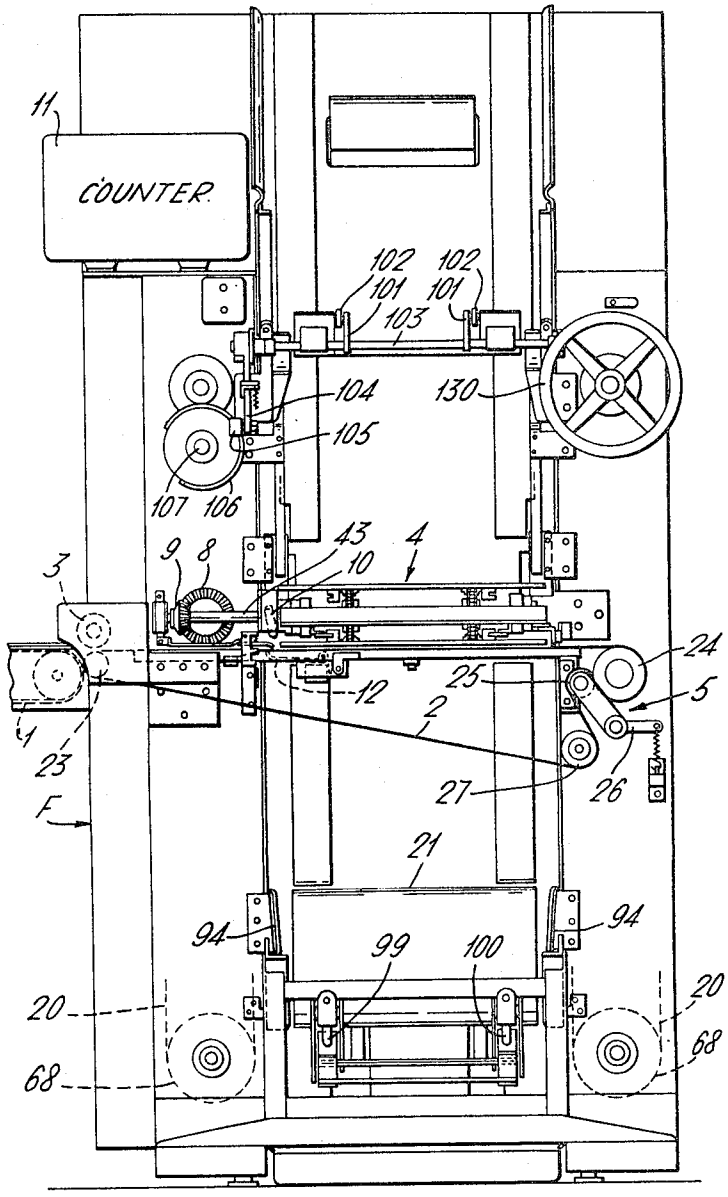
May 21, 1968 G. DEARSLEY 3,383,830

CIGARETTE CATCHING MECHANISM

Filed Jan. 28, 1964 7 Sheets-Sheet 1

Fig. 1.



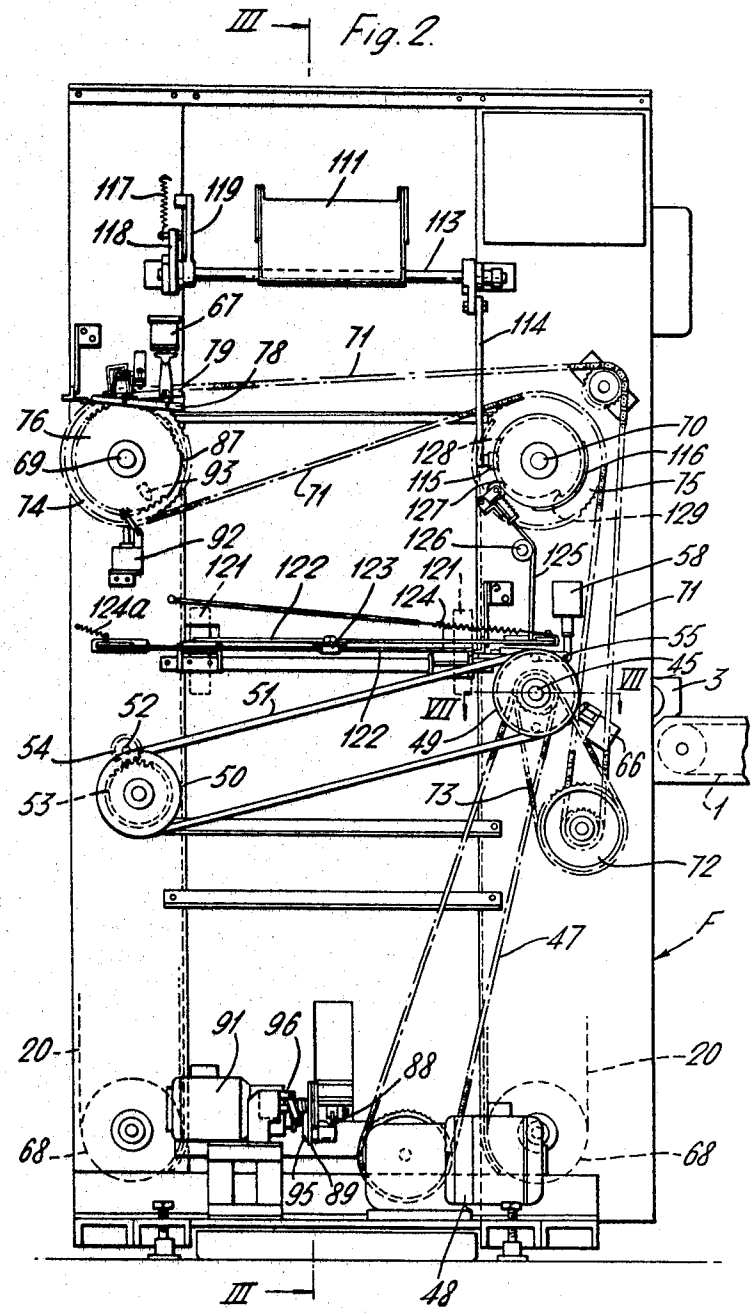

INVENTOR
GEORGE DEARSLEY
BY
Wentworth B. Clapham
ATTORNEY

May 21, 1968 G. DEARSLEY 3,383,830

CIGARETTE CATCHING MECHANISM

Filed Jan. 28, 1964 7 Sheets-Sheet 2

Fig. 2.




INVENTOR
GEORGE DEARSLEY
BY
Wentworth B. Clapham
ATTORNEY

May 21, 1968 G. DEARSLEY 3,383,830

CIGARETTE CATCHING MECHANISM

Filed Jan. 28, 1964 7 Sheets-Sheet 3

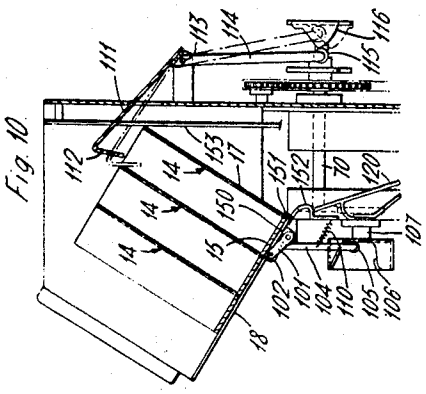



Fig. 10

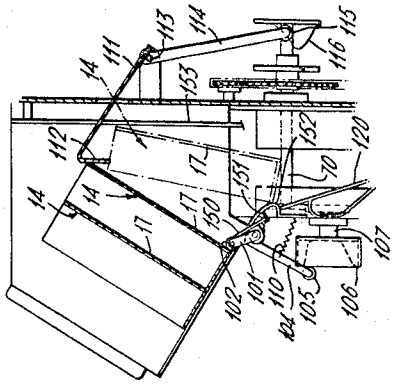



Fig. 11.

