Oct. 5. 1943. W. A. MEYER ET AL 2,330,834

COATING MACHINE

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Fig 1

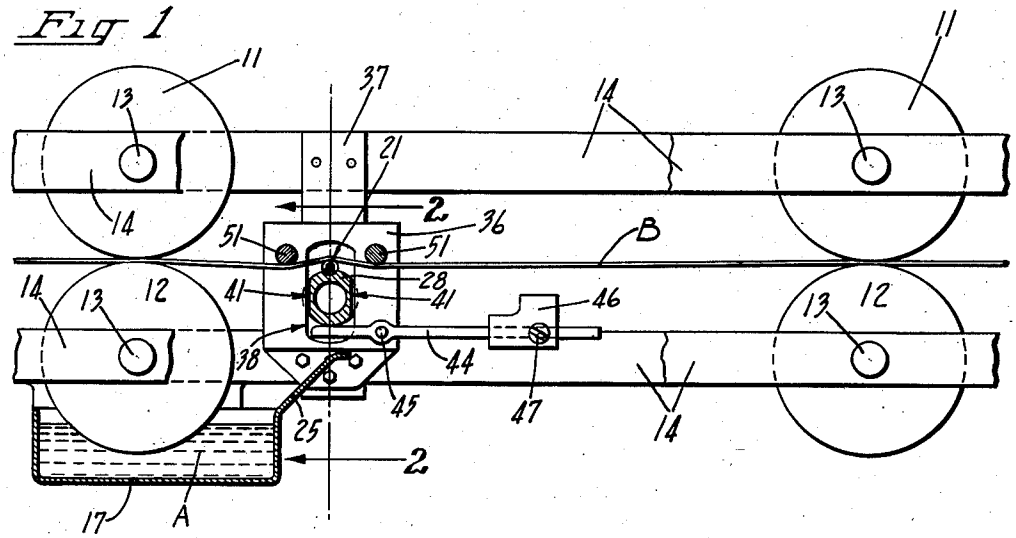


Fig 2

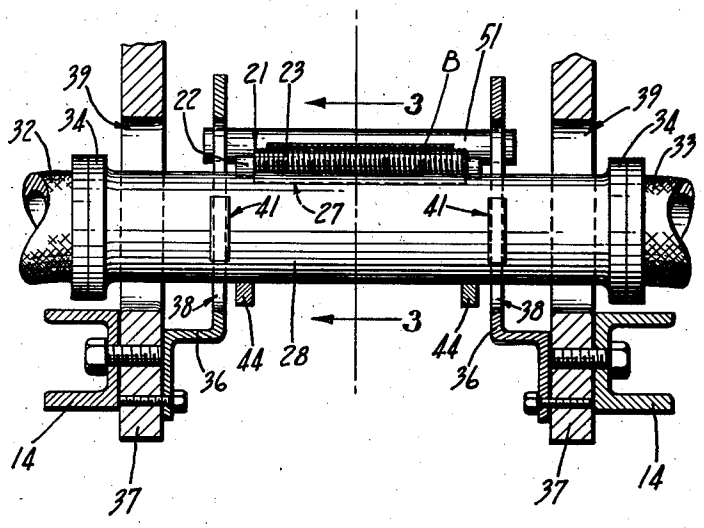
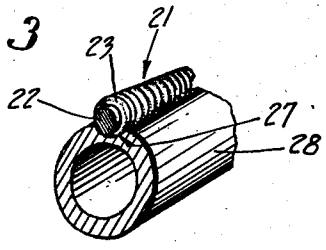


Fig 3



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2,330,834

COATING MACHINE

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4 Claims. (Cl. 91—33)

The present invention relates to coating machines for applying a film of coating substance to web material and has particular reference to a heated and weighted metering rod for controlling the thickness of the film applied to the web.

An object of the invention is the provision in a coating machine for applying a film of coating substance to web material, of a metering rod which may be maintained at a predetermined temperature so that coating substances which set rapidly will be heated by the measuring rod and will be uniformly spread by the rod over the surface of the web being coated.

Another object is the provision in such a machine of a metering rod wherein the pressure of the rod against the web material may be controlled by adjustable counter-balance weights so that a predetermined constant pressure may be exerted against the web to regulate the thickness of the film of coating substance and at the same time regulating its viscosity and temperature.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawing, discloses a preferred embodiment thereof.

