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METHOD OF COATING
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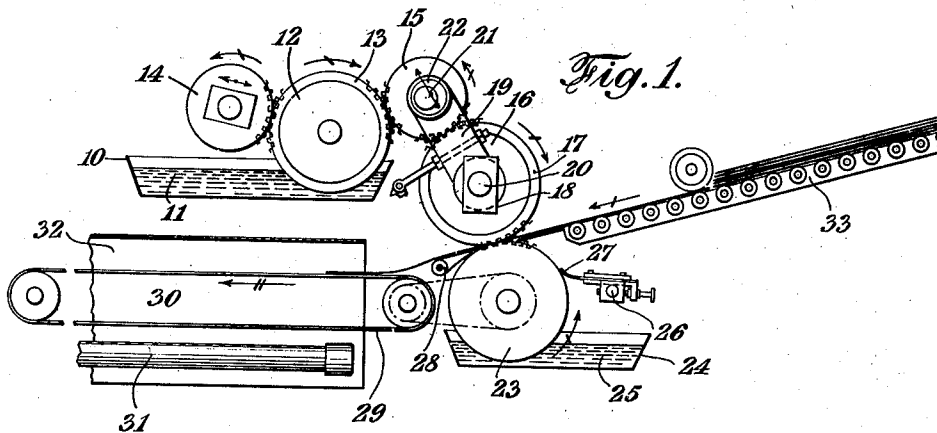


Fig. 1.

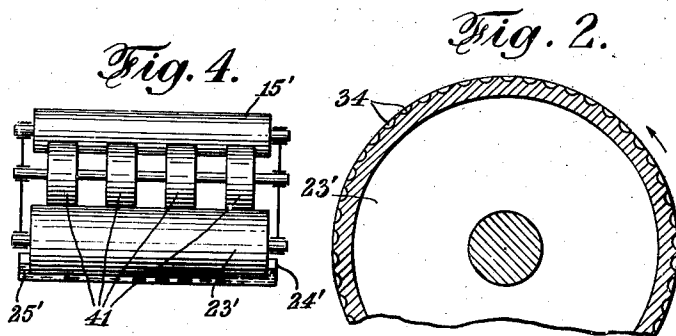


Fig. 2.

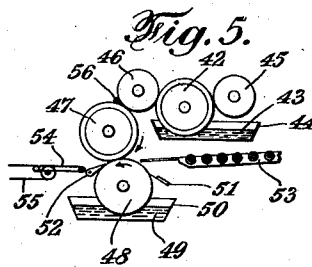


Fig. 5.

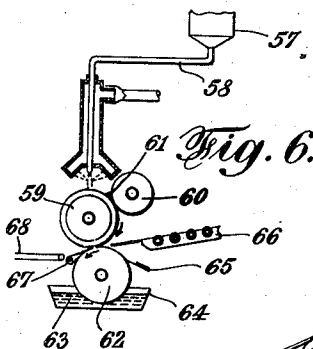


Fig. 6.

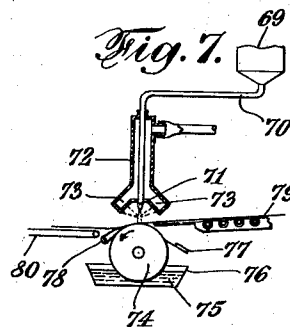


Fig. 7.

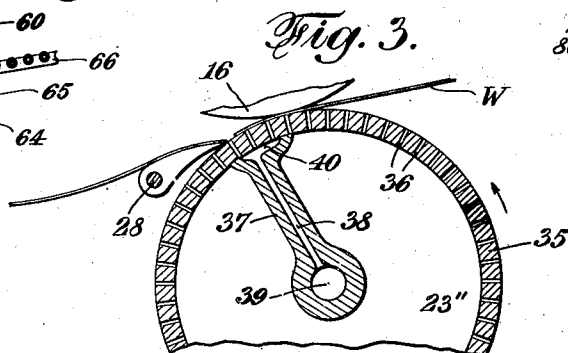


Fig. 3.

