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(54) **Apparatus for producing and transporting folded coupons**

(57) A modular system (2) for folding pre-printed material to produce multiple width folded coupons, cutting the multiple width folded coupons to produce separate individual folded coupons, transporting the separate individual folded coupons along a single path and stacking the separate individual folded coupons ready for placement onto packaged consumer goods, such as cigarette packs, comprises a buckle folder (4), a separation unit (6), a joining unit (8), an alignment unit (10), a feeding unit (12) and a hopper (14) linked to one another by a series of belt transport systems.

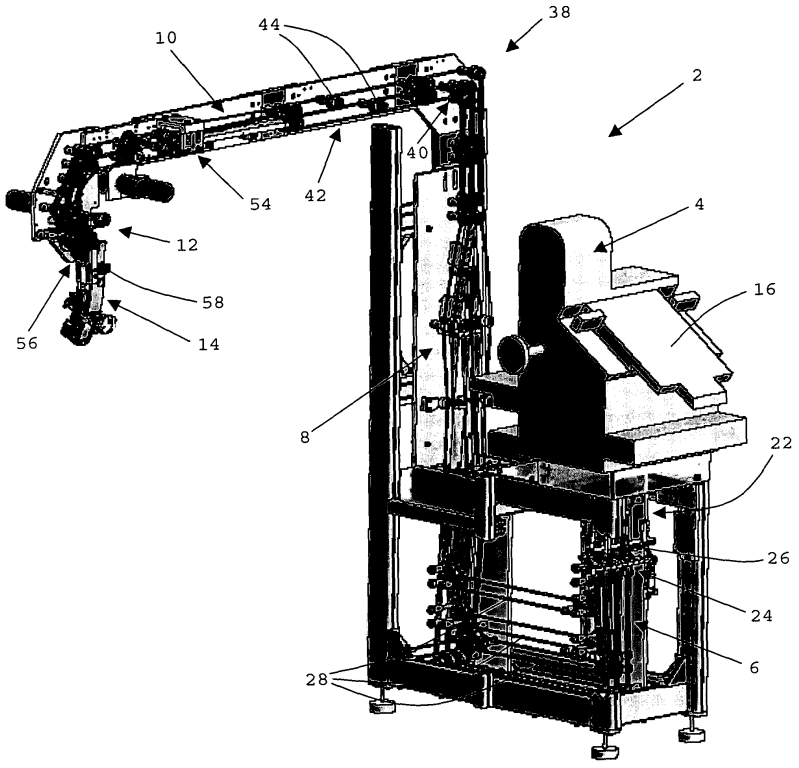

Figure 1

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Description

[0001] The present invention relates to apparatus for producing and transporting folded coupons and, in particular to apparatus for producing, transporting and stacking folded inserts, onserts and outserts for cigarette packs.

[0002] To serve as a medium for advertising or promotional purpose and/or to provide information about products, it is known to include folded sheets of pre-printed material with packaged consumer goods. The folded pre-printed material may be included as an insert within the packaging so that it is not visible to the consumer until after they have purchased the goods and the packaging has been opened or removed. Alternatively, the folded pre-printed material may be affixed to the exterior of the packaging so that it is directly visible to the consumer before purchase of the goods. In the latter case, it is particularly important that the quality or precision of the folding of the sheet of pre-printed material is high. For example, folded sheets of pre-printed material are often included on cigarette packs having an outer transparent film wrapper either as onserts, positioned between the pack and the outer film wrapper, or as outserts, affixed to the exterior of the outer film wrapper.

[0003] Buckle folders are commonly used to fold sheets of pre-printed material one at a time to produce individual inserts, onserts and outserts. However, the higher the speed at which buckle folders operate, the lower the folding quality of the inserts, onserts and outserts produced. Consequently, to achieve high folding quality without limiting the output speed of packaging machinery, inserts, onserts and outserts for packaged consumer goods have conventionally been produced by folding sheets of pre-printed material in buckle folders off-line. The pre-folded individual inserts, onserts or outserts are then stacked in cartridges that are delivered to the packaging machinery where the individual inserts, onserts or outserts are fed from the cartridges to inserters or applicators that deliver and insert them into or apply them onto the packaged consumer goods.

[0004] The use of pre-folded individual inserts, onserts and outserts that have been formed off-line has a number of disadvantages. As well as involving additional expense, the process of filling and storing cartridges, transferring the cartridges to packaging machinery and then feeding individual folded inserts, onserts or outserts from the cartridges to inserters or applicators is labour intensive. Furthermore, the individual pre-folded inserts, onserts or outserts can be difficult to handle at the very high production speeds at which packaging machines typically operate, cigarette packaging machines for example may produce 400 packs per minute or more, having a tendency to jam. To overcome such problems, a number of in-line insert and onsert folder systems have been proposed.

[0005] WO-A1-2004/003726 describes an in-line insert folder system including a continuous roll of unfolded printed inserts, a cutter head that cuts individual inserts from the continuous roll and a buckle folder for folding the individual inserts and delivering them to an applicator for placement directly onto consumer packs such as cigarette packs or onto the outer film wrap for the packs.

[0006] WO-A1-2004/076322 describes an in-line onsert folder system that comprises a continuous roll of pre-printed onserts and a transverse cutter assembly constructed and arranged to cut a pair of onserts in side-by-side relationship from the roll. The pair of printed onserts in flat unfolded condition is delivered in a downstream direction to a buckle folder with wide rollers that receives the pair of onserts and folds them as a single unit along at least one fold line. The pair of folded onserts are then cut by a longitudinal cutter into individual units and conveyed in a downstream direction along dual diverging paths for application onto consumer packs such as cigarette packs also travelling along dual paths.