Referring to the drawing:

Figure 1 is a longitudinal section of a portion of a coating machine embodying the instant invention, with parts broken away;

Fig. 2 is a transverse sectional view taken substantially along the line 2—2 in Fig. 1, with parts broken away; and

Fig. 3 is a perspective, part sectional view of a detail of the metering rod and its mounting as it would appear when viewed from a position indicated by the line 3—3 in Fig. 2, with parts broken away.

As a preferred embodiment of the invention the drawing illustrates principal parts of a conventional coating machine in which a fluid coating substance A is applied to a surface of a substantially continuous web B of sheet material, such as for example, fibre stock from which containers are sometimes made.

The web B is fed through the machine in a horizontal position by spaced pairs of cooperating upper and lower feed rollers 11, 12 (Fig. 1) respectively, between which the web passes. These rollers are mounted on rotatable shafts 13 which are journaled in bearings formed in side frames 14 which constitute the main frame of the coating machine. The roller shafts are rotated in synchronism by any suitable means.

One of the lower feed rollers 12 serves as a coating roller for applying the coating substance A to a surface of the web B. This roller rotates in a bath of the coating substance or material which is retained in a reservoir 17. The reservoir is located below the roller and is secured to the machine main frame 14. Hence as the coating roller 12 rotates in the bath of the coating substance A it carries up a film of the substance on its outer surface and applies the film to the engaging surface of the moving web B. In the drawing the lower surface of the web is shown as receiving the film.

In order to uniformly spread the film over the surface of the web B and to reduce the film to a predetermined controlled thickness, the web after receiving its coating substance passes over a metering rod 21 (Figs. 1, 2 and 3) which is located adjacent the reservoir 17. The metering rod preferably is a small diameter metal rod 22 around which a wire 23 is closely wound in the fashion of a spring, the adjacent coils of the wire being contiguous. This is a usual metering rod construction.

The usual metering rod merely functions by wiping excess coating substance off the coated surface of the web passing over the rod. Such coating substance comes primarily from the material which is able to pass into the grooves or hollows between the wire coils of the rod. In addition, however, a certain film thickness of the coating material on the coils also enters into the film thickness of the web. Such a film thickness varies as to the pressure between the web and the metering rod and the pressure in turn is dependent somewhat on the angle of contact. In the ordinary machine such a pressure cannot be controlled owing to the driving irregularities of the machine which are occasioned by the passing of the relatively long web extending between the ordinary feeding rollers 11 and 12 and the metering rod.

The coating substance remaining on the web when it has passed beyond the rod is sufficiently plastic to flow together into a continuous and even film before solidification normally takes place. The removed excess coating substance drains back into the reservoir 17 by way of an inclined drain board 25 which is formed on one end of the reservoir.

More uniform control of the pressure between the web and the metering rod and more precise metering of the film of coating substance A on the web B is facilitated in the present construction by introducing other web guiding elements so that only a relatively short web distance is neces-

sary between the metering rod and such adjacent guide members. This will be explained hereinafter.

More precise metering is also made possible by maintaining the metering rod 21 in a heated condition. For this purpose the metering rod is secured in place in a longitudinal groove 27 formed in the top of the outside surface of a pipe or conduit 28 disposed transversely of the machine and located below the passing web B.

A fluid heating medium, such as for example, steam is continuously circulated through the pipe 28 by way of a flexible inlet pipe 32 and a similar outlet pipe 33 which are connected to flanges 34 formed on the ends of the pipe 28. The inlet pipe leads from any suitable source of steam maintained at a predetermined temperature and the outlet pipe leads to a suitable place of disposal for the used steam. This circulating steam maintains the metering rod at a predetermined temperature.

The metering rod 21 is movable toward and away from the web B and is pressed yieldably against the web with a constant pressure to regulate the thickness of the film of the coating substance. This pressure is made effective within close limits by reason of the fact that the adjacent web sections are maintained relatively short on either side of the metering rod and in addition by means of a floating mounting for the steam pipe 28.

The floating mounting includes a pair of spaced and parallel bracket plates or guide members 36 which are located one on each side of the machine and are secured to vertical tie members 37 of the machine frame 14. The plates and the tie members are formed with elongated openings 38, 39, respectively, through which the steam pipe extends. The openings 38 in the plates 36 are narrower than the openings 39 in the tie members and the inner edges of the plates extend into vertical slide grooves 41 formed in the steam pipe. These plate edges and slide grooves retain the steam pipe in place against turning and against endwise displacement while permitting vertical movement of the pipe.

