Dec. 3, 1968 H. L. WOELLNER 3,413,956

DRIVE SYSTEM FOR APPARATUS FOR APPLYING CODE MARKINGS OF DIFFERENT COLORS ONTO ELONGATED ARTICLES

Filed Feb. 24, 1967 3 Sheets-Sheet 1

Fig. 1.

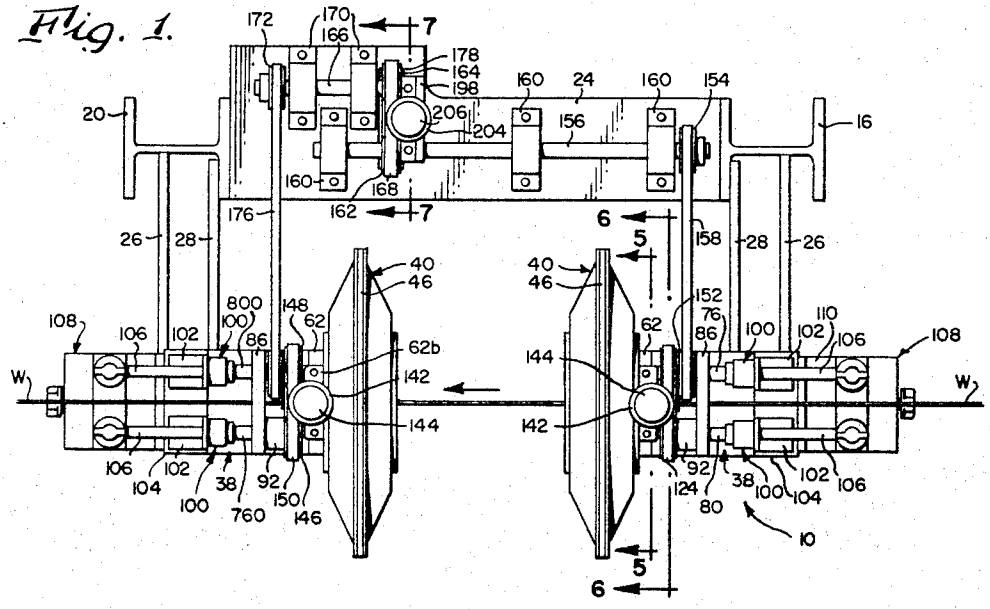
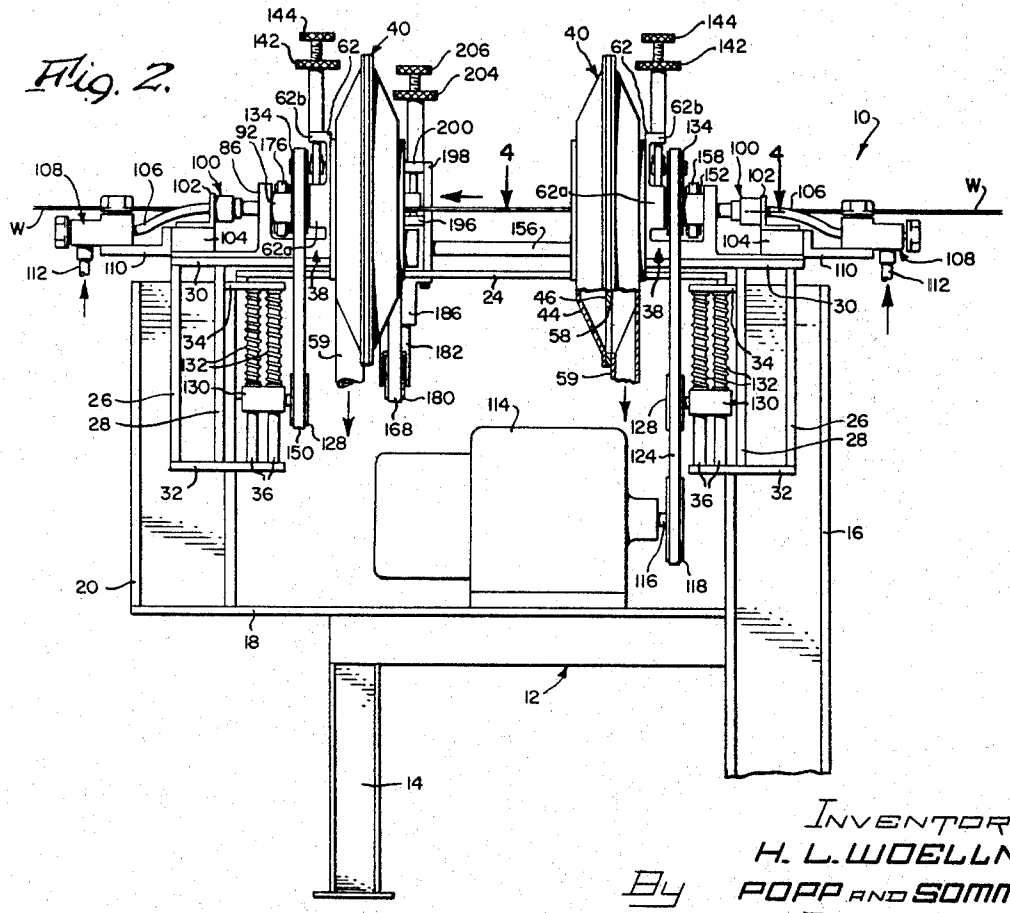


Fig. 2.



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Fig. 4.

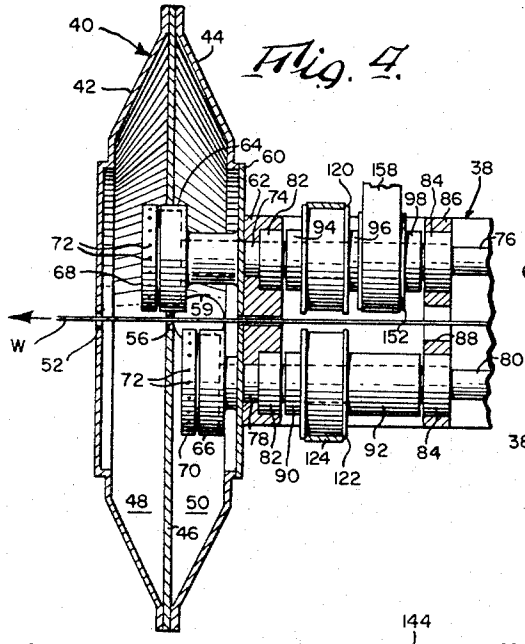


Fig. 5.

