

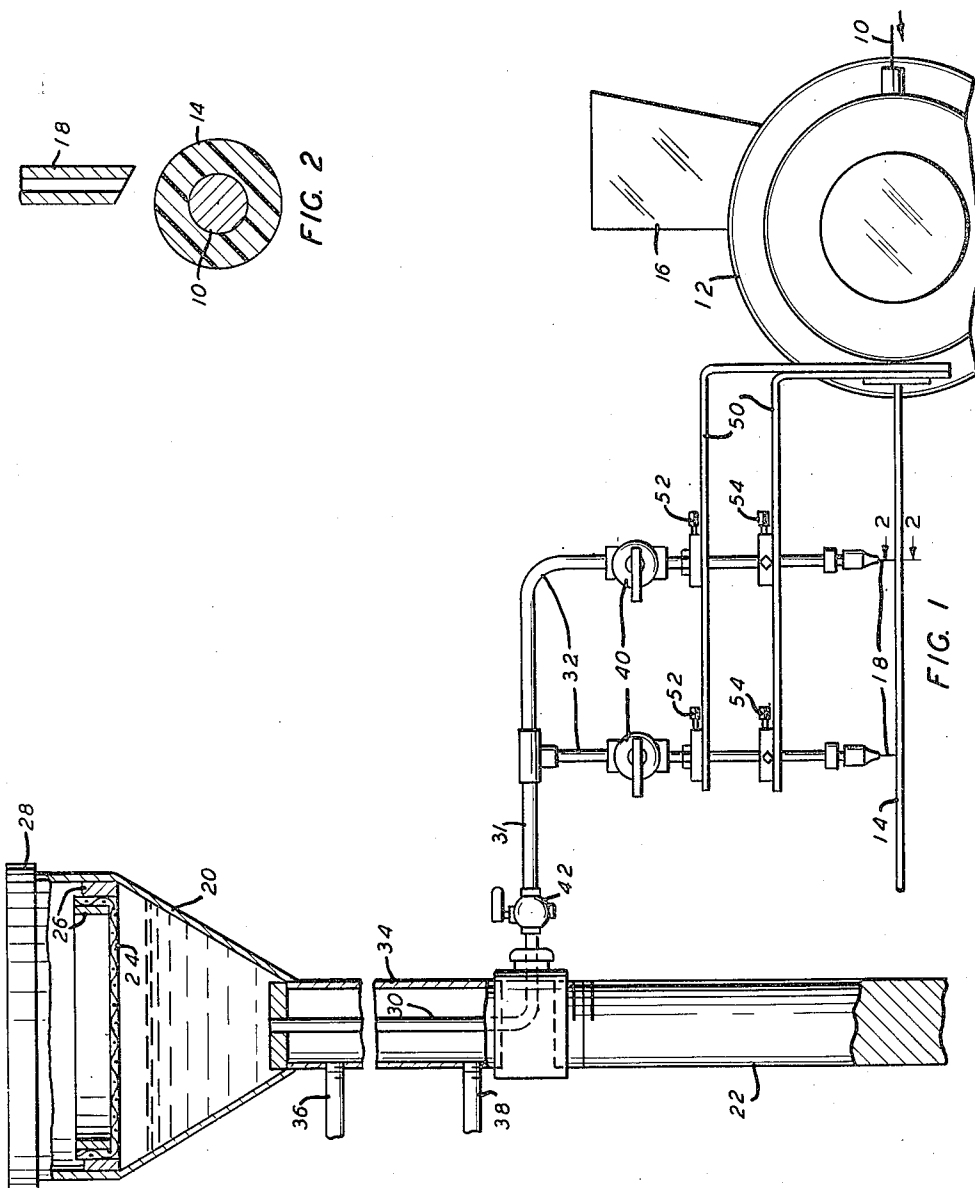
Oct. 9, 1956

A. N. GRAY
METHODS OF AND APPARATUS FOR APPLYING STRIPES TO
INSULATED CONDUCTORS

2,766,136

Filed June 1, 1953

3 Sheets-Sheet 1



INVENTOR
A. N. GRAY
BY *A. N. Gray*
ATTORNEY

Oct. 9, 1956

A. N. GRAY
METHODS OF AND APPARATUS FOR APPLYING STRIPES TO
INSULATED CONDUCTORS

2,766,136

Filed June 1, 1953

3 Sheets-Sheet 2

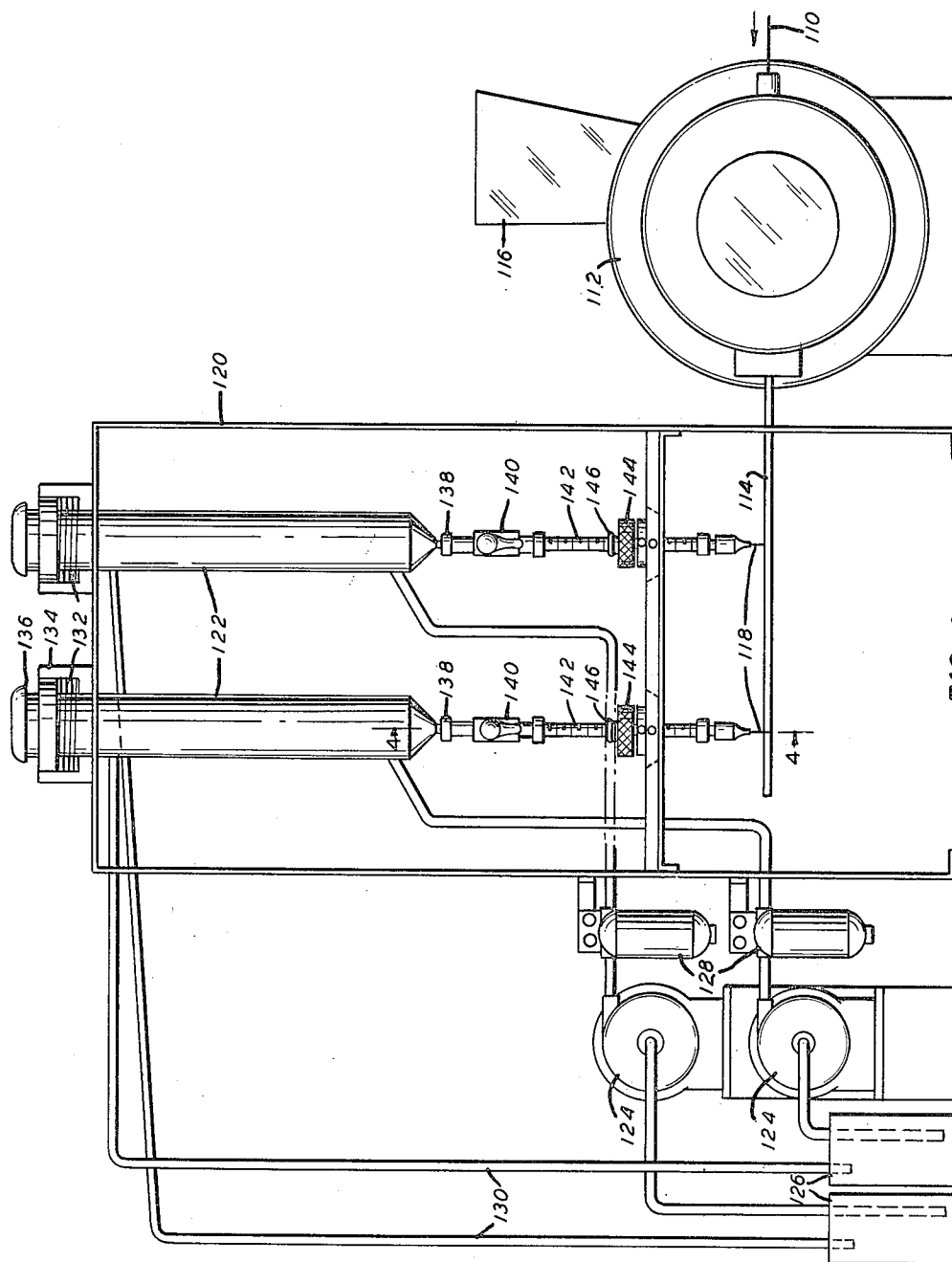


FIG. 3

INVENTOR
A. N. GRAY

BY *E. H. Gray*
ATTORNEY

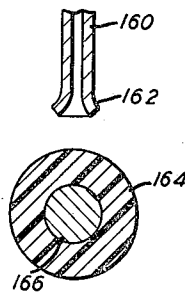
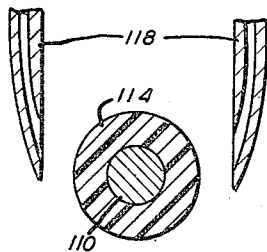
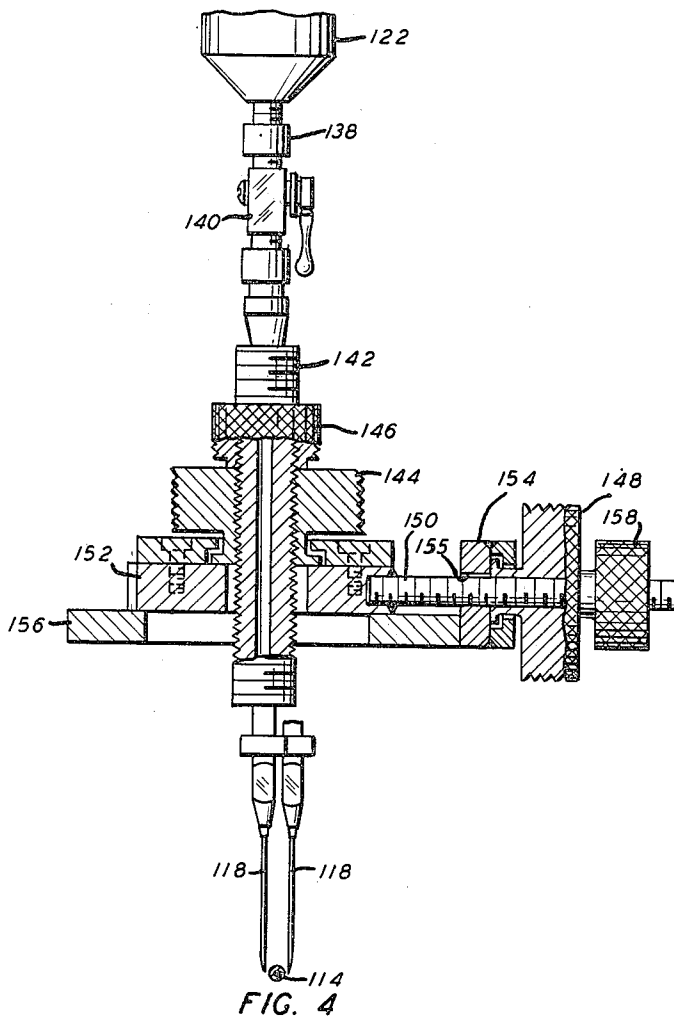
Oct. 9, 1956

A. N. GRAY
METHODS OF AND APPARATUS FOR APPLYING STRIPES TO
INSULATED CONDUCTORS

2,766,136

Filed June 1, 1953

3 Sheets-Sheet 3



INVENTOR
A. N. GRAY
BY *W. H. Gray*
ATTORNEY

1

2,766,136

METHODS OF AND APPARATUS FOR APPLYING STRIPES TO INSULATED CONDUCTORS

Alvin N. Gray, Edgewood, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application June 1, 1953, Serial No. 358,748

4 Claims. (Cl. 117—43)

