This invention relates to a new machine and apparatus for applying high viscosity coatings to moving flexible flat sheet base materials, in accordance with the methods described in our U.S. Patent No. 2,175,125 "Method for forming film and film coating," issued October 3, 1939.

Heretofore, so far as we are advised, there have been no coating machines available which permits the extrusion of high viscosity filming solutions, the substantial stretching of continuous flat sheets of such solutions while unsupported in order to reduce their thickness, and their application to continuously moving bands of flexible web material.

Accordingly, it is an object of our invention to provide a machine and apparatus suitable for the extrusion of high viscosity filming solutions in a manner so that a flat sheet of the extruded solutions may be materially stretched while unsupported, so that the thickness of the sheets is substantially reduced, and so that the stretched material may be applied or coated continuously upon moving bands of flexible material such as paper, aluminum foil, fabrics, or the like.

It is also within the purview of our invention not only to provide a machine as described for coating papers or the like but also to utilize such a machine for the coating of flexible backing materials with liquid materials which are adherent to the backing materials while wet, but which are not adherent thereto when dry, all in accordance with the disclosure in our above identified method patent.

It is a further object of our invention to provide a horizontally and vertically adjustable extrusion hopper adapted to extrude high viscosity solutions in flat sheet form in such manner that they may be continuously stretched while unsupported, and preferably tangentially applied continuously to flexible flat sheet backing materials.

It is a further object of our invention to provide such an extrusion and coating machine which includes controls and adjustments permitting high-speed operation and uniformity of product.

It is a further object of our invention to provide a unique supply system for the high-viscosity filming material so that the same may be supplied to the extrusion hopper head under predetermmine constant pressures, variable at will, substantially without pulsations.

The accompanying drawings illustrate a preferred embodiment of one manner in which the present invention may be practised but it is to be expressly understood that the drawings are for purposes of illustration only and are not to be construed as limiting the invention, but that the scope thereof should be referred to in the appended claim.

In the figures:
Fig. 1 is an assembly view of a coating machine embodying our invention;
Fig. 2 is a detail view of a convention form of a paper unwind device;
Fig. 3 is an enlarged view of the coating device;
Fig. 4 is an end view of the coating device shown in Fig. 3;
Fig. 5 is a cross section taken on the line 5—5 of Fig. 4;
Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 3;
Fig. 7 is a section taken on the line 7—7 of Fig. 6;
Fig. 8 is a section taken on the line 8—8 of Fig. 6;
Fig. 9 is an enlarged section of the extrusion hopper nozzle;
Fig. 10 is a fragmentary view of the resulting product.

The machine includes a paper supply station, or unwind stand, A, a film applicator B, a drying chamber C and a rewind D.

The paper supply station is a conventional type of automatic braking unwind stand and includes a framework carrying the paper roll 10. The paper is fed under roller 11, which is movable vertically and is in balance with weight 12, and connected thereto by a cord and pulley mechanism 13. The balance crank mechanism 14 is actuated by the vertical movement of roller 11 and applies the braking mechanism indicated generally as 15. It will be understood that this conventional automatic braking unwind forms no part of our invention, except in combination with the other machine elements about to be described.

The paper indicated as 16 is lead from station A over appropriate guide rollers to application roller 17, which latter is adjustable in a vertical direction through screw and hand wheel 18 in dovetail guide 19.

On a framework 20, there is provided a horizontal guide rail 21 carrying a horizontally adjustable block 22 which is adjustable by means of a hand wheel 23 in either direction entirely across the apparatus. The adjustable block 22 carries an extrusion member or hopper 24, and the same will normally be rotatably mounted in
block 22 as by trunnions 25 (see Fig. 7). The end portion 26 of one trunnion 25 carries an outside threaded sleeve 27 by a key indicated as 28. A hand wheel 29 may serve to lock extrusion hopper 24 in the desired position. The other trunnion 29 may be provided with a worm and worm wheel arrangement 25a actuated by hand wheel 25b.

By means of this apparatus, it will be observed that we provide for horizontal and vertical adjustment for the extrusion hopper 24. Extrusion member 24 may include end members 30 (see Fig. 4) to which is fastened a body nozzle section 31 with a central core portion 32 leading to extrusion duct 33. The elongated extrusion opening 34, which is in the form of a knife slit, is defined by plate member 35 which is fixed to body section 31, and an L shaped adjustable plate member 36, which latter is adjustably mounted upon member 31 by a suitable screw and shank arrangement, indicated as 37. (see Fig. 9). In order that the thickness of the material extruded from member 24 may be definitely regulated. High viscosity liquid, suitable for coating papers or metal foils or other flexible backing material, is supplied to our apparatus, for example, in a suitable composition, parts by weight, is as follows: cellulose acetate 17.1, diethyl phthalate 5.7 and acetone 77.2.

Such a solution, indicated as 38, may be stored in tank 39 and fed thereto through pipe 40, through filter 41, pump 42, pressure gauge 43 and therefrom through articulated piping 44 to pipe connections 45 of end members 30 in the extrusion head 24, and thence through channels 46 to the interior of extrusion hopper or nozzle member 24.

An appropriate hand gate valve 47 will be provided before pressure gauge 43, to regulate the pressure of the film supplied to member 24. In order that the solution may be kept circulating and in order to provide constant pressures to extrusion head 24, the pump 42 is so arranged as to supply solutions under more pressure than it is desired, and the surplus pressures, and a certain amount of solution is returned to tank 39 by return pipe 41 which is provided with a pressure gauge 48 and a pressure relief valve 47a: this is in effect a by-pass circulating system.

After the paper 16 has solution applied to the same, when upon application roller 17 the paper is guided by appropriate guide rolls through a counting mechanism indicated as 49 and through a drying mechanism indicated as 50 and 75 and a drying mechanism for the film therein indicated generally as 53. If desired, after leaving the drying apparatus, the coated paper may be guided over a large roller 51 where a rubber pressure roller indicated as 52 may be utilized to smooth the coated paper before it is wound on rewind roller 53 or alternate rewind roller 54. If desired, the coated base material and its coating may be separated and each material rewound separately. The entire paper feed is accomplished by motor 55 driving the rewind rollers and pulling paper 16 through the apparatus from the unwind roller.

In operation, the solution will be supplied under pressure to nozzle member 24 which will be moved, by virtue of its horizontal and vertical adjustability, away from roller 11. The width of extrusion orifice 34 will be determined by adjustable plate member 36. After the filming solution is extruded in a continuous flat sheet form, the paper, or flexible sheet to be coated, which has already been threaded over the guide rollers through the entire machine, will be pulled, as described, through the machine, and the extrusion nozzle head placed adjacent thereto in the position shown in Fig. 9. The extruded flat sheet film is attached to the moving paper which is faster than the rate of the extrusion of the film thereby effectuating the stretching of the film, while unsupported, between the nozzle member and roller 11.
means for said extrusion member for regulating the amount of said flow, reservoir tank means separated from said extrusion member and adjustable pipe means connecting said tank means and said extrusion member, and an adjustable related power driven roller apparatus of small diameter adapted to tangentially feed a continuous web of flexible base material at a speed greater than the rate of extrusion of said liquid and in proximity thereto, so that the base material may be coated with said extruded liquid in stretched condition.

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