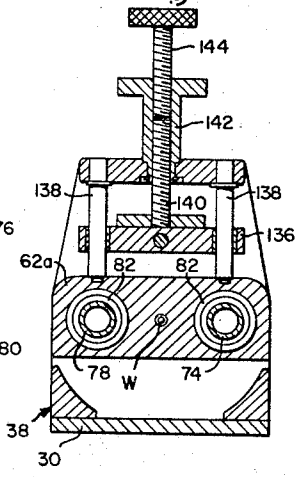


Fig. 6.

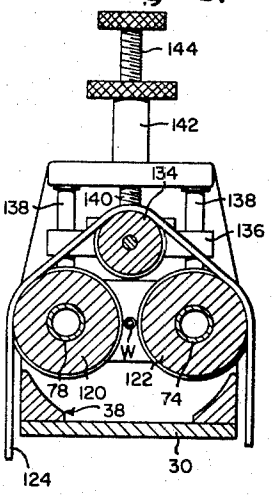


Fig. 3.

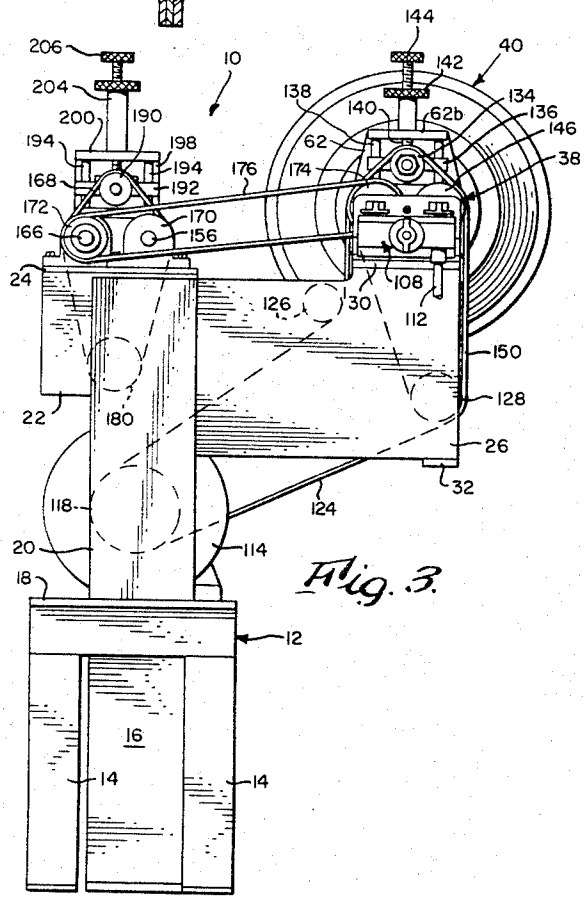
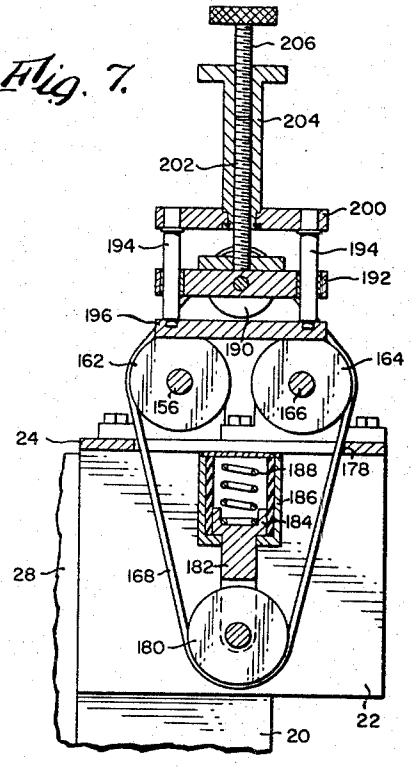


Fig. 7.



