Dec. 24, 1935. J. A. CAMERON ET AL 2,025,375

METHOD OF COATING WEBS

Filed July 13, 1933 5 Sheets-Sheet 1

Fig. 2

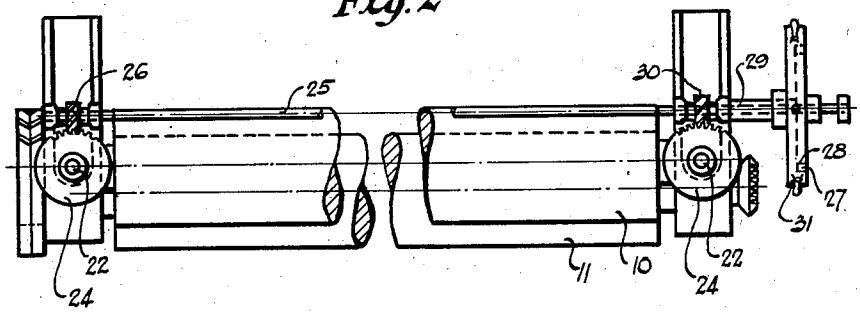


Fig. 1

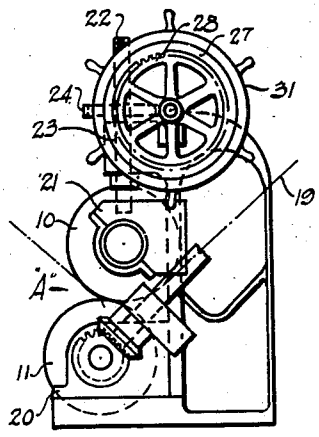


Fig. 3

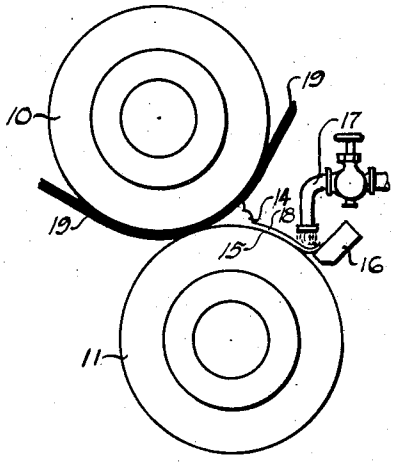
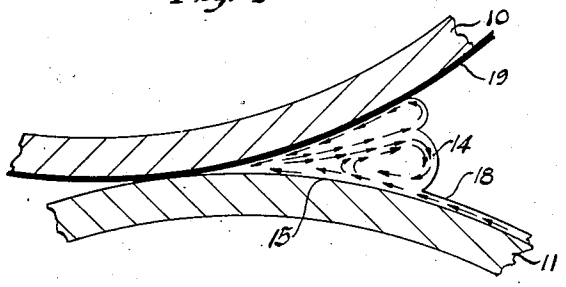


