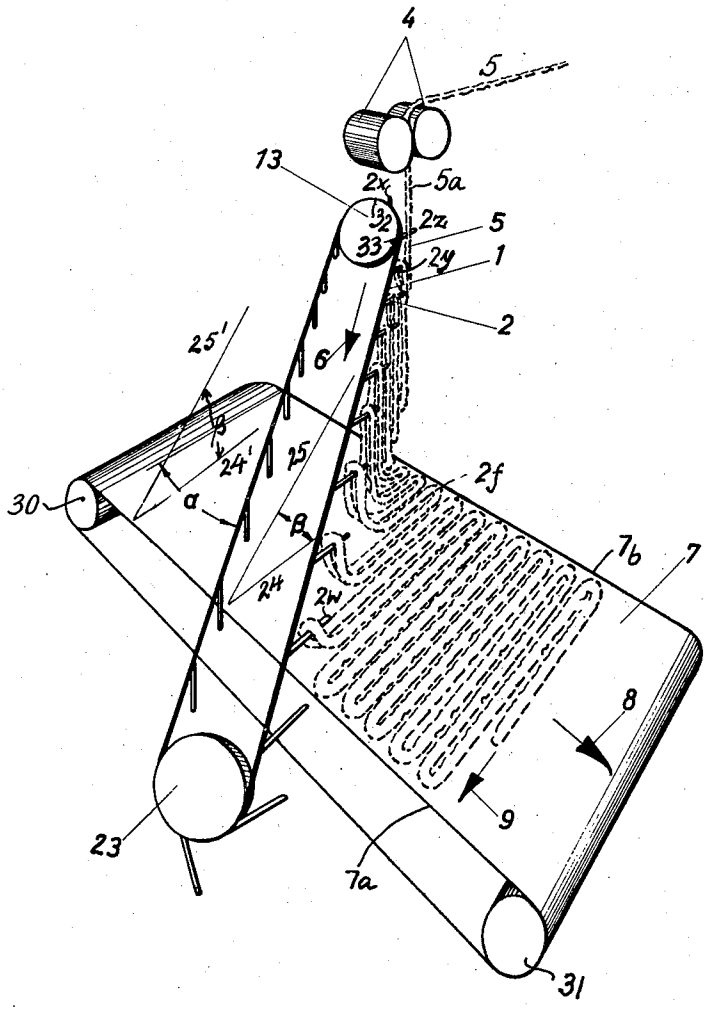
Feb. 7, 1961 W. FRIEDEL 2,970,364

CABLE DEPOSITING APPARATUS

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FIG. 1



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FIG. 2

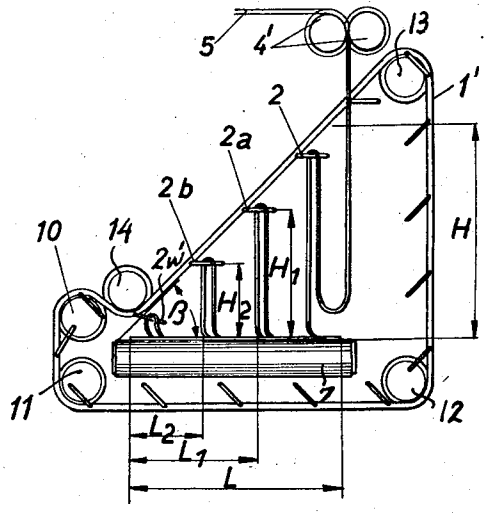


FIG. 3

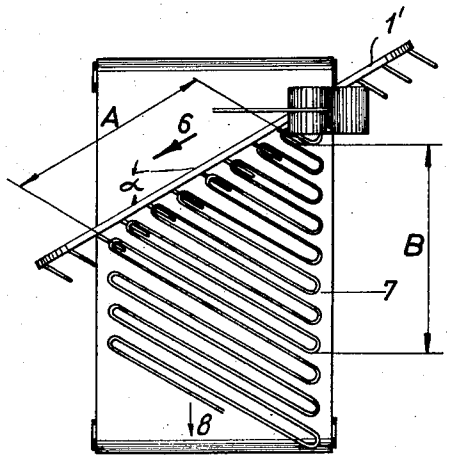
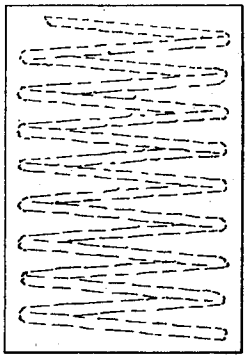


FIG. 4



PRIOR ART

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2,970,364

CABLE DEPOSITING APPARATUS

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8 Claims. (Cl. 28—1)

This invention relates to a system of handling and laying cables, cords, strings, bands, strips, and lengthy webs. The term "cable" herein used is intended to comprehend any lengthy flaccid material, which may be fibrous, cellular, plastic or the like.

