and, more particularly, to a device adapted to automatically orient and deliver tubular articles in axial alignment from a hopper.

Although the orientation and delivering means shown herein illustrates one form of the invention particularly useful in conjunction with means for delivering closed end tubes in the process of manufacture into cartridge cases to a cartridge case trimming machine, it will be understood that the delivery means may have other applications and that modifications of the embodiment shown and described may be made without departing from the scope of the invention as defined in the appended claims.

It is an object of this invention to provide a comparatively inexpensive automatic hopper feed having relatively few moving parts. A further object is to provide an article orienting and delivering device having converging apertures provided with article retarding surfaces and to provide means for agitating the device while articles are being fed thereto so that the articles will be shaken off the retarding surfaces and delivered from the device in axial alignment.

Other objects, features and advantages of the invention will be set forth in detail in the following description.

As now practiced, cartridge cases are fed to case drawing, trimming and annealing machines by either one of two well known forms of mechanical hoppers. One such device is the so called pin wheel hopper which comprises a rotating wheel having inwardly projecting pins adapted to be moved through a mass of cartridge cases within a hopper, the cases being picked up on the ends of the pins and delivered closed end first in axial alignment from the hopper. The second type is the so called paddle wheel hopper feed wherein a wheel having laterally projecting shelves or paddles is rotated within a hopper.

The cases are carried upwardly on the shelves and deposited in axial alignment on a moving belt which is adapted to convey the cases into engagement with suitable cam surfaces, the latter being designed to orient the cases and feed them heavy end down into a feed tube.

While both of these automatic hopper feed devices are being used extensively they are, nevertheless, relatively expensive and embody many movable parts which are subject to wear and breakdown, and have other disadvantages.

The following description and drawing illustrates one embodiment of the present invention comprising a relatively inexpensive hopper feed means having no moving parts.

In the drawing:

Fig. 1 is a schematic illustration of the automatic hopper feed shell alignment device of this invention used in conjunction with a cartridge case tube trimming machine.

Fig. 2 is an end elevation of the hopper feed agitating means.

Fig. 3 is a plan view of the hopper feed tray and shell aligning device.

Fig. 4 is an elevation in section on line 4—4 of Fig. 3.

Fig. 5 is an elevation in section on line 5—5 of Fig. 3.

Fig. 6 is a perspective view partly in section of one of the cellular members shown in Figs. 4 and 5.

Fig. 7 is a perspective view of the lowermost cellular member.

Referring to Fig. 1, the article or cartridge case aligning device is indicated generally by the numeral 10 and is secured at its upper end by a welded joint or other suitable fastening means to one end 11 of a cartridge case supporting tray 12. The lower end of the aligning device is shown connected to the usual type of feed tube 100 which delivers the aligned cases directly to the oscillating sector 101 of a trimming machine. The latter is schematically represented as comprising a feed plunger 102 adapted to push cases onto the rotating mandrel 103, the cases being trimmed thereon by a cutter 104 and removed therefrom by a stripper 105. The tray is mounted at its opposite end 13 on suitable agitating means indicated in general by numeral 14, the tray being inclined at an angle indicated at (a) with respect to the horizontal so that its end 11 is lower than its opposite end 13. Immediately above the tray adjacent its end 13 is a hopper 15 fixedly supported with respect to the tray and provided with a converging mouth adapted to deliver cases into the tray 12, the sides of the latter being extended upwardly as at 17 to prevent the cases from falling out.

Means for orienting the cases in the tray comprises a relatively course screen adjacent the lower end 11 of the tray. This screen consists of a plurality of apertures 18, numbering nine holes in the embodiment shown, the diameter of each hole being somewhat greater than the distance measured from the closed end of a cartridge case to the center of gravity thereof and considerably less than the distance from the center of grav-
ity of the case to its open end. In practice, the holes 18 are made substantially one and one half inch in diameter which dimension is particularly adapted for such cases, the center of gravity of which is substantially one inch and a quarter from its closed end. It will be understood, of course, that the size and relationship of the apertures in the screen may be varied in accordance with the size and shape of the articles or cases to be orientated thereby.