This invention relates to methods of and apparatus for applying stripes to articles of manufacture, and more particularly to methods of and apparatus for continuously applying identification stripes to filamentary articles of great length, such as insulated conductors.

Some types of communications cables contain a multiplicity of individually insulated conductors which must be provided with means for identifying particular individual conductors or special groups of conductors therein. A large number of color combinations may be utilized for identification purposes by incorporating pigments of different colors into the plastic insulation extruded onto the conductors, and then applying one or more longitudinal stripes of a contrasting color to the colored insulation. These stripes should preferably be applied immediately after the plastic insulation is extruded onto the conductors, while the insulation is still soft due to the heat of the extrusion operation, so that the striping ink will penetrate the insulation and thereby mark the insulation permanently.

This system of identification has not been employed extensively in the past, because it has been so difficult to apply a satisfactory stripe at a sufficiently rapid rate. In large scale production operations, it is not at all unusual to perform the extrusion operation on a conductor that is moving at the rate of 1500 or more feet per minute. At such speeds, the systems heretofore known have not been entirely satisfactory.

An object of this invention is to provide new and improved methods of and apparatus for applying stripes to articles of manufacture.

Another object of the invention is to provide new and improved methods of and apparatus for continuously applying identification stripes to articles of great length, such as insulated filamentary conductors.

A method illustrating certain features of the invention may include the steps of continuously advancing such an article longitudinally past an applicator having a fluid discharge orifice of a predetermined small size and spaced closely to the advancing article, filtering a supply of coloring fluid to remove any agglomerates therefrom, feeding the fluid to the applicator at a constant predetermined pressure, and correlating the speed of the article, the size and the spacing of the discharge orifice of the applicator to produce a continuous stripe having a predetermined width on the article.

