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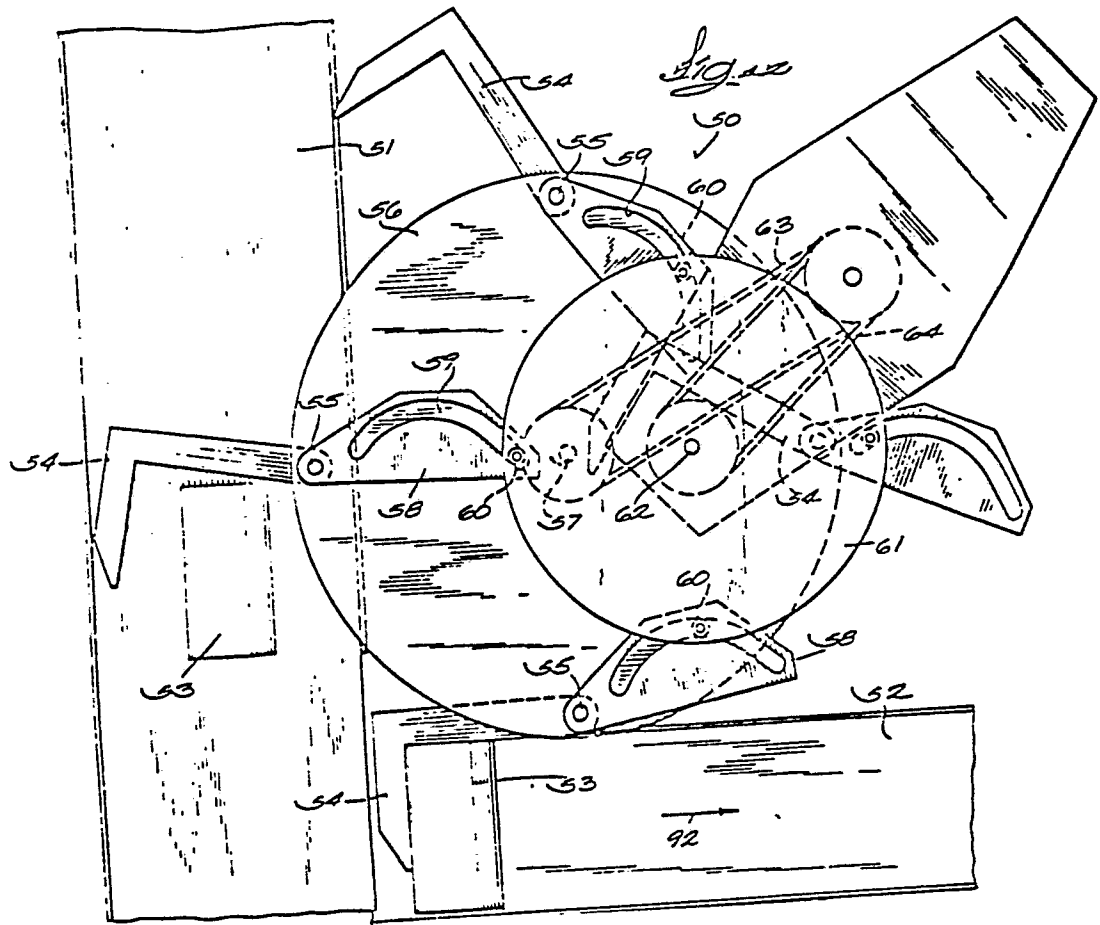
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54 **High speed wrapping machine.**

57 Article handling apparatus comprises one or more handling arms for performing operations on articles as those articles move continuously through a work station without slowing down or stopping. The operations that may be performed include direction changing with or without changes in the orientation of the articles, assembly, processing or wrapping. Each handling arm (54) is pivotally mounted on a first rotary member (56) and comprises cam means (58) engaged by a cam follower (60) mounted on a second rotary member (61). The shapes of the cam means (58) and the circular paths of the handling arm pivots (55) and cam followers (60) are such that the handling arms maintain a fixed angle of presentation through the handling zone, then rotate in the opposite sense to the first rotary member (56) to retard their tip speeds, then move laterally from the path of the articles to be handled, and finally rotate in the same sense as the first rotary member to approach the handling zone to repeat the cycle.



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TITLE:

Article Handling Apparatus

DESCRIPTION:

5 This invention relates to apparatus for handling articles
as they move without interruption on a conveyor. It is
desirable that on any conveyor line system for assembly,
processing or wrapping, the products moving along the
conveyor are handled without slowing down or stopping
the conveyor. This provides the maximum efficiency of
10 operation, and many handling devices have been proposed
to operate in this way. In general, however, such
devices are either inefficient or complex, and there is
a need for a simple yet flexible mechanism which is
capable of high speed operation.