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METHOD OF COATING

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7 Claims. (Cl. 91—68)

This invention relates to coating devices and the process of coating sheet material.

The principal objects of this invention are a machine and a process whereby sheet work of any given characteristics may be coated and conveyed, without gripping the work, for the purpose of propelling it while being coated.

Another object of this invention is a process whereby work in the shape of individual, relatively soft, thin and pliable sheets may be simultaneously coated, propelled and stripped from the means which apply the coating, without the use of "grippers".

Another object of this invention is a process of coating and stripping work, and simultaneously propelling it without the use of gripping means, which consists of causing the work to adhere to a moving support.

Another object of this invention is a process of coating work, and simultaneously propelling it without the employment of "grippers", which consists of causing the work to adhere to a moving support, while subjecting it to the coating operation.

Another object of this invention is a process of simultaneously coating and subjecting the work to a blast of gaseous media under pressure, for the purpose of propelling it by a moving support.

Another object of this invention is to provide in a device of this kind suitably operable work supporting and work propelling means, whereby the work is caused to temporarily adhere to, and/or to be retained by, or held or forced against a movable supporting surface, while being subjected to the coating operation, for the purpose of conveying the work during the coating operation, without the use of "grippers".

A still further object of this invention is to provide in connection with said work-supporting and work propelling means, stripping devices for separating the work from said work-supporting means immediately after the coat-applying operation.

Another object of this invention is to provide a device of this kind, which is applicable for either what is known as "strip-gumming", "strip-coating", or "full surface coating", and which may be employed for one or the other operation at will, with but a slight rearrangement of its parts.

The foregoing and numerous other objects and advantages of the present invention will become more readily apparent from the ensuing description and the accompanying drawing, the latter illustrating in a purely diagrammatical form the principles and outstanding features of the present device, which drawing however is not intended to limit my invention in any way, but rather to serve for explanatory purposes only.

In the drawing:

Figure 1 is a diagrammatical side elevation of the device,

Figure 2 is a partial detail view of one form of a work supporting roller,

Figure 3 is another partial detail view of another form of a work supporting roller,

Figure 4 is a partial diagrammatical front elevation of a modified form of the device, similar to that shown in Figure 1, in which a plurality of narrow coating applying rollers take the place of a single, long roller,

Figure 5 is a diagrammatical side elevation of a modified arrangement of my device, with some of the elements reversed in their order, as compared with the device shown in Figure 1,

Figure 6 is a diagrammatical side elevation of a simplified form of my device, and

Figure 7 is a side elevation of a still simpler arrangement thereof, also in diagrammatical outlines.

Before commencing with a detailed description of the device and of the new process of simultaneously coating, stripping and propelling work without the use of "grippers", it may be well to mention in a cursory way the heretofore employed machines and methods in the coating industry.

The application of a coating, such as adhesives, varnishes or colors upon sheet metal, cardboard or other similarly stiff, relatively hard materials is well known. Due to the stiffness of the work its passage through the coating applying rollers is relatively simple and does not require any special means for gripping it, as the work issues from, or during its passage through the coating applying device.

When, however, relatively thin material is to be handled, such as paper or other tissue which is soft and pliable and does not possess sufficient stiffness of its own to enable it to pass unaided through the coating applying device, and by itself strip therefrom, the operation becomes rather complex. For this reason various kinds of grippers or marginal guide devices were employed, which necessarily leave unmistakable impressions or marks upon the work. Such marks are unsightly and expose some of the undersurface which should be covered by the coating.

The above disadvantages are entirely overcome by the present process and by the device, which latter I shall now describe. In Figure 1, numeral 10 denotes a well or fountain containing coating material 11, in which latter operates a coating pick-up roller 12. This roller is preferably covered with a resilient working surface 13. In cooperation with pick-up roller 12 there is adjustably mounted relative thereto a smooth, hard coating controlling roller 14, which operates above the coating material 11, and is intended to return into well 10 unwanted or excess coating material picked up by roller 12. By adjusting

roller 14 relative to roller 12 the thickness of the coating layer is determined.