Fig. 4



INVENTORS

James A. Cameron

BY Robert McC. Johnstone

Albert Beeten

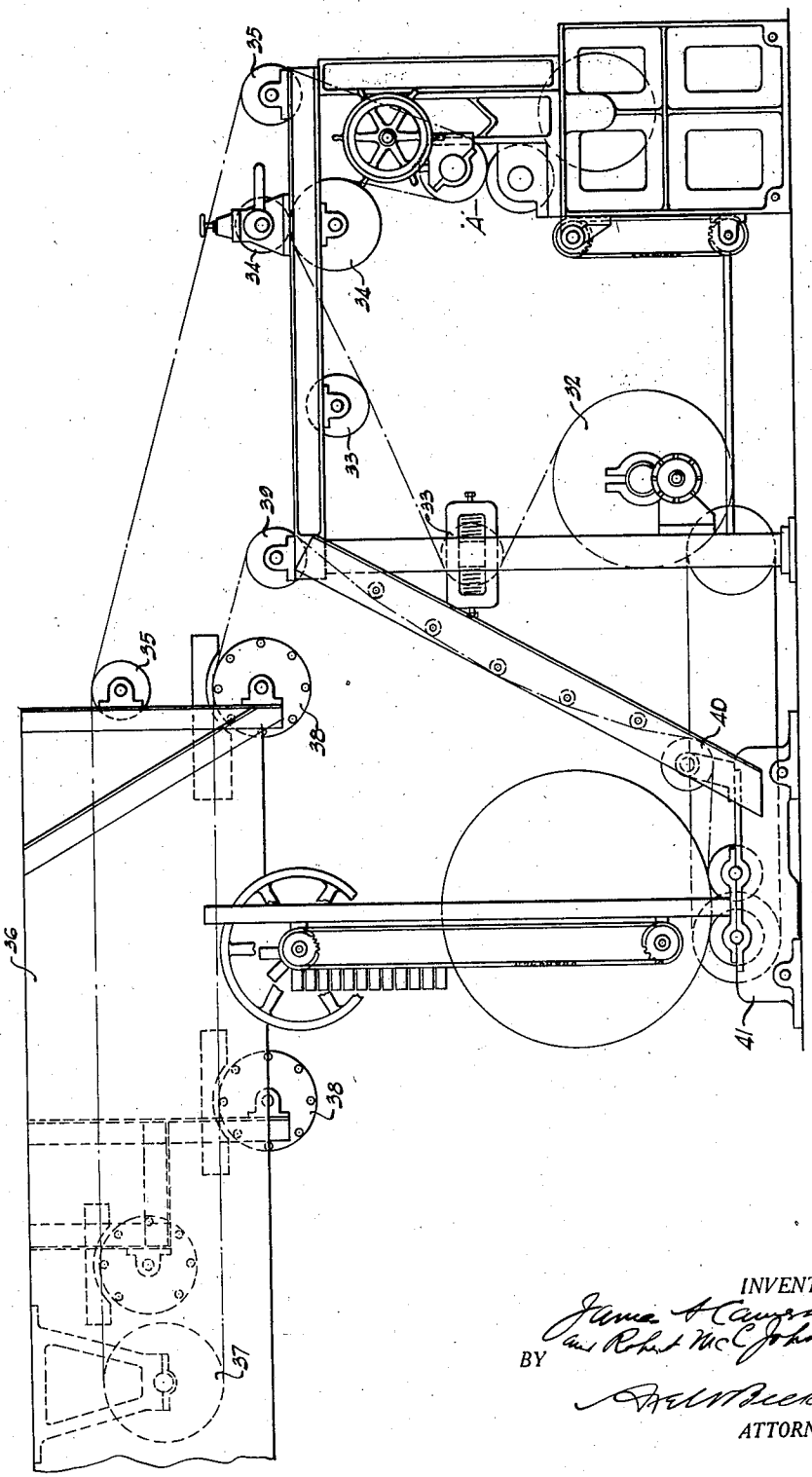
ATTORNEY.

