United States Patent

[11] 3,577,998

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Division of Ser. No. 615,792, Feb. 13, 1967, abandoned. Continuation-in-part Ser. No. 529,424, Feb. 23, 1965, abandoned
[45] Patented **May 11, 1971**

[73] Assignee **R. J. Reynolds Tobacco Company**
Winston-Salem, N.C.

[54] **IMPACT METHOD**
9 Claims, 23 Drawing Figs.

[52] **U.S. Cl.** **131/96,** 131/20, 131/146, 241/188
[51] **Int. Cl.** **A24c 05/36**
[50] **Field of Search** 131/96, 20, 146, 145; 241/188

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ABSTRACT: A method of striking an article, particularly a wrapper enclosed product such as a cigarette, by striking the article and achieving a clear impact without cutting the wrapper to create a blast of air upon impact so as to force the product out of the wrapper by an air pump action.

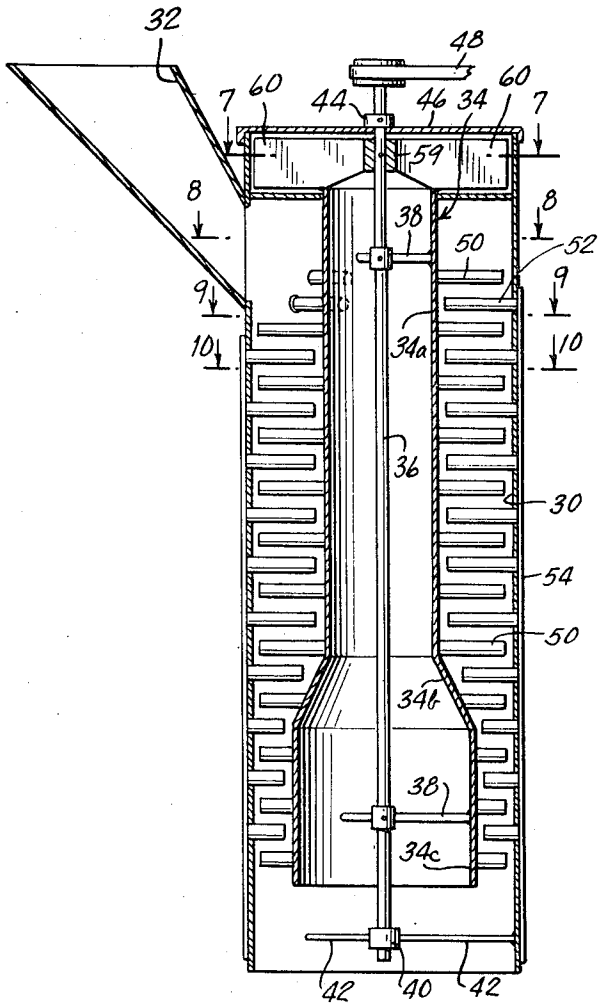
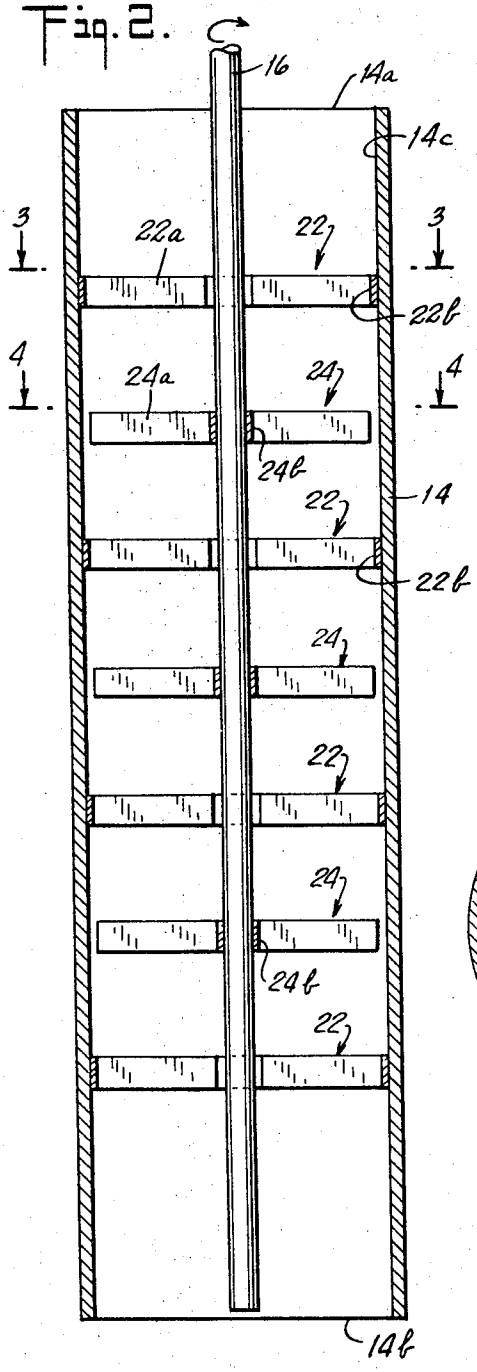


Fig. 2.



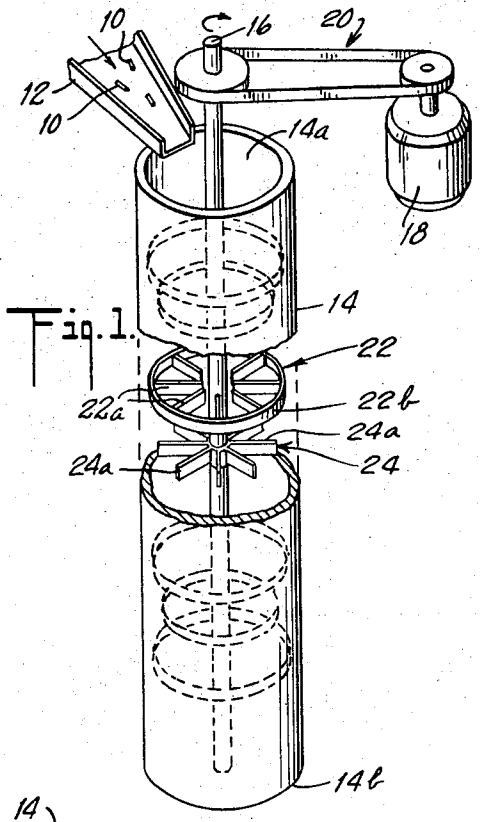


Fig. 1.

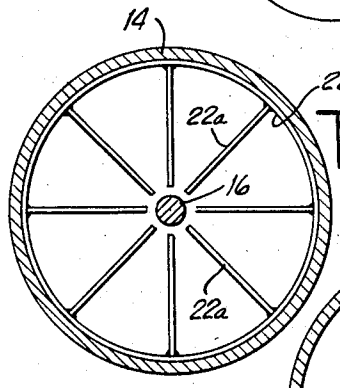


Fig. 3.