As the cases slide down the tray towards its apertured end 11, any case which approaches a hole 18 open end first will slide over the hole since the center of gravity of the case is outside of the hole. However, when the open end of the case has crossed over sufficiently and is supported on the opposite edge of the hole so that the center of gravity of the case falls within the hole, the case will then fall down into the hole heavy end first. It will be clear without further explanation that any case which approaches a hole closed end first will readily fall into the hole with its heavy end down. Thus, all cases which slide down the tray 12 will be oriented and fall through the apertures 18 heavy end first.

In order to deliver the cases to the apertures 18 in a single layer a leveling-off bar 19 is mounted across the tray 12 between its apertured end 11 and the hopper. The bar 19 is supported above the tray bottom at a height sufficient to hold back any cases which may be riding or superposed on the bottom layer of cases.

Suitable means are provided to supplement the force of gravity and to give the cases a more positive sliding movement and comprises the agitator means 14 which is of a type used extensively in the art. Briefly, the agitator comprises a frame 20 on which are fixedly mounted two parallel shafts 21. These shafts are adapted to reciprocatingly support the inclined tray 12 to which purpose suitable brackets 22 are welded or otherwise secured to the bottom of the tray, the brackets being provided with bushings sliding on the shafts 21. The tray is reciprocated or agitated by means of a vertically oscillating arm 24 pivotally connected at its upper end to a link 25, see Fig. 2, which is in turn pivotally connected at its opposite end to a lug 26 suitably fixed on the bottom of the tray 12. The lower end of the vertical arm 24 is keyed to a rotationally supported horizontal shaft 23 which is oscillated by a rotating cam 27 arranged to engage a cam follower 28 carried by the shaft 23. A coil tension spring 29 is secured at one end to the arm 24 and its opposite end to the frame for maintaining the cam follower 28 in continuous engagement with the rotating cam 27. As the latter rotates, an extremely short reciprocating stroke is transmitted to the tray thus effectively agitating the cases supported therein.

As shown in Fig. 3, the screen apertures 18 in the end 11 of the tray are arranged in three substantially parallel rows comprising three holes or apertures per row, each row of apertures being on the diagonal or at an angle of substantially 45° with respect to the longitudinal axis of the tray. The purpose of this construction is more fully described below.

The cartridge case aligning device shown at 10 in Fig. 1 comprises a cellular unit formed by assembling a plurality of individual cellular members in the relationship shown in detail in Figs. 4 and 5. Three of these individual cellular members are substantially identical, one of which is indicated generally by numeral 30 in Fig. 6. This cellular member comprises hollow rectangular sections 31 and 32 arranged in superposed relationship, the lower section 32 being fixedly secured to the lower end of the upper section 31 by a weld joint 33 or other suitable fastening means.

The upper section 31 is shaped substantially like an inverted truncated pyramid comprising converging front and rear faces and end walls, its upper end having a rectangular opening 34 substantially equal in length to one of the rows of three apertures 18 in the tray 12, and in width to the diameter of one of these apertures. A pair of baffles plates 35 are provided adjacent the upper edge of the opening 34 for dividing the opening into separate apertures. These baffle plates are substantially parallel and are supported on edge in slots 41 cut in the front and back faces of the section 31, the plates 35 being suitably spaced so as to form three apertures 36 of substantially equal size corresponding in size to the apertures 18 in the tray 12. As shown in Fig. 4, the baffle plates 35 are sufficiently long to extend continuously through three of the cells 30 when assembled together as hereinafter described.

The lower rectangular end 39 of the section 31 is provided at its opposite ends with shoulders or substantially horizontal shelf-like surfaces 40, see Fig. 6, which extend inwardly so as to define a restricted opening 42 in the lower end of the section 31 of such dimensions as to permit the free passage of two cartridge cases. Where the unit is to be used for .50 caliber cases the opening 42 should be substantially one and one eighth inches wide and two and one half inches long.