An apparatus illustrating certain features of the invention may include means for advancing such an article longitudinally in a predetermined path, a fluid applicator having a discharge orifice spaced closely to the path of the advancing article for directing a stream of coloring fluid onto the surface of the article, means for feeding a supply of the fluid to the applicator at a constant predetermined pressure, and means for filtering the supply of fluid to remove any agglomerates therefrom.

A complete understanding of the invention may be obtained from the following detailed description of meth-

2

ods and apparatus forming specific embodiments thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a fragmentary, side elevation of apparatus embodying the invention;

Fig. 2 is an enlarged, vertical section taken along line 2—2 of Fig. 1;

Fig. 3 is a fragmentary, side elevation of apparatus forming an alternative embodiment of the invention;

Fig. 4 is an enlarged, vertical section taken along line 4—4 of Fig. 3;

Fig. 5 is an enlarged, vertical section of portions of a pair of applicators employed in the embodiment of the apparatus illustrated in Figs. 3 and 4, and

Fig. 6 is an enlarged, vertical section of a portion of another shape of applicator which may be incorporated in apparatus embodying the invention.

Referring to Fig. 1, a filamentary conductor 10, such as a copper wire, is continuously advanced longitudinally in the direction indicated by the arrow, through an extruder 12 in which a tubular sheath 14 of plastic insulation is formed around the conductor. The plastic insulation may be composed of a thermoplastic compound, such as polyethylene, or polyvinyl chloride, mixed with suitable pigments and stabilizers. In some cases a cellular structure may be imparted to the sheath 14 by including a heat decomposable blowing agent among the ingredients fed into the extruder 12, so that the sheath 14 will increase in size and contain a multiplicity of minute, gas-filled cells (not shown) after it issues from the extruder.

The plastic mixture is fed to the extruder 12 through a hopper 16, and within the extruder the mixture is heated and vigorously kneaded with progressively increasing intensity until it issues from the extruder in the form of the sheath 14. Certain features of this type of extruder are disclosed and claimed in A. N. Gray Patent 2,547,000, issued April 3, 1951, for "Apparatus for Simultaneously Advancing and Plasticizing Plastic Compounds."

Just after the sheath 14 issues from the extruder 12, and while the sheath is still hot and soft, it is advanced past a pair of applicators 18—18, which apply a longitudinal stripe (not shown) of a coloring fluid, such as ink, to the exterior surface of the sheath 14. The color of the ink should contrast with the color imparted to the sheath 14 by the pigments contained therein. For example, if the sheath 14 is blue, the ink might be colored red, or the plastic sheath could be colored red and have a blue stripe applied thereon. Of course, if the sheath 14 is white the stripe may be any other color and still be contrasting. In fact, the contrast is most effective if the sheath 14 is white and the stripe is any relatively dark color. Even in the complete absence of pigments, cellular insulation having a high gas content is naturally white enough to give excellent color contrast when striped.

Either a single stripe may be applied by using only one of the applicators 18—18, or two stripes positioned on opposite sides of the sheath 14 may be applied by using both applicators simultaneously. The arrangement shown in Fig. 1 is designed to apply only one stripe at a time using only one of the applicators 18—18, while the other applicator is held in reserve in case the applicator being used becomes clogged with any agglomerates or precipitated particles in the ink.

After the stripping operation, the sheath 14 travels through an unobstructed air space at least several feet long, before it enters a trough (not shown) containing cool water which lowers the temperature of and solidifies the sheath. During its travel through the air space, the stripe of ink has time to dry sufficiently to leave a permanent mark that the water in the trough will not

wash off. To some extent the ink penetrates slightly below the surface of the extruded sheath 14 while the sheath is still warm and soft from the extrusion operation. This residual heat is effective to evaporate the volatile solvents used in some types of ink, thereby drying the stripe before it reaches the water in the cooling trough. The solvents employed in other types of ink may be removed partially by evaporation due to said residual heat, and partially by their solubility in the water in the trough. In any event the amount of ink washed off is inconsequential, and a permanent stripe remains on the sheath.

For successful operation, it is vitally important to apply the ink in a steady, freely flowing and very fine stream. The fineness of the stream of ink is related to the size of the applicator used, the width of the stripe applied, and the speed at which the article being striped moves past the applicator. The width of the stripe is generally quite small and the speed at which it is applied is usually quite high.

The rate at which the conductor 10 is advanced through the extruder 12 may range from about 50 feet per minute up to about 3000 feet per minute, and the usual operating speed is about 1500 feet per minute. The outside diameter of the sheath 14 may range from about .025 inch up to about .300 inch, and the longitudinal stripe applied thereon covers only a small portion of its periphery.