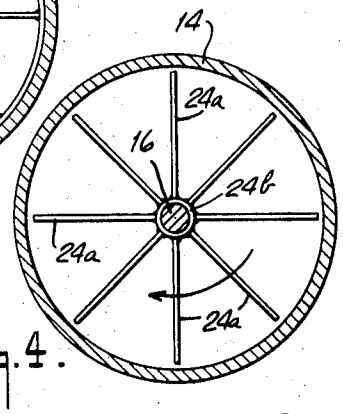


Fig. 4.

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Fig. 5.

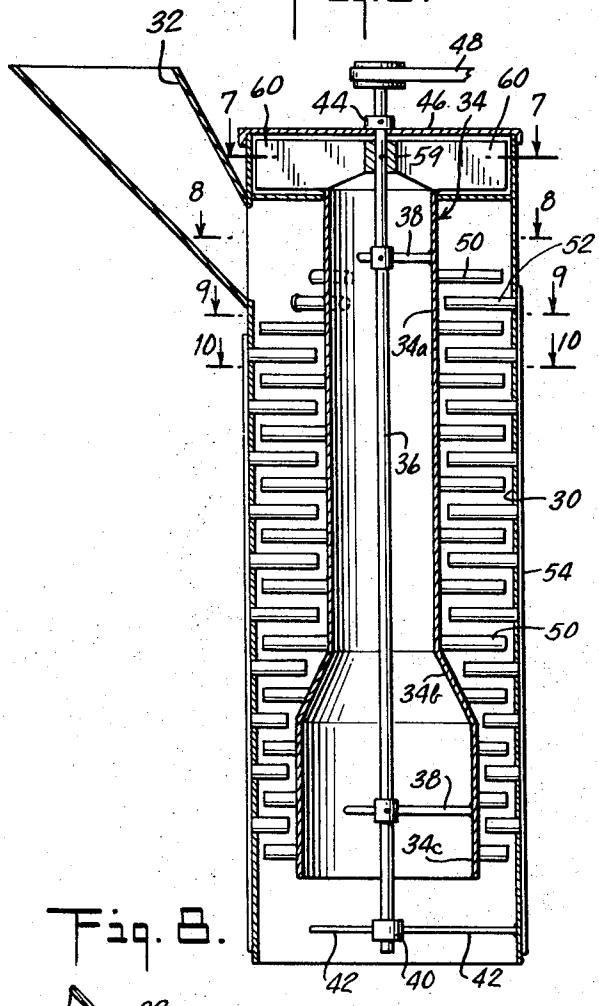


Fig. 6.

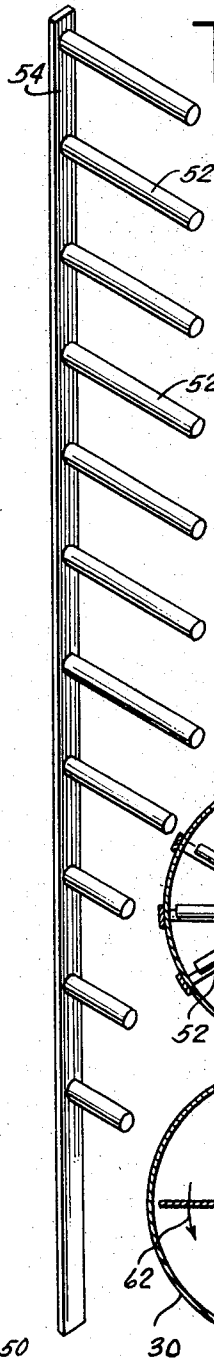


Fig. 10.

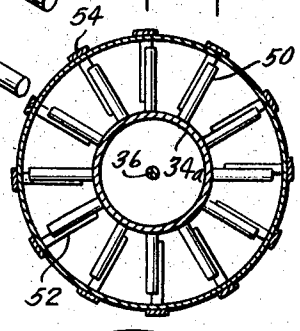
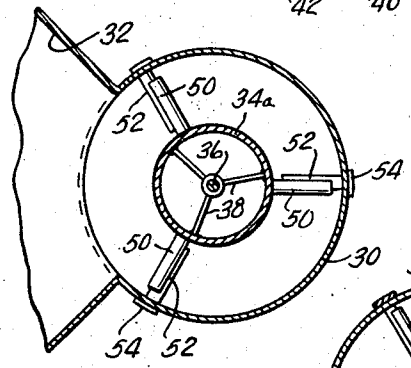


Fig. 8.



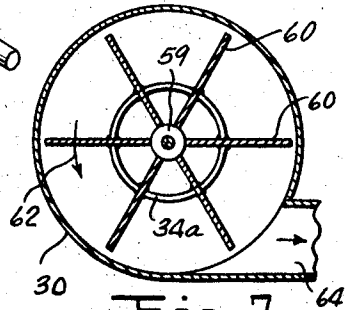
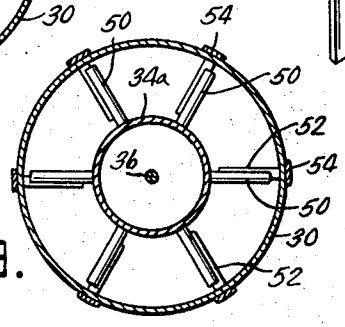


Fig. 7.

Fig. 9.



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Fig. 11.

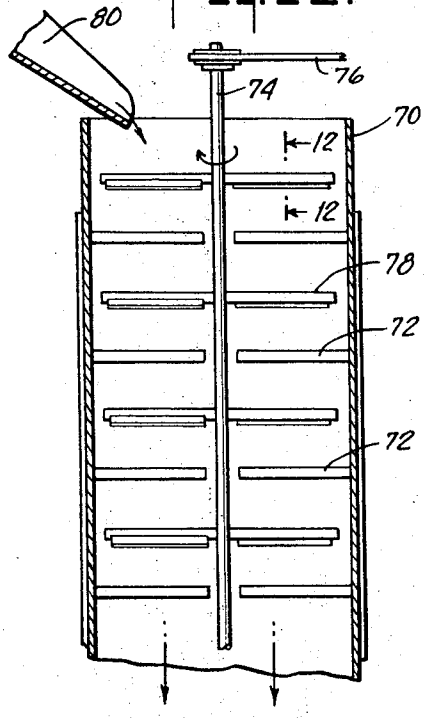


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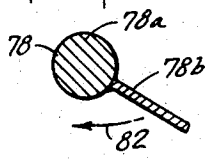


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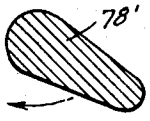
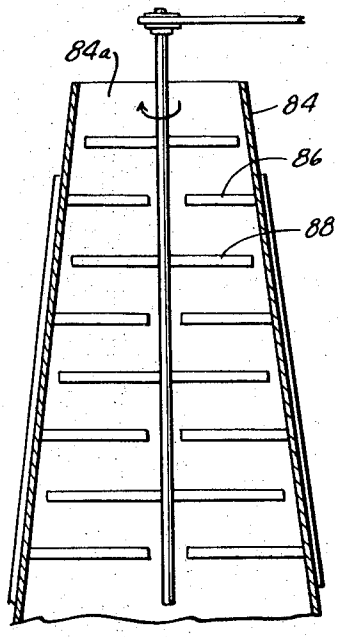


Fig. 14.