The steam pipe 28 is supported on the inner ends of a pair of spaced and parallel counter-balance lever arms 44 which are located adjacent the bracket plates 36. These lever arms are mounted on pivot pins 45 which are carried in the bracket plates. The outer ends of the arms carry counter-balance weights 46 which may be shifted along the arms and locked in place by thumb screws 47 after an adjustment. The adjusted weights counter-balance the weight of the steam pipe 28 and its connected metering rod 21 and press the latter against the web B with a predetermined pressure in accordance with the setting of the weights. This makes possible different coating thickness settings with the same metering rod.

The pressure on the web B is taken up by a pair of spaced and parallel guide rods 51 which are located transversely of the machine one on each side of the metering rod. The lower edge of the guide rods is disposed below the median line between the web feed rollers. The distance between the rods as compared to the distance between the feed rollers is relatively short and this maintains the web passing under the rods in a taut condition even though the web passing through the machine should become slack. This taut condition of the web tends to reduce friction between the web and the metering rod, as well as tending to reduce the predetermined minimum pressure required to force the rod against the web. This gives a sensitive and accurate control for regulating the coating film thickness. Such a construction also provides a control which may be varied even though a relatively small counterweight 46 is used.

The ends of the guide rods are secured in the bracket plates 36. The web engaging lower surfaces of these guide rods are disposed just below the path of travel of the web as it leaves the first set of feed rollers 11, 12 and the web passes under the guide rods and over the metering rod. This produces a tendency in the web to spring upwardly and hence maintains the web taut at all times regardless of the spacing between the respective pairs of feed rollers, thereby conditioning the web for the controlled pressure of the metering rod.

By carefully adjusting the weights 46 the pressure on the web may be controlled in accordance with the viscosity and temperature of the coating substance applied to the web with the result that the film of coating substance which remains on the web after passing the metering rod will be of a desired predetermined uniform thickness over the entire surface of the web.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In a machine for applying a film of fluid coating substance to a moving web of material, the combination of spaced guide means for engaging and pressing the web out of its normal path of travel to impart tension to the web, a metering rod for engaging and uniformly distributing the coating substance on the web, and freely floating means for supporting said metering rod to force the same with a predetermined controlled pressure against the coated web surface opposite to and between said spaced guide means.

2. In a machine for applying a film of fluid coating substance to a moving web of material, the combination of spaced guide means for engaging and pressing the web out of its normal path of travel to impart tension to the web, a metering rod for engaging and uniformly distributing the coating substance on the web, freely floating means for supporting said metering rod to force the same with a predetermined controlled pressure against the coated web surface opposite to and between said spaced guide means, means for heating said metering rod, and means for varying the pressure of said metering rod against the web at the described locality to regulate the thickness of the film of coating substance on the web.

3. In a machine for applying a film of fluid coating substance to a moving web of material, the combination of spaced guide means for engaging and pressing the web out of its normal path of travel to impart tension to the web, a metering rod for engaging and uniformly distributing the coating substance on the web, freely floating means for supporting said metering rod to force the same with a predetermined controlled pressure against the coated web surface

opposite to and between said spaced guide means, a lever arm pivotally mounted adjacent said metering rod supporting means for normally shifting the rod toward the moving web, a counter-balance weight adjustably mounted on said arm for pressing the metering rod against the web with a predetermined pressure, and guide means for retaining the metering rod in freely floating supported engagement with the moving web.

4. In a machine for applying a film of coating substance to a moving web of material, comprising in combination, feed rollers for advancing a web to be coated along a predetermined path of travel, a coating roller for applying a film of coating substance to the moving web, a pair of spaced and parallel guide bars against which the web engages for keeping it taut, a freely movable conduit mounted between the guide bars and adjacent the web and extending transversely thereof and through which a heating medium is circulated to maintain it at a predetermined temperature, guide members adjacent said conduit for retaining it in a predetermined position relative to the web, a metering rod embedded in the outer surface of said conduit and receiving heat therefrom and engageable against the coated web for uniformly distributing the coating substance on the web, a pair of pivotally mounted arms on which said conduit rests, and a counter-balance weight adjustably disposed on each of said arms for pressing the metering rod in the conduit against the web with a controlled pressure to regulate the thickness of the coating substance on the web.

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