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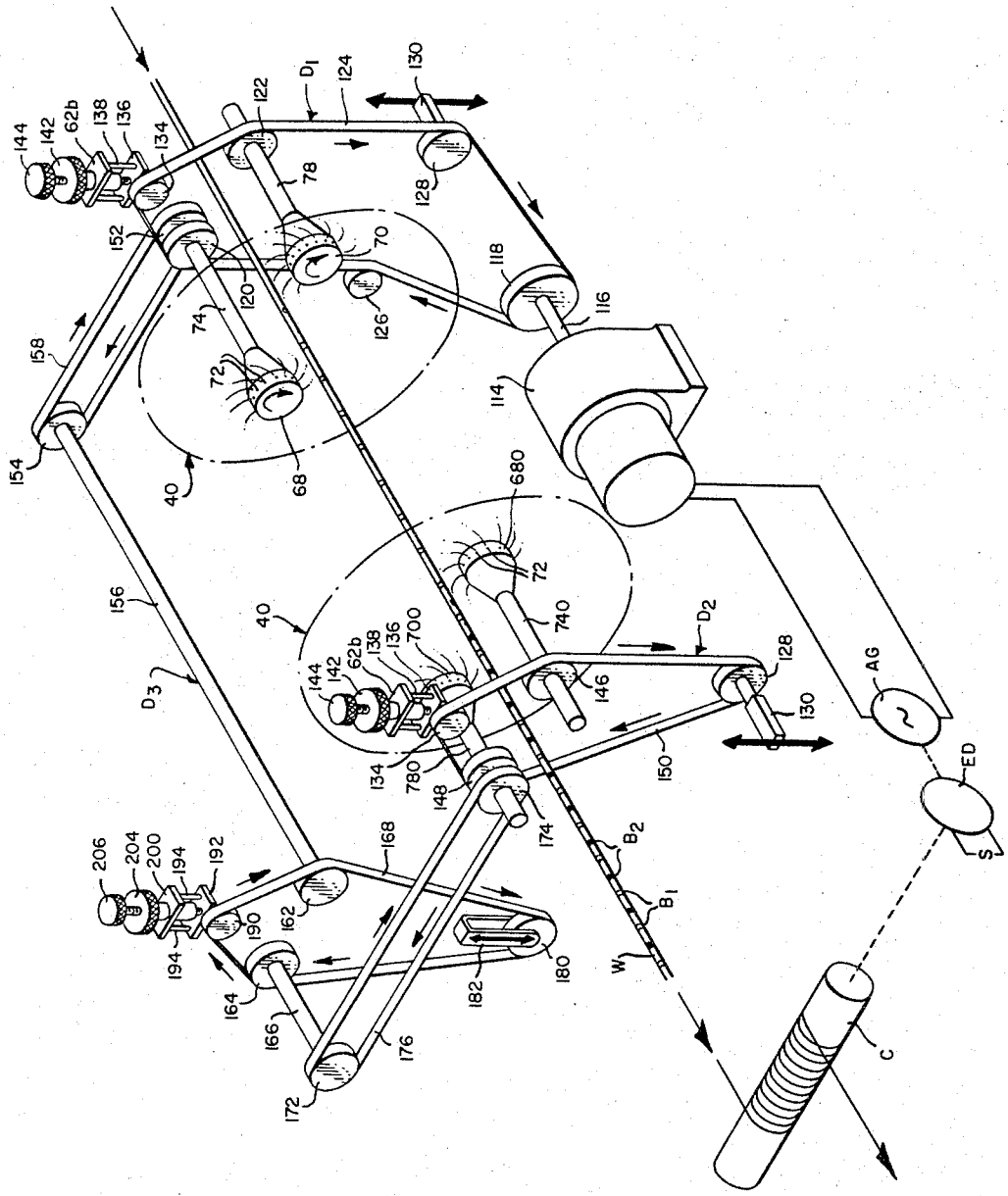


Fig. 8.

United States Patent Office

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3,413,956

DRIVE SYSTEM FOR APPARATUS FOR APPLYING CODE MARKINGS OF DIFFERENT COLORS ONTO ELONGATED ARTICLES

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Filed Feb. 24, 1967, Ser. No. 618,362
16 Claims. (Cl. 118—314)

ABSTRACT OF THE DISCLOSURE

Apparatus for applying code markings of different colors onto an insulated conductor includes two pairs of hollow perforated ink dispensing wheels spaced longitudinally along the wire travel path, with the wheels of each pair being longitudinally offset and spaced on opposite sides of the wire, and a drive system for rotating the wheels in timed relation to each other and to the speed of wire travel, so that the wheels of one pair sequentially apply registered markings on opposite sides of the wire at regular intervals to form bands of one color, while the wheels of the other pair sequentially apply registered markings of another color on opposite sides of the wire at regular intervals to form bands of another color intermediate the bands of the one color. The drive system includes individual mechanisms for adjusting the relative angular positions of the wheels in each pair to bring the markings of each band into register, a mechanism for varying the relative angular positions of the pairs of wheels for adjusting the spacing between the differently colored bands, and a transmission interconnecting such mechanisms and including a series of cog belts, pulleys and shafts arranged so that one wheel pair is driven from a motor while the other pair is driven from such one pair, with the angular movement of a wheel in one pair being synchronized with that of the corresponding wheel in the other pair. The arrangement permits not only adjustment of the register of each band without affecting the register of the other band or the spacing between bands, but also variation of the spacing between bands without affecting the register of either band.

BACKGROUND OF THE INVENTION

(1) *Field of the invention*

This invention relates to improvements in apparatus for applying code markings of different colors onto elongated articles, such as insulated conductors, and more particularly to a new and improved drive system for such apparatus.

In the art of applying alternate code bands of different colors onto insulated wire it is known to employ apparatus including a first pair of hollow wheels mounted on opposite sides of a wire advancing longitudinally along a predetermined path, a second pair of hollow wheels mounted on opposite sides of the wire in longitudinally spaced relation to the first pair, and means for driving the wheels in timed relation to each other and to the speed of the wire. Each of the wheels is provided with a peripheral row of spaced radially directed apertures and colored fluid or ink is supplied to the wheels and forced outwardly through the apertures in the form of streams as the wheels rotate. Streams of ink from one wheel of the first pair engage the advancing wire and apply markings of a first color onto one side thereof at regular intervals, and the second wheel of the first pair, which is longitudinally offset from the first wheel, applies markings of the same color to the opposite side of the wire in registration with the first markings to form annular bands of the first color on the wire at regularly spaced intervals. Streams of ink of a second

color issuing from the similarly arranged second pair of wheels form annular bands of the second color intermediate the bands of the first color.

(2) *Description of the prior art*

In prior art double color coding apparatus, as exemplified by T. C. Fitzgerald et al. Patent 2,989,943, it is known to incorporate in the drive system individual mechanisms for adjusting the register of each band, as well as a mechanism for adjusting or centering the spacing between bands. Various factors contribute to misalinement of the band markings and drift of the bands toward each other. Among these are instability in the high speed of travel of the wire, amplitude of vibration of the wire, and constant flexing of the belts in the high speed drive system.

Typically in such prior art drive system, the pairs of wheels are driven in parallel from a common shaft, with one wheel pair being driven directly from the shaft and the other wheel pair being driven from a sleeve telescoped over such shaft. The mechanism for adjusting the spacing between the differently colored bands is associated with the common shaft and sleeve to cause angular movement of the sleeve relative to the shaft or to lock the shaft and sleeve together. Such shaft and sleeve are locked whenever an individual mechanism associated with each pair of wheels is actuated to adjust the register of each band. Hence, adjustment of one register necessarily affects the spacing between bands, and tends to affect the other register. Accordingly, whenever either band register is adjusted, it is necessary to adjust the spacing between bands, and oftentimes it is necessary to adjust the other band register. Otherwise, the bands will not only be out of register, but also will drift until superimposed, eventually causing rejection of the wire for its intended purpose. Such drift has been a constant problem with such prior art apparatus.