Also in cooperation with roller 12 there will be seen a coating distributing or/and transfer roller 15, which is also made of hard, smooth material and which is also adjustably mounted as will become presently evident.

In operative connection with roller 15 is also the coating applying roller 16, which is covered by a resilient working surface 17. This roller is adjustably mounted at 18 relative to a work supporting roller, located below.

Roller 15 is supported in adjustable brackets 19, which are pivoted about the center axis of shaft 20 of the coating applying roller 16, and may be swung about the latter's circumference. This adjustability facilitates the positioning of roller 15 at proper relation to roller 12. The shaft 21 of roller 15, is mounted in an eccentric bearing 22 which facilitates the adjustment of roller 15 relative to coating applying roller 16. These adjustments of roller 15 relative to rollers 16 and 12 determine the proper thickness of the coating film and govern the distribution of the coating over the surface of roller 16.

Below roller 16 there is provided the work supporting roller 23, the center of which is offset relative to the center of roller 16 so that the plane passing through the centers of the two rollers is not perpendicular, but is inclined, for the purpose of assisting in the feed of the work.

Work supporting roller 23 is preferably made of a relatively hard material and possesses a smoothly ground, highly polished work supporting surface. This surface may be altered as will be explained presently.

The work supporting roller 23 preferably operates within a vessel 24, partially filled with a moistening medium 25 which latter, in conjunction with the smooth surface of the roller, is intended to attract, cause the adherence of, and temporarily hold the lower face of the work, passing between rollers 16 and 23, for the purpose of stripping the upper coated face of the work from the applying roller 16, and for propelling the work, while being coated. In engagement with roller 23 there will be seen an adjustable scraper 26, provided with a resilient blade 27 in tensional contact with the smooth working surface of the roller. The scraper serves for governing the amount of medium 25 desired at the upper portion of the roller's surface.

Opposite and somewhat below the adjacent points between rollers 16 and 23 there will be observed a stripper 28, intended to separate the work from roller 23, and to guide the work towards conveyor 29 of the drying mechanism, indicated at 30. The latter comprises adjustable heaters 31 and adjustable heat retaining and deflecting members 32, which may be moved relative to conveyor 29 at will.

In front of rollers 16 and 23 there is shown a work feeder 33, which is designed to deliver individual work sheets towards the rollers in close succession i. e. substantially edge to edge, or at minute intervals from one another.

In Figure 2 a work supporting roller 23' is illustrated, the working surface of which is provided with minute, vacuum cups or depressions 34, shown exaggerated in the drawing. The shape and depth of these depressions may be altered, depending upon the type of work to be handled. These vacuum cups are intended to enhance the adherence of the work to the roller.

In Figure 3 another modified form of a work

supporting cylinder 23'' is seen in which the wall 35 is perforated, as indicated at 36. Within the cylinder there is stationarily mounted a vane 37 provided with a passage 38. The latter connects with a hollow center 39, and terminates at its upper end in a hollow enlargement 40, in engagement with the inner surface of the cylinder wall. The hollow interior of the vane is connected with a suction device (not shown) arranged without cylinder 23''. As the cylinder wall passes over the enlargement 40 of the vane, apertures 36 are successively subjected to the influence of the suction created within the vane, which suction will attract and temporarily hold the lower surface of the work piece W, whereby its upper surface is stripped from coating applying roller 16. As the apertures pass enlargement 40 of the vane, the suction ceases and the work sheet is free to be stripped by stripper 28 from the work supporting roller, as clearly seen in this figure. The employment of a moistening medium in this construction is optional, but is not required.