Dec. 24, 1935. J. A. CAMERON ET AL 2,025,375

METHOD OF COATING WEBS

Filed July 13, 1933 5 Sheets-Sheet 2

Fig. 5



INVENTORS

James A. Cameron

and Robert McC. Johnstone

BY

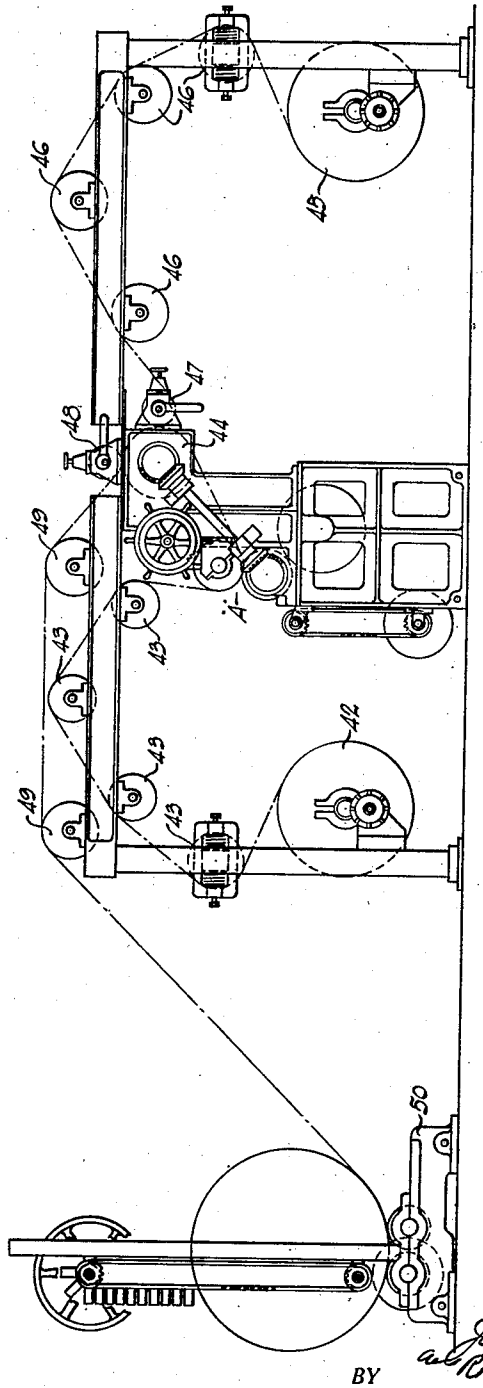
ATTORNEY.

Dec. 24, 1935. J. A. CAMERON ET AL 2,025,375

METHOD OF COATING WEBS

Filed July 13, 1933 5 Sheets-Sheet 3

Fig. 6



INVENTORS
James A. Cameron
and Robert McC. Johnstone

BY

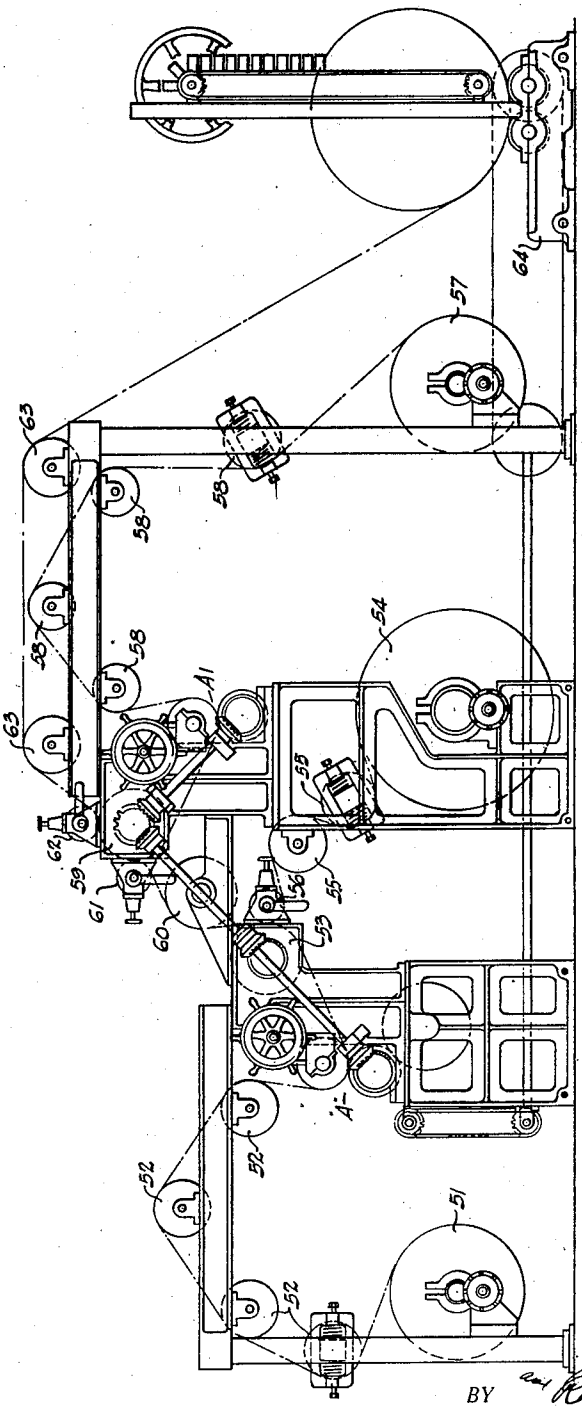
ATTORNEY.