[0007] The use of a "wider" buckle folder to produce multiple width folded inserts, onserts or outserts advantageously increases production speed and capacity and also results in less misalignment of the sheets of pre-printed material and so better folding quality. It would be desirable, however, to provide an in-line folding system comprising a wider buckle folder in which the individual folded inserts, onserts and outserts produced by cutting multiple width folded inserts, onserts and outserts are fed along a single path for loading into a cartridge or hopper, or for direct application onto a single stream of packaged consumer goods.

[0008] Furthermore, as individual inserts, onserts or outserts are transported along one or more paths during the production of packaged consumer goods it is sometimes necessary, depending upon the layout of the packaging machinery, to change the direction in which they are transported and/or to change their orientation relative to the direction of transport.

[0009] In existing paper transport systems, changes in direction and orientation of the transported material are commonly achieved by transporting the paper between pairs of belts. However, slippage between the belts can disadvantageously result in damage to the transported material, especially where the transported material is delicate or folded. In addition, the use of pairs of belts to achieve changes in orientation of the transported material requires complicated geometries as well as a number of rollers, belts and a separate drive.

[0010] It would also be desirable, therefore, to provide apparatus for changing the orientation of transported folded inserts, onserts and outserts for packaged consumer goods, which are typically made from delicate lightweight paper, that is simpler in geometry and less prone to damaging the inserts, onserts and outserts than existing paper transport systems.

[0011] When inserts, onserts and outserts are transported through packaging machinery between pairs of belts, slight changes in the position of the inserts, onserts and outserts between the belts can occur. In order to

maintain quality and allow for smooth downstream processing, inserts, onserts and outserts that become misaligned as a result of such changes must be rejected.

[0012] It would be desirable to provide simple apparatus for aligning a stream of transported inserts, onserts or outserts that would obviate the need to reject misaligned inserts, onserts or outserts and so reduce costs and waste.

[0013] According to the invention there is provided apparatus for producing and transporting folded coupons comprising: a buckle folder for receiving and folding sheet material to produce a multiple width folded coupon; a cutter for cutting the multiple width folded coupon (18) to produce at least two individual folded coupons disposed in side-by-side relationship; and a transport system for receiving the at least two individual folded coupons disposed in side-by-side relationship from the cutter and transporting the at least two individual folded coupons downstream along a transport axis, characterised in that the transport system comprises at least two separate coupon transport paths disposed in side-by-side relationship that merge to form a single coupon transport path, at least a portion of each separate coupon transport path being twisted about the transport axis, wherein, in use, each of the at least two individual folded coupons is transported along a different one of the at least two separate coupon transport paths such that, when the at least two separate coupon transport paths merge to form a single coupon transport path, the at least two individual folded coupons are displaced relative to one another along the transport axis.

[0014] Throughout the specification the term "folded coupon" is used to mean any sheet material comprising at least one fold and includes, but is not limited to, informational, instructional and/or promotional inserts, onserts, outserts, leaflets, tokens, vouchers and labels comprising one or more roll, gate and/or concertina (zigzag) folds.

[0015] The sheet material may be any suitable material such as, for example, paper, card, plastic, foil or combinations thereof. Preferably, the sheet material is paper, more preferably lightweight paper. Preferably the paper has a weight of between about 25 g/m^2 to about 80 g/m^2, more preferably of between about 30 g/m^2 to about 60 g/m^2.

[0016] By using a wide buckle folder to produce multiple width folded coupons, cutting the multiple width folded coupons to form a plurality of separate individual folded coupons disposed in side-by-side relationship and then merging the separate individual folded coupons into a single lane, the apparatus of the invention overcomes the inherent speed limitation of the buckle folder. Indeed, the operating speed of the buckle folder may be advantageously reduced while maintaining targeted output, thereby improving the folding quality of the inserts, onserts, outserts or other folded coupons produced.

[0017] Transporting the at least two individual folded coupons along twisted portions of the at least two separate coupon transport paths prior to merging the at least two separate coupon transport paths into a single path changes the orientation of the at least two individual folded coupons relative to the transport axis. This enables the individual folded coupons to be merged into a single lane without being twisted about an axis perpendicular to the plane thereof, which would result in damage to the individual folded coupons.

[0018] Preferably, the at least two separate coupon transport paths are of different length. In use, by transporting the at least two individual folded coupons along separate coupon transport paths of different length, at substantially the same speed, the at least two individual folded coupons are displaced relative to one another along the transport axis.

[0019] Alternatively, the at least two individual folded coupons could, for example, be transported along separate coupon transport paths of the same length at different speeds in order to displace the at least two individual folded coupons relative to one another along the transport axis.

[0020] Preferably, the at least two individual folded coupons are displaced relative to one another along the transport axis upstream of the twisted portions of the separate coupon transport paths.

[0021] Preferably, the apparatus further comprises a turning unit mounted downstream of the transport system for receiving the at least two individual folded coupons from the transport system along the transport axis and transporting the at least two individual folded coupons downstream along a second transport axis substantially perpendicular thereto, the turning unit comprising a single driven belt and a free roller between which, in use, the at least two individual folded coupons are transported. The use of a single driven belt and a free roller, rather than a pair of belts, advantageously avoids slippage that could damage the individual folded coupons.

[0022] According to the invention there is further provided apparatus for changing the orientation of transported laminar articles, the apparatus comprising: an elongate fixed surface twisted about its longitudinal axis; and a driven belt mounted such that it follows and is in contact with the elongate fixed surface, whereby, in use, laminar articles held between the belt and the elongate fixed surface are transported longitudinally along the elongate fixed surface by the driven belt.