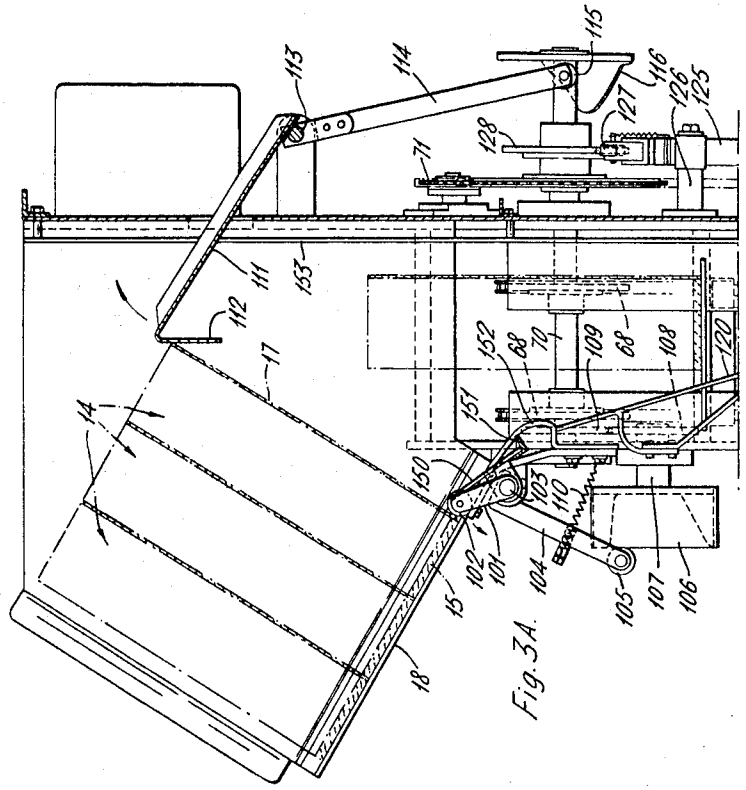



Fig. 3A.

INVENTOR
GEORGE DEARSLEY
BY
Wentworth B. Clapham
ATTORNEY

May 21, 1968 G. DEARSLEY 3,383,830

CIGARETTE CATCHING MECHANISM

Filed Jan. 28, 1964 7 Sheets-Sheet 4

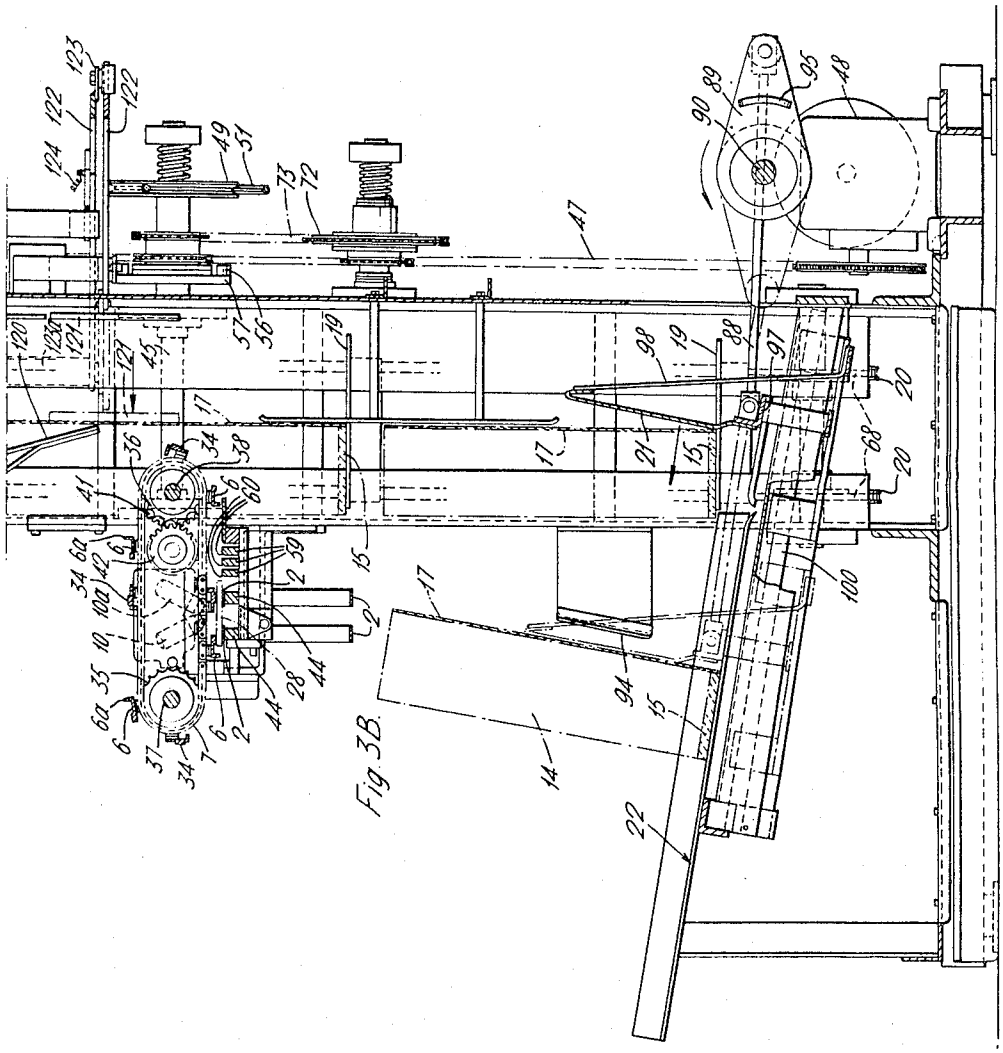


Fig 3B.

INVENTOR
GEORGE DEARSLEY
BY
Wentworth B. Clapham
ATTORNEY

May 21, 1968 G. DEARSLEY 3,383,830

CIGARETTE CATCHING MECHANISM

Filed Jan. 28, 1964 7 Sheets-Sheet 5

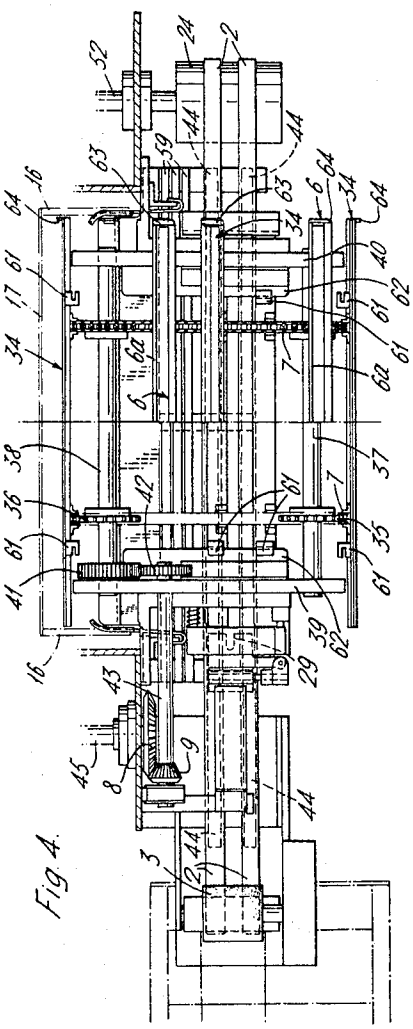


Fig. 4.

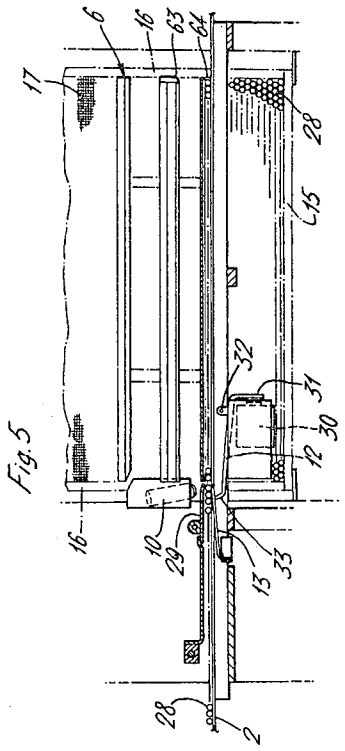


Fig. 5

INVENTOR
GEORGE DEARSLEY
BY
Wentworth B. Clapham
ATTORNEY

May 21, 1968 G. DEARSLEY 3,383,830

CIGARETTE CATCHING MECHANISM

Filed Jan. 28, 1964 7 Sheets-Sheet 6

Fig. 6.