Dec. 24, 1935. J. A. CAMERON ET AL 2,025,375

METHOD OF COATING WEBS

Filed July 13, 1933 5 Sheets-Sheet 4

Fig. 7



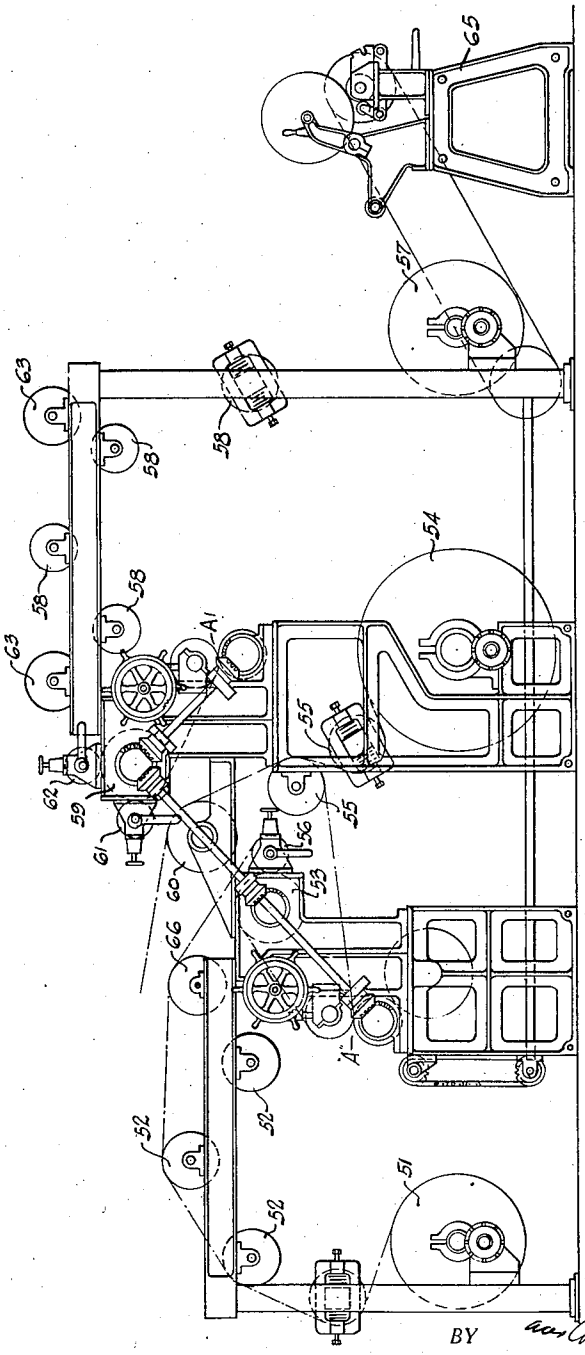
INVENTORS
James A. Cameron
and Robert McC. Johnstone
BY
Arthur Becker
ATTORNEY.

Dec. 24, 1935. J. A. CAMERON ET AL 2,025,375

METHOD OF COATING WEBS

Filed July 13, 1933 5 Sheets-Sheet 5

Fig. 8



INVENTORS

James A. Cameron

and Robert McJohnstone

BY

Allen Beeken

ATTORNEY.