15 The invention provides a handling apparatus for
articles, wherein a handling arm is movable in a cyclic
path that passes through an article handling zone, the
arm movement being controlled by a linkage which
comprises pivot means pivotally mounting the handling
20 arm on a first rotary member, cam means fast to the
handling arm, a cam follower mounted on a second rotary
member in sliding engagement with the cam means, and
drive means for rotating the first and second rotary
members to drive the pivot means and the cam follower
25 around mutually eccentric circular paths, wherein the
circular paths and the shape of the cam means are
inter-related to maintain the handling arm at a fixed

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angle of presentation during its arcuate path through the handling zone, then to cause it to rotate about the pivot means in the opposite sense to the rotation of the first rotary member to retard its tip speed, then to
5 move laterally from the path of articles to be handled, and then to rotate about the pivot means in the same sense as the rotation of the first rotary member before it again approaches the article handling zone to repeat the cycle.

10 Two examples of uses of the apparatus of the invention are the transfer of articles from one conveyor to another moving at an angle to the first, and the performance of some handling operation on the articles as they pass continuously through the handling zone in a
15 straight line. Both examples are encountered in the high speed wrapping machine which is the subject of our copending European Patent Application numbered consecutively with this Application, and which is used herein to illustrate preferred embodiments of the
20 invention.

When the handling apparatus is designed to move articles or groups of articles from a first conveyor standing at any angle to a second conveyor, it advantageously comprises a number of handling arms each
25 of which may consist of an L-shaped arm mounted on a rotating mechanism in the included angle between the first conveyor and the second conveyor. These arms are pivoted on the first rotary member and each is provided with its own cam means which cooperates with a
30 respective cam follower on the second rotary member. The first and second rotary members are preferably driven at the same speed. By appropriate design of the cam means the handling arms are able to pick up an article or groups of articles from the first conveyor and change
35 their direction of movement to that of the second

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conveyor either with or without a change in the orientation of the articles and without disturbance of a grouping of articles which are to be processed (for example wrapped) together, after which the handling arm
5 retracts in a path that carries it sideways and out of the way of the second conveyor, thereafter extending itself behind another product or group of products on the first conveyor to repeat the cycle without having to start and stop the product group for the direction
10 change.

In addition, a variation of the above handling apparatus can serve as a tucker in a product wrapping machine to make an end fold in which the handling or tucker arm moves out and sideways as it retracts, to
15 avoid pulling out the fold just made. The parts are essentially the same as those of the transfer mechanism described above excepting cam shapes.

The drawings illustrate the use of the handling apparatus of the invention as both a transfer apparatus
20 and a tucker device in the high speed wrapping machine of our copending European Patent Application, the complete disclosure of which is incorporated herein by reference.

DRAWINGS

25 Figs. 1 through 11 are a series of perspective views showing the sequence of steps in the wrapping machine of our copending European Patent Application.

Fig. 12 is a top plan view showing the handling apparatus of the invention as an article transfer device
30 between an infeed conveyor and a wrapping machine conveyor.

Fig. 13 is a top plan view of handling apparatus of the invention as a tucker mechanism to form an end

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fold in the wrapper and showing the trajectory of the tip of the tucker arm, particularly the way it tilts to the side as it backs out of the fold using mechanism similar to Fig. 12.

5 DESCRIPTION

 The wrapping machine illustrated diagrammatically in Figures 1 to 11 has a number of sections which cooperate to achieve the overall result. Each of the sections will be described very generally and the
10 relevant ones will then be described in greater detail. Unless the context indicates otherwise the word "product" refers either to a single article, such as a roll of paper tissue or towelling, or to a single group of articles to be wrapped in one wrapper.

15 First of all is the direction changing mechanism (Fig. 12) which brings the product to be wrapped from an infeed conveyor extending from a different direction to conveying means in the wrapping machine which thereafter transport the product continuously in a single direction.
20 The direction changing means are unique in their mode of action in that although they change the direction of product movement, they do not change the orientation of the product, and do not significantly change its speed, utilizing a mechanical motion believed to be unique

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and which may be utilized in other devices, such as my tucker.

After entering the wrapper machine proper through the direction changing mechanism, the product passes beneath a wrapping film supply section (Fig. 1) fed from a roll of wrapping material from which sheets of wrapping film are cut and supplied to lie in a horizontal plane above the product supported by conveying structure that will be described later.