Under these conditions the consumption of ink proceeds at a relatively low rate. For example, ink was consumed at the rate of one gallon every three hours in producing a stripe $\frac{1}{32}$ inch wide at the rate of 1500 feet per minute on an insulating sheath composed of solid polyvinyl chloride. In view of the very low and very constant rate at which the ink must be supplied to the applicators 18—18, it is not feasible to employ a conventional constant displacement pump. Hence, a gravity system is employed in which a supply of ink is maintained at a predetermined and approximately constant height above the applicators 18—18 to create the proper pressure head to produce a steady flow of ink.

The ink is fed by the action of gravity from a reservoir 20 mounted on a vertical support 22 erected conveniently close to the exit end of the extruder 12 and adjacent to the applicators 18—18. The upper end of the reservoir 20 is provided with a suitable filter 24, such as a woven metal cloth, which is supported horizontally across the reservoir between a pair of removable, concentric rings 26—26. The filter 24 serves to strain out any agglomerates and foreign particles which might obstruct the flow of ink through the applicators 18—18. All of the ink used must pass through the filter 24. Above the filter 24, the reservoir 20 is provided with a cover 28 to reduce the evaporation of solvents from the ink.

The reservoir 20 resembles a funnel in appearance and in function. It is frustoconical in shape, tapering gradually from a large end at its top to a smaller end at its bottom. Care should be taken to keep the reservoir 20 nearly full of ink at all times, by adding small quantities of ink periodically as needed, so that the upper level of the ink will not fluctuate greatly. When the reservoir 20 is kept filled in this manner, changes in the volume of the ink in the reservoir will produce relatively small changes in the upper level of the ink, due to the fact that the larger end of the reservoir is at the top thereof. Thus, the height of the ink above the applicators 18—18 is kept nearly constant.

The vertical column of ink maintained above the applicators 18—18 need not be perfectly straight, provided the flow of ink is not impeded. The lower end of the reservoir 20 is joined to a vertical drain pipe 30, which communicates with a short horizontal pipe 31 leading to a pair of vertical branch pipes 32—32 positioned above and connected to the two applicators 18—18. The drain pipe 30 extends through a tubular jacket 34 in which water is circulated constantly from an inlet 36 to an out-

let 38 to cool the ink flowing through the pipe 30, in order to counteract the heat radiated and conducted from the nearby extruder 12. The branch pipes 32—32 are provided with a pair of valves 40—40, which enable one of the applicators 18—18 to be selected for operation while the other one of the applicators is shut off. A main valve 42 in the horizontal pipe 31 may be used to cut off the entire supply of ink to both of the applicators 18—18 when the apparatus is not in operation.

The applicators 18—18 are actually tubular needles having an interior bore of uniform diameter throughout their entire length. It is important that the interior bore of the applicators 18—18 have such uniform diameter, in order to minimize possible clogging of the applicators. It has been found that commercially obtainable hypodermic needles manufactured for medical purposes, are admirably suitable for use as applicators in apparatus embodying the invention. The valves and slidable adaptor connections customarily furnished with such hypodermic needles may be used in assembling the applicators 18—18, the pipes 32—32 and the valves 40—40.

The delivery end of the applicator 18 illustrated in Fig. 2 is beveled at an angle of about 45° to the axis of the applicator. Some conventional hypodermic needles are beveled at a much larger angle, while others are beveled very little, if at all.

The positions of the applicators 18—18 relative to the sheath 14 are adjustable horizontally as well as vertically. The applicators 18—18 are supported vertically on a pair of parallel horizontal brackets 50—50 which may be conveniently attached to the extruder 12. The upper one of the brackets 50—50 carries a plurality of set screws 52—52 for adjusting the positions of the applicators 18—18 vertically. The lower one of the brackets 50—50 carries a plurality of set screws 54—54 for making horizontal adjustments in the positions of the applicators 18—18.

In order to obtain a satisfactory stripe on the plastic sheath 14, it is necessary to control and correlate a number of variable factors. The most important factors are the speed at which the insulated conductor is advanced past the ink applicator, the size of the discharge orifice of the applicator, the viscosity of the ink being used, the pressure under which the ink flows through the discharge orifice, the spacing of the discharge orifice from the moving sheath, and the width of the stripe applied to the sheath. Some of these factors are subject to greater variation than others.