[0023] Apparatus for changing the orientation of transported laminar articles according to the invention may be used in order to change the direction in which a given stream of laminar articles is transported and/or to enable separate streams of laminar articles to be merged into a single stream.

[0024] Preferably, the elongate fixed surface is twisted about its longitudinal axis through an angle of up to 90 degrees in a clockwise or anti-clockwise direction. More preferably, the elongate fixed surface is twisted through an angle of approximately 90 degrees about its longitudinal axis.

[0025] Preferably, the driven belt is substantially non-circular in cross-section, more preferably the driven belt is substantially trapezoidal in cross-section. The use of a driven belt of substantially trapezoidal cross-section assists in ensuring that the driven belt follows and is in contact with the elongate fixed surface. Furthermore, a substantially trapezoidal cross-section advantageously prevents the driven belt from rotating about its longitudinal axis as it transports the laminar articles along the elongate fixed surface.

[0026] Preferably, the elongate fixed surface is a metal plate, more preferably a metal plate having a friction reducing structured surface of a type known in the art. To avoid damage to laminar articles as they are transported along the twisted elongate fixed surface of the apparatus by the driven belt thereof, the coefficient of friction between the laminar articles and the elongate fixed surface should be less than that between the laminar articles and the driven belt. The use of a metal plate having a low friction structured surface advantageously reduces friction between the laminar articles and the elongate fixed surface as they are transported along the twisted elongate fixed surface by the driven belt.

[0027] Preferably, the longitudinal axis of the metal plate or other elongate fixed surface is bowed. The provision of a small bow or curve in the longitudinal axis of the elongate fixed surface helps to ensure that laminar articles are constantly and positively held between the elongate fixed surface and the driven belt as they are transported.

[0028] The laminar articles may be folded or unfolded printed sheet material. Preferably, the laminar articles are folded coupons, most preferably the laminar articles are folded paper coupons.

[0029] According to the invention there is also provided apparatus for aligning transported laminar articles, the apparatus comprising: an elongate fixed surface; a guide extending along the elongate fixed surface; a driven belt extending along the elongate fixed surface proximate the guide; and a pair of rollers disposed at either end of the belt, wherein the belt is mounted on the rollers with its longitudinal axis inclined at an acute angle to the axes of rotation thereof such that, in use, the belt rotates about its longitudinal axis as it is driven, whereby, in use, laminar articles held between the belt and the elongate fixed surface are transported longitudinally along the elongate fixed surface by the driven belt and concurrently transversely aligned against the guide by rotation of the driven belt about its longitudinal axis.

[0030] Preferably, the belt is substantially circular in cross-section. A substantially circular cross-section advantageously facilitates rotation of the belt about its longitudinal axis as it is driven.

[0031] Preferably, the elongate fixed surface is a metal plate, more preferably a metal plate having a structured surface which, in use, reduces friction between the laminar articles and the elongate fixed surface as the laminar articles are transported along the elongate fixed surface and aligned against the guide by the belt.

[0032] Preferably, the metal plate or other fixed surface is at least slightly curved. The provision of a small bow or curve in the longitudinal axis of the fixed surface helps to ensure that laminar articles are constantly and positively held between the fixed surface and the belt as they are transported.

[0033] The invention will be further described by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic perspective view of a modular system for producing and transporting onserts according to the present invention;

Figures 2a to 2d are schematic views of the relative positions of folded onserts produced by the modular system of Figure 1 at various stages during production.

Figure 3 is an enlarged perspective view of a twisting unit forming part of the modular system of Figure 1; and

Figure 4 is an enlarged perspective view of an alignment unit forming part of the modular system of Figure 1.

[0034] Figure 1 shows a modular system 2 for folding sheets of pre-printed paper to produce multiple width folded onserts, cutting the multiple width folded onserts to produce separate individual folded onserts and transporting the separate individual folded onserts to a hopper where they are stacked ready for placement onto packaged consumer goods, such as cigarette packs.

[0035] The modular system 2 shown in Figure 1 generally comprises a buckle folder 4, a separation unit 6, a joining unit 8, an alignment unit 10, a feeding unit 12 and a hopper 14, which are connected to one another via a series of belt transport systems, and which are linked to a computer control system (not shown).

[0036] In use, flat sheets of paper with three onserts pre-printed thereon in side-by side relationship are placed in a stacker 16, which is mounted on the buckle folder 4. As explained in more detail below, depending upon demand the sheets of pre-printed paper are drawn sequentially from the stacker 16 into the buckle folder 4 where they are processed through various rollers and folding pans or chutes in a known manner to produce triple width folded onserts 18 as shown in Figure 2a (the broken lines in Figure 2a show the three individual folded onserts making up the triple width folded onsert 18). As an alternative to using sheets of pre-printed paper, a bobbin holding a continuous roll of pre-printed paper and a registered transverse cutter assembly constructed and arranged to cut three onserts in side-by-side relationship from the continuous roll may be linked to the buckle folder 4 as described in, for example, WO-A1-2004/003726 and WO-A1-2004/076322.

[0037] Upon exiting from the buckle folder 4, the triple width folded onserts 18 are cut longitudinally by a longi-

tudinal cutter assembly (not shown) to produce a group of three separate individual folded onserts 20 disposed in side-by side relationship, as shown in Figure 2b. The arrows between Figures 2a to 2d indicate the downstream direction of transport of the folded onserts through the modular system 2 shown in Figure 1.