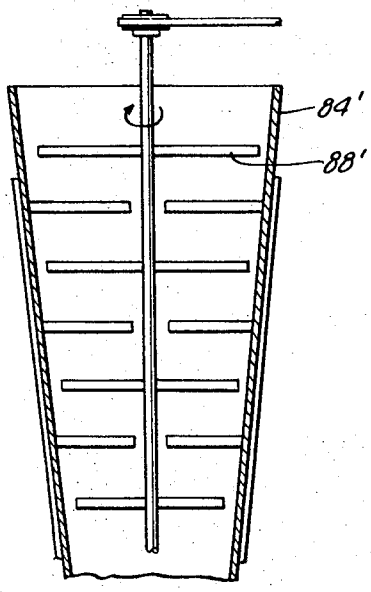


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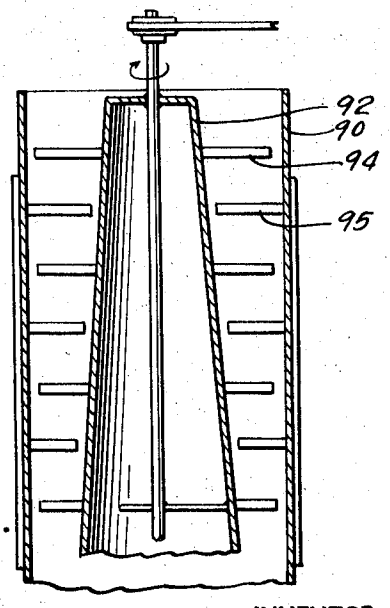


Fig. 16.

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Fig. 17.

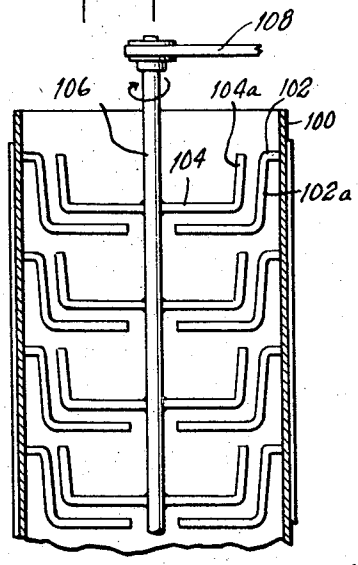


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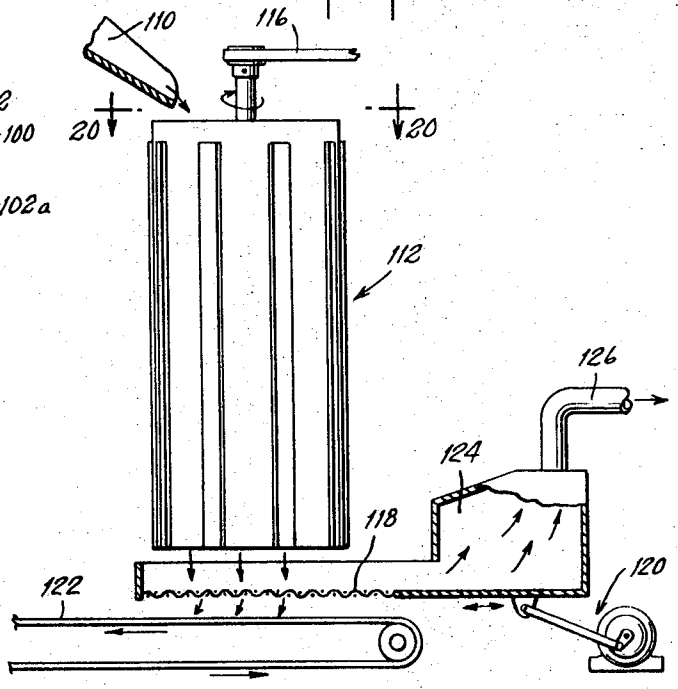
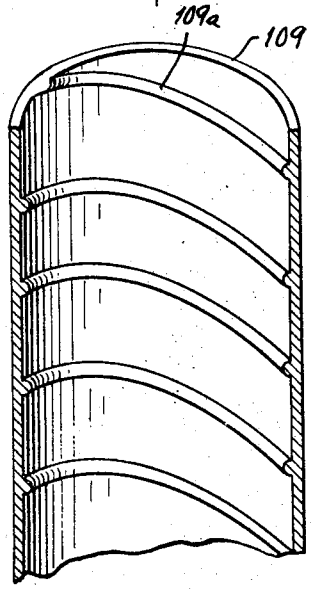


Fig. 18.



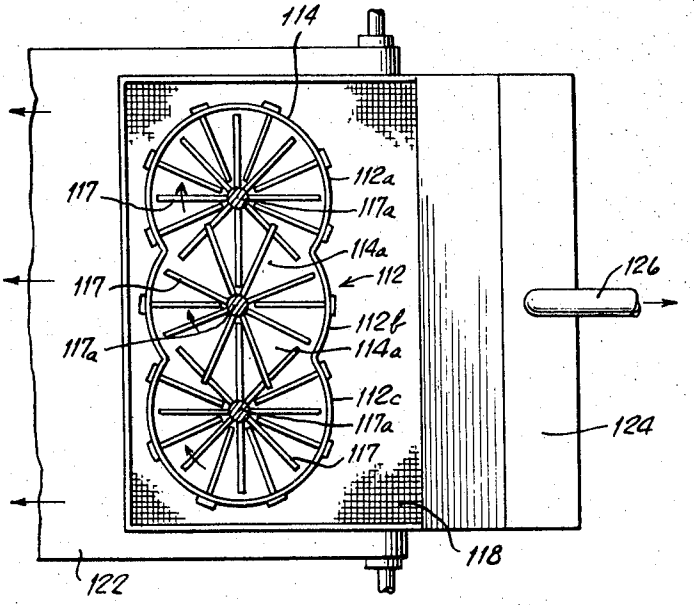


Fig. 20.

