This invention relates to coil wrapping apparatus and a method therefor and finds particular utility in providing the outer insulation for transformer-like elements such as the light ballast elements illustrated.

It is an object of this invention to provide a method and apparatus for wrapping such objects as fluorescent light ballast elements and the like which is characterized by a high degree of automatic operation and which thereby overcomes inefficiencies previously tolerated in such operations. Another object is to provide an automatic method and apparatus for wrapping coils in which variations in the coil outer dimension are automatically compensated for so that a plurality of coils can be simultaneously wrapped.

The invention will be described in conjunction with an illustrated embodiment in the accompanying drawing, in which—

FIG. 1 is a perspective view of apparatus embodying teachings of this invention, the view being taken primarily from the leaving side of the apparatus;

FIG. 2 is a fragmentary end elevational view of the apparatus taken from the entering end of the apparatus;

FIG. 3 is an enlarged sectional view taken along the line 1—1 of FIG. 2;

FIG. 4 is a exploded fragmentary view of the central top portion of the apparatus and which particularly features the adhesive applying mechanism;

FIG. 5 is a fragmentary enlarged sectional view taken along the line 5—5 of FIG. 4;

FIG. 5A is an enlarged fragmentary view of the encircled portion of FIG. 5;

FIGS. 6 and 7 are fragmentary enlarged sectional views of a portion of the FIG. 3 showing and with parts thereof in different operative conditions.

The numeral given, the numeral 10 designates generally a frame such as may be constructed of square metal tubing and which is generally rectangular in its configuration, comprising upright or vertical column members 11, longitudinal lower stringer members 12, upper longitudinal stringer members 13, lower transverse stringer members 14, upper transverse stringer members 15 and longitudinal struts 16 (see particularly FIG. 3).

The frame 10 is provided with a back-stand 17 (see FIG. 1) provided on the entering end column members 11 and which rotatably supports shaft 18. The shaft 18 in turn carries a parent roll of insulating paper 19. It will be appreciated that roll 19 may be narrower or wider, as desired, or a group of individual rolls.

In the illustration given, web W (see FIG. 3) from the parent roll is passed over the top of the frame 10 in contact with rollers 20—26 until it is wrapped around a core C rotatably carried on an arbor 27. The arbor 27 is driven by a gear motor 28 through one revolution clutch 29 (see FIG. 2). The clutch 29 may be a "one" throw clutch provided by the Hilliard Corporation, of Elmira, New York, and the motor may be a Boston Gear Motor provided by the Boston Gear Works, of Quincy, Massachusetts.

Through suitable gearing (not shown), the single throw clutch 29 may be caused to rotate the arbor 27 any desired number of revolutions, i.e., 1, 2, 3, etc., depending upon the number of times the coil C is to be wrapped by the web W. For the purpose of supporting the motor 28 and the clutch 29, the frame 10 may be equipped with a laterally-extending bracket 30 as seen in FIG. 2.

In the illustration given, the web W which issues from parent roll 19 as the latter is being unwound, is provided in the form of kraft paper and without any adhesive incorporated therewith. The adhesive for uniting the web W to itself and to the coil C is provided by adhesive supply means generally designated 31. Through the operation of the supply means 31, ribbons 32 of adhesive are laid down on the web W (see FIG. 4) which may vary in width, viscosity, etc., according to the dictates of a particular procedure.

In FIG. 4, the adhesive ribbons 32 are seen to be aligned with openings 33 in a plate 34 which is positioned below a box-like tank 35, the tank 35 carrying adhesive 36. Egress of adhesive 36 from the tank 35 is achieved through an elongated slot 37 which may be aligned with the openings 33 in plate 34 in one position of the plate 34. The tank 35 is equipped with a suitable cover 38 which may be provided with a suitable handle 39 (seen only in FIG. 2).

The web W is urged against the undersurface of the plate 34 by means of the rolls 24 and 25 (see FIG. 3). The rolls 24 and 25 are suitably journaled in a bearing (not shown) but which is provided in the bearing pedestal 40.