[0038] A first belt transport system 22 immediately downstream from the longitudinal cutter assembly serially receives the groups of three separate individual folded onserts 20 after the longitudinal cutting operation and transports them between three pairs of driven endless belts to an ejection unit 24 located beneath the buckle folder 4. As shown in Figure 1, the three separate individual folded onserts 20 in each group are moved along three parallel vertical lanes of equal length by the three pairs of endless belts, which are driven at the same speed by the buckle folder 4. Each group of three separate individual folded onserts 20 is, therefore, delivered by the first belt transport system to the ejection unit 24 in the side-by-side relation shown in Figure 2b.

[0039] A plurality of photocells 26 linked to the computer control system are mounted immediately upstream of the ejection unit 24. In use, these photocells 26 measure the width and length of individual folded onserts 20 in each of the three lanes of the first belt transport system 22 as they pass from the longitudinal cutter assembly to the ejection unit 24. The width and length measurements of each individual folded onsert 20 are compared by the computer control system with pre-set specified limits. If the measurements are within the pre-set specified limits, the computer control system allows the three individual folded onserts 20 to pass through the ejection unit 24 and continue downstream through the remainder of the modular system 2. If, however, the width or length measurement of any of the three individual folded onserts 20 falls outside of the pre-set specified limits, the computer control system instructs the ejection unit 24 to remove the three individual folded onsert 20 from the system 2.

[0040] Upon exiting the ejection unit 24, the groups of three separate individual folded onserts 20 are serially received, in the side-by-side relation shown in Figure 2b, by the separation unit 6, which transports them further downstream to the joining unit 8. As described in more detail below, in the separation unit 6 the three separate individual folded onserts 20 in each group are displaced or shifted relative to one another in the direction of travel, so that they are no longer aligned in side-by-side relation when they reach the joining unit 8.

[0041] The separating unit 6 comprises a series of pairs of driven endless belts that move the three separate individual folded onserts 20 in each group along three parallel lanes 28. In use, the pairs of endless belts are driven at the same speed, however, as shown in Figure 1, the three parallel lanes 28 along which the three separate individual folded onserts 20 in each group are transported are not of equal length. Consequently, as the three individual folded onserts 20 in each group are transported substantially vertically downwards from the ejection unit 24, turned through 90 degrees using a turn module described in more detail below, and then transported substantially horizontally along the three parallel lanes 28 between the series of pairs of driven endless belts, they travel over different distances at the same speed. As a result, when the three separate individual folded onserts 20 in each group reach the joining unit 8, upstream of the separation unit 6, they are shifted relative to one another in the direction of transport as shown in Figure 2c.

[0042] The joining unit 8 serially receives the shifted groups of three separate individual folded onserts 20 from the separation unit 6 and merges them into a single lane, as shown in Figure 2d, by means of a combination of three twisting units 30, which change the orientation of the three separate individual onserts 20 in each group as they transport them downstream. Two of the separate individual folded onserts 20 in each group are initially merged into a single lane by two of the twisting units 30 and the third individual folded onsert 20 in each group is then merged into this single lane by the remaining twisting unit 30.

[0043] As shown in Figure 3, each twisting unit 30 comprises an elongate metal plate 32 that is twisted through an angle of approximately 90 degrees about its longitudinal axis. A pair or rollers 34 with their axes of rotation (shown by a cross and a broken line in Figure 3) approximately perpendicular to the longitudinal axis and parallel to the surface of the metal plate 32 are mounted at either end of the metal plate 32. The rollers 34 are linked by an endless belt 36 of trapezoidal cross-section that follows, and is in contact with, the twisted longitudinal surface of the metal plate 32 (for clarity, a portion of the endless belt 36 has been omitted from Figure 3).

[0044] Upon entry into the joining unit 8, each of the three individual folded onserts 20 in the staggered group formed by the separation unit 6 is fed between the metal plate 32 and the trapezoidal endless belts 36 of a respective one of the three twisting units 30. The individual folded onserts 20 are held against and transported downstream along the longitudinal surface of the metal plates 32 by the endless belts 36, which are driven either by the separation unit 6 or by a second belt transport system 38 immediately upstream of the joining unit 8 and so, in use, have the same linear speed.. To minimise friction between the individual folded onserts 20 and the surface of the metal plates 32, so that the individual folded onserts 20 slide smoothly along the surface of the metal plates 32 as they are transported by the endless belts 36, the metal plates 32 preferably have a structured surface. In addition, to ensure that the individual folded onserts 20 are constantly and positively held between the endless belts 36 and the metal plates 32 as they are transported, the longitudinal axis of each metal plate 32 is slightly bowed or curved.

[0045] Since the longitudinal surfaces of the metal plates 32 are twisted through an angle of approximately 90 degrees, the orientation of the individual folded onserts 20 relative to the direction of travel also changes

by the same amount as the individual folded onserts 20 pass through the twisting units 30. Upon exiting the three twisting units 30, the re-orientated individual folded onserts 20 are merged into a single lane as previously described above. As the three separate individual folded onserts 20 in the group are shifted relative to one another in the direction of travel when they enter the joining unit 8, they are spaced apart one behind the other as shown in Figure 2d when they are merged into the single lane as they exit the twisting units 30.

[0046] Upon exiting the joining unit 8, the longitudinally spaced apart individual folded onserts 20 are transported downstream along a single lane to the alignment unit 10 by the second belt transport system 38. As shown in Figure 1, the second belt transport system 38 comprises a turn module 40 downstream of the joining unit 8, which changes the direction of the single lane by approximately 90 degrees from substantially vertical to substantially horizontal, and a straight module 42, located between the turn module 40 and the alignment unit 10.