Patented Dec. 24, 1935

2,025,375

UNITED STATES PATENT OFFICE

2,025,375

METHOD OF COATING WEBS

James A. Cameron, Brooklyn, N. Y., and Robert McC. Johnstone, Short Hills, N. J., assignors to Cameron Machine Company, Brooklyn, N. Y., a corporation of New York

Application July 13, 1933, Serial No. 680,242

2 Claims. (Cl. 91—68)

The present invention relates to coating and/or combining machines, and has for its main object and feature the more even coating of a web of flexible material and the more uniform combining of two webs than has heretofore been possible. Other objects and features of the invention will appear as the specification proceeds.

In the accompanying drawings the invention is shown in several preferred forms, in which:

Fig. 1 is a view in side elevation of a coating couple or unit embodying the invention;

Fig. 2 is a view in top elevation of the elements shown in Fig. 1, with parts broken away;

Fig. 3 is a view, on an enlarged scale of parts of the rolls constituting the coating couple;

Fig. 4 is a diagrammatic view of the nip of the rolls constituting the couple, and of the puddle of coating material;

Fig. 5 is a view in side elevation of a coating, drying and winding machine in which the coating couple of Fig. 1 is utilized;

Fig. 6 is a view in side elevation of a two-ply combining machine embodying the invention;

Fig. 7 is a view in side elevation of a three-ply combining machine embodying the invention; and

Fig. 8 is a view in side elevation of a machine showing a modified form of the invention, which machine can be used either for coating a web or for combining two webs.

A indicates a coating couple composed of two rolls 10 and 11 arranged one above the other. Coating material is supplied to lower roll 11 in any suitable manner as by immersing the lower portion of said roll in a fountain, the rotation of said roll carrying the coating material to the nip of the two rolls. The extent to which the lower roll is immersed in the fountain (not shown), the speed of rotation of the roll and the consistency of the coating material will determine the thickness of the film of coating material carried to the nip of the rolls, and these factors should be so coordinated that a puddle 14 of coating material is maintained at the ingoing side of the couple. To facilitate the maintaining of said puddle, rolls 10 and 11 preferably have their vertical center lines out of alinement, or, to put it differently, one roll is preferably set back with respect to the other so as to afford an exposed portion 15 on the upper surface of the lower roll at said ingoing side of the couple. Care should be taken, however, especially when dealing with a volatile coating material, that an excessively large puddle is not created because in such case it will be difficult, if not impossible to maintain the desired characteristics and/or consistency of the coating material as the amount of evaporation would be excessive and the coating material would become non-uniform in character. Therefore to properly control the character of the coating material, the fountain, if used, should be covered except at the point where the lower roll dips into it. Inasmuch as, under certain conditions, the volume of coating material to be carried up by the roll would require a considerable opening in the fountain to permit said roll to be immersed the required distance, the factor of evaporation and the volume of coating material to be supplied to the nip might conflict, and it has therefore been found simpler to arrange a sort of a trough, indicated diagrammatically at 16 in Fig. 3 and to arrange a supply pipe or a series of nozzles 17 leading from an otherwise closed container to thereby supply the proper amount of coating material to the surface of the lower roll. By this means, the distance which the coating material has to travel is decreased, and the volume supplied and character of said coating material can be more easily controlled. In addition to the factors above mentioned, the size of the opening at the nip of the rolls also has an influence upon the puddle, because the closer these rolls are together the greater the backward pressure, other factors being equal, with respect to the material of said puddle. It is preferred not to use scrapers or doctor blades on the coated web, because to do so is apt to produce streaks and this is disadvantageous for the reason that a non-uniform coating will result, and not only is this a disadvantage in itself but, if the coated web is to be united to another web, imperfect adhesion of the two webs will occur, and if one of the webs is of transparent material such as cellophane, the streaks will be perceptible to the eye and thereby render the combined product less desirable, sometimes so much so that the customer will not use it. It is therefore preferred that rolls 10 and 11 be calendering rolls that will act not only to coat but also to calender the web. In Fig. 4 we have attempted to indicate what we believe takes place in the puddle at the nip of the rolls. From that figure it will be seen that film 18 of coating material, carried up by the lower roll, tends to move toward the nip but that the pressure exerted by the rolls at the nip causes a backflow which tends to create the puddle, part of said puddle being again turned toward the nip by the upper as well as by the lower roll. Inasmuch as the upper roll is set