The lower section 32 of the member 30 is shaped substantially as a hollow rectangular prism, the upper opening of the section 32 corresponding to the restricted opening 42 of the upper section 31. A third baffle plate 46 is supported on edge in slots cut in the front and rear faces of section 32 adjacent the opening 42 and substantially midway of its length so as to divide the opening into two apertures 44 of substantially equal size which in the present embodiment are substantially one and one eighth inches square. The lower end 45 and the section 32 is provided with shoulders or shelf-like surfaces as at 46 adapted to form a single substantially square aperture 47.

The fourth cellular member, indicated in general by numeral 50 in Figs. 4 and 5, is substantially similar to the above described cellular member 30 but varies therefrom in the shape of its upper section 51. The section 51 comprises an inverted hollow truncated triangular prism having converging end walls but front and back faces which are substantially parallel as distinguished from the converging faces of the section 31 of the member 30. Suitable baffle plates 53 are secured in the cellular member 50 in the manner above described so as to divide the upper opening of the section 51 into three apertures 54 of substantially equal size. In this case the plates 53 are only long enough to extend through the single cellular member 50. The lower end or opening of the section 51 is provided with shelf-like surfaces 55 and secured to the lower end of section 51 is the upper end of a lower section 52 which is divided into two apertures 56 of substantially equal size by a third baffle plate 53. The lower section 52 is in turn provided with shelf-like surfaces 57 defining a single aperture 58 coinciding with the mouth of the lowermost delivery member 59. The latter, as indicated in Fig. 7, comprises
a hollow truncated cone 60 having a single aperture 61 at its lower end equal to or slightly larger than the diameter of a cartridge case so as to permit unrestricted delivery of the case.

The several cellular members above described are assembled together as a unit as indicated at 10 in Fig. 1. Referring to Figs. 4 and 5, it will be seen that three cellular members 30 of Fig. 6 are suitably joined together in face to face relationship so as to form a cellular unit having nine rectilinearly converging apertures 35 in its upper section in direct communication with six rectilinear apertures 44 in its lower section. Suitable fastening means for joining the three cellular members 30 may comprise transverse pins 60 inserted in holes in the ends of the baffle plates 36, the pins being adapted to engage the faces of the cellular members so as to prevent lateral disarrangement thereof. Further, the upper edges of the members 30 may be welded or otherwise secured to the underside of the tray 12. It will be evident, as shown in Figs. 1 and 2, that in securing the cellular members 30 to the tray, these members are so oriented that the rectangular apertures 35 thereof coincide with the apertures 15, in other words, the substantially vertical planes defined by the faces of the cellular members 30 are disposed at an angle of substantially 45° with respect to the longitudinal axis of the tray.

To the lower ends of the sections 32 of the members 30 is welded the upper end or opening of section 51 of the cellular member 50, the latter being so arranged with respect to the members 30 that its front and rear faces lie in a vertical plane substantially at right angles to the vertical planes defined by the faces of the cellular members 30.

The lowermost cellular member 60 is welded or otherwise secured to the lower end of the member 50 in axial alignment with its aperture 57.

In its assembled form, the unit 10 thus provides a plurality of rectilinearly converging apertures which constitute paths of flight for the cartridge cases, the latter being adapted to fall down through the apertures by the force of gravity supplemented by the agitating motion imparted to the unit as above described. The axial alignment of the cases during their flight may be described as for the members 30.

Referring to Fig. 5, whenever three cases fall into three apertures 35 of one of the members 30, the two outer cases will be momentarily stopped or retarded by striking the shelf-like surfaces 40 while the center case will be momentarily supported on the upper edge of the baffle plate 36. By agitating the cellular member, the shelves 40 and baffle plate 36 will in effect be displaced with respect to the cases due to the relatively great inertia of the latter and, consequently, at least two of the three cases will be forced into position over the restricted opening 42 and will thereafter fall down through the two apertures 44 of the lower section 32. It will be noted that due to the orientation of the cellular members 30 and 50 with respect to the longitudinal axis of the tray 12, the upper edges of the shelves 40, 45, 55 and 57, respectively, are arranged at substantially 45° with respect to the direction of recirculation or agitation thereof. By this arrangement dislodgment of the cases from all of the shelves is greatly facilitated.

