The present invention relates to improvements in a winding mechanism and more particularly high speed continuous web winding mechanisms such as for winding a paper web onto a roll.

The invention more particularly relates to a mechanism for eliminating the problems of controlling high velocity air currents which occur during high speed paper roll winding operation and build up layers of air between the web and the traveling surfaces. As will be appreciated from the description advantages of the invention may be utilized in mechanisms for winding other types of web material but the features are particularly well suited for use in a paper winding machine and the preferred arrangement will be described in connection with such use.

In a paper web winding machine of a conventional type a winding drum engages a rotating winding roll and forms a winding nip therebetween. The paper web is fed onto the winding drum which rolls the web along as it follows the surface of the drum and is laid onto the roll. At web speeds at the order of 2000 feet per minute and higher, high velocity air currents follow the web surface and layers of air tend to form between the surface of the drum and the web. This tends to cause wrinkles in the web and instability of the web relative to the drum surface. These winding mechanisms are frequently used in slitting operation with the web being slit into strips before being wound and the formation of air layers between the drum and web causes interweaving of the slit webs on the drum and consequently on the roll which damages the web when the roll is wound and the web when the wound rolls are separated attempts to avoid wrinkling of the web and the elimination of the interweaving of the slit strips of webs have included positioning a spreader roll immediately ahead of the winding drum but this has required the cost and space of an extra spreader roll and has not eliminated the formation of pockets or layers of air between the winding drum surface and the web.

It is accordingly an object of the present invention to provide a method and mechanism for controlling high velocity air currents traveling with a paper web during a high speed paper roll winding operation and eliminating the formation layers of air between a winding drum and a web due to these air currents.

A further feature of the invention is to eliminate the problem of interweaving of said webs during a winding operation caused by air layers or bubbles forming between the strips of web and the surface of a winding drum.

A still further object of the invention is to provide a mechanism which will avoid the necessity of including a spreader roll immediately ahead of a winding drum thereby eliminating unnecessary cost.

A feature of the invention is to provide a web winding machine having a roll engaging drum with a lay on roll forming a pressure air expelling nip with the drum receiving the web in said pressure nip with the web guided onto the lay on roll before the drum for sealing the web on the lay on roll ahead of the pressure nip forcing air to escape from between the web and outer surface of the drum. The lay on roll has a resilient outer surface and is designed to act as an anvil roll for a score-type slitting operation if desired.

Other objects, advantages and features will become more apparent with the teaching of the principles of the present invention in connection with the disclosure of the preferred embodiments thereof in the specification, claims and drawings, in which:

FIGURE 1 is a schematic showing of a winding mechanism constructed and operating in accordance with the principles of the present invention;

FIGURE 2 is a schematic showing of another form of the invention;

FIGURE 3 is a schematic showing of another arrangement of the invention; and

FIGURE 4 is a schematic showing of a single drum winder mechanism embodying the principles of the present invention.

As shown on the drawings:

FIGURE 1 illustrates a winder with a winding roll 10 receiving a traveling web W wound thereon. The winding roll 10 is mounted for rotation on suitable supporting means which include winding drums 11 and 12 which may be suitably driven such as by motor means 13.

The web is received from an unwinding roll 14 and passes suitable guide and tensioning rolls such as 15 and a spreader roll 16. The web is shown being slit by conventional slitters such as slitter knives and drums 17 and 18 before being wound on the winding roll 10. In the illustrated arrangement the web is unwound from the roll 14 and wound on the roll 10, but it will be understood that the web may be obtained from other sources such as directly from the paper machine where a paper web is being formed.

As the web passes onto the winding drum 12 the air currents which tend to travel with the surfaces of the web will form layers between the surface of the drum 12 and the web causing wrinkling and instability, and causing interweaving where the web is cut into strips. For avoiding the disadvantages incurred because of the air layers and pockets or bubbles which are formed, a lay on roll 19 is provided forming a pressure lay on nip N with the drum 12. A head of the roll 19 is a spreader such as a Mt. Hope roll 18z.