[0047] To avoid any slippage which could potentially damage the individual folded onserts 20, the turn module 40 comprises a single driven endless belt, which is bent through 90 degrees around the outside of a free roller. In use, the spaced apart individual folded onserts 20 are transported between the endless belt and the free roller to make the turn. The straight module 42 then transports the single lane of spaced apart individual folded onserts 20 horizontally downstream to the alignment unit 10 between a pair of driven endless belts. To ensure a constant pressure between the pair of belts and so prevent slippage, the transport portion of the belts is advantageously deviated by a pair of support rollers 44.

[0048] As the separate individual folded onserts 20 are transported through the modular system 2 upstream of the alignment unit 10, slight changes in position of the separate individual folded onserts 20 between pairs of endless belts can occur. In order to correct any such changes, the separate individual folded onserts 20 are transported along a guide rail 46 within the alignment unit 10, which is shown in more detail in Figure 4.

[0049] As shown in Figure 4, the alignment unit 4 comprises an elongate metal plate 48 along which the guide rail 46 is mounted. A pair of rollers 50 are mounted at either end of the metal plate 48 with their axes of rotation (shown by the broken lines in Figure 4) substantially parallel to one another and perpendicular to the longitudinal axis of the metal plate 48. The rollers 50 are linked by an endless belt 52 of circular cross-section which extends along the metal plate 48 adjacent to the guide rail 46 (for clarity, a portion of the endless belt 52 has been omitted from Figure 4). The endless belt 52 is positioned on the rollers 50 such that its longitudinal axis is disposed at an acute angle to the axes of rotation thereof and to the longitudinal axis of the elongate metal plate 48. In use, when the endless belt is driven this "misalignment" of the endless belt 52 on the rollers 50 generates a lateral friction that causes the endless belt 52 to rotate about its longitudinal axis, in the direction shown by the arrow in Figure 4.

[0050] In the alignment unit 4 shown in Figure 4, the rollers 50 are in line with one another and the "misalignment" of the endless belt 52 on the rollers 50 is created by mounting the belt in grooves proximate opposed ends thereof. It will be appreciated, however, that "misalignment" of the endless belt 52 on the rollers 50 could alternatively be achieved by, for example, mounting the belt in central grooves on rollers that are offset relative to one another in the transverse direction of the metal plate 48.

[0051] Upon entry into the alignment unit 10, the single lane of spaced apart individual folded onserts 20 is fed between the metal plate 48 and the round endless belt 52, which holds the individual folded onserts 20 against the metal plate 48 and transports them downstream along its surface. As the spaced apart individual folded onserts 20 are transported longitudinally along the surface of the metal plate 48 by the driven endless belt 52, the rotation of the endless belt 52 about its longitudinal axis also transports them transversely across the surface of the metal plate 48 to the guide rail 46 thereby laterally aligning them.

[0052] To minimise friction between the individual folded onserts 20 and the surface of the metal plate 48, so that the individual folded onserts 20 slide smoothly across the surface of the metal plate 48 as they are transported and aligned by the endless belt 52, the metal plate 48 preferably has a structured surface. In addition, to ensure that the individual folded onserts 20 are constantly and positively held between the endless belt 52 and the metal plate 48, the longitudinal axis of the metal plate 48 is preferably slightly curved.

[0053] Upon exiting the alignment unit 10, the single lane of laterally aligned spaced apart individual folded onserts 20 passes through a pressure roller unit 54 positioned between the alignment unit 10 and the feeding unit 12, which advantageously improves the flatness of the individual folded onserts 20, thereby allowing for smoother processing of the individual folded onserts 20 in the hopper 14 and so more precise application of the individual folded onserts 20 onto packaged consumer goods. The pressure roller unit 54 comprises a pair of parallel pressure rollers mounted substantially transverse to the single lane of spaced apart individual folded onserts 20, between which the spaced apart individual folded onserts 20 pass as they are transported downstream from the alignment unit 10 to the feeding unit 12.

[0054] Having passed through the pressure roller unit 54, the flattened and laterally aligned spaced apart individual folded onserts 20 are transported downstream in a single lane to the feeding unit 12 at a linear speed typically in excess of 100m/min. As described below, the feeding unit 12 stops the individual folded onserts 20 and stacks them one at a time in the hopper 14. If desired, the feeding unit 12 may be used to stack the individual folded onserts 20 in a cartridge or other receptacle in-

stead of the hopper 14.

[0055] To stop the individual folded onserts 20, the feeding unit 12 comprises a pair of spiral wheels 56 of the type used in, for example, known machinery for counting bank notes, having a plurality of spirally extending fingers that form slots in the periphery thereof 56. The spiral wheels 56 are mounted directly above the hopper 14 in a spaced apart relationship on a common shaft that, in use, is rotated in time relation to the belt transport system that feeds the flattened and laterally aligned spaced apart individual folded onserts 20 to the feeding unit 12. The slots on each spiral wheel 56 are aligned with the slots on the other spiral wheel 56 so that upon rotation of the shaft, the spiral wheels 56 rotate with their slots in synchrony.

[0056] The single lane of individual folded onserts 20 is transported through the feeding unit 12 to the top of spiral wheels 56, where the spaced apart individual folded onserts 20 are individually and sequentially directed tangentially into consecutive aligned slots on the periphery of the pair of rotating spiral wheels 56. After the individual folded onserts 20 enter the slots thereon, they are carried round to the top of the hopper 14 by the rotation of the spiral wheels 56, which cause the individual folded onserts 20 to decelerate as they move deeper into the spirally shaped slots.