The wrapping film is supplied in a specific relationship to the product such that an amount of film sufficient to wrap the forward side, bottom and part of the back of the product extends ahead of the product as it moves down the conveyor, the remainder extending above and behind the product. The wrapper is carried between pairs of belts moving beside the product at the same speed.

As the product and wrapping film proceed down the conveyor from the film supply area the lower wrapper carrying belts turn on vacuum wheels so the edge of the wrapping film is brought downward ahead of the product by engagement with the vacuum wheels which are rotating on either side of the product with axes that are not quite transverse to the conveyor but are skewed or toed outward slightly to create a slight outward pull on the wrapping film as it moves downwardly in contact with the vacuum rolls. The vacuum wheels must grip lightly to prevent wrinkles. As the forward edge moves downwardly it is stripped from the vacuum wheels by belts which nip it lightly and assure its continued travel vertically downward as it leaves the vacuum roll. A large number of belts and rolls in this vertical slot smooth and control the wrapper. As the

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product moves over the slot area in which the wrapping film was pulled downwardly, the film is pulled taut at the forward edge of the product and is withdrawn from its downward extension into the slot to cover the bottom surface of the product as the product advances so that the film now extends in a horizontally disposed U from behind the product at the top around the top, front, bottom, to behind the product at the bottom (Fig. 2).

Previous to this point both the film and the product have been conveyed on belts but the product now enters a portion of the conveyor comprising stationary upper and lower rails with paddles moving behind the product to advance it and to fold the wrapper back of the product. These paddles fold the upper film down over the back of the product (Fig. 3) and because they are advancing the product hold the film tightly.

At this stage when groups of articles make up a product to be wrapped, there may be a droop in the wrapping film between products of a group, either because the group has separated slightly or for other reasons. To produce a neat smooth wrap the articles should touch or even compress together. In my machine, with the upper portion of the film held tightly against the back of the product by the advancing paddles (Fig 3) the friction of the passage of the products and film along the conveyor bars cause very slight drag on the film. The upper stationary bars of the conveyor are selected from material and finish having slightly less friction than the lower stationary bars of the conveyor, with the result that with the film nipped between the advancing paddles of the conveyor and the back of the product, and greater

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friction on the lower portion of the film than the upper portion of the film, the film is gradually pulled around the lower side of the product a tiny amount which snugs the articles in the group tightly together and pulls the wrapping film tightly about them.

It is a major feature of the wrapping machine to wrap products by moving them linearly without stopping in a manner such that the products to be wrapped are wrapped tightly by the film to produce a package which is compact and free of wrinkles. A secondary but still major feature is to seal the package so produced on a narrow edge which in the direction of product travel in my machine is a rear surface, particularly where multiple articles are being wrapped. The rear surface being one of the narrow surfaces of the package this permits maximum printed display area on the broad surfaces of the package which is not defaced by a seal. In this machine the objective is achieved regardless of the number of articles in a package, the number typically ranging from one or two 11 inch rolls of toweling through one, two, or four rolls of toilet tissue. Other articles may be wrapped.

During this period support fingers (Figs. 3-5) approach the product at the side and move up to support that portion of the film that extends sidewardly or transversely from the product. In the same section of the machine the paddle type conveyor that has previously been described as coming down in back of the product from above to nip the film against the product to allow tightening travels upwardly at a slight angle to the product path while

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a lower chain carrying upwardly extending paddles travels from below at a slight upward angle to the product path so that as the upward paddle is withdrawn, the lower paddle moves upwardly to take
5 its place, folding the film upwardly around the back of the product at the same time. (Fig. 4)
26} Both the lower paddles and the upper paddles are discontinuous so that a mechanism can later come in to make a first attachment of the lower film
10 to the upper film to retain the tight configuration of the wrapping about the product at a later time. If the wrapper is plastic film as generally described throughout, the mechanism is a tack welding wheel to bond the plastic. Other wrapper stock and sealing
15 means are possible.

Before this time the laterally extending fingers are withdrawn from supporting the upper film, (Figs. 3-5). An air-jet (Fig. 6) pushes the upper film downwardly at the ends of the package to
20 make the first end fold. A tucker (Figs. 7, 11, and 13) makes an end fold and the package then moves into a conventional end folding section of the machine which folds the remaining side portions of the film to make end folds. The tack-welding is
25 then accomplished (Fig. 8) between the paddles of the lower paddle conveyor, which then withdraw downward. The product moves between belts that engage the ends of the product (Fig. 9) which serve to convey the product down the product path as a full back seal bar
30 comes in to permanently seal the back seam. The package then moves between end sealing belts (Fig. 10) producing a completely sealed product while the package continues its path.