It is evident that if the sheath 14 being striped is advanced too rapidly past the applicators 18—18, a discontinuous stripe will result, since the sheath will then pull the ink away from the applicators faster than it can be supplied. The applicators 18—18 should be so spaced from the sheath 14 that the fine stream of ink flowing onto the sheath curves through an arc of 90°, but does not break. The spacing of the applicators from the moving sheath usually is not varied a great deal, being between $\frac{1}{16}$ inch and $\frac{1}{32}$ inch. Under the operating conditions specified, the width of the stripe is usually about $\frac{1}{32}$ inch. Hence, the speed of the sheath being striped, the size of the discharge orifice of the ink applicator, the pressure head on the ink, and the viscosity of the ink, are the factors that are varied the most.

In one specific example, the applicator 18 was a #19 gauge hypodermic needle (inside diameter of about .027 inch), the sheath 14 was composed of solid polyvinyl chloride having an outside diameter of about .040 inch, and the sheath was advanced past the applicator at the rate of about 1500 feet per minute, resulting in a continuous longitudinal stripe approximately $\frac{1}{32}$ inch wide. In this example, the upper level of the vertical column of ink was maintained at a minimum of 39 inches above the discharge end of the applicators. The ink used was the Entwistle PVC type C marking ink, containing organic pigments, resins, and thinners. This type of ink is obtainable from the J. L. Entwistle Co., Providence, R. I.

To obtain the desired viscosity of about 5 seconds as determined by the Stormer method, thinners were added to this ink in the following proportions; 600 ml. ink, 1800 ml. acetone, and 120 ml. butyl alcohol.

In another example, the applicator 18 was a #20 gauge hypodermic needle (inside diameter of about .023 inch), the sheath 14 was composed of cellular polyethylene having 50% gas occluded therein and having an outside diameter of about .065 inch, and the sheath was advanced past the applicator at the rate of about 500 feet per minute, resulting in a continuous longitudinal stripe approximately $\frac{1}{32}$ inch wide. In this example, the upper level of the vertical column of ink was kept at a minimum of 12 inches above the sheath. The ink used was obtained from the Farboil Paint Co., Baltimore, Md. This ink contained organic pigments, and thinners, but no resins were present. Additional thinners comprising carbon tetrachloride and Circo oil (a light processing oil) were mixed with the ink to lower its viscosity to about 6.4 seconds as determined by the Stormer method. Ten grams of the pigments were used for every 1200 ml. of carbon tetrachloride, together with 60 ml. of Circo oil.

The type of thinners employed governs the compatibility of the inks with the different plastics. Inks containing organic pigments are preferred, since they are non-conductive. In some cases inorganic pigments may be used, but only when capacitance effects in the completed conductor are not important. When nonresinous inks are used the vertical column of ink should be at least 12 inches high, whereas inks containing resins require a column at least 39 inches high to obtain the proper pressure head. Inks containing resins have a greater tendency to gel and thereby clog the applicators, hence such inks are only used with the larger applicators.

The hypodermic needles used as applicators may range in size from about 18 gauge up to about 23 gauge. An 18 gauge needle has an interior bore about .030 inch in diameter, and a 23 gauge needle has an inside diameter of about .014 inch. The intermediate sizes differ in diameter in steps of about .003 inch.

These needles are so small in diameter that their length affects the rate at which ink can flow through them. A standard 21 gauge needle has an interior bore about .020 inch in diameter and is about one inch long. This length is suitable for nonresinous inks, but for resinous inks this needle should be shortened to about one half inch. In the same situation, needles having a larger interior bore need not be shortened so much.

Alternative embodiment

The alternative apparatus illustrated in Figs. 3, 4 and 5 is similar in construction and in operation to the embodiment illustrated in Figs. 1 and 2, except for the design of the reservoir, the filter and the means for adjusting the position of the applicators. While the first embodiment of the invention has been illustrated and described in relation to applying a single stripe, the second embodiment is designed to apply two stripes to opposite sides of the insulated conductor. However, it is to be understood that both embodiments of the invention may be used for either a single stripe or two stripes, merely by employing the necessary number of applicators and reservoirs.

Referring to Fig. 3, a filamentary conductor 110 is continuously advanced longitudinally in the direction indicated by the arrow, through an extruder 112 in which a tubular sheath 114 of plastic insulation is extruded onto the conductor. The plastic is fed into the extruder through a hopper 116. Just beyond the extruder 112, the sheath 114 is advanced past a pair of applicators 118—118 which are spaced apart in alignment with the path of the sheath. The applicators 118—118 apply two stripes, which may be of different colors, to opposite sides of the sheath 114, as is best shown in Figs. 4 and 5.