Laterally outward of the bearing pedestal 40 is a pedestal 41 (see FIG. 4) which carries the tank-supporting frame 42. In the exploded view seen in FIG. 4, the tank 35 is seen to be removably mounted within the frame 42 and the frame 42 also provides a slideable mounting for the plate 34. The plate 34 may be completely removed from its mounting within the frame 42 by movement to the right in FIG. 4 or as indicated in FIG. 5, or may be moved slightly to the left into the space 43a until it engages the stopping lugs 43 provided as part of the pedestal 41—in which case the openings 33 in the plate 34 are no longer in register with the slot 37 in the bottom wall of the tank 35. It is to be appreciated that with a high speed automatic operation, it may be necessary from time to time to change the adhesive formulation or to utilize webs already equipped with adhesives for certain purposes, thus by the structure just described it is possible to provide a versatile means for creating an adhesive surface on the web W.

Ordinarily, however, the plate 34 will be positioned with its openings 33 in alignment with the slot 37 and this position is readily ascertained by positioning the dogs 44 in the position seen in FIG. 3 wherein they act as abutments for the plate 34 limiting its movement to the left. The dogs 44 may be conveniently pivotally attached to the frame 43 as shown in FIG. 4. For the purpose of permitting sliding movement of the plate longitudinally of the web W, frame 42 is cut away as at 42a in FIGS. 4 and 5, also in FIG. 3.

Prior to the time that the web W encounters the adhesive supply means 31, it has already been in contact with rolls 22—23. The roll 23 is journaled within a group of pedestals 45, which like the pedestals 40 and 41 are secured to the top plate 46 on the frame 10. As seen in FIG. 1, the pedestals may be suitably secured to the plate 46 by means of bolts 46a.

The roll 20 is supported in pedestals 47 and at the roll end and, just inboard of the pedestals 47, the roll 20 is equipped with a pair of arms 48. The arms 48, at their unsupported ends, rotatably carry the roll 21 which, in effect, acts as a dance roll. For this purpose, the arms 48 are pivotally related to the roll 20 so that the dance roll 21 is free to pivot in a circular path around the roll 20 and thus compensate for changes in the tension of the web W.

I have found that this is important during start-up or cessation of the advancement of web W since the parent roll 19 has considerable inertia.
3 Limiting the downward movement of the dance roll 21 is a post 49 (see FIG. 3) which is engaged by the arm 48. In the illustration given, such posts 49 are provided, one for each arm 48, and each arm 48 is urged into con-

In the illustration given, such posts 49 are provided, one for each arm 48, and each arm 48 is urged into con-
tact with the post 49 by means of a coil spring 50 which, at one end, is connected to the free end of arm 48 and at its other end is connected to the top plate 46.

After the web passes the dance roll 21, it may pass between the marking rolls 22 and 23. Rolls 22 and 23 may be suitably embossed or equipped with cutting means, etc., to provide longitudinal slit-like perforations 51 in web W (see FIG. 4). These, or other markings (such as printing) may be employed for a subsequent saving on a bearing operation.

Providing a positive drag or tension on the web W is a brake 52 (see FIG. 3) which may take the form of the weighted lever brake shown. The apron 52 is secured as by bolting adjacent its upper end as at 53 to the entering end of upper transverse stringer 15. The lower end of the apron 52 may be folded on itself as at 54, and in the pocket 55 formed thereby carry a metal rod 56 so that a positive pressure is applied against the periphery of parent roll 19.

The web W, in leaving the adhesive-supply means 31, thereafter passes into wrapping relation with the coil C which is sleeved on an arbor or mandrel 27. In the illustration given, the arbor 27 has a square cross section, but it will be appreciated that other cross-sectional forms may be employed. The arbor 27 is rotatably supported within a pair of pillow blocks 57 and 58. Outboard of the pillow block 57, the arbor 27 is connected to the clutch 29, while the pillow block or bearing 58 is of the openable type so as to facilitate insertion of the arbor 27. For this purpose, the bearing 58 is equipped with a latch handle 59 (see FIG. 1) which is effective to lock and unlock the bearing halves.