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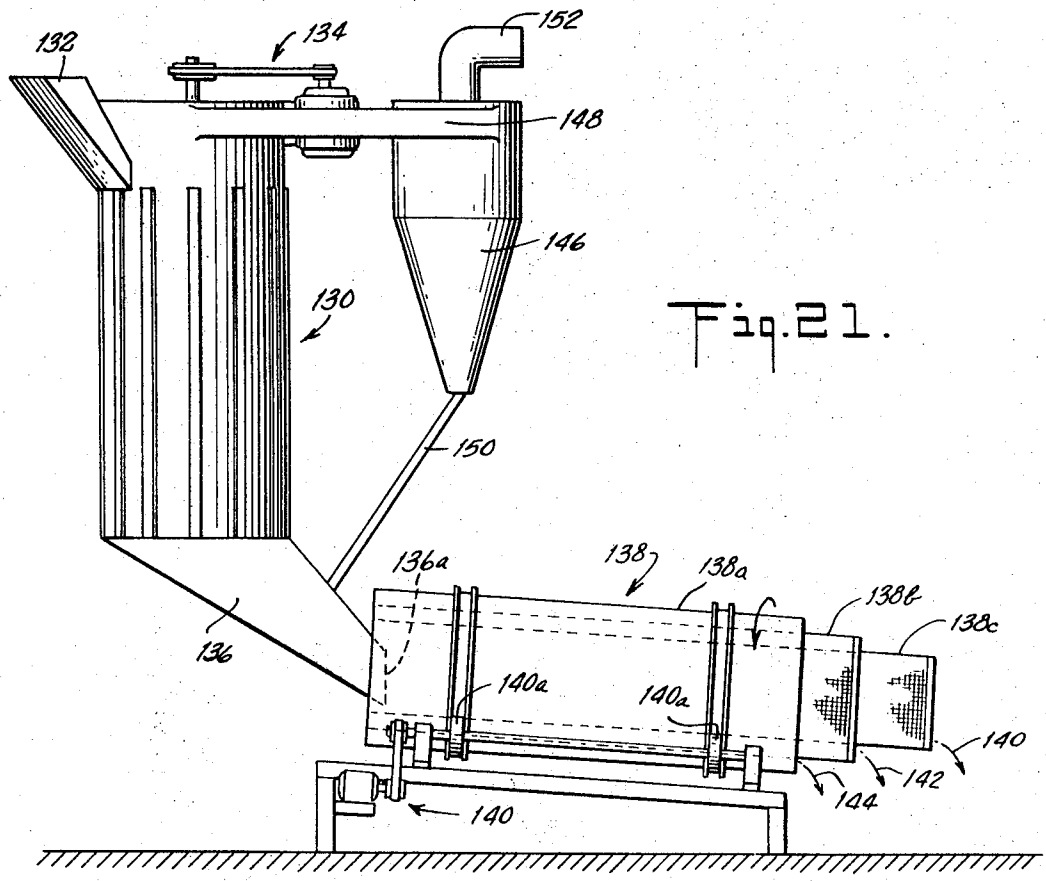


Fig. 21.

Fig. 22.

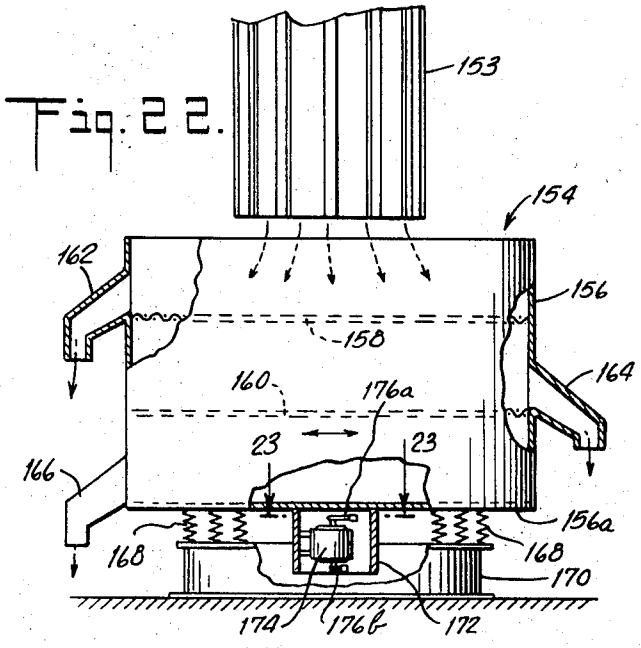
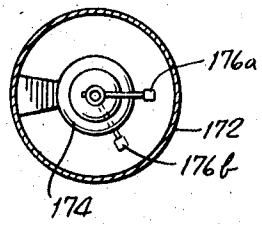


Fig. 23.



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IMPACT METHOD

RELATED APPLICATION

The present application is a division of my copending application Ser. No. 615,792 filed Feb. 13, 1967 now abandoned for IMPACT APPARATUS AND METHOD. Application Ser. No. 615,792 in turn is a continuation-in-part of my copending application Ser. No. 529,424 filed Feb. 23, 1965 now abandoned for APPARATUS FOR SEPARATING TOBACCO FROM CIGARETTE FILTERS.

BRIEF SUMMARY OF THE INVENTION

This invention relates to an impact method for the striking of material, usually to break up a material into particles or to separate a product from a wrapper. The invention finds particular application in the separation and reclaiming of tobacco and filters from filter tip cigarettes and in the separation of tobacco from enclosing cigarette papers from cigarettes rejected upon inspection in order to reclaim the tobacco.

In the manufacture and packaging of filter cigarettes, it is desirable to reclaim the tobacco and filters from cigarettes which have been rejected in an inspection process. Uncontaminated tobacco may be reused in the manufacture of cigarettes; uncontaminated filters may be used in various ways, e.g., as a stuffing for dolls or mattresses. It is also desirable to be able to separate tobacco from enclosing cigarette paper of cigarettes which have been rejected during an inspection process in order to reclaim the tobacco. It is further desirable to have an impact device which is suitable for breaking material into particles; e.g., lumps of chewing tobacco which have been rejected during an inspection process may be broken in order to place the tobacco in more convenient sizes for subsequent reclaiming.

The present invention may be accomplished by impact apparatus, suitable in the tobacco industry to carry out reclaiming as noted above, or suitable for the striking of any material. The abstract of the disclosure describes some of the different structures involved in the invention. Briefly, the rotating vane assemblies strike the material and cause the material to impinge upon the inner surface of the container and against the fixed vanes within the container. The fixed vanes cause the material to follow a regular course as it passes through the container. THe shaping of the rotating vanes as fan blades provides a movement of air through the container to aid in the material flow through the container. The helical ridge on the inside surface of the container also aids in material flow. The various container, shaft and vane shapes and numbers of vanes enhance the impact action for different materials. Particularly with reference to the separation of tobacco from paper in a cigarette, it has been found that by shaping the vanes so as not to cut the paper, the striking of the cigarette by the vanes creates an air pump action to blow the tobacco strands out of the open end or ends of the cigarette. This action may be achieved without tearing the paper, thereby avoiding contamination of tobacco with bits of paper. The sieving of struck material enables classification according to material size, and the dust removal feature described enhances the processing of material. In the processing of tobacco clinging to cigarette filters or contained within cigarette paper, a separation of the tobacco from the filters or paper is achieved without resorting to the tedious hand processes employed in the past for such reclaiming of tobacco or the cumbersome machine slitting of cigarette papers, e.g., to reclaim tobacco from rejected cigarette assemblies.