In the handling of cables it is customary to feed a cable length continuously from the extrusion or calendering or similar manufacturing plant and subject the same to further treatment prior to leading said cable onto a reel or reels. Such treatment may include drying or moistening, or may on some occasions include impregnation with a fungicide, a substance resistant to salt spray and the like. To this end, the fed cable is deposited by means of a suitable reciprocating mechanism which includes a member that traverses a straight line path somewhat above a conveyor belt surface and that deposits on the belt, in the course of such traverse, the cable that it draws along. Upon approaching an edge of the belt, the member reverses its path and proceeds in the opposite direction until the opposite edge is reached, whence another reversal occurs. Accordingly the deposited cable defines a periodic zig-zag or like pattern on the conveyor belt. While lying on the conveyor belt, the cable is subjected to one or more of the mentioned treatments. The conveyor belt is of suitable length, and the conveying speed is selected to be suitably slow, so as to permit the lapse of a sufficient period of time, so that the treatment may take full effect prior to take up of the cable on a reel.

The zig-zag and similar patterns are far from desirable out of several considerations. For one, such patterns do not permit uniformity of treatment over the length of cable extending transversely of the conveyor belt. For another, the sudden reversals of sense of deposit directions impose severe acceleration schedules on the reciprocating mechanism. Theoretical considerations, corroborated by experimental results, dictate that the optimum pattern should consist of successive transverse cable lengths that are parallel to one another with gentle curves at the points of reversal.

An array of parallel lengths is optimum in respect of permitting highly uniform cable treatment, and also in respect of accommodating a maximum of cable length per unit length of conveyor belt.

It is accordingly a principal object of the invention to provide means facilitating depositing of a cable on a conveyor belt so that the deposited cable lengths are generally parallel to one another.

Another object of the invention is to provide means avoiding excessive acceleration schedules in carrying out the deposit of cable lengths on a movable conveyor surface.

It is a further object of the invention to provide means conducive to the prevalence of substantially solely constant velocity motions.

For a proper understanding of the manner of achievement of these and other objects, and for appreciation of

further advantages and novel features of the apparatus embodying the invention, reference is made to the following more detailed description, considered together with the accompanying drawings, in which

Fig. 1 is a perspective view of an apparatus which is somewhat schematically shown and embodies the invention,

Fig. 2 is a side elevational view of an apparatus pursuant to the invention, but modified with respect to that shown in Fig. 1,

Fig. 3 is a top plan view of the apparatus of Fig. 2, and

Fig. 4 is a top plan view of the conveyor surface showing the positioning of the material according to the prior art.

Referring now more particularly to Fig. 1, there is disclosed a pair of friction cage rollers **4**, which are disposed above and somewhat to the rear of a substantially horizontal conveyor belt **7**, which is driven at uniform velocity in the direction indicated by arrow **8** by means of a pair of cylindrical rollers **30** and **31**, which in turn are driven by external constant-speed drive means (not shown). The axes of the rollers **30** and **31** are parallel to one another and therefore perpendicular to the direction of motion **8**, as indicated by the arrow **9**.

One or both of the rollers **4** are driven by suitable constant speed drive means (not shown), and frictionally engage a cable that is fed therebetween from any suitable supply apparatus (not shown). The cable **5** is ultimately deposited on the conveyor **7** in a pattern as shown, i.e. in lengths substantially parallel to the axes of rollers **30** and **31** (perpendicular to the direction of conveyor belt motion) with loops joining consecutive parallel lengths alternately near the opposite edges of the conveyor belt **7**. The conveyor belt **7** may be of relatively small length; it should be, however, understood that in actual practice it may be sufficiently long to accommodate considerable cable length at any given instant, thus permitting prolonged and uniform cable treatment of the type described.

Means are provided for forming these loops and to deposit them on the conveyor belt **7**, which include an endless chain or belt **1** driven in the direction indicated by arrow **6** by means of a pair of pulleys **13** and **23**, one or both of which in turn are driven by suitable constant speed means (not shown). It is to be appreciated that the described arrangement involves three constant speed motions, namely the speed of feed of the cable **5**, the speed of endless belt **1**, and the speed of conveyor belt **7**. It is preferable that the means providing the three drives be adjustable, that is operable over a speed range; however the speed at any setting should be constant. These three speeds are progressively lower in predetermined relations in the order named. This arrangement is to be contrasted to a known apparatus of the prior art which requires sudden stoppage upon cable reversal. As will be seen immediately hereinafter, the apparatus in accordance with the invention performs the functions of loop forming and loop depositing while moving unidirectionally and at constant speed.