The coil C conventionally has a length of about 28 inches with an outside dimension of between 1" and 2" on a side—the coil C illustrated herein being generally square in cross section. On the coil C, it is possible to provide ten or so separate longitudinally-spaced windings which subsequently can be separated one from the other by passing the coil C through a bandsaw. This necessarily results in different thickness dimensions in the coil C and often results in "draw wrinkles" as the coil C is being wrapped. Heretofore, it has been necessary to first sever the coil C into discrete coil segments—prior to the important final wrapping operation—necessitating costly handwork and expensive gummed insulating paper. Now, through the practice of this invention, it is possible to envelop the entire coil C in one operation. Therefore, the coil C can be conveniently severed along the dotted lines provided by the slot-like perforations 51 and a plurality of coils are immediately provided. The coils provided, although not shown as such, comprehend a plurality of windings so as to provide, for example, a primary and secondary, if such is desired, the windings being suitably insulated one from the other. In some instances it may be desirable to provide a plurality of secondary windings or the like on each coil portion that is ultimately severed from the coil C. Such is achieved conveniently through slip or gripping winding in a manner well known in the art, and this form of coil C is also amenable to the wrapping operation described herein. Alternatively, the coil C may be a group of individual bobbin wound coils assembled on the arbor 27 with individual barricade rolls 19.

The pillow blocks or bearings 57 and 58 are suitably secured to bearing pedestals 60 which at the extreme leading end of the machine provide a platform 61 on which is secured a resilient pad 62. The pad 62 provides a convenient abutment against which the web W may be placed in order to sever the same after a coil C has been enveloped.

Just inboard of the pedestals 60 are a pair of pedestals 63 which are equipped with slantly mounted posts 64 (see FIG. 3). The posts 64 at their upper ends rotatably support the roll 26. For this purpose, the upper ends of the posts 64 are equipped with bearing journals 65. Each bracket 64a is L-shaped and has an upstanding portion 64b in which the roll 26 is journaled. Each bracket 64a has a horizontal portion 64c in which the associated post 64 is mounted—the portion 64c being confined between collars 62a and 62b (as seen only in FIGS. 6 and 7). The posts 64 adjacent their lower ends are each equipped with collar 65 which may be threaded or otherwise secured thereon. The extreme lower ends of the posts 64 are connected to a transversely extending treddle bar 66. Depending from the leaving end top plate 67 (which is coplanar with entering top plate 46—see FIG. 3) is a bracket 65 and depending from the collar 65 is a coiled spring 70. Thus, the coil spring 70 urges the brackets 64a and, hence, the roll 26, upward against the stick C. The alternative positions of the roll 26 can be seen by reference to FIGS. 6 and 7, the bracket 64a in FIG. 6 being in its raised position while in FIG. 7 it is in its lowered position. For this purpose, the brackets 64a are equipped with guides 64d which ride in a slot 61a provided in the platform 61. Secured to the treddle bar 66 are a pair of strut members 71 which, at their lower ends, are each mounted on a treddle plate 73. The plate 73, in turn, is secured to a pair of arms 74 for foot operation of the machine. The arms 74 are pivoted on the longitudinal stringer members 12 as at 75. If desired, the strut members 71 may be equipped with turn buckles 72 for adjusting the length thereof. Thus, by depressing the treddle plate 73, the spring 70 is compressed and the roll 26 is taken out of bearing engagement with the coil C.

In the operation of the device just described, the web W may be constructed of kraft paper or suitably reinforced with a Mylar (Du Pont trademark for polyethylene terphthalate) impregnated or laminated. The web W as it passes under the plate 34 picks up adhesive issuing through the openings 33 therein. The openings 33, as can be seen from FIG. 5, are countersunk as at 33a and at the lower ends thereof are equipped with tapered channels or chambers 33b, the channels extending in the direction of web travel on the side of the openings 33 last contacted by a given portion of the web. Thus, they are effective to provide discrete smooth ribbons of adhesive.