A vertical frame 120 supports a pair of cylindrical reservoirs 122—122 conveniently close to the exit end of the extruder 112. Each of the reservoirs 122—122 contains a supply of ink which is fed under the action of gravity to the applicators 118—118. In both of the reservoirs 122—122 the upper level of the supply of ink is maintained at a constant level above the discharge orifices of the applicators 118—118. At the same time, the ink is recirculated constantly through each of the reservoirs 122—122 to keep the ink homogeneous and to prevent gelling thereof.

A pair of pumps 124—124 draw separate supplies of ink from a pair of sumps 126—126, and force the ink through a pair of filters 128—128, which communicate separately with the bottoms of the reservoirs 122—122. Near the tops of the reservoirs 122—122, the ink overflows through a pair of pipes 130—130 and returns to the sumps 126—126. The level at which the ink overflows from the reservoirs 122—122 is fixed to maintain a constant pressure head above the level of the discharge orifices of the applicators 118—118.

The upper ends of the reservoirs 122—122 rest on a pair of springs 132—132 mounted within a pair of housings 134—134 which are secured to the top of the frame 120. In this manner, the reservoirs 122—122 are supported resiliently within the frame 120. A pair of removable covers 136—136 are located on the tops of the reservoirs 122—122 to minimize the evaporation of volatile solvents contained in the ink held by the reservoirs.

The applicators 118—118 are positioned directly below and aligned with the axes of the cylindrical reservoirs 122—122. The ink flows from the reservoirs 122—122 in straight paths through a pair of adaptors 138—138 communicating with a pair of valves 140—140, and thence through a pair of straight pipes 142—142 to the applicators 118—118. Minor vertical adjustments in the positions of the applicators 118—118 and their reservoirs 122—122 may be made by manually rotating a pair of knurled discs 144—144 which threadably engage the pipes 142—142. A pair of lock nuts 146—146 may be screwed down against the discs 144—144 to retain the pipes 142—142 in the positions to which they have been adjusted.

Horizontal adjustments in the positions of the applicators 118—118 and their reservoirs 122—122 are made by selectively rotating a pair of knurled discs, of which a disc 148 is shown (Fig. 4) threaded onto a shaft 150 which is welded to a collar 152 surrounding one of the pipes 142—142. The disc 148 rotatably engages a plate 154 having a central aperture 155 through which the shaft 150 extends. The plate 154 extends vertically upward from a horizontal crossbar 156 secured to the frame 120, and the collar 152 is mounted slidably on this crossbar. A lock nut 158 is provided to prevent the disc 148 from moving out of adjustment. Each of the pipes 142—142 is provided with an adjusting means, identical with the means just described, for making horizontal adjustments in the positions of the applicators 118—118.

As shown in Fig. 5, the lower ends of the applicators 118—118 are positioned on opposite sides of the sheath 114, to which two longitudinal stripes (not shown) of ink are being applied. The tips of the applicators 118—118 are curved towards the sheath 114, and they are spaced the same distance from the sheath 114 that the applicators 18—18 and 46 are spaced from the sheath 14 (Figs. 2 and 6). As in the case of the applicators 18—18 and 46, the applicators 118—118 are actually hollow needles. A conventional type of commercially obtainable hypodermic needle, known as the Huber Point needle, has been found to serve satisfactorily. The types of adaptors and valves usually furnished with commercial hypodermic needles may be used as the adaptors 138—138 and the valves 140—140.

It is desirable to have the interior bores of the adaptors 138—138, the valves 140—140 and the pipes 142—142

all be equal in diameter. Such an arrangement minimizes any danger of blocking the flow of ink to applicators 118—118 by providing straight bores of uniform diameter extending from the bottoms of the reservoirs 122—122 to the applicators. About 1/8 inch is a desirable diameter.

The operation of the above-described alternative embodiment of the invention is based on the same principles enumerated for the first embodiment of the invention. That is, it is necessary to control and correlate the speed at which the sheath 114 is advanced past the applicators 118—118, the size of the applicators, the spacing of the applicators from the moving sheath, the viscosity of the ink, the pressure of the ink, and the width of the stripes applied. The specific examples described in connection with the first embodiment of the invention are equally applicable here.

Alternative applicator

In another recommended modification, the delivery end of the hypodermic needle employed as an applicator is flared into a bell mouth shape. This construction is illustrated in Fig. 6 by an applicator 160 having a flared delivery end 162 positioned directly above and perpendicular to a sheath 164 on a conductor 166. The applicator 160 can be substituted for the applicator 18 in the apparatus illustrated in Fig. 1. However, the applicator 160 should be mounted perpendicular to and aligned with the axis of the sheath, while the applicator 18 should be offset slightly therefrom, as shown in Fig. 2. The applicator 160 can also be substituted for the applicator 118 in the apparatus illustrated in Figs. 3, 4 and 5.