Rotating vane assemblies have been employed in the past. Irmscher U.S. Pat. No. 2,818,985 is representative and discloses apparatus for reclaiming the contents of filled packages. A rotating vane assembly is employed; however, the vanes do not rotate about an axis which passes through a container from container entrance to exit, as in the present invention. Neither does Irmscher disclose employing the combination of fixed vanes and rotating vanes to achieve the striking of material as in the present invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a perspective view of an impact device in accordance with the invention.

FIG. **2** is a longitudinal sectional view, to an enlarged scale, of the impact device of FIG. **1**.

FIGS. **3** and **4** are sectional views taken respectively along the section lines **3–3** and **4–4** of FIG. **2**.

FIG. **5** is a longitudinal sectional view of another form of impact device in accordance with the invention.

FIG. **6** is a perspective view (to an enlarged scale) of a fixed vane assembly for use in the impact device of FIG. **5**.

FIGS. **7**, **8**, **9** and **10** are sectional views taken respectively along the section lines **7–7**, **8–8**, **9–9** and **10–10** of FIG. **5**.

FIG. **11** is a longitudinal sectional view of still another form of impact device in accordance with the invention.

FIGS. **12** and **13** are sectional views of different rotating vanes suitable for use in the impact devices of the invention.

FIGS. **14**, **15**, **16**, **17** and **18** are longitudinal sectional views of varying forms of impact devices in accordance with the invention.

FIG. **19** is a side view, partly in section, of a system in accordance with the invention for striking material and classifying material according to size.

FIG. **20** is a top view of the system of FIG. **19**, looking downwardly in the direction of the arrows **20–20** in FIG. **19**.

FIG. **21** is a side view of another system in accordance with the invention, similar to the system of FIG. **19**.

FIG. **22** is a side view, partly in section, of still another system in accordance with the invention, similar to the system of FIG. **21**.

FIG. **23** is a sectional view, to an enlarged scale, of part of the apparatus shown in FIG. **22**, taken along the section line **23 23** in FIG. **22**.

DETAILED DESCRIPTION

FIG. **1** shows an impact device in accordance with the invention. As an example, the device will be explained with reference to the separation of cigarette filters and tobacco clinging thereto. Cigarette filters **10** having tobacco clinging to the ends thereof are supplied via a chute **12** to a container **14**. Such filters and clinging tobacco may be received from apparatus which severs the filter tip from the tobacco section of a cigarette or which separates the filter section from the tobacco sections of a dual cigarette assembly. Severance typically occurs within the tobacco section or sections so as to avoid including any filter material in the severed tobacco section or sections. As a result, the severed filter section normally includes tobacco clinging to an end or both ends thereof.

The container **14** is advantageously formed as a cylinder having open ends **14***a* and **14***b*. A shaft **16**, whose axis coincides with the axis of the container **14**, is mounted for rotation within the container. The shaft **16** may be rotated by a motor **18** that is coupled by a belt drive **20** to the shaft.

A plurality of fixed vane assemblies **22** are mounted along the container **14**. Each vane assembly **22** (see also FIGS. **2** and **3**) is formed from a group of vanes **22***a* extending radially inwardly from a ring **22***b* mounted on inner wall **14***c* of the container toward the rotating shaft **16** within the container. The vanes **22***a* may be secured to the ring **22***b* and the ring in turn may be secured to the inner wall **14***c* of the container all by welding, for example, if the vanes, ring and container are made of steel. The vanes **22***a* in each assembly **22** thus are positioned circumferentially about the cylinder **14** and extend toward the shaft **16**. As shown in FIG. **2**, there are four such fixed vane assemblies **22**; the number of assemblies is arbitrary, however.

Disposed between the fixed vane assemblies **22** are rotating vane assemblies **24**. Each vane assembly **24** (see FIGS. **2** and **4**) is formed from a group of vanes **24***a* extending circumferentially around the shaft **16** and radially outwardly toward the inner wall **14***c* of the container. The vanes may be attached to a ring **24***b* which surrounds the shaft **16** and which is

secured to the shaft. In FIG. 2, three such rotating vane assemblies are shown; the number is arbitrary. Normally, the fixed and rotating vane assemblies should be alternatively positioned along the cylinder.

The shaft **16** is rotated so as to rotate the vane assemblies **24**. As filters pass by gravity downwardly through the container **14**, they first pass through the uppermost fixed vane assembly **22**. The filters next encounter the uppermost fixed vane assembly **24**. The individual vanes **24***a* of this assembly strike the filters and cause them to impinge against the inner wall **14***c* of the container, and against the fixed vanes **22***a* of the next lower vane assembly so as to shake the tobacco loose from the filters. The uppermost fixed vane assembly **22** ensures that the filters will not be thrown upwardly and out of the container by the rotating vanes **24**.

The filters pass downwardly through the series of fixed vane assemblies and rotating vane assemblies. Each fixed vane assembly **22**, while providing surfaces against which the filters impinge, ensures that the filters move properly downwardly and corrects any sidewise movement of the filters caused by the rotating vane assemblies. By the time the filters reach the bottom, open end **14***b* of the container, all the tobacco has been shaken from the filters so that tobacco and filters, separated from each other, emerge from the open end **14***b* of the container. The lowermost fixed vane assembly **22** ensures that the filters move downwardly following the final striking of the filters by the lowermost rotating vane assembly **24**. Fixed vane assemblies, rather than rotating vane assemblies, may be positioned at the top and bottom of the container adjacent the entrance and exit zones of the container, as shown in FIG. **2**, to ensure the downward, vertical course of the filters.

Any suitable sieving arrangement, such as the sieving arrangements shown in FIGS. **19—22**, to be described in detail later, may be positioned beneath the lower, open end **14***b* of the container so as to segregate the tobacco and the filters.

It has been found that for the separation of tobacco from conventional filters, the container **14** advantageously may be approximately 3 feet in length and of an inside diameter of approximately 10 to 12 inches. Four assemblies of fixed vanes and three assemblies of rotating vanes have been found to be desirable, with the vertical spacing of the assemblies approximately 2 to 3 inches and with a speed of rotation of approximately 500 to 700 r.p.m. for the rotating vane assemblies.

As noted above, the embodiment of the invention shown in FIGS. **1—4** has been described in its relation to the separation of cigarette filters and tobacco clinging thereto. The apparatus shown may be employed as an impact device suitable for striking any material.