[0057] As they reach the top of the hopper 14, the individual folded onserts 20 are forced out of the slots on the rotating spiral wheels 56 and deposited in the hopper 14 by a stripper mounted between the pair of spiral wheels 56, which engages the leading edge of the individual folded onserts 20 thereby removing them from the rotating spiral wheels 56.

[0058] In use, the hopper 14 advantageously acts as a buffer, where the folded onserts 20 are stacked before being fed further downstream to an application unit (not shown) which applies them to the packaged consumer goods in a conventional manner. However, the feeding unit 12 and the hopper 14 may alternatively be omitted and the single lane of laterally aligned spaced apart coupons fed straight to an applicator for placement directly onto the packaged consumer goods.

[0059] Two longitudinally spaced apart photocells 58 linked to the computer control system are mounted in the upper region of the vertical hopper 14. In use these photocells 58 are used to detect the filling level of the hopper 14 and so, by way of the computer control system, control the operation of the buckle folder 4. For example, if both photocells 58 within the hopper 14 are covered by the stack of individual folded onserts 20 therein, the computer control system instructs the buckle folder 4 to stop drawing sheets of pre-printed paper from the stacker 16. If, however, only the lower photocell 58 is covered by the stack of folded onserts 20 in the hopper 14, the computer control system instructs the buckle folder 4 to operate slowly and only draw a sheet of pre-printed paper from the stacker 16 on every second stroke. Finally, if both photocells 58 within the hopper 14 are uncovered, the computer control system instructs the buckle folder 4 to draw sheets of pre-printed paper from the stacker 16 continuously.

[0060] While the invention has been exemplified above with reference to a system for producing and transporting folded paper onserts, it will be appreciated that apparatus according to the invention may also be employed to produce and transport any other kind of folded coupon.

[0061] In the system described above the buckle folder produces triple width folded onserts that are then cut to produce three separate individual onserts. It will also be appreciated, however, that the system could alternatively comprise a buckle folder which produces double width folded coupons that are cut to produce two separate individual coupons or multiple width folded coupons that are cut to produce more than three separate individual coupons which, following appropriate minor modifications to the separation unit 6 and joining unit 8, may be transported downstream and merged into a single lane as previously described.

[0062] The modular nature of the present system advantageously enables it to be readily adapted to any packaging machinery layout. By positioning the various modules or units in an appropriate manner, apparatus according to the present invention may be easily configured to produce folded coupons and then transport them in any required direction and over any required distance.

Claims

1. Apparatus for producing and transporting folded coupons comprising:

a buckle folder (4) for receiving and folding sheet material to produce a multiple width folded coupon (18);
a cutter for cutting the multiple width folded coupon (18) to produce at least two individual folded coupons (20) disposed in side-by-side relationship; and
a transport system (6) (8) for receiving the at least two individual folded coupons (20) disposed in side-by-side relationship from the cutter and transporting the at least two individual folded coupons (20) downstream along a transport axis,

characterised in that the transport system (6)(8) comprises at least two separate coupon transport paths (28) disposed in side-by-side relationship that merge to form a single coupon transport path, at least a portion of each separate coupon transport path (28) being twisted about the transport axis,
wherein, in use, each of the at least two individual folded coupons (20) is transported along a different one of the at least two separate coupon transport paths (28) such that, when the at least two separate

coupon transport paths (28) merge to form a single coupon transport path, the at least two individual folded coupons (20) are displaced (20) relative to one another along the transport axis.

2. Apparatus according to claim 1 wherein the at least two separate coupon transport paths (28) are of different length.

3. Apparatus according to claim 1 or 2 wherein the at least two individual folded coupons are displaced relative to one another along the transport axis upstream of the twisted portions of the separate coupon transport paths.

4. Apparatus according to claim 1, 2 or 3 further comprising a turning unit (40) mounted downstream of the transport unit (6)(8) for receiving the at least two individual folded coupons (20) from the transport unit (6) (8) along the transport axis and transporting the at least two individual folded coupons (20) downstream along a second transport axis substantially perpendicular thereto, the turning unit (40) comprising a single driven belt and a free roller between which, in use, at least two individual folded coupons (20) are transported.

5. Apparatus (30) for changing the orientation of transported laminar articles (20), the apparatus comprising:

an elongate fixed surface (32) twisted about its longitudinal axis; and
a driven belt (36) mounted such that it follows and is in contact with the elongate fixed surface (32),
whereby, in use, laminar articles (20) held between the belt (36) and the elongate fixed surface (32) are transported longitudinally along the elongate fixed surface (32) by the driven belt (36).

6. Apparatus (30) according to claim 5 wherein the elongate fixed surface (32) is twisted through an angle of approximately 90° about its longitudinal axis.

7. Apparatus (30) according to claim 5 or 6 wherein the longitudinal axis of the elongate fixed surface (32) is bowed.

8. Apparatus (30) according to claim 5, 6 or 7 wherein the driven belt (36) is substantially trapezoidal in cross-section.

9. Apparatus (30) according to any of claims 5 to 7 wherein the elongate fixed surface is a metal plate with a structured surface.

10. Apparatus according to claim 1 wherein each of the at least two separate coupon transport paths (28) of the transport system (6)(8) comprises apparatus (30) according to any of claims 5 to 9.