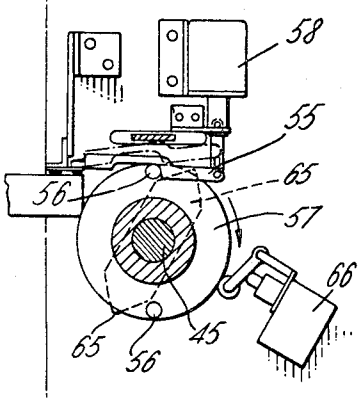



Fig. 7.

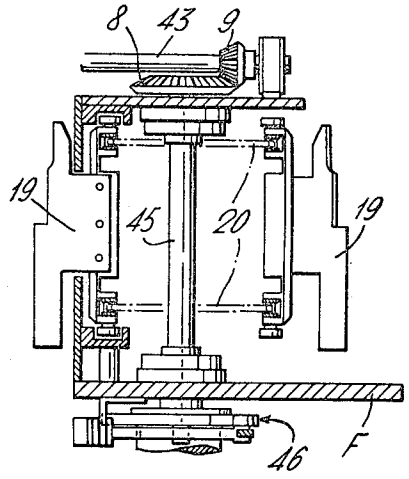



Fig. 8.

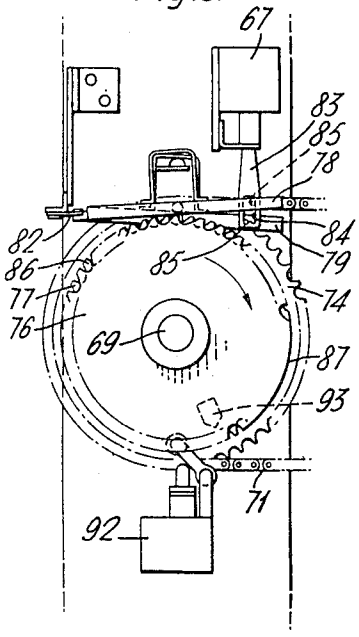
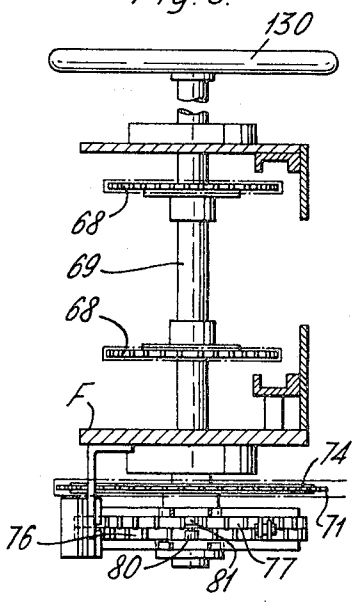



Fig. 9.




INVENTOR
GEORGE DEARSLEY
BY
Wentworth B. Clapham
ATTORNEY

May 21, 1968 G. DEARSLEY 3,383,830

CIGARETTE CATCHING MECHANISM

Filed Jan. 28, 1964 7 Sheets-Sheet 7

Fig. 12.

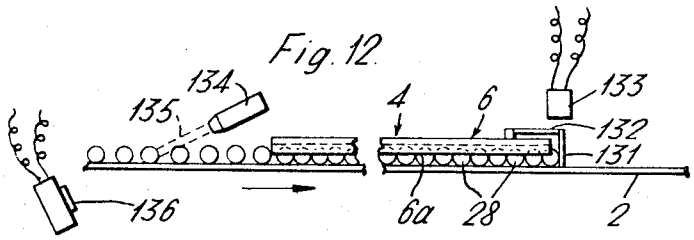



Fig. 13.

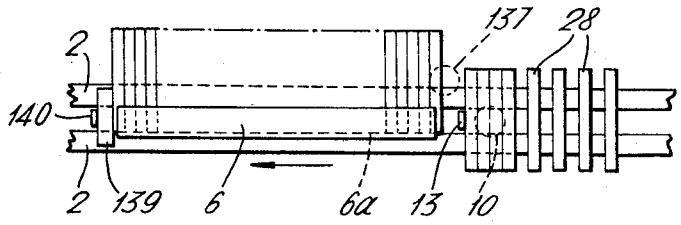
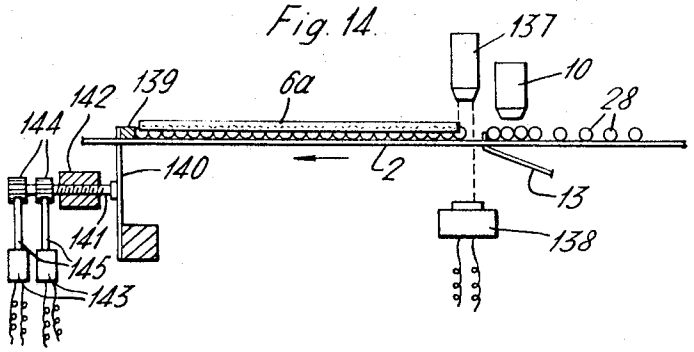



Fig. 14.




INVENTOR
GEORGE DEARSLEY
BY
Wentworth A. Clayton
ATTORNEY

United States Patent Office 3,383,830 Patented May 21, 1968



3,383,830

# CIGARETTE CATCHING MECHANISM

George Dearsley, Richmond, Va., assignor to American Machine & Foundry Company, a corporation of New Jersey

Filed Jan. 28, 1964, Ser. No. 343,180
Claims priority, application Great Britain, Feb. 25, 1964, 7,524/63
18 Claims. (Cl. 53—78)

This invention relates to the handling of articles carried by a continuously moving conveyor, and is particularly directed to the provision of new or improved apparatus for removing articles from such a conveyor in batches. Such an operation has frequently to be carried out, of course, at some stage in the manufacture of articles of the most varied kinds, such as for example at a stage when the finished articles issuing from a final manufacturing step are to be transferred to containers for transportation or storage.

Thus, according to the invention there is provided apparatus for removing articles from a continuously moving conveyor in batches each consisting of a predetermined number of articles, comprising a batch removal station to which articles are, in operation, led by such conveyor, sweep means at said removal station, such sweep means being mounted for movement transverse to the direction of movement of the conveyor and operative upon such movement to sweep articles at the removal station from the conveyor, and means adapted to sense the presence of a batch of articles at the removal station and, upon sensing the same, to cause operation of said sweep means to sweep such batch from the conveyor.

Although in some circumstances apparatus according to the invention may include its own conveyor for receiving articles and feeding them to the said removal station, it should be clearly understood that the invention is not limited to apparatus having such a conveyor but may provide apparatus for use in conjunction with other mechanism having such a conveyor which is capable of delivering articles to the article removal station of apparatus according to the invention.

The apparatus may be so constructed as, in operation, to remove batches of articles whilst the latter are moving on a conveyor and may then, for example, simply include sensing means for counting the number of articles entering the removal station at the upstream end thereof and operating the said sweep means after a number of articles corresponding to one batch has entered the removal station. However, such an arrangement may not always be satisfactory, particularly if the spacing of articles being delivered on the conveyor is liable to variation as in such circumstances it would not be possible to determine a maximum length for the removal station and sweep means. Preferably, therefore, and in accordance with a further feature of the invention, the apparatus includes means adapted to arrest the movement of the most downstream article in each batch when such article arrives at the downstream extremity of the removal station.