It is believed that the use of such a bell mouth may reduce surface tension effects which tend to cause the discharging ink to creep up around the outside of the delivery end of the applicators. This creeping ink dries rapidly and eventually forms a crust which may block the flow of ink.

What is claimed is:

1. The method of applying longitudinal identification stripes to filamentary insulated conductors, which comprises advancing such a conductor longitudinally past a tubular needle having its discharge end spaced closely to the surface of the insulated conductor and having a bore with a maximum diameter of about .030 inch, supplying continuously to said needle a free-flowing, rapid-drying coloring fluid having a viscosity of the order of about 5 seconds measured by the Stormer method, maintaining the coloring fluid supplied to said hollow needle at a constant predetermined pressure whereby a fine, high velocity stream of the coloring fluid is directed toward the advancing insulated conductor at a constant rate of flow and impinges upon the surface of the insulated conductor, and correlating the speed of the insulated conductor with the rate of flow of the stream of coloring fluid so that the stream produces on the conductor a continuous stripe having a predetermined width.

2. Apparatus for applying longitudinal identification stripes to filamentary insulated conductors advancing continuously at relatively high speeds along a predetermined path, which comprises a pair of small-bored, tubular needles mounted vertically on opposite sides of said path and having the discharge ends thereof curved towards and positioned close to the surface of such an insulated conductor at opposite sides thereof, means for supplying to each of said tubular needles a free-flowing, low viscosity, rapid-drying coloring fluid, and means for maintaining the coloring fluid supplied to each of the tubular

needles at a constant predetermined pressure so that fine, high velocity streams of the coloring fluid having substantially constant flow rates are directed toward the advancing insulated conductor and impinge thereupon to produce thereupon discrete, continuous, longitudinal stripes having predetermined widths.

3. Apparatus for applying longitudinal identification stripes to filamentary insulated conductors advancing continuously at relatively high speeds along a predetermined path, which comprises a small-bored, tubular needle having its discharge end spaced closely to the surface of the advancing insulated conductor and having a bore with a maximum diameter of about .030 inch, a reservoir for maintaining a supply of a free-flowing, low viscosity, rapid-drying coloring fluid in a vertical column above the discharge end of the tubular needle, means for maintaining the height of said vertical column of coloring fluid substantially constant to create a constant, predetermined pressure, means communicating with the reservoir and the tubular needle for supplying the coloring fluid to the tubular needle at said constant predetermined pressure so that a fine, high velocity stream of said coloring fluid is directed toward the advancing insulated conductor at a substantially constant rate of flow and impinges upon the surface of said conductor to produce thereupon a continuous stripe having a predetermined width, and means for continuously agitating and simultaneously filtering the coloring fluid supplied to the tubular needle to remove agglomerates that might obstruct the flow of said coloring fluid through the bore in the needle.

4. Apparatus for applying longitudinal identification stripes to filamentary insulated conductors advancing continuously at relatively high speeds along a predetermined path, which apparatus comprises a finely bored hypodermic needle having its discharge end spaced closely to the surface of such an advancing insulated conductor and having a bore with a maximum diameter of about .030 inch, a reservoir for maintaining a supply of a free-flowing, rapid-drying coloring fluid in a vertical column at a substantially constant level to create a constant predetermined pressure, means communicating with the reservoir and the hypodermic needle for supplying the coloring fluid to said hypodermic needles so that a fine, high velocity stream of the coloring fluid is directed toward the advancing insulated conductor at a substantially constant rate of flow and impinges upon the surface of the insulated conductor, a valve for adjusting the rate of flow of the coloring fluid to correlate the rate of flow of the coloring fluid with the speed of the conductor to produce a continuous longitudinal stripe having a predetermined width, and means for continuously agitating and simultaneously filtering the coloring fluid supplied to the hypodermic needle to remove agglomerates that might obstruct the flow of the coloring fluid through the bore in the hypodermic needle.

References Cited in the file of this patent

UNITED STATES PATENTS

1,630,451	Ray	May 31, 1927
1,740,979	Golrick	Dec. 24, 1929
2,412,429	Slingluff et al.	Dec. 10, 1946
2,569,755	Griffith	Oct. 2, 1951
2,659,343	Kucher	Nov. 17, 1953

FOREIGN PATENTS

255,578	Great Britain	July 29, 1926
---------	---------------	---------------