FIGS. **5—10** show another impact device, particularly suitable for the separation of tobacco from enclosing cigarette papers in the reclaiming of tobacco from defective cigarette assemblies. The device of FIG. **5** employs a cylindrical container **30** having an entrance funnel **32** or similar structure attached to the upper end of the cylinder to which material to be struck is applied. A shaft assembly **34** is positioned with the container. As shown, the shaft is hollow and includes an upper cylindrical portion **34***a*, an intermediate frustoconical portion **34***b*, and a lower cylindrical portion **34***c*. Thus the shaft is circular in transverse section, the diameter of transverse sections varying from one end of the shaft to the other. In particular, the diameter increases from the top end of the shaft to the lower end of the shaft.

The shaft **34** is mounted to a drive shaft **36** by means of spiders **38**. The drive shaft **36** is in turn supported for rotation at its lower end by a bearing **40** and spiders **42** which secure the bearing **40** within the cylindrical container **30**. A collar **44** is secured to the drive shaft **36** above top plate **46** closing off the top of the cylindrical container **30** and maintains the shaft **36** in place. A belt drive **48** drives the drive shaft **36**.

Mounted about the hollow shaft **34** are pins **50** which comprise rotating vanes within the cylindrical container **30**. The vanes **50** may be rod-shaped in order to eliminate sharp edges in the impact device and to avoid cutting the material being processed. Fixed vanes **52** (with respect to the container **30**) extend toward the rotating shaft **34** and are advantageously mounted as shown in FIG. **6** on a strap **54**, e.g., by being welded to the strap. A plurality of such straps are positioned about the outside of the container as shown in FIGS. **8**, **9** and **10**. EAch strap extends vertically on the container. The container is drilled or otherwise suitably formed with holes to permit the fixed vanes **52** to extend into the container. As shown in FIG. **6**, the vanes **52** are of varying lengths in order to compensate for the varying diameters of the transverse sections of the supporting shaft **34***a*. In position, the ends of the fixed vanes **52** are all spaced substantially the same distance from the supporting shaft **34**. In the same fashion, the rotating vanes **50** are of varying lengths so that they too are spaced substantially equidistantly from the inner surface of the cylindrical container **30**.

The diameter of the supporting shaft **34** is varied to provide a varying volume for the striking of material as the material passes downwardly through the impact device. At the upper or entrance end of the device, the volume available for striking is much greater than the reduced volume at the lower or exit end of the device. It will also be noted from the sectional views of FIGS. **8**, **9** and **10** that, for succeedingly lower positions in the impact device, the number of vanes (both rotating and fixed) at any level varies. For example, the sectional view of FIG. **8** shows that adjacent the entrance zone of the device there are three rotating vanes **50** at the topmost level of vanes and three fixed vanes **52** at the next lower level. As shown in the sectional view of FIG. **9**, taken below the sectional view of FIG. **8**, there are six rotating vanes **50** spaced circumferentially about the supporting shaft **34** and, at the next lower level, the same number of fixed vanes **52** are spaced circumferentially about the cylinder **30**. As shown by the sectional view of FIG. **10**, taken below the sectional view of FIG. **9**, there are 12 rotating vanes **50** circumferentially spaced about the supporting shaft **34** at each level of rotating vanes and the same number of fixed vanes **52** at each level of fixed vanes. The actual number of vanes shown is exemplary. Varying the number of vanes at different levels in the impact device and varying the striking volume, as described, ensures the smooth downward flow of material through the device. In particular, fewer vanes in a larger volume near the entrance zone permits the material to move initially downwardly through the device without hindrance. By providing an increasing number of vanes in a smaller striking volume, the material is increasingly struck after it has assumed a substantial downward component of motion.

By decreasing the striking volume and increasing the number of rotating vanes for succeedingly lower positions in the impact device, the striking action may be enhanced for certain materials. In particular, in the event that a large chunky material is broken into smaller particles by the action of the device, it is appropriate to provide increasing striking action per unit volume in the container as the particle size decreases during the course of the material through the device to ensure sufficient breakup of the material.

The use of rod-shaped vanes is advantageous in handling some material in which it is desired to strike the material without cutting it. Vanes having flat planar surfaces such as the vanes **22** and **24** shown in FIG. **2** tend to cut the material. The rod-shaped vanes as shown in FIG. **6** are particularly advantageous in the striking of finished cigarettes to reclaim the tobacco therein.

In FIG. **5** it will be noted that the lower end of the hollow vane-supporting shaft **34** is positioned somewhat above the bottom or exit end of the container **30**. As thus positioned the hollow supporting shaft may be employed for the evacuation of dust from the container. With reference also to FIG. **7**, the drive shaft **36** (by a collar **59** pinned to the shaft) supports a plurality of fan blades **60** mounted to the shaft above the upper, open end of the vane-supporting shaft **34**. As the drive shaft **36** is rotated, the blades **60** rotate, as shown by arrow **62** in FIG. **7**, creating a movement of air upwardly through the

hollow vane-supporting shaft **34** which carries dust and other fine particles of waste material upwardly through the shaft. The upper part of the container **30** adjacent the blades **60** communicates with an exit port **64** shown in FIG. **7** to exhaust the fine particles of dust and other waste material from the device. The exhaust action is such as to remove only waste particles and not to suck other material upwardly out of the exit area of the device. Typically all the material to be reclaimed passes downwardly out of the container **30**. However, it will be noted that some material to be reclaimed might be specifically removed by being sucked upwardly through the hollow vane-supporting shaft **34** if desired. It will be appreciated that by varying the number of fan blades **60** and their angular disposition with respect to each other and with respect to the axis of the container, a varying air flow can be provided in order to remove dust or other material from the impact device. Further, a closure valve (not shown) provided in the exit **64** may also provide adjustment of the air flow.

In a representative impact device that was constructed for use in separating tobacco from finished cigarettes, a cylinder approximately 15 inches in diameter and 34 inches long was employed as container **30**. The vane-supporting shaft **34** was roughly 6 inches in diameter and 24 inches long in the cylindrical section **34***a*, increasing to a maximum diameter of 10 inches in the frustoconical portion **34***b* (7 inches long) and remaining at that diameter for a total length of approximately 8 inches in the cylindrical section **34***c*. The number of vanes in the device were as shown and described above in connection with FIGS. **8—10**. The inlet funnel **32** extended approximately 90° around the container **30**. A total of six fan blades **60** spaced 60° apart were employed, and the drive shaft **36** was driven at roughly 725 r.p.m. Rod-shaped vanes about five-eighths inch in diameter as shown in FIG. **6** were employed to strike the cigarettes applied to the impact device. A spacing of about three-eighths inch was maintained between the ends of the movable vanes **50** and the container **30** and between the ends of the fixed vanes **52** and the hollow shaft **34**.