SUMMARY OF THE INVENTION

Accordingly, it is the purpose of the present invention to provide for double color coding apparatus a new and improved drive system which is so constructed and designed as to substantially eliminate the aforesaid disadvantages of such prior art drive system. To this end, the inventive drive system includes a separate drive for each pair of wheels, with one drive being driven by the other through a third drive which synchronizes the rotation of one wheel of one pair with the corresponding wheel of the other pair, and thereby maintains the position of the markings of such corresponding wheel between the differently colored markings of the one wheel, in order to prevent drift of the differently colored bands.

An object of the invention is to provide such a new and improved drive system wherein the third drive includes means for varying the relative angular positions of the synchronized wheels and hence the relative positions of or spacing between the differently colored bands, while the separate drives maintain the relative angular positions of the wheels of each pair and hence the registration of the markings forming each differently colored band.

Another object is to provide such a new and improved drive system wherein each of the separate drives includes means for varying the relative angular positions of the wheels of each pair without affecting the relative angular positions of the wheels of the other pair and hence the registration of the markings forming each differently colored band without affecting the registration of the markings forming the other band. while the third drive maintains the relative angular positions of the synchronized wheels and hence the relative positions of or spacing between the differently colored bands.

Additional objects and advantages of the invention will become apparent upon consideration of the following

detailed description and accompanying drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a double color coder apparatus and drive system forming a preferred embodiment of the invention, with certain underlying structural elements omitted for clarity of illustration;

FIG. 2 is a front side elevation of the apparatus and drive system shown in FIG. 1;

FIG. 3 is a left end elevation thereof;

FIG. 4 is an enlarged fragmentary section taken on line **4—4** of FIG. 2 and illustrating a pair of hollow wheels arranged within a coder head for applying code markings on an insulated wire;

FIG. 5 is an enlarged section taken on line **5—5** of FIG. 1 and illustrating one portion of a register adjusting mechanism for varying the relative angular positions of the wheels shown in FIG. 4;

FIG. 6 is an enlarged fragmentary section taken on line **6—6** of FIG. 1 and illustrating another portion of the register adjusting mechanism of FIG. 5 and part of the associated drive;

FIG. 7 is an enlarged fragmentary section taken on line **7—7** of FIG. 1 and illustrating a band adjusting mechanism for varying the relative angular positions of one hollow wheel of one pair and the corresponding hollow wheel of another pair, and

FIG. 8 is an enlarged diagrammatic perspective view illustrating means for advancing the insulated wire through the apparatus and the inventive drive system including the two pairs of hollow wheels, their individual drives and register adjusting mechanisms, and the synchronizing drive and band adjusting mechanism connected to the individual drives.

DETAILED DESCRIPTION

Referring to the drawings and particularly FIG. 8, the double color coder apparatus for applying annular bands B_1 and B_2 of different colors to an elongated article in the form of an insulated conductor wire W generally comprises a first pair of hollow wheels **68, 70** disposed on opposite sides of the path of longitudinal movement of wire W and in longitudinally offset relation to each other for applying the colored bands B_1 to wire W, and a second pair of hollow wheels **680, 700** disposed on opposite sides of wire W in longitudinally offset relation to each other and in longitudinally spaced relationship to wheels **68, 70** for applying annular bands B_2 intermediate bands B_1.

The pairs of wheels are rotated about their axes in timed relation to each other and to the longitudinal advancing movement of wire W, and the colored marking fluids or inks therein issue from the peripheral rows of uniformly spaced radially directed small apertures **72** in the form of radially directed steams which are angularly spaced apart from one another and are intercepted by wire W to form bands B_1 and B_2 thereon at uniform intervals. As the wire advances from right to left in FIG. 8, wheel **70** applies a series of substantially semi-annular markings thereon on one side of the wire, while wheel **68** applies a series of substantially semi-annular markings of the same color on the opposite side of the wire in registration with the first markings to form the annular bands B_1. In like manner, the wheels **680** and **700** each apply substantially semi-annular markings of a second color to the wire to form bands B_2 of the second color intermediate bands B_1.

In view of the high speed of travel of wire W and the high rotational speed of the ink dispensing wheels, it is necessary to maintain the proper relative angular positions of each pair of wheels so that the markings remain in register, and to maintain the bands B_2 centered between bands B_1. To this end, the inventive drive system includes separate drives for each pair of wheels, drive D_1 for wheels **68, 70**, and Drive D_2 for wheels **680, 700**, as well as a third, synchronizing drive D_3 which is driven by drive D_1 and in turn drives drive D_2 so that the rotation of wheels **68** and **700** is synchronized. This drive arrangement maintains the desired centered position of bands B_2 between bands B_1, but if for any reason it is desired to vary the position of bands B_2 relative to B_1, drive D_3 is provided with a mechanism for this purpose. Likewise, each of drives D_1 and D_2 is provided with a mechanism for adjusting the register of bands B_1 and B_2 respectively. As will be described in greater detail below, the drive system is so designed so that adjustment of one band register does not effect the other or the spacing between bands, while adjustment of the band spacing does not effect either band register. As a consequence, the desired register of each band and the spacing between can easily be maintained during operation of the apparatus.

Referring to FIGS. 1–3 of the drawings, the various structural components of the double color coder apparatus and their relationships with each other will now be described in greater detail. The apparatus is generally indicated at **10** and includes a lower horizontal rectangular frame **12** supported at one end by a pair of small I-beams **14** and at its other end by a larger I-beam **16** extending vertically above the frame **12**. A lower platform **18** is supported on frame **12** and at its one cantilever end supports another large vertical I-beam **20** opposite I-beam **16**. The opposing flanges of I-beams **16, 20** are provided with suitable plates such as **22** (FIG. 3) for supporting an elongated upper platform **24** extending between these I-beams. In addition, the webs and opposed flanges of I-beams **16, 20** are provided with spaced lateral plates **26, 28** respectively for supporting two opposed, longitudinally spaced and alined coder head supporting platforms **30** arranged on the upper edges of these plates. A pair of horizontal plates **32** are attached across the lower edges of plates **26, 28** to provide opposing lower shelf portions arranged beneath upper shelf plates **34** attached to plates **28**. These shelf forming plates **32, 34** support pairs of vertical rods **36** for a purpose to be described below.