A similar but simpler process takes place in stripping of the work sheet in the construction illustrated in Figure 1. The surface of the roller 23 being extremely smooth and uniform will, when wetted, or even when slightly moistened, sufficiently attract, by a sort of vacuum action, the lower surface of the work and cause it to adhere to the roller sufficiently to pry the work away from coating roller 16. The medium to be employed for moistening roller 23 must have the property of not affecting the material of the work. I prefer to employ easily evaporative liquids. In cases where the material of the work becomes difficult to handle I employ for moistening roller 23 an adhesive substance, dissolved in suitable solvent. The attraction of the work by the roller may be greatly enhanced by providing minute vacuum impression, as explained in connection with Figure 2.

From Figure 1 it will be evident that all of the rollers are forcibly operated with one another by means of gears or other positive power transmitting means, and that I do not depend upon the friction engagement between the respective rollers. The same principle applies to the propulsion of conveyor 29, which latter is connected by means of a chain drive with work supporting roller 23. Also feeder 33 is operated correspondingly by positive means from the mechanism of the applying device, but at a surface speed somewhat lower than that of the latter. All of the positive transmissions between the working elements of this device are absolutely necessary for the reason that the surface speed of the work must be substantially equal to the surface speeds of the applying and work supporting rollers, and of all other rollers employed in the device. All equal surface speeds are indicated by arrows crossed with a single mark. The speed of the drier conveyor is somewhat greater and is marked by an arrow with two crossing marks.

The adjustability of roller 14 relative to roller 12, and of roller 15 relative to rollers 12 and 16, and of roller 16 relative to work supporting roller 23 is highly essential for, firstly, controlling the amount and the thickness of the coating to be applied, secondly, for the even distribution of the coating over the coating applying roller, and, lastly, for correctly positioning the applying roller against the work supporting roller. The length dimensions of all of the rollers are practically uniform, except that I prefer to make the dis-

tributor roller 15 somewhat shorter, so as to prevent the picking-up and transferring to roller 16 of surplus coating material, usually gathering at the ends of pick-up roller 12.

From the foregoing the principal features of the device shown in Figure 1 become readily evident. Due to the construction of work supporting roller 23 in either its smooth design, as shown in Figure 1, or in its modified forms, as indicated at Figures 2 and 3, the lower face of the work is attracted and temporarily held against the work-supporting roller and thus pried away or stripped from the coating applying roller 16. In this way any external gripping devices for the work are entirely eliminated; consequently the coated surface remains uniform and is not marred in any place. Incidentally, by the elimination of grippers, the working speed of the device is increased to the highest possible degree, and is far greater than in any heretofore employed similar devices. In addition to the increased speed obtained with my device, its operation is continuous and extremely accurate, whereby a high degree of efficiency and a marked reduction in cost is assured.

Referring now to Figure 4, this illustration is intended to show that a plurality of individual, relatively narrow applying rollers 41 may be employed instead of a long applying roller, such as shown in Figure 1 at 16. Of course the usual distributor roller 15' is required for transferring coating to, and distributing it over the individual applying rollers 41. Beneath these rollers there is again illustrated a smooth work supporting roller 23', which is partly immersed in a vessel 24' filled with a diluted adhesive medium 25'.

The employment of individual, narrow applying rollers is particularly advantageous for what is known as "strip coating" or "strip gumming". This operation consists of applying a coating to either the edges or to narrow portions of the work in the form of coating strips. Needless to say, the principle of stripping the coated work from the narrow applying rollers remains the same as that explained in connection with Figure 1.

The modified form of my device shown in Figure 5 consists of the usual rubber covered coating pick-up roller 42, partially submerged in a coating material 43 within a tray 44. The amount of coating is again governed by an adjustable control roller 45, and the coating is transferred by means of a transfer and distributing roller 46. The latter supplies the coating material to a rubber covered coating applying roller 47, superimposed above work-supporting roller 48, operating in a diluted adhesive 49, in tray 50. The adhesive coating on roller 48 is controlled by the usual scraper 51, and the work is stripped from the work supporting roller by stripper fingers 52, arranged in a row. The work is fed in by feeder 53 and is delivered upon an auxiliary conveyor 54, from which it is transferred to a drying conveyor 55.