back of the vertical center line of the lower roll it will be seen that gravity also plays a part in causing the coating material to flow toward the nip. The puddle therefore extends from the nip to a point substantially in advance of the nip. 19 indicates the web of flexible material which is guided into close contact with the dry surface of the upper roll at a point well in advance of the puddle and which, after it has passed through the nip, is retained in close contact with the surface of the upper roll, at the outgoing side of the couple, for a distance beyond the point where the film of coating material, common to the two rolls at the point of nip, breaks. In this way it is unnecessary to provide dams to confine the coating material as is usually done to prevent said coating material from working over the dry side of the web and over the surface of the upper roll that contacts with the dry side of the web. In connection with this it should be explained that there is, of course, a film of coating material between the upper and lower rolls at the point of nip and that this film is carried outward a certain distance, at the outgoing side of the couple, before it breaks, and that when it snaps it causes a series of miniature explosions which sends particles of coating material in all directions and some of which would work behind the web if the latter leaves the rolls say at a tangent to the nip. So likewise by bringing the web into close contact with the upper roll, at the ingoing side of the couple, at a point well in advance of the puddle, the bubbling and boiling of the material of said puddle will not throw particles of coating material on the dry surface of the drum or on the uncoated side of the web. The absence of dams renders it very easy to change from one web-width to another, as no adjustment is necessary.

Rolls 10 and 11 are preferably driven at the same surface speed as the web. Roll 11 is here shown mounted in stationary bearings 20, and roll 10 is mounted in slidable boxes 21, one at each end. Said boxes carry upwardly extending non-rotatable screws 22 that engage rotatable but non-slidable nuts 23, each of which nuts is provided with a gear 24. Extending transversely of the machine is a shaft 25 carrying a pinion 26, at the far side of the machine, which engages gear 24 at that side, and carrying also a slidably mounted gear 27, at the near side, which engages an internal gear 28 at said near side. Internal gear 28 is carried by a sleeve 29 loosely surrounding shaft 25, and said sleeve further carries a pinion 30 that meshes with gear 24 at the near side. Mounted on shaft 25, at the near side, is a handwheel 31. It will now be understood that, when gears 27 and 28 are in mesh, shaft 25 and sleeve 29 are connected, and therefore rotation of handwheel 31 will actuate both pinions 26 and 30, which will cause both gears 24 to be rotated in unison and that rotation of gears 24 will raise or lower both ends of roll 10 equally. If for any reason it is desired to raise or lower one end of said roll independently of the other, then slidable gear 27 can be moved out of mesh with gear 28 thereby disconnecting shaft 25 and sleeve 29. If this is done, then rotation of handwheel 31 will raise or lower the far end of roll 10 independently of the near end of said roll, and if it is desired to raise or lower the near end of roll 10 independently of its far end, then gear 28 can be rotated independently by hand thereby actuating sleeve 29 but not shaft 25.

In Fig. 5 the invention is shown embodied in a coating machine. As there shown, the web to be coated comes from source of supply 32 and after passing over suitable guides as 33 is led between feed rollers 34 either or both of which may be driven. The web then passes between the rollers of coating unit A, in the manner previously described, and over guides 35 to drier 36. It will be seen that in so doing, the coated side of the web is out. The web is now reversed over guide 37 and passes over guides 38, 39 and 40 to winder 41, here of the two-drum type, where it is wound with the coated and dried side in and with the uncoated side out.