11. Apparatus (10) for aligning transported laminar articles (20), the apparatus comprising:

an elongate fixed surface (48);
a guide (46) extending along the elongate fixed surface (48);
a driven belt (52) extending along the elongate fixed surface (48) proximate the guide (46); and
a pair of rollers disposed at either end of the belt (52),

wherein the belt (52) is mounted on the rollers with its longitudinal axis inclined at an acute angle to the axes of rotation thereof such that, in use, the belt (52) rotates about its longitudinal axis as it is driven, whereby, in use, laminar articles (20) held between the belt (52) and the elongate fixed surface (48) are transported longitudinally along the elongate fixed surface (48) by the driven belt (52) and concurrently transversely aligned against the guide (46) by rotation of the driven belt (52) about its longitudinal axis.

12. Apparatus (10) according to claim 11 wherein the driven belt (52) is substantially circular in cross-section.

13. Apparatus (10) according to claim 11 or 12 wherein the elongate fixed surface is a metal plate with a structured surface.

14. Apparatus for stacking a stream of transported laminar articles (20) into a receptacle (14), the apparatus comprising:

alignment apparatus (10) according to any of claims 11 to 13 for aligning the stream of transported laminar articles (20);
a receptacle (14) downstream of the alignment apparatus (10) for receiving a stack of the laminar articles (20); and
a feeder (12) mounted between the alignment apparatus (10) and the receptacle (14) for receiving the aligned stream of transported laminar articles from the alignment apparatus (10) and stacking the laminar articles individually in the receptacle (14).

15. Apparatus according to claim 14 wherein the feeder (12) comprises at least one wheel (56) having a plurality of slots defined in the periphery thereof that, in use, receive the laminar articles (20).

16. Apparatus according to claim 14 or 15 further com-

prising a pair of pressure rollers mounted between the alignment apparatus (10) and the feeder (12), between which, in use, the aligned stream of lamina articles (20) is transported.

17. A modular system (2) for producing, transporting and stacking folded coupons (20) comprising:

apparatus according to claim 1, 2, 3, 4 or 10 for producing and transporting the folded coupons; and
apparatus according to any of claims 14 to 16 for stacking the transported folded coupons into a receptacle.