As will be seen from this figure, compared with Figure 1, the upper roller arrangement is reversed, in that the pick-up roller, the control roller and the distributing roller are transferred to the right of applying roller 47, the purpose of which is to position the rollers in such a way as to provide, what I term, a puddle 56 of the coating material which is to be maintained between distributor roller 46 and applying roller 47. The size of that puddle is controlled by adjusting roller 46, and is governed by the consistency of

the coating material. It is essential that applying roller 47, is generously supplied with the coating material so as to uniformly transfer it to the work. In order to permit sufficient coating material to be transferred to the work, the applying roller must not bear too tightly against the work piece. Because of this requirement, the work supporting roller 48 is chiefly relied upon to move the work during the coating operation, in accordance with the afore explained principle of the present invention. The rest of the component elements of this machine are practically identical with those explained in connection with Figure 1, with the exception of auxiliary conveyor 54, which latter permits the handling of very short work pieces.

Obviously instead of a single, long applying roller 47, I may employ a plurality of narrow applying rollers, as those explained in connection with Figure 4. The advantage of the device in Figure 5 resides in the visible, readily controllable puddle 56, which can not be maintained as satisfactorily in the construction shown in Figure 1.

The modification illustrated in Figure 6 simplifies the arrangement of the coating supply mechanism and has the added advantage of preventing the coating material from evaporating and becoming thicker during operation, and thereby affecting the uniformity of the coating layer upon the work. In this device the coating material is maintained in a closed vessel 57, from which it is passed through a conduit 58, under pressure, against applying roller 59, intended to move in clockwise direction. A control roller 60, adjustably mounted relative to roller 59, governs the size of the puddle indicated at 61 between the two rollers. In every other respect I again rely upon the basic principle of my invention, in that I employ, for the propulsion of the work, a work supporting roller 62, partially immersed in a liquid medium 63 contained in vessel 64. The amount of coating upon the work supporting roller is governed by scraper 65, so as to produce the proper tack, by means of which the work sheet is attracted to the work supporting roller and propelled thereby, thus being effectively stripped from the surface of the applying roller. A suitable feeder 66, stripper fingers 67, and a conveyor 68 complete the arrangement of this construction.

Referring now to Figure 7, the mechanism of my device in this illustration is still more condensed to the simplest elements, employing again the basic principle of my idea of attracting the coated work to the moving support thereof in such a way as to cause it to travel, while being coated, without the employment of any gripping device, rollers, or similar means, intended to propel the work mechanically.

In this figure there is employed a closed vessel 69, adapted to contain the coating material, which latter is conveyed under pressure through conduit 70 to a nozzle 71, from which it issues directly against the work. Surrounding conduit 70 at its vertical portion is a chamber 72, adapted to contain a gaseous medium under pressure, as for instance compressed air. The lower end of the chamber 72 is bifurcated, as shown at 73. These bifurcated ends are equipped with small apertures through which the gaseous medium escapes at high velocity, and impinges the stream of the coating material, thereby producing a very minute coating spray before reaching the work.

The position of the nozzle and of the openings

in the bifurcations 73 relative to the work is such, that the work piece is directly subjected to the pressure of the escaping gas, whereby it is thrust against the tacking surface of supporting roller 74, operating in liquid 75, contained in vessel 76.

The pressure of the gaseous medium or air is sufficiently high to press the work sheet against roller 74, so as to effect an intimate engagement between the lower face of the work and the tacking surface of the roller. The amount of the coating applied to roller 74 is governed by a conventional, resilient scraper 77, and the work is prevented from adhering to roller 74 by the usual stripper fingers 78. The work to be coated is delivered to the machine by a feeder 79, and the finished work is conveyed from the machine by conveyor 80.