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As shown in Fig. 11, the sealing is effected in just the same way if the product group includes more than one product. Fig. 11 may represent the wrapping either of two rolls of towel or four rolls of toilet tissue. Thus, Figs. 1 through 10 schematically represent the steps in applying the film to the product to form a complete package while Fig. 11 represents a view like that of Fig. 7 where more than one product is involved in the axial direction of product flow.

The linear path of product flow is the path extending horizontally from one end to the other end of the wrapping machine. The product moves without substantial deviation in direction or speed while it is being wrapped. The linear product path could be other than horizontal, but as the preferred form is here described the path is level. The reason for having a generally linear product path is to allow very high speed wrapping of the product, at a rate much higher than accomplished by previous machines which do not have a linear product path or which started and stopped the product or substantially changed its speed during the course of wrapping. While linear flow and generally uniform movement of the product are important to high speed wrapping, they are by no means sufficient, as is shown in this application. Many innovative details were necessary to solve the problems of high speed wrapping, in addition to the general concept.

The basic axis of the machine will be taken to be the product path. To the right and the left of the product path the directions will be referred to as side, lateral or transverse. The remaining

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directions at right angles to the product path will be referred to as up and down. In the event of a machine oriented otherwise than horizontally, right and left side, lateral or transverse directions will
5 be taken to be directions lateral to the first conveyor and (generally) aligned with the axes of the vacuum wheels, while up and down would refer to directions at right angles to those.

Looking now at Fig. 12, the wrapping machine
10 proper begins with a direction changing mechanism 50 operating to move articles 53 from conveyor 51 which is an infeed conveyor, toward conveyor 52 which is the first element in the conveyors defining a linear product path on which products will be
15 wrapped. Operating in the angle between the two conveyors is my direction changing mechanism 50 which could operate between conveyors in other mechanism as well. The direction changing mechanism includes L-shaped arms 54 secured to shafts 55 extending
20 through respective bearings in rotating member 56 which is rotated about a bearing 57. A cam plate 58 having a cam slot or track 59 is rigidly secured to the top of each shaft 55. A cam follower roller 60 enters each cam track or slot 59 from a second
25 rotating member 61 driven to rotate around a bearing at center 62. Belts 63 and 64 which may desireably be timing belts drive rotating members 56 and 61 about their respective centers 57 and 62 at equal rotational speeds.

30 The action of L-shaped arms 54 is to synchronize behind product 53 on infeed conveyor 51 enclosing the back and end of the product. The precise shape of the arm might vary with product type and shape and cam shape but should prevent separation of articles

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making up a product to be wrapped as products are swept in an arc from conveyor 51 to linear product path 92 without change in product orientation. As applied to rolls of paper, rolls with axes along conveyor 51 now have axes directed laterally of product path 92 as they are placed between upper and lower belts. Arms 54 retard respecting products 53 and withdraw to the side, then move at high acceleration to come behind a product on infeed conveyor 51 and synchronize with it to repeat the cycle. The number of arms and exact cam shape may vary, and of course cams and cam followers could be reversed, with appropriate design changes, here or in the tucker of Fig. 13.

In Fig. 13 the track of the tip of L-shaped arm 71 is shown as a dot and dash line. The product path is not shown in Fig. 13 structurally but is between the tucker arms 71. Arm 71 stops as it reaches the Fig. 7 or Fig. 11 position as shown by the cusp of the path in Fig. 13. It then turns slightly to form a greater angle with the end of product 53, reducing drag on wrapper 91. As shown by the dot and dash line the tip of arm 71 slows down in relation to the product and retreats backward and to the side to clear the product and to get out of the way. As shown in Fig. 13 there are only two such arms 71 per side operated to fold wrappers on successive products. Other numbers of arms are possible if properly synchronized to make the second fold.

The cam track 59 or 76 is shaped to achieve the described path.

CLAIMS:

1. A handling apparatus for articles, wherein
a handling arm is movable in a cyclic path that passes
through an article handling zone, the arm movement
being controlled by a linkage which comprises
5 pivot means pivotally mounting the handling arm
on a first rotary member, cam means fast to the
handling arm, a cam follower mounted on a second
rotary member in sliding engagement with the cam
means, and drive means for rotating the first and
10 second rotary members to drive the pivot means and
the cam follower around mutually eccentric circular
paths, wherein the circular
paths and the shape of the cam means are inter-related
to maintain the handling arm at a fixed angle of
15 presentation during its arcuate path through the
handling zone, then to cause it to rotate about the
pivot means in the opposite sense to the rotation of the
first rotary member to retard its tip speed, then to
move laterally from the path of articles to be handled,
20 and then to rotate about the pivot means in the same
sense as the rotation of the first rotary member before
it again approaches the article handling zone to repeat
the cycle.
2. A handling apparatus according to claim 1, wherein the
25 cam means is a plate that has a cam slot therein which
is closed at its ends and which engages the cam follower

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during the whole of the cyclic movement thereof.

