Nov. 17, 1964 G. A. STRAHL 3,157,528

APPARATUS AND METHOD FOR CAST COATING SHEET MATERIAL

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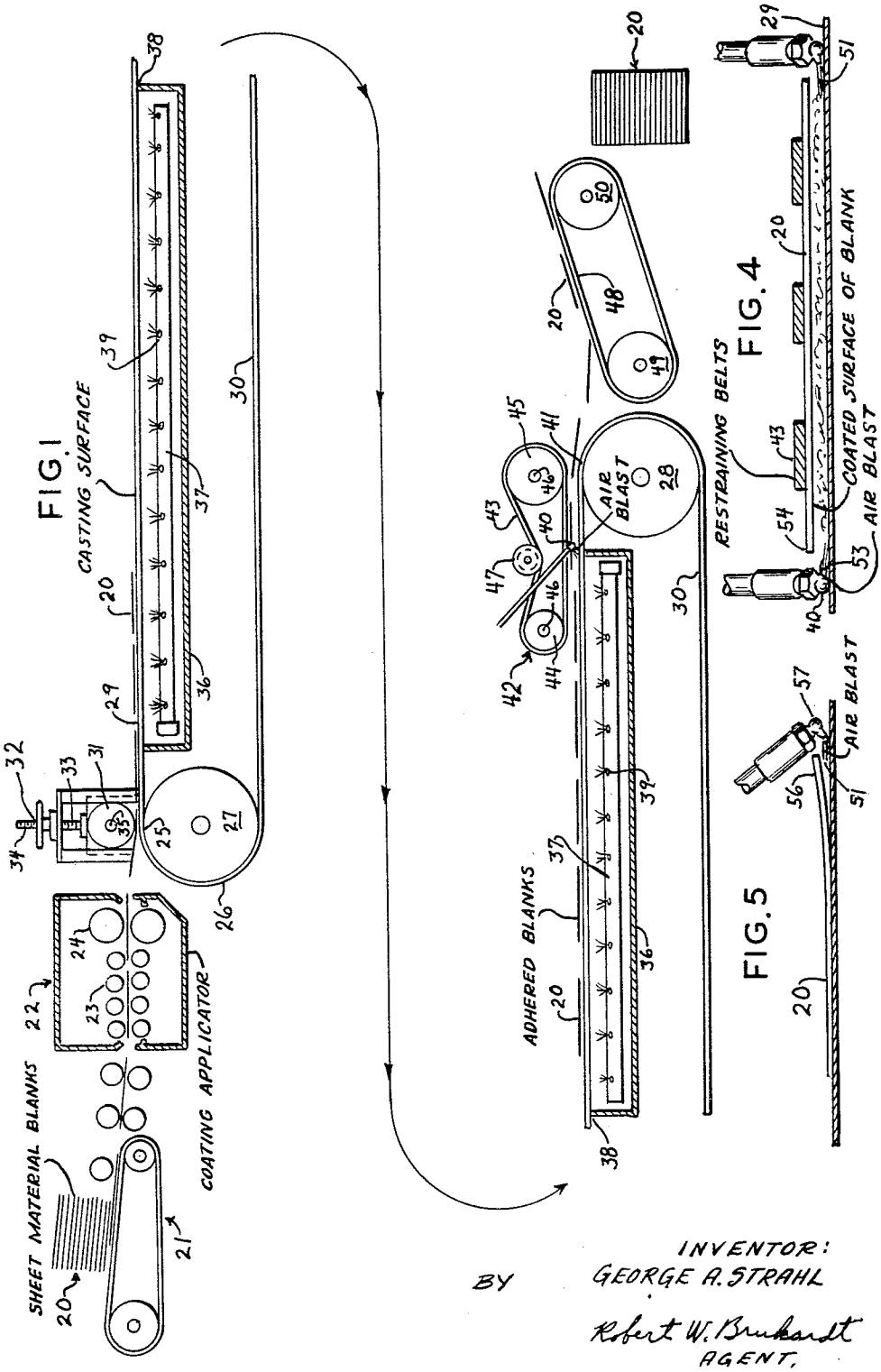