In this way the position of the downstream end of each batch of articles will be defined, and succeeding articles of the batch will pile up against one another until such time as the batch is completed and the sweep means is caused to operate. At such time, however, it is not of course necessary for all of the articles in the batch to have piled up against one another unless, of course, it is desired that all the articles in each batch should be resting against one another in a continuous row when the batch is removed. In practice, however, the latter arrangement will usually be preferred.

When the articles pile up against one another in this way considerable downstream pressure may be built up along the row of articles by reason of the conveyor moving past beneath them, which may result in the articles at the downstream end of the batch tending to be crushed or otherwise damaged. It is therefore preferred that the construction of the arresting means and the conveyor, if the latter is included in the apparatus of the invention, should be of the kind described in our U. S. Patent No. 3,270,856 in which the arrangement is such that the building up of any such undesired pressure is prevented or considerably reduced.

If desired the said arresting means may comprise a fixed stop adapted to lie permanently in the path of the conveyor-borne articles at the downstream end of the removal station. Preferably, however, and in accordance with a further feature of the invention, the arresting means is mounted on the sweep means or a part movable therewith.

The sweep means will desirably include a plurality of simi ar sweep members mounted for movement in a closed path so that, in operation, each sweep member in turn is operated to sweep a batch of articles from the conveyor. The construction and operation of the sweep means will then preferably be such that its movement to cause one sweep member to remove a batch of articles automatically results in the movement of the succeeding sweep member into a position ready to remove the next batch. In this case, where the arresting means is associated with the sweep means as aforesaid each sweep member will be provided with its own arresting member in the form of a stop mounted at the downstream end thereof.

Where article arresting means are provided the sensing means of the invention may be in the form of a device adapted to detect the piling up of articles at the upstream end of the article removal station, as will occur when the removal station is full. Such a device could comprise a combination of a light source and a photoelectric cell positioned to lie, in operation, on opposite sides of the stream of articles moving on the conveyor so that when the articles pile up the light beam is cut off and a signal is transmitted to the sweep means to operate the same.

Alternatively the sensing means may comprise a device situated upstream of the removal station for counting the articles as they pass and adapted to actuate further stop means to cut off the stream of articles at a point upstream of the removal station when a number of articles constituting one batch has passed such stop means, release mechanism for such stop means being provided and being automatically actuable in consequence of the removal of each batch from the conveyor so as to initiate the delivery of articles in the next succeeding batch. In this case the sensing means may again take the form of an electronic device.

In some circumstances, and where the arrangement is such that the articles of each batch form a continuous row with no gaps between adjacent articles when they are removed from the conveyor, it may be desirable to locate the position of the batch very accurately relatively to the sweep means; such a circumstance may arise, for example, when the articles being treated are comparatively small and are also liable to slight variation in size, as then an inadvertent increase in the size of the articles fed to the apparatus may result in the last or most upstream article of a batch being missed by the sweep means and thus not removed from the conveyor. Such an occurrence would, of course, result in the batch being one article short and in the succeeding batch possibly being too large if a counting device is employed. Preferably, therefore, and in accordance with a further feature of the invention, where the apparatus includes article arrest-

ing means, the apparatus may include a further sensing device adapted to scan the position of the upstream extremity of the most upstream article in each batch when the latter is ready for removal and to cause the position of said arresting means to be adjusted in consequence thereupon so as correctly to locate the batch of articles relatively to the sweep means.

Very conveniently, and in accordance with a further feature of the invention, additional means may be arranged to transmit a visual signal dependent on the position of the adjustable arresting means which signal will thus indicate variations in the size of articles being fed to the apparatus. Such a signal could indicate to an operator that articles of a size smaller than a predetermined minimum or larger than a predetermined maximum are being produced by article manufacturing apparatus from which the articles are fed to the apparatus of the invention, as a result of which the operator may make any necessary adjustments to such manufacturing apparatus; alternatively or in addition the signal from such additional means could be arranged automatically to cause suitable adjustment of the manufacturing apparatus to compensate for discrepancies in article size.

Where the first-mentioned sensing means is of the kind adapted to detect the piling up of articles at the upstream end of the article removal station, the said further sensing means will conveniently be arranged to one side of said articles fed to the removal station so as to scan the upstream extremity of the most upstream article during its removal from the conveyor, as before such removal a good view of the said extremity may not be obtainable due to the presence of the next succeeding article adjacent thereto. Where the first-mentioned sensing means comprises a counting device and associated stop means the said further sensing device may, however, be aligned with the article stream as the article which it has to scan will have been separated from the next succeeding one by said stop means.

The invention also extends to the provision of such apparatus for sensing article size when used alone and thus, viewed from another aspect, provides apparatus for sensing variations in the size of articles delivered from manufacturing apparatus in a single stream on a continuously moving conveyor, comprising means operatively to arrest an article in such stream so as to cause succeeding articles to pile up behind the arrested article to form a continuous row, first sensing means adapted to transmit a signal when the row contains a predetermined number of articles, and further sensing means adapted to scan the position of the upstream extremity of the most upstream article in the completed row and to transmit a signal dependent on such position. Here again the last-mentioned signal may be a visible one to indicate to an operator that steps should be taken to correct the size of the articles being manufactured or, alternatively, it may be arranged to control the article manufacturing apparatus automatically.

The apparatus of the invention has particular utility in the removal of articles from a conveyor and their stacking in containers for storage or transportation. In such circumstances it may be desired, where the articles are of a suitable shape, to stack them in nested relationship, i.e. with the articles of each succeeding stacked row offset from the articles in the preceding row by half of the width of one article. Each such row will, of course, be constituted by a batch of articles as delivered by the apparatus of the invention, and such offsetting of successive batches may be accomplished by providing means whereby the position of the said arresting means, and thereby the location of the batch on the conveyor, alternates between two positions longitudinally of the conveyor to offset succeeding batches.

Where the arresting means is separate from the said sweep means it may then be movably mounted and provided with means for alternating its position between the removal of each successive batch of articles. Where an arresting member is associated with each sweep member of the sweep means, however, the positions of the arresting members on the sweep members will be suitably arranged to locate each successive batch longitudinally of the conveyor as desired.

It will be understood, moreover, that the apparatus of the invention may be arranged to stack articles in such manner that alternate rows in the stack contain one more article than the intervening rows. Such an effect may easily be accomplished by suitable arrangement of the arresting means to offest alternate batches of articles and by adapting the sensing means to admit one more article to the removal station in alternate batches. It should therefore be clearly understood that the invention extends to apparatus in which the number of articles in alternate batches removed thereby from a conveyor is one more than the number in each intervening batch.

A further object of the invention is to provide means for automatically stacking batches of articles, removed from a conveyor by the apparatus already referred to, in containers for transportation or storage. Thus, in accordance with another feature of the invention, the apparatus may include movable means adapted to support a container in a position to receive the batches of articles removed from a conveyor, and means adapted automatically to adjust the position of said support means between the removal of each successive batch of articles so as, in operation, to cause such batches to be stacked one upon another in such container. Such adjusting means will preferably be controlled consequent upon movement of the sweep means of the apparatus, to index the said support means downwardly by approximately the depth of one article immediately after the operation of the sweep means to move a batch of articles into a container; in a preferred form of the invention a microswitch adapted to control operation of such adjusting means is associated with the control for the sweep means so as to be operated thereby.

It will, of course, be necessary for each full container to be removed and replaced by an empty one during operation and the apparatus will therefore preferably include a plurality of container supports movable around a closed path; means may also be provided for automatically supplying empty containers to the apparatus from a store thereof and for removing full containers therefrom. In such circumstances the said container support adjusting means will be arranged to index the container supports through a suitable increment when a container at the article removal station has been filled, so as to move an empty container into position to receive succeeding batches of articles; it is preferred that such container replacement should be carried out without interrupting the removal of articles from the conveyor and the said adjustment means will therefore preferably be adapted to index the container supports through a suitable container replacement increment during the period which normally elapses between the removal of successive batches of articles from a conveyor.