An elongated bearing block **38** is supported on each of platforms **30**, and at its inner end supports a coder head **40**. Inasmuch as each coder head **40** is substantially identical to the other, a detailed description of one will suffice for both.

Referring to FIG. 4, the right hand coder head **40** includes a pair of dished casings **42, 44** removably secured together along their peripheral portions and divided by a central plate **46** into separate ink confining chambers **48, 50**. Casing **42** is provided with a central exit opening **52** for wire W, while divider plate **46** is provided with a central entrance opening **54** for passage of the wire, as well as an opening **58** at its lower end (FIG. 2) permitting communication between chambers **48, 50** and drainage of ink through outlet pipe **59** in casing **44**.

Returning to FIG. 4, casing **44** is also provided with a removable central closure plate **60** which is removably secured to an upstanding leg **62** on bearing block **38**, with each of closure plate **60** and leg **62** being provided with alined holes for passage of wire W. Closure plate **60** is also provided with hollow wheel housings **64, 66**, housing **64** extending through chamber **50** and divider plate **46** into chamber **48** and housing **66** extending only into chamber **50**. A hollow ink dispensing wheel **68** is arranged in and projects outwardly beyond the open end of housing **64** in chamber **48**, while a hollow ink dispensing wheel **70** is likewise arranged in and projects outwardly beyond housing **66** in chamber **50**. Each of wheels **68, 70** is provided with a row of equally spaced radial apertures **72** extending around its outer periphery for dispensing the radially directed streams which are intercepted by wire W to form bands B_1 of the desired color.

Continuing with FIG. 4, wheel **68** is provided with

a hollow shaft **74** having a reduced end **76**, while wheel **70** is likewise provided with a hollow shaft **78** having a reduced end **80**. Each of shafts **74**, **78** extend through bearings **82** in upstanding leg **62** of block **38** and bearings **84** in another upstanding leg **86** of the block, such leg **86** also being provided with a central opening **88** for passage of wire W. Because of the particular drive system employed, shaft **78** also extends through spacers **90** and **92** arranged between leg **62** and leg **86** of block **38**, while shaft **74** extends between spacers **94**, **96** and **98** arranged between these legs.

Returning to FIGS. 1 and 2, each reduced shaft end **76**, **80** is connected to a rotary union **100** supported by a flange plate **102** on a block **104** provided on block **38**, and each union **100** is connected by a hose **106** to a dual manifold **108** supported by flange plate **110** attached to block **104**. A marking fluid or ink inlet pipe **112** leads into manifold **108** so that the marking fluid of one color passes through hoses **106** and rotary unions **100** in separate paths through the hollow shafts **74**, **78** to hollow wheels **68**, **70** respectively.

As shown in FIG. 4, the wheel housings **64**, **66** protect the rotating wheels **68**, **70** and their shafts respectively against gumming by the ink while the divider plate **46** prevents interference between the sprays or streams issuing from each wheel. As the ink accumulates in chambers **48**, **50**, it is readily drained through return pipe **59**, and then can be recirculated by any suitable means (not shown) to a pump (not shown) connected to inlet pipe **112**.

Inasmuch as the left hand bearing block **38**, color head **40** and associated ink supplying structure are substantially identical to that of the bearing block, coder head and ink supplying structure just described, except for a mere reversal of position, the same numerals are used for corresponding elements, as shown in FIGS. 1 and 2. However, in order to differentiate between the two pairs of wheels, those of the second pair corresponding to wheels **68** and **70** of the first pair are designated by the numerals **680** and **700** respectively, as shown in FIG. 8, while their hollow shafts corresponding to shafts **74** and **78** are designated by the numerals **740** and **780** respectively, as are their reduced ends **760** and **800** respectively. In addition, because of the particular drive system employed, larger spacer **92** is arranged on shaft **740** instead of shaft **780**, as shown in FIGS. 1 and 2.

DRIVE SYSTEM

The inventive drive system includes an A.C. synchronous motor **114** which is supported on platform **18** and includes a drive shaft **116**. As best shown in FIG. 8, motor **114** is connected in circuit with and driven at the desired speed by an alternator-generator AG which is driven at the desired frequency by an eddy current drive ED connected to a suitable source S. The eddy current drive ED also drives a wire advancing capstan C at an appropriate speed in timed relation to the rotation of motor drive shaft **116**. The drive D_1 for rotating the first pair of wheels **68**, **70** in the same clockwise direction and at the same rate of speed includes a drive pulley **118** on motor drive shaft **116** and driven pulleys **120**, **122** on wheel shafts **74**, **78** respectively. An endless belt **124** is trained over pulleys **118**, **120** and **122** for transmitting the desired motion. Although not shown, cog belts and pulleys are employed throughout the various drives D_1, D_2 and D_3, unless otherwise specified.

As also seen in FIG. 3, drive D_1 is provided with an ordinary idler pulley **126** which is rotatably mounted on right-hand plate **28** or right-hand platform **30** for engagement with the exterior of belt **124**, in order to maintain an adequate amount of contact between the belt and pulley **120** as the belt travels from drive pulley **118** on the motor drive shaft **116**.