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FIG. 2

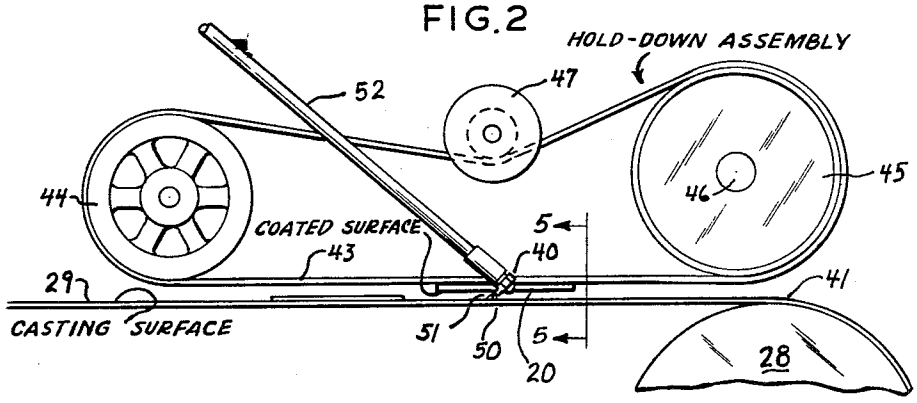
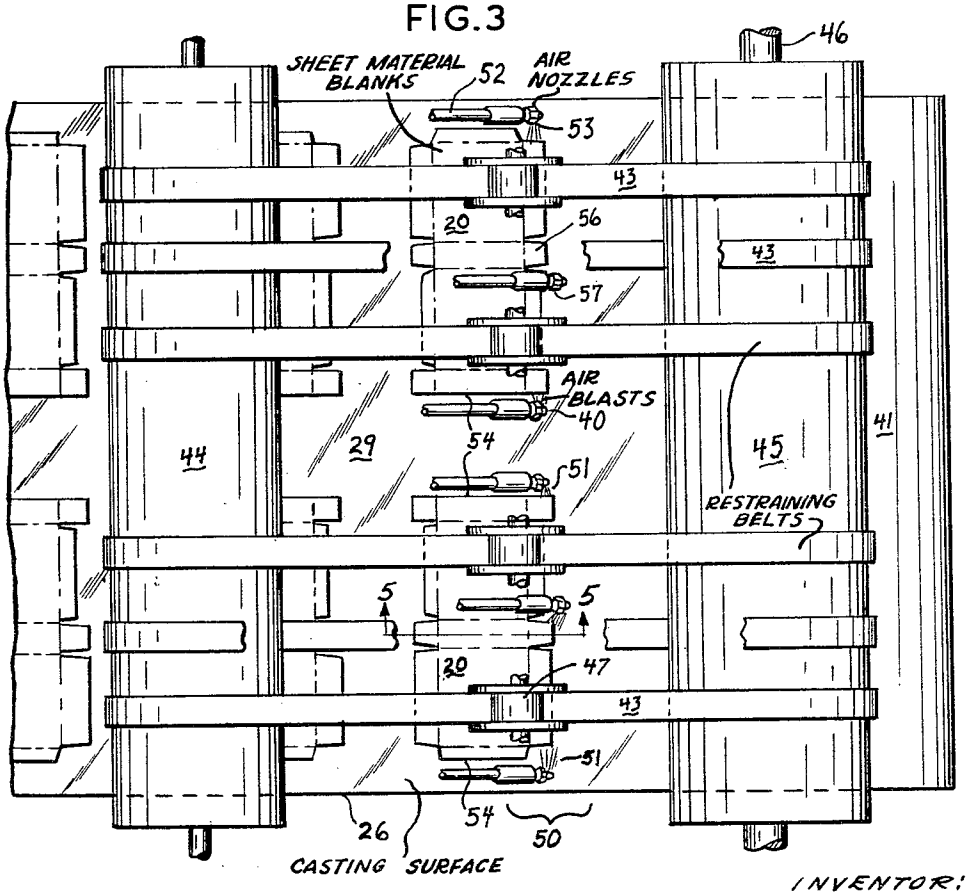


FIG. 3



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APPARATUS AND METHOD FOR CAST COATING SHEET MATERIAL

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This invention relates to an improvement in the art of cast coating wherein fluid coating compositions are applied to discrete blanks of sheet material and then solidified in contact with a casting surface to obtain a desired finish on the coating after solidification thereof.