3. A handling apparatus according to either preceding claim, wherein the handling arm is generally L-shaped and pivoted at one end thereof to the first rotary
5 mounting member.

4. A handling apparatus according to claim 3, wherein the cam plate extends from the handling arm in cantilever past the pivot means.

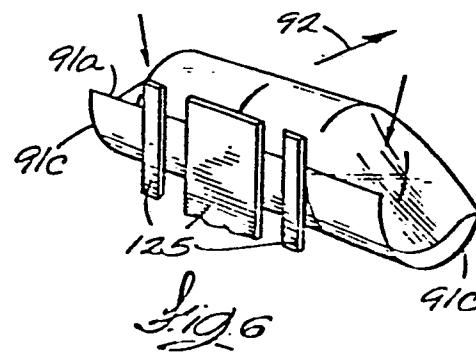
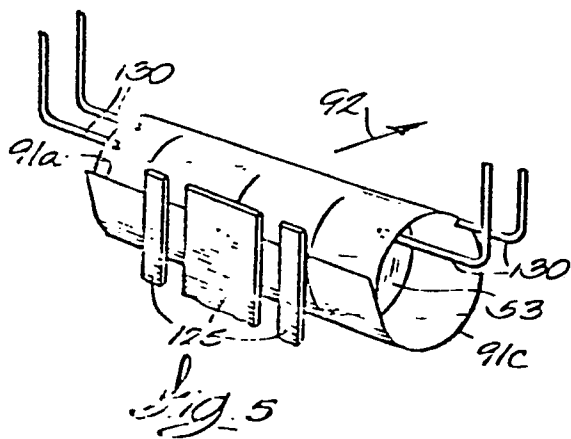
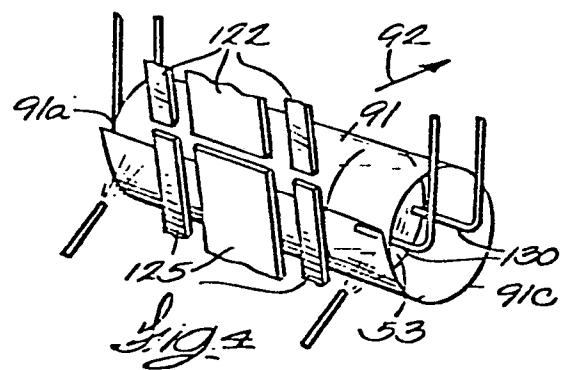
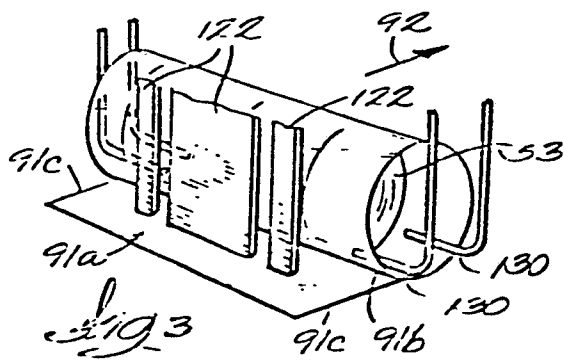
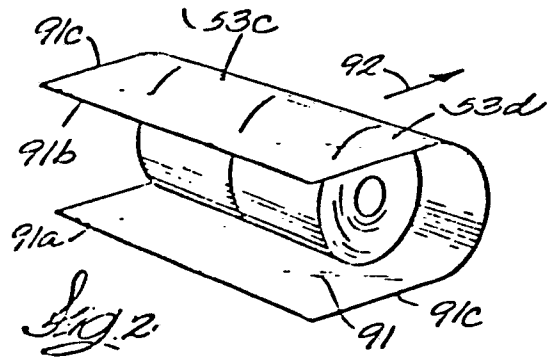
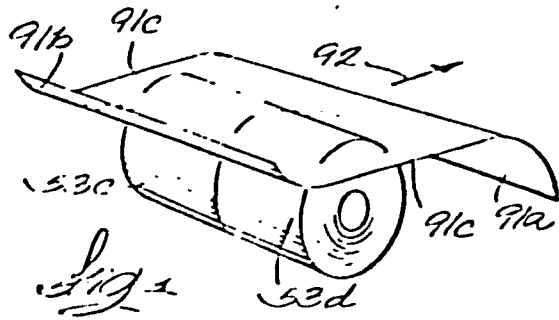
5. A handling apparatus according to any preceding
10 claim, wherein the means for rotating the first and second rotary members is effective to drive them both at the same angular speed.