In this manner, the two cases in the lower section 32 of the cellular member 30 will be momentarily retarded by the shelf-like surfaces 40 from which one case will be dislodged and gain entrance down through the single aperture 41. The two cases falling after the leading case will subsequently escape through the aperture 41, all three cases thus being delivered in axial alignment from the member 30 and in the vertical plane defined by its faces.

Since the function of the two remaining cellular members 30 is that of the above described member 30, it will be evident as shown in Fig. 4 that three cases will be fed substantially simultaneously from the three apertures 47 downwardly between the baffle plates 53 into the upper section 51 of the cellular member 50. As the cases continue their downward flight, the two outer cases will be momentarily retarded by the shelf-like surfaces 55 while the middle case will be stopped by the baffle plate 53. Continued agitation of the cellular unit will dislodge two of these cases from the retarding surfaces 55 and baffle plate 53. It will be observed that, due to the arrangement of the member 50 with respect to the members 30, the displacement of the cases in the member 50 will be in a vertical plane at substantially right angles to the vertical planes in which the cases were displaced in the cellular members 30. After the cases have dropped through the two apertures 56 of the lower section 52, the cases are again momentarily retarded by the lower shelf-like stops 57 until one of the two cases makes its escape into the single aperture 57 of the lowermost cellular member 60. In a similar manner, the cases falling after the leading case will be delivered out of the single discharge aperture 61 of the member 60 in axial alignment with the leading case. The cases may thereafter be delivered heavy end down directly into a feed tube 190 secured to the lower end of the member 60 whereby the cases are transported to the case manufacturing machine such as the trimming machine illustrated in Fig. 1.

What is claimed is:

1. An article aligning device comprising article supporting and orienting means; means for agitating said supporting means; and means to discharge articles delivered into said orienting means from said supporting means comprising superposed guide members associated with said orienting means and agitated by said supporting means, said guide members being constructionally arranged and caused to each article to move vertically successively in two planes at substantially right angles to each other and to the plane of said supporting means.

2. An article aligning device comprising article supporting and orienting means; means for agitating said supporting means; means to discharge articles delivered from said orienting means comprising superposed guide members associated with said orienting means and agitated by said supporting means; and article retarding elements carried by said guide members to be gaged by the articles to cause each article to move successively in two vertical planes at substantially right angles to each other.

3. An article aligning device comprising article supporting and orienting means; means to agitate said supporting means; means to discharge articles delivered from said orienting means comprising vertically disposed article guide members connected to said supporting means in communication with said orienting means, said guide members being agitated by said supporting means and embodying a series of article retarding elements spaced vertically in said members to be
engaged by said articles to cause each article to move in a predetermined vertical plane; and a second series of article retarding elements spaced vertically in said guide members to be engaged by said articles to move each article in a vertical plane at substantially right angles to the first vertical plane.

4. An article aligning device comprising article supporting and orienting means; means to agitate said supporting means; means to discharge articles delivered from said orienting means comprising a plurality of integrally connected superposed article guide means agitated by said supporting means, each member having an article receiving aperture communicating with the article receiving aperture of an adjacent member; and article retarding elements extending into said apertures to cause each article to move in two vertical planes while passing down through said superposed guide members.

5. An article aligning device comprising article supporting and orienting means; means for agitating said supporting means; and article guide means associated with said orienting means and agitated by said supporting means to discharge articles delivered by gravity from said orienting means in axial alignment, said guide means comprising a plurality of rectilinearly converging superposed cellular members.