The art of obtaining specific surface finishes on coated paper material by means of cast coating is described in Patent No. 1,719,166, dated July 2, 1929, to Bradner. Bradner teaches us that fluid coatings may be solidified in contact with a casting surface, either by chilling in the case of thermo-plastic coatings or by heating in the case of liquid coatings having a volatile carrier. Bradner teaches us further that an essential feature of the cast coating art is that the coating after solidification must be substantially non-adherent to the casting surface otherwise the coating would be imperfect. A further contribution to the cast coating art is shown in Patent No. 2,437,492, dated March 9, 1948, to Allen. An apparatus therein disclosed provides an endless belt in generally horizontal disposition wherein the top surface of the belt may be heated or chilled by an underlying tanks or troughs of water or other suitable liquid heat transfer agents. Materials deposited on the belt surface are solidified thereon.

This apparatus is particularly adapted to the cast coating art and an example of a similar apparatus is shown in the Patents No. 2,892,735, dated June 30, 1959, and 2,982,245, dated May 2, 1961, to Curler et al. These patents are directed particularly towards a solution of the problem of obtaining release of discrete paperboard blanks from a casting surface after suitable solidification of thermoplastic coatings. The method therein disclosed provides coatings having a determined adhesion to the casting surface whereby the coated blanks separate from the casting surface at the abrupt change in direction of the belt whereat the belt follows a curvilinear return path. There is further shown in these patents an air blast which is directed against the leading edges of the blanks as they separate from the belt at the curvilinear return path to assist in the removal of the blanks from the casting surface.

The known means for separating discrete blanks from casting surfaces also include the use of mechanical devices which have a sharp edge in close adjacency to the belt surface to catch a leading edge of the blank and plow it or lift it from the casting surface. This means, however, has not been entirely satisfactory in that such mechanical devices may either scratch highly polished casting surfaces or on the other hand may scratch the coating and thereby defeat the purpose of the casting operation. The beforementioned Curler patents, while avoiding this mechanical operation means, are necessarily limited to specific coating compositions which have the required adhesion to the casting surface. However, as the cast coating art is applied to ever expanding commercial applications it has been found that various coating formulations having special properties may not be adjusted to the determined adhesion levels and therefore other means of interrupting residual adhesion to the casting surface are required.

The present invention provides a method and apparatus for solving the problem of interrupting a residual adhesion of a coated blank from a planar casting surface. This

invention more particularly provides for an air blast in closely spaced adjacency to the casting surface in acute angular relation thereto and directed at the casting surface adjacent the side edges of the successive passing coated blanks to interrupt the adhesion thereof. The invention further provides for means for maintaining the thus separated blanks in relative position on the advancing casting surface until they can be removed at the end of the horizontal travel of the belt into an orderly arrangement removed from the casting surface.

The present invention thus provides for positive release of discrete coated blanks from a planar casting surface without deleterious effect on either the finely finished casting surface or to the finish imparted to the coated blanks. The invention is further adapted to high speed production and is relatively unaffected by intermittent running and the resulting variables such as variance in temperature or compositions of the coating material or the temperature of the belt surface which has been a serious disadvantage of prior art methods and apparatus. In this connection it is well to note that in cast coating machines utilizing a continuous belt casting surfaces and having high production capacities, the retention of even a single blank on the casting surface tends to compound the difficulty and results in annoying and costly work stoppage and the discarding of the resulting defectively coated blanks.

These and other objects and advantages of the invention will become apparent from the following description when read in connection with the accompanying drawings, in which:

FIGURE 1 is a vertical cross-sectional view showing a cast coating machine embodying the invention;

FIGURE 2 is an enlarged vertical cross-sectional view showing the disposition of the air jet nozzle in relation to the planar belt surface and the blank retaining means;

FIGURE 3 is a top perspective view partially broken away to show the disposition of the air jet nozzle in relation to carton blanks in adhered relation to the casting surface;

FIGURE 4 is a cross-sectional view through a carton blank released from the casting surface by an opposed pair of air jets;

FIGURE 5, a cross-sectional view through line 5–5 in FIGURE 2, shows the initial stage of the separation of a blank portion by an air jet directed adjacent one edge thereof.