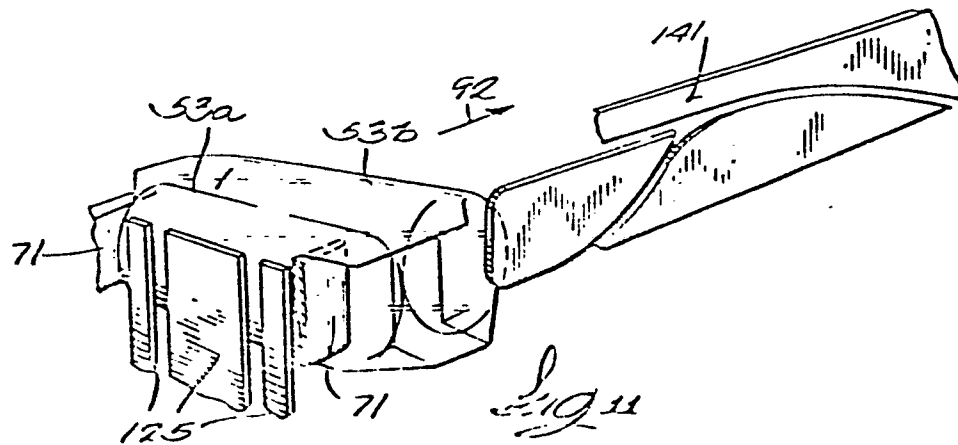
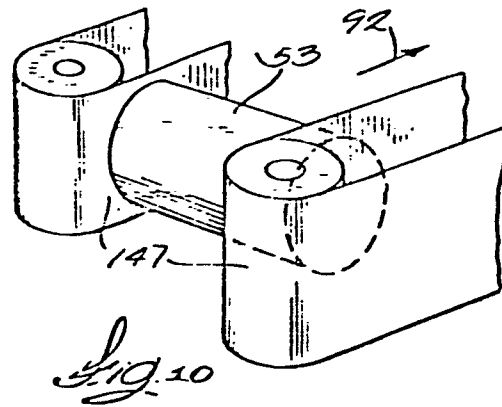
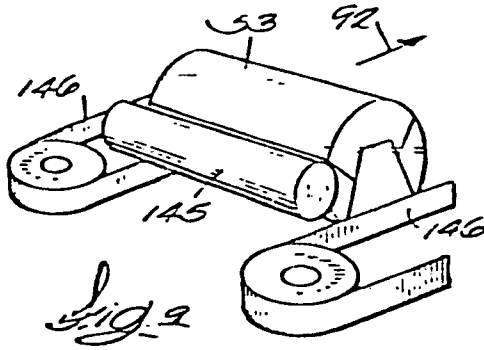
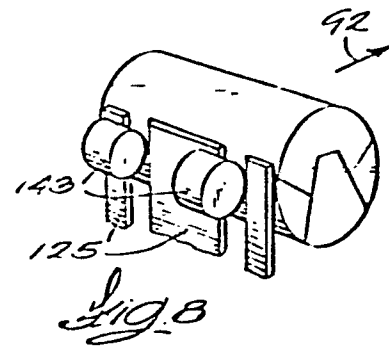
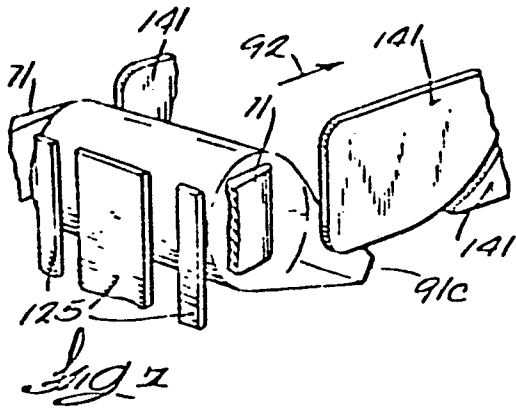
6. A handling apparatus according to any preceding claim, wherein the circular paths of the pivot means and
15 the cam follower have different radii.