To operate the apparatus, an arbor containing a coil C is inserted into the pillow blocks 57 and 58. At this time, the motor is not connected with the arbor 27 inasmuch as the clutch 29 is de-activated. From a preceding operation, the web extends over the roll 26 and onto pad 62 and this leading edge can be applied to the coil C. Through a suitable switch (not shown), the clutch 29 may be activated to turn the coil C the required number of times for the desired wrapping.

Immediately upon rotation of the arbor 27, the operator depresses the treddle plate 73 so as to relax any pressure on the coil C. Through this operation, it is possible to wrap coils which are uneven in their outer dimensions. Here, it is to be appreciated, that the plurality of coil windings provided on any coil C may vary considerably so that there is a possibility that the web may be wrinkled during the wrapping. Any wrinkling of the wrapping of web W on the coil C is not only undesirable but may lead to the rejection of the element thus wrapped. This critically, in the past, has led to the individual wrapping of coil forms with the attendant expense and low production accompanying a manual operation. I have found that by increasing the pressure applied by the roll 26 to the coil C to a value less than that provided in the form of a drag or tensioning of the web in the direction contrary to web travel, produces the desirable result of avoiding draw wrinkles in the sheet or web W. In other words, the maximum pressure exerted by the roll 26 on the coil.
C is less than the restraining pressure exerted by tension developed by the restraining brake 52.

While in the foregoing specification, I have set forth a detailed description of an embodiment of the invention for the purpose of illustration thereof, many variations in the details herein given may be made by those skilled in the art without departing from the spirit and scope of the invention.

1. In a coil wrapping apparatus, a generally rectangular frame, a paper web roll mounted on one end of said frame and arranged to discharge a continuous web for movement over said frame, brake means on said frame restricting the free unrolling of said web roll and effective to apply a tensioning pressure to said web, means intermediate the ends of said frame for applying an adhesive to the upper web surface, said adhesive-applying means being equipped with an elongated bottom plate extending transversely of said web and having a plurality of longitudinally aligned openings intermediate the sides of said plate for laying down a plurality of ribbons of adhesive atop said web in parallel, spaced-apart relation, each opening being forwardly enlarged at its lower end, a coil-supporting arbor having a length adapted to support a coil of about 28 inches in length mounted on said frame opposite the end equipped with said web roll, said arbor and frame being equipped with means for rotating said arbor to wrap said web thereabout, a roll movably mounted on said frame in aligned relation with said arbor, spring means on said frame urging said movable roll into contact with said arbor to apply a compressive pressure to the web being wrapped on said arbor, said compressive pressure always being less than said tensioning pressure, and means for pedally opposing said spring means to reduce said compressive pressure.

2. The apparatus of claim 1 in which said arbor has a generally square shape in cross section.

3. In a coil wrapping apparatus, a generally rectangular frame, a web roll mounted on one end of said frame and arranged to discharge a continuous web for movement over said frame, brake means on said frame restricting the free unrolling of said web roll, means for applying an adhesive to the upper web surface intermediate the ends of said frame, said web-applying means being effective to lay down a plurality of ribbons of adhesive in parallel, spaced-apart relation and including a plate equipped with openings for distributing adhesive, each of the plate openings having a chamfered portion extending in the direction of web movement at the opening bottom, tank means above said plate for delivering adhesive to said openings, a coil-supporting arbor on said frame, means for rotating said arbor to wrap said web thereabout, a pressure roll on said frame mounted in aligned relation with said arbor, spring means on said frame urging said pressure roll into contact with a coil of said arbor, and treadle means on said frame coupled to said pressure roll for overcoming the urging of said spring means and thereby relieving the pressure exerted by said pressure roll on said arbor, the maximum pressure exerted by said pressure roll being less than the restraining pressure exerted on said web to tension the same.

4. The apparatus of claim 3 in which said frame is equipped with means for supporting said plate and tank means, said tank means being equipped with a bottom slot alignable with said openings, said supporting means being cut away to permit movement of said plate parallel to the direction of travel of said web, whereby said slot and openings may be positioned out of alignment to stop the flow of adhesive through said openings.

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