The device appeared to act with a clear impact action on the cigarettes without any substantial cutting. It was observed that a large number of cigarette paper tubes empty of tobacco passed downwardly through the bottom of the container without any tearing of the paper. It is believed that the action of the vanes on the cigarettes was pneumatic. In particular, it will be noted that the tobacco filler in a cigarette is roughly 20 percent solids (tobacco strands) and 80 percent air, and hence is soft and pliable. When the cigarette is struck by one of the rotating vanes, the blow is sufficient to flatten or reduce the dimension of the cigarette at the point of impact. An air pump effect is created, and the air movement within the paper tube virtually blows the tobacco strands out the open end or ends of the tube. With the round rodlike vanes, the paper is not cut substantially, and the spacing between fixed and rotating vanes is sufficient to prevent any scissors action. It is believed that in a device of the dimensions given above, the optimum peripheral speed at the tips of the vanes **50** is from 2200 to 3200 feet per minute, depending on the moisture content of the material operated upon, to separate filter material and tobacco. Too low a speed prohibits complete separation; too high a speed bursts some filters, contaminating the tobacco.

FIGS. **11—13** show an alternative form of impact device involving a particular vane structure to provide for an air flow downwardly through the device to aid in the movement of the material through the device. The impact device employs a container **70**, fixed vanes **72** and a rotating shaft **74** driven by a belt drive **76**. Vanes **78** are affixed to the shaft **74** and strike the material which is applied to the device by a chute **80** positioned adjacent the upper end of the container. The vanes **78** may take the form shown in FIG. **12**, comprising a rodlike portion **78***a* to which is secured a fan blade member **78***b* on the trailing edge of the vane (as noted by arrow **82** designating movement of the vane). The fan blade member **78***b* provides for the downward movement of air through the device as the vane rotates. SUch a movement of air aids in ensuring the downward movement of material through the device and increases the capacity (rate of material flow) of the device. FIG. **13** shows an alternative structure in which vane **78'** is generally of fan blade shape in its entirety. There are no sharp edges in the vane **78'** so as to avoid tearing of the material struck by the vane as well as to provide a good aerodynamic shape.

FIG. **14** shows an alternative form of impact device in which container **84** is of frustoconical shape. In other words, the container is circular in transverse section, with the diameter of transverse sections increasing for succeedingly lower sections in the container. Fixed vanes **86** and rotating vanes **88** are provided as in the other impact devices described. Material to be struck is applied to upper end **84***a* of the device. The device of FIG. **14** is suitable for the striking of material which is "fluffed" i.e., which increase in bulk after being struck. For example, if tightly packed material is struck and expands upon impact, the increasing diameter of the container is advantageous since it accommodates the increase in bulk as the material cascades downwardly through the fixed and rotating vane assemblies.

FIG. **15** shows a form of impact device similar that of FIG. **14**, except that container **84'** is frustoconical with its greatest diameter at the top of the device rather that at the bottom as in FIG. **14**. The container is thus circular in transverse section, with the diameter of transverse sections decreasing for succeedingly lower levels of the d3vice. The device of FIG. **15** is suitable, e.g., in the event that the struck material becomes granular upon impact by rotating vanes **88'**. Because the volume at any cross section in the container decreases as the material passes downwardly through the container, more striking action per unit volume in the container takes place in the lower portion of the container.

Another impact device is shown in FIG. **16**, in this case employing a cylindrical container **90** and vane-supporting shaft **92** which is frustoconical in shape. In other words, the shaft **92**, which supports vanes **94**, is circular in section, with the diameter of transverse sections increasing from the top of the container **90** to the bottom of the container. As in the impact devices previously described, material to be struck is applied to the top of the container. It will be noted that the volume of any section in the container available for the striking of material decreases for succeedingly lower positions within the container, and in this respect the device of FIG. **16** is similar to the device of FIG. **15**. It will also be noted that the lengths of fixed vanes **95** and rotating vanes **94** vary so that the ends of the fixed vanes are all substantially uniformly spaced from the surface of the shaft **92**, while the ends of the rotating vanes **94** are all substantially uniformly spaced from the inner surface of the container **90**.

FIG. **17** shows another impact device in accordance with the invention. Mounted within container **100** are fixed vanes **102**. Rotating vanes **104** are mounted on shaft **106** which is driven by belt drive **108**. It will be noted that ends **104***a* of the rotating vanes extend substantially parallel to the shaft **106**, and that the fixed vanes **102** include portions **102***a* thereof extending parallel to the rotating vane ends **104***a*. This configuration of blades reduces scrubbing of the material against the inner surface of the container **100** inasmuch as the ends of the vanes **104** are spaced a substantial distance from the surface of the container.

FIG. **18** discloses a modified form of container suitable for use in any of the impact devices previously described. Container **109** is typically cylindrical and includes a helical ridge **109***a* on the inside surface thereof. The helical ridge aids in the flow of material downwardly through the container. In particular, it should be noted that as the material is struck by the rotating vane assemblies of the impact devices, the movement of the struck material is outwardly toward the inner surface of the container. As the material is hurled outwardly, it tends to remain suspended in annular rings above each group of rotating vanes. The helical ridge **109***a* directs the material downwardly and thus aids in the flow of material through the

device. It has been found that such a helical ridge increases the capacity of an impact device since it speeds the flow of material through the device.

The ridges are particularly helpful when combined with the shaping of the rotating vanes such as shown in FIGS. **12** and **13** to move air downwardly through the container. Both shaped vanes and helical ridge enhance the passage of material through the container.

FIGS. **19** and **20** show an arrangement suitable for the striking of material and the subsequent classification of material according to size. A material to be struck is applied from a chute **110** to an impact device arrangement **112**. As shown in FIG. **20** the impact device arrangement **112** comprises a series of three separate impact devices **112***a*, **112***b* and **112***c* all disposed to receive material to be struck. EAch of the three impact devices may take the form of any of the impact devices previously described. It will be noted, however, that a single container **114** is employed so that there is communication between the different impact devices. The rotating vane assemblies in each of the devices may rotate in the directions shown by the arrows; e.g., all may rotate in a clockwise direction. A belt drive assembly **116** shown in FIG. **19** may be provided to rotate all of the rotating vane assemblies **117**. Any number of impact devices may be employed, and rotation in any direction may be utilized. If desired, the rotating vane assemblies may be given directions of rotation which differ from one device to another. Although the impact devices communicate with each other by virtue of the single container **114**, the communication does not provide substantial shifting of material from one impact device to another, although such shifting, if it takes place, is not necessarily undesirable.

Although a single container **114** has been shown for the plurality of impact devices employed, a plurality of separate impact devices each within its own container and not communicating with any other device may be used. What is desired in the arrangement of FIG. **20** is to have an impact device arrangement which extends across an entire inlet area, such as provided by chute **110** of FIG. !9, without requiring a single, very large impact device if a relatively large inlet area is encountered.