The lay on roll 19 has either a hard or a somewhat resilient outer surface. For example a metal roll may be used. It has been discovered that good operation is accomplished with a surface covering formed of polyurethane, and a polyeurethane plastic with a hardness of 70 durometer has been found to be particularly well suited for use.

The lay on nip N is pressure loaded, and the lay on roll 19 is movably supported such as on pivotal support arms 20 and is loaded with a piston and cylinder loader 21. A nip load in the range of 1/2 to 50 pounds per linear inch is preferred for a speed range of 2000 to 6500 feet per minute and this has been found to effectively expel and exclude air from the nip N preventing the formation of any air against the surface of the drum 12 which would cause wrinkling of the web or interweaving of the web strips.

In the arrangement illustrated in FIGURE 2 a winding roll 25 is supported on winding drums 26 and 27 with a web W supplied off an unwinding roll 28. The web passes over guide and tensioning rolls such as 29 and is directed beneath the winding roll 25 onto the surface of the drum 26. A lay on roll 31 forms a nip N with the drum 26 and is held in the proper pressure relationship being supported on the pivotal arms 33 and being forced against the drum by a piston and cylinder assembly 32.

The lay on roll can function as an anvil roll for a score slitting operation and a score slitter 34 is shown forming a score slitting nip N' with the lay on roll 31. The web W is thus score slit when it reaches the lay on roll 31 and the lay on roll prevents air bubbles from forming between the web and the outer surface of the drum 26.

In the arrangement of FIGURE 3, a score slitter ar-
rangement is shown where the web is fed onto the closest drum 37 rather than being led across beneath the winding roll 35, as it is in FIGURE 2. In FIGURE 3 the winding roll 35 is supported on drums 36 and 37, and the web W passes over a guide and tensioning roll 38 and a spreader roll 39. A lay on roll 42 forms a pressure lay on nip N with the drum 37 excluding the formation of bubbles of air. The lay on roll is supported on pivotal arms 43 which are forced toward the drum 37 to provide pressure in the nip N, by piston and cylinder members 44.

In the arrangement of FIGURE 4 a single drum winder is shown with a winding roll 45 being supported on suitable means such as a rail 41 and engaged by a winding drum 46. The web W passes guide and tensioning rolls 47 and a spreader roll 48 to pass through slitters 49 and 50.

A lay on roll 51 forms a pressure lay on nip N that is supported on pivotal arms 52 urged toward the drum 46 by piston and cylinder members 53.

In each of the arrangements the web is preferably guided so that it first engages the lay on roll and is firmly seated thereon before reaching the pressure lay on nip N. This fixes the positioning of the strips if the web is slit and since any layer or bubbles of air formed on the exposed surface of the strips or web W are excluded a positive relative location between the strips is achieved and maintained on the drum.

Thus it will be seen that there has been provided an improved winding mechanism and method which meets the objectives and advantages above set forth. The mechanism is particularly advantageous at high speed web travel and eliminates unstable conditions heretofore caused by the high velocity air currents.

The drawings and specification present a detailed disclosure of the preferred embodiments of the invention, and it is to be understood that the invention is not limited to the specific forms disclosed, but covers all modifications, changes and alternative constructions and methods falling within the scope of the principles taught by the invention.

I claim as my invention:

1. In a web winding machine for winding a roll from a traveling web, the combination comprising,
   a roll engaging winding drum forming a winding nip with a roll being wound,
   means delivering a traveling web to said drum,
   a lay on roll forming a pressure air expelling nip with said roll engaging winding drum forming a winding nip with a roll being wound,
   means delivering a traveling web to said drum,
   said spreader roll positioned relative to said lay on roll so that said web will engage the lay on roll before the drum for seating the web firmly on the lay on roll ahead of the pressure nip first eliminating air from between the web and the drum and then forcing air to escape from between the web and surface of the drum as the lay on roll carries the web positively against the drum.

2. In a web winding machine for winding a roll from a traveling web, the combination comprising,
   a roll engaging winding drum forming a winding nip with a roll being wound,
   means delivering a traveling web to said drum,