In the event the proper relative angular positions of wheels **68**, **70** is not maintained, so that the markings forming bands B_1 are not in register, drive D_1 includes a mechanism for adjusting such register. As seen in FIGS. 1, 2 and 8, a lower idler pulley **128** is rotatably mounted on a slide **130** below pulleys **120**, **122** and in substantially vertical alinement with pulley **122**. Slide **130** is reciprocable vertically on rods **36** and is normally biased transversely downwardly away from pulleys **120**, **122** by springs **132** surrounding rods **36**, in order to maintain belt tension. An upper idler pulley **134** is arranged above and between pulleys **120**, **122** as best seen in FIGS. 6 and 8. Idler pulley **134** is rotatably mounted on a slide **136** which is reciprocable vertically on rods **138** having their lower ends secured in an enlarged central portion **62***a* of bearing block leg **62** and their upper ends secured in an overlying top shelf portion **62***b* on leg **62**. An adjusting screw **140** is suitably fixed on slide **136** and threadedly engages an adjusting nut **142** rotatably mounted in shelf portion **62***b*. A stop screw **144** threadedly engaged in adjusting nut **142** limits the relative movement of nut **142** and screw **140** to fix the position of slide **136** and idler pulley **134**. In the event that the markings forming bands B_1 are out of register, it is but a simple matter to move idler pulley **134** transversely downwardly toward or upwardly away from pulleys **120**, **122** by loosening stop screw **144** and adjusting nut **142**, until the relative angular positions of wheels **68**, **70** are varied sufficiently to bring the markings forming bands B_1 back to register.

The second drive D_2 for rotating wheels **680** and **700** in the same direction and at the same speed as wheels **68**, **70** includes a pulley **146** on shaft **740**, a pulley **148** on shaft **780** and an endless belt **150** trained over these pulleys, as best seen in FIG. 8. The mechanism for adjusting the relative angular positions of wheels **680**, **700** and hence the registration of the markings forming bands B_2 is substantially identical to that just described for drive D_1. Accordingly the same numerals are employed for corresponding elements such as lower idler pulley **128** and slide **130** which are vertically alined with pulley **146**, as shown in FIG. 3, as well as for upper idler pulley **134** and the various elements constituting the mechanism for adjusting the position of the idler pulley **134** relative to pulleys **146**, **148**, as shown in FIGS. 1 and 2.

Continuing with FIG. 8, the third or synchronizing drive D_3 includes a drive pulley **152** on wheel shaft **74** and a driven pulley **154** on one end of a long synchronizing shaft **156**, with pulleys **152**, **154** being connected by an endless belt **158** trained thereover. As also shown in FIG. 1, shaft **156** is rotatably mounted in bearings **160** on platform **24** and is provided at its other end with a drive pulley **162** which is located adjacent to a driven pulley **164** on one end of a short synchronizing shaft **166**, with pulleys **162**, **164** being connected by an endless belt **168** trained thereover. Shaft **166** is rotatably mounted in bearings **170** on platform **24** and at its other end is provided with a drive pulley **172** which is connected to a driven pulley **174** on shaft **780** by an endless belt **176** trained thereover.

Thus, the rotation of wheel **68** and wheel **700** is synchronized so that whatever amount and direction of angular movement are imposed upon one of these two wheels, will likewise be imposed upon the other wheel. As a consequence, the spacing of bands B_2 between bands B_1 will be maintained.

However, in the event that it becomes necessary to adjust the position of bands B_2 relative to bands B_1, drive D_3 is provided with a mechanism for this purpose, as best seen in FIGS. 7 and 8. This mechanism is quite similar to the adjusting mechanisms of drive systems D_1 and D_2, and includes a lower idler pulley **180** which is arranged centrally below pulleys **162**, **164** in engagement with belt **168** which passes through a slot **178** in platform **124**. Idler pulley **180** is rotatably mounted on a bracket **182** which is provided with an enlarged upper end **184** supported by and vertically reciprocable in a housing **186** suitably removably secured to the underside of platform

24. Bracket 182 and idler pulley 180 are normally biased transversely downwardly away from pulleys 162, 164 by a spring 188 within housing 186. An upper idler pulley 190 is centered above and between pulleys 162, 164 in engagement with belt 168 opposite pulley 180, and is rotatably mounted on a slide 192 which is vertically reciprocable along rods 194 having their lower ends secured in a lower shelf 196 projecting outwardly from a vertical plate 198 (FIGS. 2 and 3) supported on platform 24. The upper ends of rods 194 are suitably secured in an upper shelf 200 projecting from plate 198. An adjusting screw 202 is suitably fixed on slide 192 and threadedly engages an adjusting nut rotatably secured in shelf 204, while a stop screw 206 threadedly engageable with nut 204 limits the relative movement of screw 202 and the nut.

Accordingly, in the event that bands B_2 are not properly centered between bands B_1, the spacing between the differently colored bands can readily be adjusted by loosening stop screw 206 and rotating nut 204 to raise or lower idler pulley 190 relative to pulleys 162, 164, and thereby vary the relative angular positions thereof. The adjustment of pulley 162 is transmitted through synchronizing shaft 156, pulley 154, belt 158, pulley 152 and shaft 74 to wheel 68, while the adjustment of pulley 164 is transmitted through synchronizing shaft 166, pulley 172, belt 176, pulley 174 and shaft 780 to corresponding wheel 700.

OPERATION

Continuing with FIG. 8, the operation of the double color coder apparatus is as follows. The eddy current drive ED drives capstan C to advance wire W rapidly through the apparatus in the direction shown. The alternator-generator AG is, in turn, driven by eddy current drive ED to cause motor 114, its drive shaft 116 and drive pulley 118 thereon to rotate in timed relation to the longitudinal movement of wire W at an appropriate speed, so that drive systems D_1–D_3 rotate wheels 68, 70 and 680, 700 in the desired direction and speed to properly apply bands B_1 and B_2. As the wire advances longitudinally, wheel 70 first applies markings at the desired longitudinally spaced intervals, while wheel 68 applies likewise spaced markings registering with the markings of wheel 70 to form bands B_1. Then, wheel 680 applies regularly spaced markings between bands B_1 and wheel 700 applies markings registered with the markings of wheel 680 to form bands B_2 centered between bands B_1. In the preferred embodiment shown, wheels 68 and 70 are mounted on parallel axes on opposite sides of wire W, as are wheels 680 and 700, with wheels 70 and 680 rotating about a common axis and wheels 68 and 700 also rotating about a common axis. Likewise. synchronizing shafts 156 and 166 preferably are arranged to rotate about laterally offset axis substantially parallel to the common axis of wheels 68 and 700 on the same side of the path of the wire.