In connection with the device illustrated in Figure 7 it is to be borne in mind that my device is primarily designed for handling work possessing practically no stiffness of its own, as has been stated before. One of the outstanding features of my invention resides in the fact that the finished work must not show any gripping marks, or for that matter, any other marks resulting from conveying the work through the coating mechanism. I have achieved this in every one of the designs illustrated in the drawing, irrespective of the properties of the work.

In Figures 6 and 7 I have indicated individual nozzles for spraying the coating material, which of course would have only a limited use for producing relatively narrow coating stripes upon the work. It is quite obvious however that the working capacity of the device may be considerably augmented by employing adequately designed nozzles for covering any width, while adhering to the same basic principle of my invention.

Referring again to the constructions illustrated in Figures 1, 4 and 5, in which applying rollers are employed, attention is called to the fact, that although I have stated that the surface speed of all rollers is practically the same, this is in fact not entirely so. I have found that much superior coating results are obtained when the surface speed of the work is slightly slower than the surface speed of the applying rollers.

The fact that the surface speed of the work, as it is delivered by the feeder, is somewhat slower than that of the applying roller, prevents the formation of slight accumulations of coating material at the leading edge of the work; this is important inasmuch as I thus obtain an absolutely even coating over the entire coated surface of the work.

Another important feature is to be noted in connection with the design shown in these three figures. Contrary to the assumption that when the machine runs idle, i. e. when the work pieces are spaced far apart, that the coating material will be transferred to the work supporting roller, and from the latter retransferred to the bottom face of the work, this is decidedly not the case since the coating layer transferred from the coating roller to the work supporting roller is wiped off by the scrapers 27 and 51 of Figures 1 and 5.

In view of the fact that I have illustrated several modified forms of my invention, applicable to the same process, and achieving the same results sought by me, it is quite readily evident that my invention is capable of a great many changes, modifications, applications and improvements to meet any contingencies and con-

ditions required in the course of the employment of my device in the trade, and I therefore reserve for myself the right to make changes therein as may become necessary for handling, for instance, work of specific character, based upon my principle of imparting movement to the work, while being coated, by causing the work to be attracted by, or forced in operative contact with a movable support, without being gripped or otherwise engaged for the purpose of moving it, all within the broad scope of my idea, as set forth in the annexed claims.

I claim:

1. The process of coating material, substantially in sheet form, which consists of movably supporting it at one of its surfaces, subjecting its movable support to the influence of a readily evaporative moistening medium, controlling the thickness of said medium so as to provide a friction and adhesion-producing, non-transferring film upon said support for temporarily attracting the material and thereby facilitating its propulsion, and applying a coating to the other surface of the material, while its supported surface is thus temporarily attracted.

2. The process of coating material, substantially in sheet form which comprises movably supporting its undersurface applying to its movable support a readily evaporative moistening medium, removing the excess of the medium from the support so as to leave a thin, adhesion and traction-producing, non-transferring film for temporarily attracting the undersurface of the material, thereby facilitating its propulsion, and applying a coating to the upper surface of the material, while its undersurface is thus attracted.

3. The process of coating material as set forth in claim 2, and wherein the movable support is a cylinder having a highly finished supporting surface.

4. The process of coating material as set forth in claim 2, and wherein the movable support possesses an endless, highly finished supporting surface.

5. The process of coating material as set forth in claim 2, and wherein the movable support possesses an endless, highly finished supporting surface and wherein the application of the coating is made under pressure.

6. The process of coating relatively thin sheet material, possessing either little or no inherent body firmness, in a substantially close, continuous succession, simulating the coating of a continuous web, which consists of movably supporting the material at its undersurface, applying to its movable support an adhesion and traction-producing moistening medium, removing the excess of such medium from the support so as to leave thereon a non-transferring readily evaporative thin film for temporarily attracting the undersurface of the material, thereby facilitating its propulsion and its subsequent stripping, and applying a coating to the upper surface of the material, while its undersurface is thus propelled, and before it is stripped for the purpose of being freed from the coating application.

7. The process of coating as set forth in claim 6, and wherein the movable support is provided with an endless, highly finished surface for receiving the film of said medium.

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