Referring now to the drawings in detail, the complete cast coating machine embodying the invention is shown in FIGURE 1 where cut and scored discrete paperboard blanks **20** are positioned in stacked relation on a conventional blank feeding apparatus **21** which successively feeds the bottom blank from a stack into a coating applicator **22**. The coating applicator may be of any conventional type, a spray type applicator being diagrammatically shown in the drawing wherein a coating of molten wax composition is sprayed on the applicator rolls **23** and thence transferred to the successive blanks **20**. Metering rolls **24** remove excess coating as the blanks are projected from the coating applicator **22**. Alternatively, the coating may be applied by a system of pick-up, transfer and applicator rolls; or by dipping in a fluid coating composition and passing through suitable metering means such as paired rollers or doctor blade. The important factor in the coating application being that the coating must be applied and maintained in a fluid or plastic state until the blank **20** is pressed into intimate contact with the casting surface.

After the blanks are coated with a molten composition, which for example may be a thermo-plastic wax composition, the blanks are fed onto the casting surface at the feed end **25** of the continuous casting belt **26** with the at

least one coated surface of the blank **20** in contact therewith. The casting belt is disposed about sheaves **27** and **28**. The belt **26** is generally horizontally disposed presenting a planar horizontal upper surface **29** and a return portion **30**. The belt **26** may be of any suitable material for imparting the desired finish to the particular coating composition in use, but in the case of thermo-plastic wax compositions wherein a high gloss finish is desired, the belt is preferably stainless steel which is highly polished to provide a specular finish. Stainless steel is durable and provides desirable high heat transmission characteristics. One of the sheaves is power driven to motivate the casting belt **28**.

An ironing roll **31** is rotatably positioned over the feed end **25** of the casting belt upper surface **29** and firmly presses the coated blank **20** into intimate contact with the casting surface while the wax coating composition is still in a plastic state. The ironing roll **31** is adjustably mounted in relation to the casting surface to provide constant pressure under varying conditions. The ironing roll **31** adjustment means **32** may be spring loaded having a spring **33** responsive to the threaded shaft **34** which imparts the desired pressure and spacing to the ironing roll shaft **35**. The ironing roll **31** is further provided with a heating means to insure that the thermo-plastic coated blanks will have a greater adherence for the casting belt which is chilled, as described hereinafter, than for the ironing roll. The heating means, not shown, is preferably internally operative in the ironing roll **31** and may be a circulating hot oil system having external heating and pumping means, the oil being circulated through the ironing roll by means of ports in the ends of the ironing roll shaft **35**. The temperature is maintained above the melting point of the thermo-plastic coating. It is to be noted further that the blanks **20** emitting from the coating applicator **22** are projected initially against the lower portion ironing roll and thence almost instantaneously downward onto the casting surface **29**. This prevents a sliding action of the blank **20** on the casting surface **29** which may be deleterious to the finished coating.

A heat transmitting means is disposed subjacent the casting belt upper surface **29** and comprises troughs **36** wherein is disposed pipe conduits **37** for circulating a liquid heat transfer agent such as water. In this case the water is cooled by refrigerant means not shown and circulated through the conduits **37** to maintain the water in the troughs and adjacent the belt within a desired temperature range. In the case of thermo-plastic coatings the temperature range, of course, must be maintained at a lower temperature than the solidification temperature of the thermo-plastic coating. A trough **36** and conduit **37** assembly may correspond in length to the belt upper surface **29** intervening the sheaves **27** and **28**, but preferably two or more troughs, as shown, and included cooler circulation means are used. It has been found that a first trough adjacent the feed end **25** of the belt **26** may advantageously be maintained at a slightly higher temperature, even approaching the melting point of the coating in some instances, to facilitate the ironing down of the blanks **20** into intimate contact with the casting surface **29**. In any case, the trough or troughs **36** correspond closely to the width of the casting surface belt **26**. The belt **26** in passing over the troughs **36** is in contacting relation with the upper edges **38** of the troughs **36** and the chilled water being under pressure is presented against the bottom facing of the belt upper surface **29** effectively maintaining the desired temperature thereof. Provision for overflow is provided along the longitudinal side edges of the troughs **36**, whereby the excess coolant may be recirculated through the refrigerant means and then returned to the trough **36** through the conduit orifices **39**.