If the register of the markings forming bands B_1 needs adjustment, the adjusting mechanism of drive D_1 is actuated to perform this function without any effect upon the spacing between bands B_1 or B_2 or on the register of bands B_2. This is true because the amount and direction of angular motion of wheel 68 is transmitted to corresponding wheel 700 by synchronzing drive D_3 to maintain the spacing between bands B_2 and B_1, and of course, drive D_2 transmits the motion of wheel 700 to wheel 680 to maintain the desired relative angular positions thereof for maintaining register of bands B_2. Likewise, if the register of bands B_2 needs adjustment, the adjusting mechanism of drive D_2 is actuated for this purpose with the same result, there being no effect upon the spacing between bands B_1 and B_2 or the register of the markings forming bands B_1. On the other hand, if it is necessary to adjust the position of bands B_2 relative to bands B_1, then the adjusting mechanism of synchronizing drive D_3 is actuated to change the relative angular positions of wheels 700 and 68. While this does change the spacing between band B_1 and B_2, drive D_1 transmits whatever motion is impressed upon wheel 68 to wheel 70 in order to maintain the register of the markings forming bands B_1, while drive D_2 transmits the motion of wheel 700 to wheel 680 in order to maintain the register of bands B_2.

It will now be seen how the inventive drive system accomplishes its various objectives. While such drive system has been described and illustrated herein by reference to a single preferred embodiment, this is to be considered as illustrating rather than as limiting the inventive concept, the scope of which is to be determined by the appended claims.

What is claimed is:

1. Apparatus for applying code markings of different colors onto an elongated article advancing longitudinally along a predetermined path, and including a first hollow wheel rotatably mounted alongside of said path for applying first markings of one color at spaced points onto said article, a second hollow wheel rotatably mounted alongside of said path in longitudinally spaced relation to said first wheel for applying second markings of a different color onto said article between said first markings, each of said wheels having a peripheral row or orifices for directing angularly spaced streams of colored marking fluid therefrom, and means for supplying fluid of different colors respectively to said wheels, wherein the improvement comprises a drive system for simultaneously rotating said wheels in timed relation to each other and to the longitudinal movement of said article, said drive system including first drive means for rotating said first wheel, second drive means for rotating said second wheel, and third drive means driven by said first wheel and driving said second wheels for synchronizing the rotation of said first and second wheels, and thereby maintaining the position of said second markings between said first markings.

2. The apparatus of claim 1 wherein said third drive means includes means for varying the relative angular positions of said wheels, and thereby adjusting the position of said second markings relative to said first markings.

3. The apparatus of claim 2 wherein said first and second wheels are rotatably mounted along the same side of said path, and said third drive means drives said second wheel in the same direction and at the same speed as said first wheel.

4. The apparatus of claim 1 wherein each of said first and second wheels is provided with a shaft, and said third drive means includes a drive pulley on said first wheel shaft, a driven pulley on said second wheel shaft, rotatably mounted synchronizing shaft means having driven and drive pulleys, an endless belt connecting said drive pulley on said first wheel shaft and said driven pulley on said synchronizing shaft means, and an endless belt connecting said drive pulley on said synchronizing shaft means and said driven pulley on said second wheel shaft.

5. The apparatus of claim 4 wherein said third drive means includes means for varying the relative angular positions of said wheels and thereby adjusting the position of said second markings relative to said first markings, said synchronizing shaft means including first and second synchronizing shafts each having driven and drive pulleys at opposite ends and being arranged so that said driven pulley on said first synchronizing shaft is driven by said drive pulley on said first wheel shaft, said drive pulley on said second synchronizing shaft drives said driven pulley on said second wheel shaft, and said drive pulley on said first synchronizing shaft is adjacent said driven pulley on said second synchronizing shaft, said third drive means including an endless belt connecting said drive and driven pulleys on said first and second synchronizing shafts respectively, and said varying means including two idler pulleys rotatably and reciprocably mounted in engagement with said last mentioned belt on opposite sides of said

last mentioned drive and driven pulleys for transverse movement toward and away therefrom, resilient means normally biasing one of said idler pulleys transversely away from said last mentioned drive and driven pulleys for maintaining belt tension, and adjustable means for moving the other of said idler pulley transversely toward and away from said last mentioned drive and driven pulleys to vary the relative angular positions thereof.

6. The apparatus of claim **5** wherein said first and second wheel shafts are rotatably mounted on a common axis along the same side of said path, and said first and second synchronizing shafts are rotatably mounted on laterally offset axes substantially parallel to said common axis and along the same side of said path for driving said second wheel in the same direction and at the same speed as said first wheel.

7. Apparatus for applying code markings of different colors onto an elongated article advancing longitudinally along a predetermined path, and including a first pair of hollow wheels rotatably mounted on opposite sides of said path and in longitudinally offset relation to each other for applying registered markings forming first bands of one color at spaced points along said article, a second pair of hollow wheels rotatably mounted on opposite sides of said path in longitudinally offset relation to each other and in longitudinally spaced relation to said first pair of wheels for applying registered markings forming second bands of a different color onto said article between said first bands, each of said wheels having a peripheral row of orifices for directing angularly spaced streams of colored marking fluid therefrom, and means for supplying fluid of different colors respectively to said pairs of wheels, wherein the improvement comprises a drive system for simultaneously rotating said first and second pairs of wheels in timed relation to each other and to the longitudinal movement of said article, said drive system including first drive means for rotating said first pair of wheels, second drive means for rotating said second pair of wheels, and third drive means driven by one wheel of said first pair and driving one wheel of said second pair for synchronizing the rotation of said one wheel of said first pair with the rotation of said one wheel of said second pair, and thereby maintaining the position of the markings of said one wheel of said second pair between the markings of said one wheel of said first pair.

8. The apparatus of claim **7** wherein said third drive means includes means for varying the relative angular positions of said one wheels of said first and second pairs, and thereby adjusting the position of said markings of said one wheel of said second pair relative to said markings of said one wheel of said first pair, while said first and second drive means maintain the relative angular positions of said wheels of said first and second pairs respectively, and thereby maintain the registration of said markings forming said first and second bands respectively.