With a single container such as the container **114** of FIG. **20**, the rotating vanes **117** in adjacent devices must be positioned at different levels along associated shafts **117***a* in order to clear one another in the regions **114***a* of communication between adjacent devices. The difference in height between adjacent levels of vanes in adjacent devices should be sufficient to avoid a scissors action. The spacing between the ends of the rotating vanes **117** of one device and the shaft **117***a* of an adjacent device should be about the same as the spacing between the ends of the vanes and the container **114**.

The material from the impact devices **112**, after being struck, passes downwardly to a vibrating screen assembly **118** shown in FIG. **19** which is vibrated by means of a conventional vibrator **120**. The screen assembly **118** is of a mesh size to pass certain particles of material downwardly through the screen onto a removal conveyor **122**, while particles of a larger size than the mesh size are retained on the screen assembly and withdrawn therefrom through an outlet chamber **124**. The outlet chamber **124** may be provided with a vacuum through a conduit **126** to draw particles of material on the screen assembly **118** into the chamber **124** and out through the conduit **126**. In the processing of tobacco enclosed in cigarette papers, e.g., the impact devices **112** may separate the tobacco from the paper. The mesh size of the screen arrangement **118** may be chosen so that tobacco passes downwardly through the screen onto the conveyor **122** while paper is retained on top of the screen to be drawn into the chamber **124** and passed out through the conduit **126**.

FIG. **21** discloses an arrangement similar to FIG. **19** for the striking of material and the subsequent sieving of material for classification according to size. One or more impact devices **130** of the type described above are positioned to receive material to be struck from a chute **132**. A drive mechanism **134** drives the rotating vane assemblies (not shown) in the impact structure **130**. Material struck in the impact structure passes downwardly through an outlet chute **136** into a rotating screen assembly **138** shown as comprising an outer cylindrical drum **138***a* and inner cylindrical screens **138***b* and **138***c*. Screens **138***b* and **138***c* and the cylindrical drum **138***a* are all mounted concentrically with respect to each other by any suitable mounting arrangement (not shown), and both screens and drum are rotated by a drive **140** which drives rollers **140***a* that engage the drum. Exit and **136***a* of the chute **136** discharges material from the impact structure **130** inside the innermost screen **138***c*.

As an example, assume that rejected filter cigarettes are being processed by the impact structure **130**. The mesh sizes of the screens **138***b* and **138***c* are chosen so that the screen **138***c* retains cigarette papers and filters therein to be discharged from the lower end thereof as shown by arrow **140**. Tobacco passes through the screen **138***c* but is retained within the screen **138***b* to pass outwardly from the lower end thereof as shown by arrow **142**. Fine scrap and dust pass through the screen **138***b* and are retained within the drum **138***a* from which they pass out the lower end thereof as shown by arrow **144**.

In FIG. **21** a cyclone **146** is employed which is connected by a conduit **148** to the upper end of the impact structure **130**. The conduit **148** corresponds to the exit port **64** shown in FIG. **7** and serves to withdraw fine dust and air from the lower end of the impact structure **130**, as explained above with respect to the impact device of FIG. **5**. Fine particles of material are returned via conduit **150** to the outlet chute **136** from the impact structure to be applied to the screen arrangement **138**. OUtlet **152** from the cyclone is a conventional clean air outlet.

FIG. **22** shows an arrangement similar to that of FIG. **21** involving a different screen arrangement. One or more impact devices **153** of the type described above discharge material downwardly into a screen arrangement **154** comprising an open topped container **156** closed by a bottom plate **156***a* and including two screens **158** and **160**, one over the the other, therein. The screen **158** corresponds to the screen **138***c* of FIG. **21**; the screen **160** corresponds to the screen **138***c* of FIG. **21**. An outlet **162** discharges material from above the screen **158**, an outlet **164** discharges material from above the screen **160**, and outlet **166** discharges material from above bottom plate **156***a*. The entire screen arrangement **154** is mounted by springs **168** onto a base structure **170**. As shown in FIGS. **22** and **23**, bottom plate **156***a* also includes a downwardly extending cylindrical housing **172** inside of which is mounted a motor **174** whose shaft includes eccentric weights **176***a* and **176***b*. The motor is energized to rotate the eccentric weights. The angular spacing of the eccentric weights on the motor shaft may be varied in conventional fashion to provide any desired degree of eccentricity in order to provide for vibration as the weights are rotated, as is well known. In this fashion, the screen arrangement **154** of FIG. **22** is continuously vibrated as material is applied thereto by the impact structure **153**. Particles of coarse material are retained on top of the screen **158** and removed from the exit **162** while finer particles pass through the screen **158**. Some of these finer particles are retained on top of the screen **160** and pass through the exit **164**. Finally, dust and other very fine particles pass through the screen **160** and are retained on top of the bottom plate **156***a* to pass from the screen arrangement through the exit **166**.

Preferred embodiments of the invention have been described above. It will be understood that modifications of the apparatus shown may be made. Accordingly, the invention should be taken to be defined by the following claims.

I claim:

1. A method of separating a product having multiple separate fragments with air spaces therebetween from a wrapper enclosing the product, said wrapper having a portion thereof which provides substantially little resistance to the movement of the product therethrough, comprising striking

the wrapper with blows sufficient to reduce the cross-sectional dimension of the wrapper at the zones of impact and without tearing said wrapper to create an air pump effect within the wrapper to discharge the product out of said portion of the wrapper.

2. A method as recited in claim 1 in which the product is cigarette tobacco and the wrapper is cigarette paper.

3. A method of separating tobacco from cigarette pieces such as cigarette filters, cigarette wrappers and the like, comprising passing the cigarette pieces through a container having a solid wall portion and vanes extending inwardly from said solid wall portion and past a central rotating shaft having outwardly extending vanes alternating with said first-mentioned vanes so that said cigarette pieces strike the vanes and the solid wall to achieve said tobacco separation, the speed of rotation of said shaft and the spacing of said vanes being such that the cigarette wrappers remain untorn.

4. A method according to claim 3, wherein the rotating vanes are rotatable about an axis in line with the direction of movement of cigarette pieces through the container.

5. A method according to claim 3, wherein the cigarette pieces are moved by gravity through the container whose axis is oriented in a vertical direction.

6. A method according to claim 3, wherein the cigarette pieces are passed through a container whose effective volume diminishes at succeeding positions therein.

7. A method according to claim 3, wherein air is extracted from inside the container.

8. A method according to claim 3, wherein the material emerging from the container is sieved to segregate tobacco from other material.

9. A method according to claim 5, wherein tobacco is removed downwardly from the lower end of the container, and an air flow is created from the lower end of the container to the upper end of the container to remove dust or other fine material from said lower end upwardly through said container and out of said upper end.