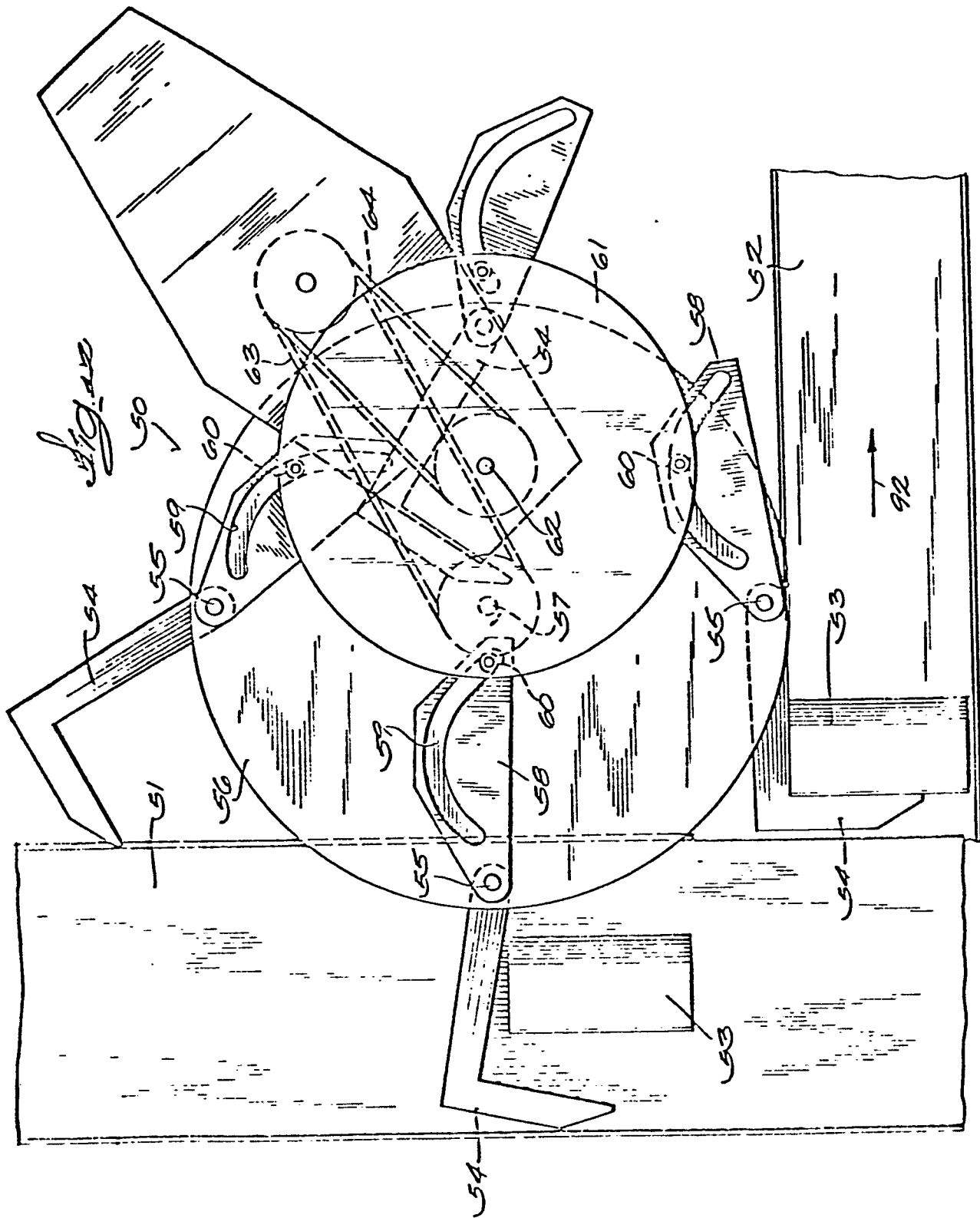
7. A handling apparatus according to any preceding claim, wherein the handling arm is arranged to transfer a succession of articles from a first conveyor travelling in a first direction to a second conveyor travelling in
20 a different direction by engaging each article as it enters the article handling zone, drawing the article along an arcuate path onto the second conveyor without changing the angle of presentation of the article, disengaging the article by the said retardation of the
25 tip speed of the handling arm, moving laterally from the article path and completing its cyclic path to re-enter the handling zone.

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P. A handling apparatus according to any preceding claim, wherein the first rotary member pivotally mounts a number of such handling arms at spaced intervals, and the second rotary member mounts
5 a number of cam followers in sliding engagement with cam plates fast to the handling arms, so that on rotation of the rotary members by the drive means each handling arm moves along a similar or identical cyclic path to the other or others.