6. An article aligning device comprising article supporting and orienting means; means for agitating said supporting means; article guide means associated with said orienting means and agitated by said supporting means to discharge articles delivered by gravity from said orienting means in axial alignment, said guide means comprising a plurality of rectilinearly converging superposed cellular members, said delivery means comprising a cellular unit embodying a plurality of article retarding apertures, a hopper for feeding cases to said tray; means for agitating said tray whereby the cases are fed into said apertures heavy end first; and guide means agitated by said tray and in communication with said apertures to deliver cases in axial alignment to said trimming means, the delivery means comprising a plurality of axially offset superposed tubular members to guide each case into two vertical planes while being delivered to said trimming means.

7. A device for aligning tubular articles comprising an inclined article supporting tray having a plurality of article orienting apertures at one end thereof; means for agitating said tray; means associated with said tray for leveling off the tubular articles sliding towards the apertures; article delivery means affixed to and depending substantially vertically from said tray to guide the tubular articles delivered by gravity from said apertures, said delivery means comprising a cellular unit having vertical walls defining a plurality of individual superposed paths each in communication with the article orienting apertures of said supporting means; and a plurality of article retarding means extending from the walls defining said paths, said retarding means comprising baffle plates in the paths of articles falling through said apertures to guide the free fall of the tubular articles whereby said articles are delivered from the cellular unit in axial alignment.

8. A device for aligning tubular articles comprising an inclined article supporting tray having a plurality of article orienting apertures at one end thereof; means for agitating said tray; means associated with said tray for leveling off the tubular articles sliding towards said apertures; article delivery means affixed to and depending substantially vertically from said tray to guide the tubular articles delivered by gravity from said apertures, said delivery means comprising a cellular unit embodying a plurality of article retarding apertures, a hopper for feeding cases to said tray; means for agitating said tray whereby the cases are fed into said apertures heavy end first; and guide means agitated by said tray and in communication with said apertures to deliver cases in axial alignment to said trimming means, the delivery means comprising a plurality of axially offset superposed tubular members to guide each case to said trimming means; and article retarding surfaces projecting from the inner walls of said tubular members comprising baffle plates in the paths of articles falling through said tubular members and disposed at substantially 45° to the direction of reciprocation of said tray to cause each case to be dislodged from said baffles and guided through said tubular members in two vertical planes at substantially right angles to each other.

9. Feeding means for delivering cartridges to the trimming means of a cartridge case trimming machine comprising an inclined cartridge case supporting tray having a plurality of article orienting apertures; a hopper for feeding cases to said tray; means for agitating said tray whereby the cases are fed into said apertures heavy end first; and guide means agitated by said tray in communication with said apertures to deliver cases in axial alignment to said trimming means, the delivery means comprising a plurality of axially offset superposed tubular members to guide each case to said trimming means.

10. Feeding means for delivering cartridges to the trimming means of a cartridge case trimming machine comprising an inclined cartridge case supporting tray having a plurality of article orienting apertures; a hopper for feeding cases to said tray; means for agitating said tray whereby the cases are fed into said apertures heavy end first; and guide means agitated by said tray in communication with said apertures to deliver cases in axial alignment to said trimming means, said delivery means comprising a plurality of axially offset superposed tubular members to guide each case to said trimming means; and article retarding surfaces projecting from the inner walls of said tubular members comprising baffle plates in the paths of articles falling through said tubular members and disposed at substantially 45° to the direction of reciprocation of said tray to cause each case to be dislodged from said baffles and guided through said tubular members in two vertical planes at substantially right angles to each other.

11. Feeding means to feed cartridges to a trimming machine comprising an inclined cartridge case supporting tray having a plurality of rows of apertures adjacent one end thereof; a hopper for feeding cases to the tray; means for agitating the tray in a direction substantially diagonal to the rows of apertures whereby the cases are fed into the apertures heavy end first; cartridge case delivering means substantially vertically from said tray and agitated thereby for delivering the cases by gravity in axial alignment to the cartridge case trimming means; said delivery means comprising superposed rectangular members having apertures in communication with the rows of apertures in said tray; and a plurality of case retarding surfaces in the apertures of the rectangular members, said surfaces lying in vertical planes at substantially 45° with respect to the longitudinal axis of said tray.