Along the planar surfaces of the casting belt **26** adjacent the take-off end **41** there is disposed one or more air jet nozzles **40** which are precisely related to the casting surface **29** and to the adhered carton blanks **20** thereon as

will be described hereinafter in more particular detail. The carton blank hold-down assembly **42** is disposed over the casting belt concurrent with the air nozzles **40** and comprises an arrangement of one or more belts **43** linearly aligned with the direction of movement of the casting belt **26** and mounted on sheaves **44** and **45**. The sheaves, as best shown in FIGURE 3, extend the full width of the belt **26** and are rotable about their respective shafts **46** supported on a frame not shown. Sheave **45** is driven to provide substantially synchronous movement of the hold-down belts **43** and the casting belt **26**. This may be conveniently accomplished by the provision of a protruding flange on the driven sheave **45** in contacting relation with the longitudinal margin of the casting belt **26**. The hold-down belt sheaves **44–45** are otherwise spaced from the casting belt to permit slight upward movement of the blanks **20** to attain complete separation thereof from the casting surface **29** and yet retain complete control and relative disposition of the individual blanks on the casting belt. Hold-down belt tensioning means **47** are pivotally mounted to a frame and weighted to provide the desired degree of tension. After release from the casting belt upper surface **29** the blanks are retained in relative position on the casting surface and are transported by frictional engagement with the casting belt surface **29** and the hold-down belts **43** outwardly to the take-off end **41** of the casting belt **28**.

The blanks **20** are successively projected onto an inclined collector belt **48** rotably mounted on sheaves **49–50**. The collector belt may be synchronized to the speed of the casting belt to receive the blanks **20** in spaced relation thereon so that may be ejected into straight stacking relation as shown at **70**. Other conventional collecting and stacking means may be used.

The hold-down assembly **42** is shown in enlarged view in FIGURE 2. It may be seen that the hold-down belt **43** are in closely spaced adjacency to the upper surface **29** of the casting belt so that the air blast on the casting belt surface adjacent the side edges of the carton blanks may force the blanks upwardly off the belt throughout their lateral width, but at the same time said blanks must be restrained under control and the flutter dampened to minimize displacement of the blanks on the casting sursurface. This arrangement thus permits orderly collecting and stacking of the blanks as they pass from the take-off end **41** of the casting belt. The belts of course are so disposed laterally of the casting belt **26** that they overlie the carton blanks to accomplish the desired purpose as best shown in FIGURE 3.

FIGURE 3 shows a preferred commercial embodiment of the invention wherein the blanks, depending on their overall size, may be disposed in two or more longitudinally aligned lines on the casting surface to obtain maximum utilization of the casting surface available width and consequently maximum production. The blanks **20** as they progress from the feed end **25** of the casting machine and prior to passing the release station **50** at the air nozzles **40** are substantially adhered to the belt surface **29**. The air jets **51** are directed from the nozzles **40** which are connected by piping **52** to suitable air supply. The orifice **53** in each nozzle may be of varied shape, as for example, a circular opening approximately $\frac{3}{64}$ inch in diameter with a 40 pound pressure air supply. The air blast **51** is directed at the casting surface **29** adjacent the longitudinally aligned edges **54** of the blanks **20** in an acute angular relation to the belt surface **29** preferably in the range of 15—45 degrees. Here the longitudinal aligned edges are to be understood as those parallel to the direction of travel of the casting belt, that is, longitudinally of the casting machine. The tolerance as to the disposition of the air blasts **51** in relation to the sides **54** of the blanks, while critical, is well within a tolerable range in the ordinary commercial operation and in fact may vary up to about one inch. Apparently, the sharply defined air blast **51** emitting from the nozzles **40** strikes the casting surface

29 and fans out in a deltoid manner intervening the blank edges and the casting surface 29, lifting the same, and progressing inwardly throughout the lateral width of the blank.

The arrangement of the air jets must be adjusted to conform to the particular blanks being cast coated. This may be accomplished by mounting the piping 52 on a fixedly positioned mounting bar 55, not shown, extending across the width of the casting belt 26 in vertically spaced relation thereto. Certain carton blanks which have a flexible protruding free edge portion 56, along the leading edge thereof, which may tend to adhere to the casting surface, can be specificially provided for by the addition of an intervening nozzle 57 which will serve to break the adhesion of this carton blank portion. Even through this interevning nozzle 57 necessarily exerts downward pressure on the top surface of the blank as the blank passes thereunder it does not interrupt the action of the nozzles 40 disposed adjacent the side edges 54 of the blank and complete separation of the blank is attained. Thereafter, while the blanks are completely separately from the casting surface they are retained in relative position and passed under the driven sheaves 45 and outwardly of the take-off end 41 of the casting belt 26 as before described.