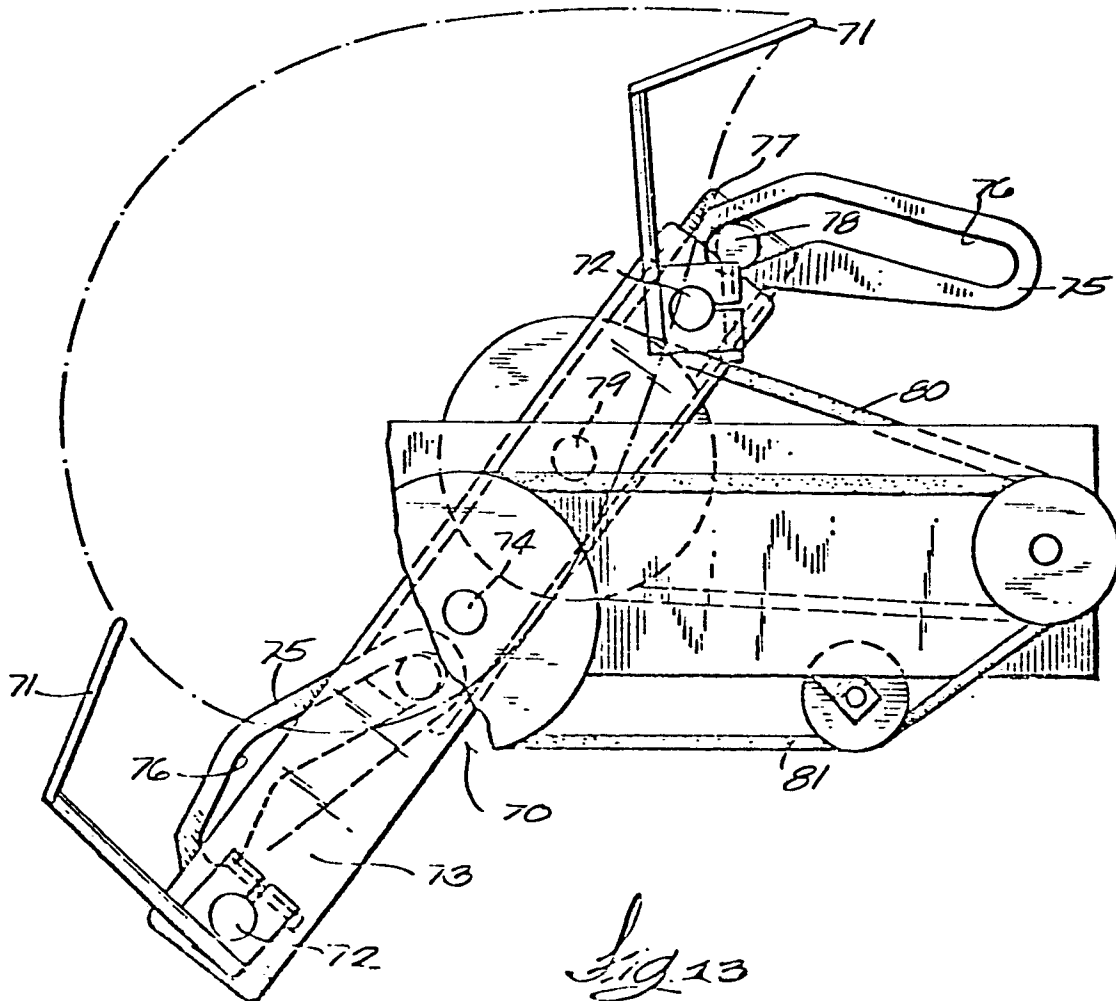
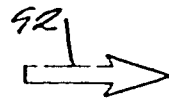


Fig. 13



European Patent
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EUROPEAN SEARCH REPORT

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Application number

EP 81 30 3965

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	US - A - 3 176 824 (J.ELDRED) * column 2, line 5 to column 4, line 22; figures 1 to 3 * -- DE - A - 2 461 530 (PRINZ RUDOLPH) * page 3, line 8 to page 4, line 26; figures * -- US - A - 3 899 069 (H.HEINZER) * column 2, line 20 to column 3, line 24; figures 1,4 * -----	1,2,3, 6,7,8 1,7 1,7	B 65 G 47/84 B 65 B 35/26 TECHNICAL FIELDS SEARCHED (Int.Cl. ³) B 65 B B 65 G CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	22-12-1981	JAGUSIAK	