Such container replacement may be initiated in any of a number of ways; thus in one form of the invention the apparatus may include suitable sensing means such as an electronic eye adapted to sense the height of the stack of articles in a container being filled and to cause indexing of the container supports to replace the container when such stack reaches a predetermined height. In a preferred form, however, the sensing means which controls the entry of articles to the removal station will also be arranged to count the number of batches swept into the container and to cause the latter to be replaced when a predetermined number of batches have been stacked therein.

The apparatus may include means for rejecting some of the stream of articles being fed thereto, if the articles should be faulty for example. Such means may comprise

a manually operable control for withdrawing the said arresting means out of alignment with the stream of articles, where the arresting means is separate from the sweep means, so as to allow faulty articles to flow past the removal station. In the case of some kinds of articles, such as cigarettes for example, the presence of a fault in the article manufacturing apparatus, and the consequent production of faulty articles, will frequently cause an unusually wide gap to occur in the stream of articles fed to the apparatus; the apparatus may then include means adapted to sense the occurrence of such a gap and thereupon automatically to cause such withdrawal of the arresting means, such as by transmitting a suitable electrical signal to the latter. The latter sensing means may, for example, take the form of a light source and a photo-electric cell arranged to lie, in operation, one above and the other below a stream of articles with the path of the light oblique to the stream so that it will be cut off by the articles when they are closely spaced but will be able to shine through any unusually large gap occurring between successive articles so as to actuate the cell.

In order that the invention may be more readily understood one embodiment of the same, together with certain modifications thereof, will now be described by way of example and with reference to the accompanying drawings, in which:

FIG. 1 is a front elevation of the apparatus;

FIG. 2 is a rear elevation thereof;

FIGS. 3A and 3B are upper and lower parts respectively of a side elevation of the apparatus, partly in cross-section on the line III—III of FIG. 2;

FIG. 4 is a plan view of the sweep means of the apparatus;

FIG. 5 is a front elevation, partly in section, of such sweep means and associated parts;

FIG. 6 is an enlarged view in elevation of the control for the sweep means;

FIG. 7 is a section on the line VII—VII of FIG. 2, showing the parts on the front face of the apparatus frame;

FIG. 8 is an enlarged view in elevation of the means for controlling the movement of containers through the apparatus;

FIG. 9 is a plan view, partly in section, of the apparatus of FIG. 8;

FIGS. 10 and 11 are side elevations of the upper part of the apparatus, showing the process of feeding trays into the apparatus;

FIG. 12 shows, in diagrammatic form, a modification of the apparatus embodying a mechanism for rejecting faulty articles; and

FIGS. 13 and 14 show diagrammatically, in plan and side elevation respectively, a further modification of the apparatus.

The embodiment of the invention to be described is one particularly adapted to remove batches of cigarettes, rods of filter tip material or similar rod like articles from a conveyor and stack them in trays for storage.

The parts of the apparatus will first be described in general fashion and their operation then explained in greater detail.

The cigarettes are delivered to the apparatus, the various parts of which are carried by a main frame F, in a single stream with their axes approximately perpendicular to their direction of movement, and lying on a conveyor **1** (see FIGS. 1 and 2). The conveyor **1** will usually be the so-called "catcher band" of a cigarette making machine on which, in the past, finished cigarettes have been delivered to an operator who removed them from the catcher band manually and stacked them in the above-mentioned trays. In this embodiment, the apparatus of the invention has its own conveyor **2** to which cigarettes are transferred from the catcher band conveyor **1** by passing under a roller **3** driven in synchronism with the conveyor **2** and having a surface formed of resilient material such as expanded plastic so as not to crush the cigarettes. It should be understood, however, that the apparatus of the invention could be adapted to remove cigarettes directly from a cigarette machine catcher band and the conveyor **2** thus omitted.

The conveyor **2** comprises two separate endless bands (see FIG. 4) which pass through an article removal station generally indicated at **4** (FIG. 1) where batches of cigarettes are, during operation, swept from the conveyor **2** into containers. Downstream of the removal station the bands **2** pass through tensioning mechanism **5** of known form.

At the removal station **4** sweep means are provided for sweeping batches of cigarettes from the conveyor **2**, such sweep means comprising four sweep bars **6** carried by a pair of endless chains **7** (FIGS. 3B and 4) driven through a crown wheel **8** and pinion **9** (FIG. 1). The sweep bars **6** are formed with flanges **6***a* to engage the ends of cigarettes at the removal station and operative to sweep the same from the conveyor bands **2**.

Means are provided for sensing the presence of a complete batch of cigarettes at the removal station **4**, comprising a photo-electric device **10** which transmits signals to a counting device **11** as the cigarettes pass under it on the bands **2**. The counting device is arranged to operate stop means in the form of arms **12** and **13** movable in a vertical plane and arranged between the bands so that the arm **13** may be raised by the arm **12** into the stream of cigarettes to cut off the flow when a complete batch has been delivered to the removal station.

Containers to receive the cigarettes removed from the conveyor **2**, in the form of trays **14** each formed with an end wall **15**, two side walls **16** and a perforated metal base **17**, are stored on a platform **18** at the top of the apparatus (FIG. 3A). Means are provided for transferring the trays one by one to supports **19** (FIGS. 3B and 7) mounted in opposed pairs on two pairs of endless chains **20** at opposite sides of the apparatus. Means including a pusher plate **21** (FIG. 3B) are provided at the bottom of the apparatus for ejecting filled trays therefrom up a sloping ramp **22** from which the trays will be removed by an operator.

The operation of the various parts of the apparatus will now be described in greater detail.

Referring first to the romoval station **4**, shown in FIGS. 1 and 3B, and in more detail in FIGS. 4 and 5, the conveyor bands **2** run around a roller **23** adjacent the downstream end of the conveyor **1**, through the removal station **4**, around a roller **24**, over a tensioning roller **25** mounted on a spring-urged bell crank lever **26**, and around a roller **27**. Where they pass through the removal station the bands **2** are supported on bars **44** the downstream end parts of which may be pivotally mounted in the manner disclosed in U.S. Patent No. 3,270,856 mentioned hereinbefore.

Upon entering the removal station the cigarettes **28** pass under a pivotally mounted plate **29** arranged to cooperate with the arm **13** to cut off the flow of cigarettes when such arm is raised by the arm **12** as mentioned above. As they enter the removal station the cigarettes are counted by reflected light from light source **10***a* to photoelectric cell **10** which transmits an impulse to counter **11** until, when a number of cigarettes constituting one batch, i.e. so many as will fill one row in a tray **14**, have passed, the counter **11** transmits a signal to operate an electromagnet **30** to pivot the arm **12**, by way of an extension **31** thereof, clockwise about the mounting **32** of the arm so as to raise its upwardly bent end **33** between the bands **2** causing it to raise arm **13** into the stream of cigarettes to prevent any more cigarettes entering the removal station.

In the sweep means at the removal station each sweep bar **6** is paired with a further bar **34** arranged to overlie the ends of the cigarettes in a batch which are adjacent the

tray whilst the latter are being assembled in the removal station (see FIG. 3B) so as to prevent their piling up upon one another.

In order to enable the apparatus readily to be used for cigarettes of different lengths bars **59**, three are shown for example, having beveiled edges **60** (FIG. 3B) are provided at the removal station. These bars are adjustable depending on the length of cigarette and the bevelled edge **60** serves to facilitate movement of a batch towards and into a tray under the influence of the sweep bars **6**.

The sweep bars **6** and their associated control bars **34** each carry a pair of slotted lugs **61** which, during the time when such bars are in the operative positions of their movement adjacent a batch of cigarettes, embrace rails **62** so as correctly to locate the bars vertically, relatively to the cigarettes.