As best shown in FIGURE 4 the blanks are completely separated from the casting surface 29 by the intervention of the air blast 51 between the blank 20 and said casting surface, but the blanks 20 are prevented from displacement from their relative position on the casting surface 29 by the hold-down belts 43. The characateristic action of the blank at this point is a fluttering action rather than a sustained disposition against the belts 43 and after passing the turbulence of the release station 50 said blanks are propelled by frictional engagement with the casting surface 29 and the belts 43. The air blast being directed in acute angular relation to the travelling planar surface of the belt fans out in a sharp edged layer on the belt surface 29. This air blast 51 engages the blank edges 54 or protruding portions 56 lifting the same and thence intervenes the edge of the blank and casting surface 32 as shown in FIGURE 5. This provides a substantial and positive force for breaking the residual adhesion of the coated blank to the casting surface without impairment of the finish imparted to the coating thereon. Thus the blanks are progressively separated from their leading edge continuing to their trailing edge and inwardly from the side edges towards the center or opposite side thereof.

This invention, while being described particularly in respect to a cast coating machine particularly for thermoplastic coated fibreboard blanks, may obviously be adapted to cast coating of other comparable materials and various types of coatings or solid materials solidified on a casting surface which is heated or chilled to solidify such material as the case may be. This invention is intended to cover all changes and modifications of the example of the invention herein chosen for purposes of disclosure, which do not constitute departures from the spirit and scope of the invention.

What I claim is:

1. The method of cast coating discrete blanks of paperboard material comprising the steps of applying a plastic coating to a succession of discrete blanks, placing the coated blanks into contact on a continuous moving casting belt having a generally horizontal upper surface terminating at opposite ends around circular rotating means, advancing the casting belt and blanks thereon until the coating is substantially solidified, releasing the blanks upwardly from the horizontal surface of the casting belt by means of one or more high velocity streams of air directed at a margin of said blank at an acute angle to the belt and in normal relation to the direction of travel thereof, restraining the separated blank from unrestricted displacement from the belt, returning the blank to the horizontal moving belt, moving said separated blank on said belt to the curved end portion thereof where said blank is permanently separated from said belt.

2. In a cast coating machine for discrete blanks having means for applying a coating to the discrete blanks, means for continuously advancing a casting surface in a horizontal linear path, means for impressing the coated blanks in intimate contact with the casting surface with the side edges of the blanks in substantial alignment with the direction of travel of the casting surface; the improvement comprising means for interrupting the residual adhesion of the coated blanks to the casting surface comprising at least a pair of air jets oppositely directed and inclined to the casting surface in the linear path thereof at an included angle of about 15°–45°, said air jets disposed in substantially normal relation to the direction of travel of the casting surface and impinging thereon in zones adjacent the side edges of the coated blanks and towards said edges, means adjacent the air jets to engage the upper surface of said released blanks for retaining the blanks in relative position on the casting surface after the adhesion is interrupted, and guide means for removing the blanks from the casting surface.

3. In the cast coating machine described in claim 2, the further improvement wherein the means for retaining the blanks comprises longitudinally extending members overlying the blanks and in closely spaced relation to the casting surface.

4. The retaining means in claim 3 wherein the longitudinally extending members comprise belts driven in substantially synchronous movement with the casting surface.

5. In a machine for cast coating thermo-plastic coated discrete blanks in succession, the machine having a continuous advancing belt casting surface disposed in extended horizontal relation with the upper portion providing an essentially planar casting surface and a lower portion following a return path, said upper casting surface having means for chilling the same to solidify the thermo-plastic coating, means for interrupting the residual adhesion of the coated blanks to the casting surface after substantial solidification of the coating comprising at least a pair of air jets oppositely directed and inclined in acute angular relation to the casting surface, said air jets inwardly directed in substantially normal relation to to the direction of travel of the casting surface and impinging thereon in zones adjacent the side edges of the successive blanks, means for retaining the blanks in relative position on the casting surface after separation therefrom, and guide means for removing the blanks from the casting surface adjacent the end of the horizontal portion of said casting surface.

6. In the machine for cast coating thermo-plastic coated discrete blanks claimed in claim 5 wherein the air jets are fixedly positioned in relation to the moving casting surface and inclined thereto at an included angle of about 15°–45°.

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