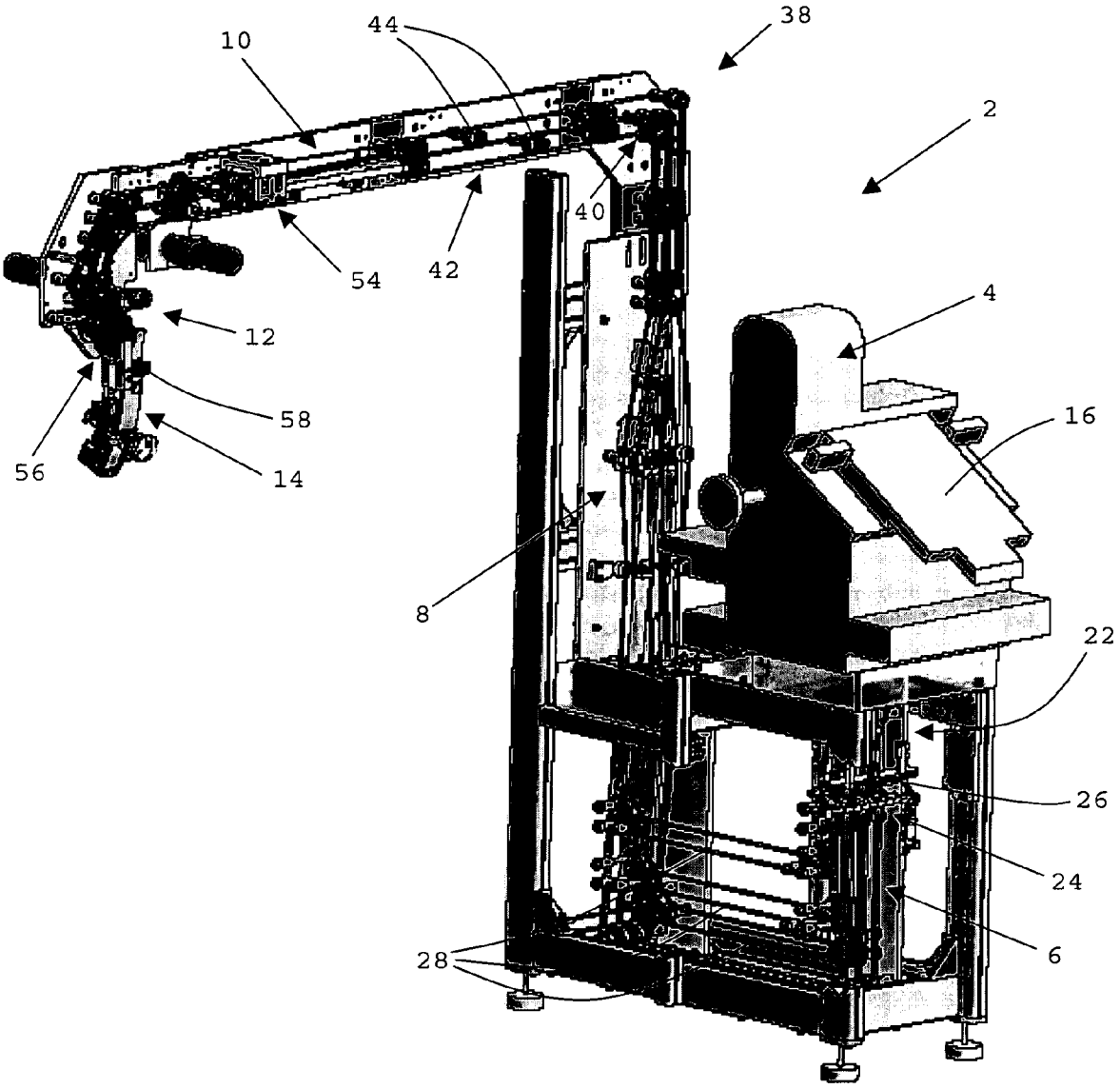


Figure 1

Figure 2a

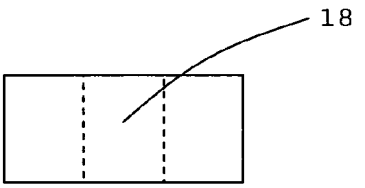


Figure 2b

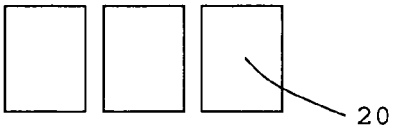


Figure 2c

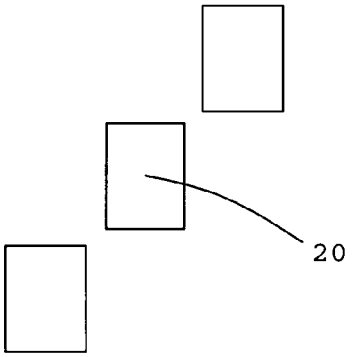
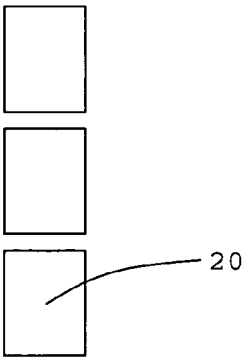


Figure 2d



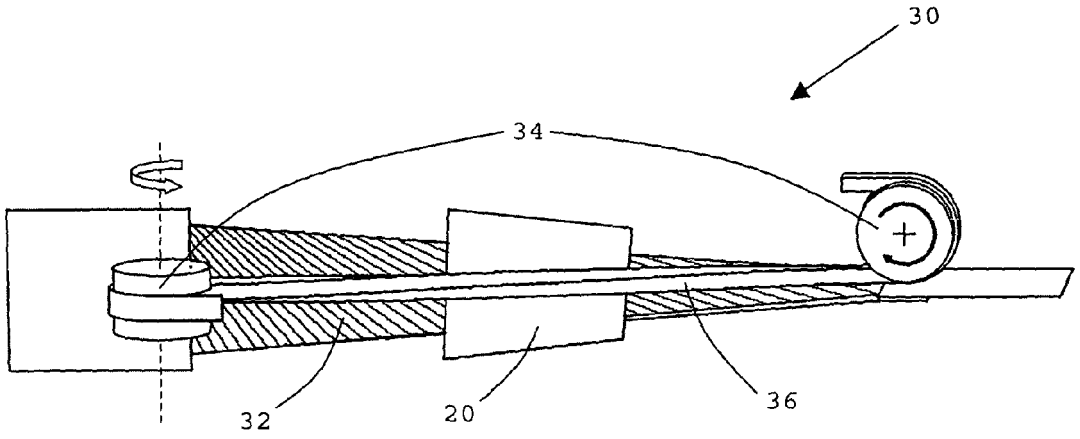


Figure 3

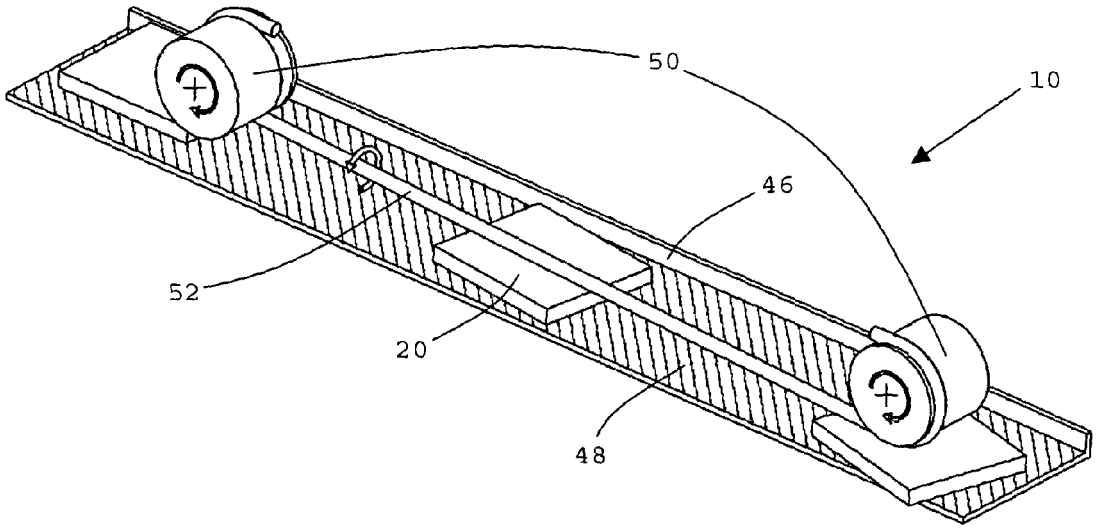


Figure 4

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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 7246

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

B65H
B65B
B31B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 June 2006	Johne, O

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EUROPEAN SEARCH REPORT

Application Number
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 June 2006	Johne, O

CATEGORY OF CITED DOCUMENTS

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 05 25 7246

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-10

transport path twisted about the transport axis
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2. claims: 11-17

belt mounted on a pair of rollers with its longitudinal axis inclined to the axes of rotation of the rollers
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 25 7246

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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19-06-2006

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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