Each of the bars **6** and **34** is provided at its downstream end with integral arresting means in the form of relatively thick stops **63** and relatively thin stops **64** on alternate pairs of bars. As each batch of cigarettes is assembled the downstream one engages against stops **63** or **64**, the differing thicknesses of which cause each succeeding batch to be longitudinally offset by half a cigarette diameter relatively to the preceding and succeeding batches so as to cause the cigarettes of each batch to be stacked in nested relationship in the trays **14** as may be clearly seen from FIG. 5.

The chains **7** carrying the sweep bars **6** and bars **34** travel around respective pairs of toothed wheels **35** and **36** mounted on shafts **37** and **38** journalled in frame members **39** and **40**, the shaft **38** also mounting a toothed wheel **41** driven by a further toothed wheel **42** mounted on a shaft **43**. The latter shaft carries the pinion **9** driven by the crown wheel **8**.

The crown wheel **8** is mounted on a shaft **45** (FIGS. 6 and 7) journalled in bearings in the frame F and driven at its rear end through a slipping clutch mechanism **46** by a chain drive **47** connected to a main driving motor **48** of the apparatus (FIG. 2). The chain drive **47** drives a wheel **49** in continuous rotation to drive a further wheel **50** through a belt **51**, the wheel **50** driving a shaft **52** (FIG. 4) through gears **53** and **54** so as to drive the roller **24** carrying the conveyor bands **2**. The latter bands are thus driven continuously.

The shaft **45** is normally held against rotation by a cranked latch arm **55** (FIG. 6) engaging over one of two pins **56** situated on a disc **57** keyed to such shaft, the latch arm **55** being spring mounted and so biased into its pin engaging position. The free end of the arm **55** is, however, connected to a solenoid **58** which is controlled by the counter **11** so that, simultaneously with the complete assembly of a batch of cigarettes at the removal station and the cutting off of the flow by the arms **12**, **13**, the solenoid **58** is operated for a very brief period sufficient to lift the latch arm **55** and thus permit rotation of the disc **57** and shaft **45** through 180° in the direction of the arrow (FIG. 6). The sweep means is thereby driven through one cycle to sweep the assembled batch of cigarettes into a tray **14** and to move the succeeding sweep bar **6** and its co-operating bar **34** into a position to receive the next batch.

As the disc **57** rotates, one of a pair of cams **65** carried thereby operates a microswitch **66** which in turn operates a solenoid **67** (FIGS. 2 and 8) which causes operation of the tray indexing mechanism to lower the tray **14** which is being filled to a position to receive the next batch of cigarettes.

The chains **20** previously mentioned, on which the tray supports **19** are mounted, are carried on toothed wheels **68** (FIGS. 2 and 9) the upper ones of which wheels are mounted on shafts **69** and **70**. The latter shafts are driven in rotation intermittently by an endless chain **71** which takes its drive from a toothed wheel **72** through a slipping clutch mechanism, the wheel **72** being driven continuously through a chain **73** from the shaft **45**. The chain **71** passes over further toothed wheels **74** and **75** on the shafts **69** and **70**.

A control wheel **130** is provided at the front end of the shaft **69**, which may be used to index the tray supports manually if desired, e.g. if some fault should occur which necessitates adjustment of the apparatus parts to a particular position in order to rectify it.

Rotation of the shafts **69** and **70** to drive the chains **20** and thus index the trays **14** downwardly is prevented, during the assembly of each batch of cigarettes at the removal station, by a mechanism associated with the shaft **69** and comprising a pair of similar ratchet wheels **76** and **77** keyed coaxially to such shaft in face-to-face relationship and offset from one another by a distance equal to half a tooth's width as may be seen from FIG. 8. Two pawl arms **78** and **79** carrying lugs **80** and **81** respectively are mounted above the wheels **76** and **77** with their lugs in respective alignment with the latter, and are mounted on spring strips **82** so as to be biased downwardly. The lugs **80** and **81** are offset from one another longitudinally of the arms **78** and **79**, again by a distance corresponding to half of the width of a tooth on the wheels **76** and **77**, so that when one lug (e.g. **81** as seen in FIG. 9) is resting between two of such teeth on one wheel the other will be resting on top of an adjacent tooth on the other wheel. The solenoid **67** has an operating arm **83** formed with an opening **84** which receives pins **85** on the arms **78** and **79** so that, when the solenoid is actuated by the microswitch **66** as mentioned above, it lifts whichever of the arms **78** and **79** has its lug resting between two teeth and thus allows the wheels **76** and **77** and the shaft **69** to be driven in rotation for a very short distance, i.e. until the lug on the other arm falls between two teeth to arrest such rotation, whilst the first arm remains in its elevated position with its lug resting on top of a tooth for the process to be repeated.

If it is found that the trays are not being indexed downwardly by a sufficient amount of each operation of the device of FIGS. 8 and 9, or if it is desired to reduce the number of batches of cigarettes fed into each tray, one or more stops **86** (FIG. 8) may be placed between two teeth on one of the wheels **76** and **77** so as to prevent the associated lug **80** or **81** from dropping between such teeth and thus causing the wheels to rotate by a double increment one or more times in every rotation of the wheels **76** and **77**.

A toothless portion **87** of each of the wheels **76** and **77** causes the trays to be indexed downwards by a distance sufficient to replace a full tray by an empty one at suitable intervals; it will thus be understood that the total number of spaces between the teeth on the two wheels **76** and **77** together will be equal to the number of batches of cigarettes to be stacked in each tray.

The above-described arrangement of face-to-face ratchet wheels **76** and **77** paired with pawl arms **78** and **79** has the important advantage of providing means which enable the shaft **69** to be rotated through a large number of small increments interspersed by fast movement through a relatively large increment at predetermined intervals, by means of a simple and compact control mechanism. It will be clear that the achievement of a similar control by means of a single pawl and ratchet arrangement would necessitate the use of a very much larger ratchet wheel.

As already mentioned, means are provided for removing a previously filled tray from the bottom of the apparatus, including a pusher plate **21** which engages the tray to be removed. The plate **21** is connected by a rod **88** to a sector-shaped plate **89** mounted on a shaft **90** driven by a secondary motor **91**.

The motor **91** is started at a suitable point in the cycle by a microswitch **92** below the wheel **74**, the latter carrying an operating lug **93** for the microswitch. It will thus be seen from FIG. 8 that the microswitch **92** is operated when the succeeding tray is approximately one third full.

Upon starting, the motor **91** rotates the shaft **90** to move the pusher plate **21** forward to the position shown in dotted lines in FIG. 3B where the filled tray is retained by spring fingers **94** which move into position behind it. The pusher plate is then retracted by further rotation of shaft **90** until it returns to its rest position, when a lug **95** on the plate **89** operates a microswitch **96** (FIG. 2) on the motor **91** to stop the latter.

The pusher plate **21** is carried on an angle bar **97** and supported by arms **98** which run on rails **99** and **100** of the ramp **22**.

The mechanism by means of which empty trays are fed into the apparatus is shown in FIGS. 3A, 10 and 11 and basically comprises means for allowing trays on the platform **18** to drop one by one on to tray supports **19**, and means for restraining succeeding trays on the platform until they are required. The first of such means comprises a pair of levers **101** carrying rollers **102** which engage the base **17** of the tray to be fed near to its end wall **15** (FIG. 3A). The levers **101** are keyed to a shaft **103** carrying a further downwardly extending lever **104** which mounts a cam follower roller **105** riding on a rotary cam **106** at the front of the apparatus. Shaft **103** also carries in fixed relation to arm **101** a flat plate **150** terminating in an upwardly extending lip **151**. On the frame of the machine there are fixed two curved plates **152**, these plates being disposed on either side of the ends of lip **151**. The cam **106** is mounted on a shaft **107** driven through gear wheels **108** and **109** (FIG. 3A) from the shaft **70** which, as already described, is driven intermittently by the chain **71**. Thus, at an appropriate time in the apparatus cycle the lever **104**, which is biased towards cam **106** by a spring **110**, is permitted by the cam **106** to rotate anticlockwise as seen in FIG. 3A so as to rotate shaft **103** and move the levers **101** in the direction of the arrow so as to release the lower part of the tray **14** for movement into the apparatus.