Fig. 6 shows a two-ply combining machine in which the web passes from source of supply 42 over suitable guide rollers 43 to coating couple A and thence to combining drum 44. Another web which may or may not be coated is led from source of supply 45 over suitable guide rolls 46 and thence to pressure roll 47 coacting with combining drum 44. The two webs are thus united under pressure between 44 and 47, and the combined webs are then led still further over combining drum 44 and may, if desired, be subjected to additional pressure by a second pressure roll 48. After this, the combined webs are led over suitable guide rolls 49 to winder 50. The combining drum is driven preferably at web speed, and pressure rolls 47 and 48 may or may not be driven. The rolls of the coating couple and the combining drum may or may not be heated or may be chilled in a manner well understood, depending upon the character of the coating material used. Some of the guide rolls may also be heated or chilled as may be desired.

In Fig. 7 is shown a three-ply combining machine. Here a web is led from source of supply 51 over suitable guide rolls 52 to coating couple A and thence to combining drum 53. A second web is led from source 54 over suitable guide rolls 55 to pressure roll 56 and combining drum 53 where the two webs are combined. A third web is led from source 57 over suitable guide rolls 58 to coating couple A1 and thence to combining drum 59. The previously combined webs are led from combining drum 53 over roller 60 and thence to pressure roll 61 and combining drum 59 where they meet the web from coating couple A1 and are combined into a three-ply product which then continues over combining drum 59 and, if desired, passes under another pressure roll 62. The three-ply product now passes over guide rolls 63 to winder 64.

In Fig. 8 is shown the same machine as in Fig. 7, except that a different winder, viz: a one-drum type winder 65 is disclosed. The webs may here be led exactly as described in Fig. 7 and a three-ply product be obtained. If it is desired, however, merely to coat a web instead of combining it with other webs, then the web may be led as follows, as shown in dash-and-dot lines: from source of supply 51 the web passes over two guide rollers 52, but instead of passing thence to the third guide roller 52 and to coating couple A, the web is led over a different guide roller 66, around pressure roller 56 and thence between pressure roller 56 and combining drum 53 which now act merely as feed rolls. The web is then led to coating couple A and thence to idler rollers 55 and 60 and so to a drier or other instrumentality for further manipulation. Thus it will be

seen that none of the driven rolls have to have their direction of rotation reversed.

Throughout the specification and claims, the expression "coating material" has been used and it will be evident from the foregoing that this expression is used in a very broad sense and is intended to cover any material whether adhesive or not.

We claim:

1. The method of coating one surface of a web of flexible material which consists in: guiding the web into contact with the dry surface of one roll of a coating couple at a point, on the ingoing side of the rolls, well in advance of the point of nip of said rolls; supplying coating material to the entire width of the surface of the other roll of said couple at a point relatively remote from said nip; maintaining at said nip on the ingoing side of the couple, by rotation of said rolls at substantially equal speed in the same direction as the movement of the web, an unconfined puddle of coating material of controlled volume to thereby keep the character of the coating material substantially uniform and to apply said coating material to the exposed surface of the first-mentioned roll as well as to the flexible web; passing said web through the nip of said couple; and retaining said web in contact with the dry surface of the first-mentioned roll at the outgoing side of said couple for a distance beyond the point where the film of coating material, common to the two rolls at their point of nip, breaks.

2. The method of coating one surface of a web of flexible material which consists in: guiding the web into contact with the dry surface of one roll of a coating couple at a point, on the ingoing side of the rolls, well in advance of the point of nip of said rolls; supplying coating material to the entire width of the surface of the other roll of said couple at a point relatively remote from said nip; maintaining at said nip on the ingoing side of the couple, by rotation of said rolls at substantially equal speed in the same direction as the movement of the web, an unconfined puddle of coating material of controlled volume to thereby keep the character of the coating material substantially uniform and to apply said coating material to the exposed surface of the first-mentioned roll as well as to the flexible web; passing said web through the nip of said couple and calendering it; and retaining said web in contact with the dry surface of the first-mentioned roll at the outgoing side of said couple for a distance beyond the point where the film of coating material common to the two rolls at their point of nip, breaks.

JAMES A. CAMERON.
ROBERT McC. JOHNSTONE.