9. The apparatus of claim **7** wherein each of said first and second drive means includes means for varying the relative angular positions of said wheels of each of said first and second pairs respectively without affecting the relative angular positions of said wheels of the other pair, and thereby adjusting the registration of said markings forming each of said first and second bands respectively without affecting the registration of said markings forming the other band, while said third drive means causes the same amount of variation in the angular position of said one wheel of each of said first and second pairs as of said one wheel of the other pair, thereby maintaining the position of said markings of said one wheel of said second pair between said markings of said one wheel of said first pair.

10. The apparatus of claim **9** wherein said third drive means includes means for varying the relative angular positions of said one wheels of said first and second pairs, and thereby varying the position of said markings of said one wheel of said second pair relative to said markings of said one wheel of said first pair, while said first and second drive means maintain the relative angular positions of said wheels of said first and second pairs respectively, and thereby maintain the registration of said markings forming said first and second bands respectively.

11. The apparatus of claim **10** wherein said one wheels of said first and second pairs are mounted along the same side of said path, and said third drive means drives said one wheel of said second pair in the same direction and at the same speed as said one wheel of said first pair, while said first and second drive means drive the other wheels of said first and second pairs in the same direction and at the same speed as said one wheels.

12. The apparatus of claim **7** wherein each of said wheels is provided with a shaft, and said third drive means includes a drive pulley on said one wheel shaft of said first pair, a driven pulley on said one wheel shaft of said second pair, rotatably mounted synchronizing shaft means having driven and drive pulleys, an endless belt connecting said drive pulley on said one wheel shaft of said first pair and said driven pulley on said synchronizing shaft means, and an endless belt connecting said drive pulley on said synchronizing shaft means and said driven pulley on said one wheel shaft of said second pair.

13. The apparatus of claim **12** wherein said third drive means includes means for varying the relative angular positions of said one wheels of said first and second pairs, and thereby adjusting the position of said markings of said one wheel of said second pair relative to said markings of said one wheel of said first pair, while said first and second drive means maintain the relative angular positions of said wheels of said first and second pairs respectively, and thereby maintain the registration of said markings forming said first and second bands respectively, said synchronizing shaft means including first and second synchronizing shafts each having driven and drive pulleys at opposite ends and being arranged so that said driven pulley on said first synchronizing shaft is driven by said drive pulley on said one wheel shaft of said first pair, said drive pulley on said second synchronizing shaft drives said driven pulley on said one wheel shaft of said second pair and said drive pulley on said first synchronizing shaft is adjacent said driven pulley on said second synchronizing shaft, said third drive means including an endless belt connecting said drive and driven pulleys on said first and second synchronizing shafts respectively, and said varying means including two idler pulleys rotatably and reciprocably mounted in engagement with said last mentioned belt on opposite sides of said last mentioned drive and driven pulleys for transverse movement toward and away therefrom, resilient means normally biasing one of said idler pulleys transversely away from said last mentioned drive and driven pulleys for maintaining belt tension, and adjustable means for moving the other of said ldler pulleys transversely toward and away from said last mentioned drive and driven pulleys to vary the relative angular positions thereof.

14. The apparatus of claim **12** wherein each of said first and second drive means includes means for varying the relative angular positions of said wheels of each of said first and second pairs respectively without affecting the relative angular positions of said wheels of the other pair, and thereby adjusting the registration of said markings forming each of said first and second bands respectively without affecting the registration of said markings forming the other band, while said third drive means causes the same amount of variation in the angular position of said one wheel of each of said first and second pairs as of said one wheel of the other pair, and thereby maintains the position of said markings of said one wheel of said second pair between said markings of said one wheel of said first pair, each of said first and second drive means including a second pulley on each of said one wheel shafts of said first and second pairs, a third pulley on each of the other wheel shafts of said first and second

pairs, and an endless belt connecting said second and third pulleys, each of said varying means including two idler pulleys rotatably and reciprocably mounted in engagement with said last mentioned belt on opposite sides of said second and third pulleys for transverse movement toward and away therefrom, resilient means normally biasing one of said idler pulleys transversely away from said second and third pulleys for maintaining belt tension, and adjustable means for moving the other of said idler pulleys transversely toward and away from said second and third pulleys for varying the relative angular positions thereof.

15. The apparatus of claim **14** wherein said third drive means includes means for varying the relative angular positions of said one wheels of said first and second pairs, and thereby adjusting the position of said marking of said one wheel of said second pair relative to said markings of said one wheel of said first pair, while said first and second drive means maintain the relative angular positions of said wheels of said first and second pairs respectively, and thereby maintain the registration of said markings forming said first and second bands respectively, said synchronizing shaft means including first and second synchronizing shafts each having driven and drive pulleys at opposite ends and being arranged so that said driven pulley on said first synchronizing shaft is driven by said drive pulley on said one wheel shaft of said first pair, said drive pulley on said second synchronizing shaft drives said driven pulley on said one wheel shaft of said second pair and said drive pulley on said first synchronizing shaft is adjacent said driven pulley on said second synchronizing shaft, said third drive means including an endless belt connecting said drive and driven pulleys on said first and second synchronizing shafts respectively, and said

last mentioned varying means including two idler pulleys rotatably and reciprocably mounted in engagement with said last mentioned belt on opposite sides of said last mentioned drive and driven pulleys for transverse movement toward and away therefrom, resilient means normally biasing one of said last mentioned idler pulleys transversely away from said last mentioned drive and driven pulleys for maintaining belt tension, and adjustable means for moving the other of said last mentioned idler pulleys transversely toward and away from said last mentioned drive and driven pulleys to vary the relative angular positions thereof.

16. The apparatus of claim **15** wherein said one wheel shafts of said first and second pairs are rotatably mounted on a common axis along one side of said path, said first and second synchronizing shafts are rotatably mounted on laterally offset axes substantially parallel to said common axis and along the same side of said path for driving said one wheels in the same direction and at the same speed, and said other wheel shafts of said first and second pairs are rotatably mounted on a common axis along the other side of said path and substantially parallel to said common axis of said one wheels, while said first and second drive means drive said other wheels in the same direction and at the same speed as said one wheels.

References Cited

UNITED STATES PATENTS

2,989,943 6/1961 Fitzgerald et al. ------ 118—314

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