The second of such means comprises a stop plate **111** the downwardly bent end **112** of which serves to engage the upper edge of each successive tray **14** to assist in preventing its entering the apparatus until required. Such stop plate is mounted on a rotatable shaft **113** to which a lever **114** carrying a cam follower **115** is keyed. The cam follower **115** runs on a rotary cam **116** carried by the shaft **70** at the rear of the apparatus.

Considering the apparatus shown in FIG. 3A, the relative arrangement of the cams **106** and **116** is such that as the levers **101** are lowered and lip **151** is raised, so is the stop plate **111** raised so that all the trays resting on platform **18** are released and slide under the influence of gravity until they are arrested by lip **151** and the engagement of the upper edge of the foremost tray against the rear plate **153** all as shown in FIG. 10. Further movement of the mechanism causes plate **111** to be lowered again so that the bent end **112** engages the next tray in the stack beyond the one being fed, pushing the stack backwardly a short distance so that the tray being fed is relieved of the weight of the trays in the stack, rendering it quite free to move when released.

Simultaneously with the downward movement of plate **111**, levers **101** are raised so that lip **151** is lowered to a point where it is disengaged from the edge of the tray being fed which then falls by gravity, rolling off the rollers **102**, sliding down the plate **150**, over the two curved plates **152** which prevent it from engaging again on the lip **151**, to be received on a pair of supports **19** which are timed to be in a suitable position to receive it. It will be seen that the upward movement of the levers **101** which releases the tray being fed also puts the rollers **102** into such a position that they support the lower edge of the stack of trays beyond the one being fed so that, in conjunction with the bent end **112** the stack is effectively supported leaving the tray being fed to fall quite freely, all as shown in FIG. 11. The apparatus is thus restored to the condition shown in FIG. 3A ready to feed the next tray according to the cycle of events described above.

The stop plate **111** is biased towards its operative position by a spring **117** (FIG. 2) connecting a lever **118** on the shaft **113** to the frame F, a further lever **119** on such shaft engaging the frame, so as to limit the movement of plate **111** independently of cam **116**.

When an empty tray has been introduced into the apparatus it is indexed downwardly as already described and the front edge of its end wall **15** comes into engagement with sloping guide plates **120** arranged on either side of the frame and so disposed as to cause the tray to be moved on its supports **19** towards the rear of the apparatus so as to ensure that such tray can as it continues to move downwardly pass clear of the upper run of the sweep bars as they operate to fill the preceding tray.

When the end wall **15** of a succeeding tray has passed below the sweep bars and thus, when the preceding tray is full, the empty tray is pushed forward into the batch receiving position by two pushers **121** each carried on a pusher arm **122**, the arms being pivotally mounted on the sides of the frame F; one such pivotal mounting **123***a* is shown in FIG. 3B. One arm **122** carries a roller **123** which bears against the other arm, a spring **124***a* serving to retain such other arm in slidable contact with roller **123**. The arms **122** are biased towards their forward positions by spring **124** and are controlled by a bell crank lever **125** mounted on a stub shaft **126** and carrying a cam follower **127** riding on a rotary cam **128** (FIGS. 2 and 3A) carried by the shaft **70**. The cam **128** is formed with a steep portion **129** and, as it rotates anticlockwise as seen in FIG. 2, serves in its cycle of rotation to rotate the lever **125** anticlockwise to withdraw the pusher arms **122** against their spring **124** and then to release them sharply so as to push the empty tray quickly forward into its cigarette-receiving alignment.

This forward movement of the empty tray is arranged to occur during the latter part of the downward indexing of the trays by a large increment, i.e. when the pawl arms **78** and **79** ride over the smooth portions **87** of ratchet wheels **76** and **77**, as soon as the upper end of the filled tray has cleared the level at which cigarettes are fed, so that the empty tray will be correctly aligned in its cigarette receiving position as soon as filling of the preceding tray is completed. Thus reference to FIG. 2 will show that the cam follower **127** will drop over the steep portion **129** of cam **128**, to operate the scissors **122** and pusher **121**, during the movement of the smooth portions **87** of the ratchet wheels **76** and **77** past pawl arms **78** and **79**.

It will thus be seen that the apparatus of the invention provides continuously and automatically operable means for feeding empty trays one by one to a cigarette receiving position, transferring cigarettes row by row from a conveyor into the trays in nested relationship, replacing a filled tray by an empty one during the time interval between the transfer of two successive rows of cigarettes from the conveyor, and transferring filled trays to a position where they can easily be removed by an operator. It will be understood that the uninterrupted operation of the apparatus is achieved by the provision of a continuous drive from the main motor **48** to all of the apparatus parts except the pusher plate **21**, the drive being operatively engaged when it is required for the various operations by the provision of slipping clutches arranged to be released by the operation of solenoids, the latter depending for their actuation on the operation of microswitches in parts of the apparatus which has previously operated.

FIG. 12 illustrates in diagrammatic fashion a modification of the apparatus embodying means for automatically or manually controlling the rejection of faulty cigarettes during operation. In this case the means for arresting the most downstream of one each batch of cigarettes comprises a stop **131** mounted on a spring

strip **132** secured to each sweep bar **6** so as to be liftable away from the conveyor **2** to allow faulty cigarettes to flow straight past the removal station **4**. Lifting of the stop **131** is controlled by an electromagnet **133** which may if desired be operated directly by an operator if he should observe that faulty cigarettes are being fed to the apparatus. Preferably, however, such stop means is controlled automatically by making use of the fact that the delivery of faulty cigarettes is almost invariably accompanied by the occurrence of a considerable gap in the steam of cigarettes being delivered. Thus a light source **134** may be arranged as shown upstream of the removal station **4** so as to transmit a light beam **135** obliquely to the stream towards a photocell **136**. The light beam will normally be cut off by the stream of cigarettes as shown but if a large gap should occur it will shine through to actuate the photocell, which is arranged to operate the electromagnet **133** to lift the stop **131** and thus reject the faulty cigarettes. Preferably a suitable delay will be arranged to occur between the subsequent cutting off of the light beam as the stream of cigarettes closes up again, and the consequent de-energisation of the electromagnet, so as to ensure that all of the faulty cigarettes are rejected.

FIG. 13 illustrates, again diagrammatically, a further modification of the apparatus in which means are provided for detecting changes in the diameters of the cigarettes being delivered to the apparatus and for making the necessary adjustments to the position of the batch arresting means upon such dimensions varying beyond a predetermined point, so as to maintain each batch centralised relatively to the sweep bars. Thus, in addition to the cigarette counting means **10** already described, further sensing means were provided in the form of a light source **137** and a photocell **138** arranged in vertical alignment with the region where the most upstream extremity of the upstream cigarette of each batch will lie when the batch has been completed and is being removed from the conveyor **2**. The sensing means **137** and **138** is thus arranged to scan the position of such upstream extremity and the photocell will transmit a signal dependent thereon as the amount of light falling on it will clearly depend on the proportion of the light beam which is cut off by the most upstream cigarette of the batch.

In this embodiment the batch arresting means comprises a stop member **139** separate from the sweep bars **6** and carried on a spring strip **140** extending up between the conveyor bands **2**. Rotatably secured to the strip **140** is a threaded shaft **141** carried by a stationary nut member **142**, the shaft **141** being controlled in its rotation in either direction by solenoids **143** acting on a pair of opposed ratchet wheels **144** on the shaft through rods **145** carrying suitable pawls. Thus, should the cigarette diameters decrease, causing the upstream edge of the most upstream cigarette in the batch to move to the left as seen in FIGS. 13 and 14, light in excess of a predetermined amount will fall on photocell **138**; in this case the photocell transmits a signal to operate one of the solenoids **143** to screw shaft **141** to the right to adjust the position of the stop **139** whereby the batch is centralised relatively to the sweep **6**. On the other hand should the cigarette diameters increase to cut off most of the light from the photocell, the other solenoid will be operated to move the stop **139** to the left so that the batch is once again centralised relatively to the sweep bar.

Very conveniently the position of stop **139** may be used, by known means, to produce a signal on a suitable display panel to indicate to an operator of a cigarette-making machine from which the cigarettes are being delivered that the cigarettes are being made either too small or too large; the operator can then make any necessary adjustments to such machine. Alternatively, such a signal generated by the position of stop **139** could be arranged to act directly and automatically on the cigarette-making machine to make such adjustments.

In yet another embodiment of apparatus similar to that shown in FIGS. 13 and 14, the cigarette diameter measuring apparatus may be used without the cigarette counting device to maintain the desired batch of cigarettes central with the sweep bar so that the number of cigarettes in the batch removed by said bar is determined by its length; i.e. the number of cigarettes removed would, in this case, be determined by the dimensional width of the batch without actually counting individual units. In order to actuate the sweep bars immediately a complete batch of cigarettes is ready for removal, a second light source and photocell combination similar to **137** and **138** would be provided immediately upstream of the upstream end of the sweep bar **6**, approximately in place of unit **10** (FIG. 14) which in this case is not employed. This second combination would sense spaces between cigarettes passing until a sufficient number are crowded together against stop **139** to pile up in contiguous formation as far as the photocell combination which, upon the consequent complete interruption of the light received by the cell, would transmit a signal to operate the sweep bar, removing one batch to automatically provide space for the stream to again flow up to stop **139** thus permitting the cycle of events to be repeated indefinitely. During this operation the light source **137** and photocell **138** would sense the position of each batch of cigarettes delivered to maintain the position of stop **139** in the appropriate position for correct functioning; the position of stop **139** could also be sensed to provide a signal to display the cigarette diameter and/or automatically to adjust the cigarette-making machine to maintain a desired cigarette size as in the previously described embodiment.

What is claimed is:

**1.** Apparatus for removing articles from a continuously moving conveyor in batches each consisting of a predetermined number of articles, comprising a batch removal station to which articles are, in operation led by such conveyor, means for arresting the movement of the most downstream articles, in each batch at the most downstream extremity of such station, sweep means at said removal station, such sweep means being mounted for movement transverse to the direction of movement of the conveyor and operative upon such movement to sweep articles at the removal station from the conveyor, and sensing means for causing operation of said sweep means the said sensing means comprises a device situated upstream of the removal station for counting the articles as they pass and adapted to actuate stop means to cut off the stream of articles at a point upstream of the removal station when a number of articles constituting one batch has passed such stop means, release mechanism for such stop means being provided and being automatically actuable in consequence of the removal of each batch from the conveyor so as to initiate the delivery of articles in the next succeeding batch.

**2.** Apparatus according to claim **1**, wherein the said sensing device comprises a combination of a light source and a photo-electric cell positioned to lie, in operation, on opposite sides of the stream of articles moving on the conveyor so that when the articles pile up the light beam is cut off and a signal is trasmitted to the sweep means to operate the same.

**3.** Apparatus according to claim **1**, wherein the said sweep means includes a plurality of similar sweep members mounted for movement in a closed path so that, in operation, each sweep member in turn is operated to sweep a batch of articles from the conveyor.

**4.** Apparatus according to claim **3**, wherein the sweep means is such that, in operation, its movement to cause one sweep member to remove a batch of articles automatically results in the movement of the succeeding sweep member into a position ready to remove the next batch.

**5.** Apparatus according to claim **1**, wherein each sweep member is provided with its own arresting member in the form of a stop mounted at the downstream end thereof.

6. Apparatus according to claim 1, including a further sensing device adapted to scan the position of the upstream extremity of the most upstream article in each batch when the latter is ready for removal and to cause the position of said arresting means to be adjusted in consequence thereupon so as correctly to locate the batch of articles relatively to the sweep means.

7. Apparatus according to claim 6, including means adapted to transmit a signal dependent on the position of the adjustable arresting means.

8. Apparatus according to claim 6, wherein the said further sensing means is arranged to one side of said articles fed to the removal station so as to scan the upstream extremity of the most upstream article during its removal from the conveyor.

9. Apparatus according to claim 1, including means whereby the position of the said arresting means, and thereby the location of the batch on the conveyor, alternates between two positions longitudinally of the conveyor to offset succeeding batches, and thus enable the batches to be stacked one upon the other with the articles in nested relationship.

10. Apparatus according to claim 9, wherein the positions of the arresting members on the sweep members are arranged so to locate each successive batch longitudinally of the conveyor as mutually to offset succeeding batches.

11. Apparatus according to claim 1, wherein the said counting device is adapted to cause alternative batches of articles to contain one more article than the intervening batches.

12. Apparatus according to claim 1, including means for rejecting faulty articles from the stream fed to the removal station comprising means for sensing the occurrence of an unusually wide gap in a stream of articles fed to the apparatus and, upon sensing such a gap, to cause automatic withdrawal of the said arresting means out of the stream of articles so as to allow articles to flow past the removal station.

13. Apparatus according to claim 12, wherein the sensing means of the said rejecting means includes a light source and a photo-electric cell arranged to lie, in operation, one above and the other below a stream of articles with the path of the light oblique to the stream so that it will be cut off by the article when they are closely spaced but will be able to shine through any unusually large gap occurring between successive articles so as to actuate the cell.

14. Apparatus for removing articles from a continuously moving conveyor in batches each consisting of a predetermined number of articles, comprising a batch removal station to which articles are, in operation, led by such conveyor, sweep means at said removal station, such sweep means being mounted for movement transverse to the direction of movement of the conveyor and operative upon such movement to sweep articles at the removal station from the conveyor, means located at the upstream end of said removal station adapted to count the number



of articles at the removal station and, upon the counting of a discrete number, to cause operation of said sweep means to sweep such batch from the conveyor, a container for receiving said article swept from said conveyor, movable means adapted to support said container, and means adapted automatically to adjust the position of said support means between the removal of each successive batch of articles so as, in operation, to cause such batches to be stacked one upon another in such container.

15. Apparatus according to claim 14, wherein said adjusting means is controlled consequent upon movement of the sweep means of the apparatus, to index the said support means downwardly by approximately the depth of one article immediately after the operation of the sweep means to move a batch of articles into a container.

16. Apparatus according to claim 15, wherein a microswitch adapted to control operation of such adjusting means is associated with the control for the sweep means so as to be operated thereby.

17. Apparatus according to claim 14, including a plurality of container supports movable around a closed path, means adapted to supply empty containers to the apparatus from a store thereof, and means adapted to remove full containers from the apparatus, the said container support adjusting means being arranged to index the container supports through a suitable increment when a container at the article removal station has been filled, so as to move an empty container into position to receive succeeding batches of articles.

18. Apparatus according to claim 17, wherein the said adjustment means is adapted to index the container supports through a suitable container replacement increment during the period which normally elapses between the removal of successive batches of articles from a conveyor.


**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,764,663 | 6/1930 | Voigt | 53—59 |
| 1,964,084 | 6/1934 | Rundell | 53—245 |
| 2,661,091 | 12/1953 | Maloney | 209—121 |
| 2,782,577 | 2/1957 | Beall | 53—59 |
| 3,010,593 | 11/1961 | Adams | 198—40 |
| 3,097,460 | 7/1963 | O'Brien | 53—64 |
| 3,190,459 | 6/1965 | Kochalski | 214—1 |
| 3,193,081 | 7/1965 | Harrison | 198 137 |
| 3,204,752 | 9/1965 | Connor | 198—21 |
| 3,204,754 | 9/1965 | Conner | 198—24 |
| 3,250,056 | 5/1966 | Rudszinat | 53—236 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 586,813 | 11/1959 | Canada. |
| 378,606 | 4/1932 | Great Britain. |



RICHARD E. AEGERTER, *Primary Examiner.*

WILLIAM B. LA BORDE, EVON C. BLUNK, *Examiners.*