The roller **13** is disposed above and somewhat behind the adjacent rear edge of the conveyor belt **7**, but below and somewhat to the front of the vertical plane of contact of the feed rollers **4**, in which vertical plane the cable **5** is caused to descend generally vertically downwardly due to the feed motion of rollers **4**.

The other roller **23** is disposed somewhat forwardly inclined of and somewhat below the front edge of the conveyor belt **7**. The plane of belt **1** and of pulleys **13** and **23** is inclined with respect to the plane of conveyor belt **7** at the indicated angle β (see also Fig. 2); as represented in Fig. 1, the angle β is defined by a pair of lines

24 and 25 generated by the intersection of a vertical plane with the plane of the conveyor belt 7, and the plane of the belt 1 and pulleys 13 and 23, respectively; more particularly the vertical plane is one that is parallel to the transverse cable lengths reposed on belt 7. The belt 1 is tilted through an angle α with respect to the vertical plane in a counterclockwise direction; for convenience's sake these spacial arrangements of the plane represented by lines 24 and 25 are indicated as translated rearwardly (in the direction of movement of belt 7) by respectively coplanar and parallel lines 24' and 25'; the angle α is thus formed by the intersection of the vertical plane including belt 1 and pulleys 13 and 23, and the vertical plane including lines 24' and 25'. Thus the plane containing pulleys 13, 23 and belt 1 is rotated through the angle α with respect to the vertical plane including lines 24 and 25, such that pulley 13 is located to the rear, and pulley 23 to the front of line 25, as seen in the direction of the conveyor belt motion.

As will be seen hereinafter the oblique tilting of the belt 1 by the angle α results in deposition of the cable 5 on conveyor belt 7 parallel to the direction 9, i.e. to the axes of rotation of cylinders 30 and 31, rather than obliquely thereto.

The belt 1 is provided with a plurality of equispaced, smoothly polished pegs or pins 2 which as indicated may be secured to the belt in any appropriate manner, or may be integral therewith. The integral formation is especially suitable in the case of selection of metal or rubber as the material of belt 1. The relation of each of the pegs 2 to the belt 1 is such, that the fixed end of the peg is located on an inwardly directed surface of the belt so as to avoid interference with the smooth belt passage over the pulleys 13 and 23. Each peg extends substantially horizontally in parallel relation to the axes of rollers 13, 23, and rearwardly of the belt 1, thus forming the angle β therewith. Alternatively the pegs may form an angle somewhat greater than β, i.e. extend downwardly as well as rearwardly from belt 1.

The disposition of the belt 1 and pegs 2 relative to the feed rollers 4 is such, that a given peg 2z engages the cable portion 5a then dependent from rollers 4, as peg 2z travels from the topmost location 32 to the point of tangency 33 of the straight belt portion and pulley 13. The peg thus pushes the cable portion 5a toward the right-hand; in view of the fact that the rate of descent of the cable 5 from the rollers 4 is substantially greater than the rate of motion of the belt 1, as previously explained, the cable 5 is caused to loop over the peg and to depend also from the left side of said peg as shown with reference to peg 2y, that immediately precedes peg 2z, as seen in the direction of movement 6. Each peg thus supports a cable loop, and in addition a second free loop is formed for each such supported loop, again by reason of the fact that the rate of downward descent of the dependent cable portion 5a is greater than the rate of rightward and subsequently downward movement of the portion of cable dependent from the left of peg 2z. The loop generation is repeated as each subsequent peg 2z contacts a subsequent cable portion 5a. Again due to the speed differential of feed rate of the cable 5 and speed of belt 1, aided by the fact that the pegs are smoothly polished, the loop portion of belt 5 that is instantly supported by a peg is not carried permanently thereby, but rather is slidably displaceable relative to such peg.

Therefore, as a peg advances in the direction of arrow 6, the lengths of cable instantly dependent from the left and right sides of such peg increase continuously, but at a progressively diminishing rate. As illustrated, ultimately each free loop 2f reaches and touches the upper surface of the conveyor belt 7 at its rear edge 7b, whence it is deposited thereon towards the front edge 7a of the same. The deposited free loop is then carried along by belt 7, while at the same time the correspondingly supported loop is further guided downwardly by a peg,

thus gradually depositing double cable lengths across the conveyor belt 7. As a peg, such as the peg 2w reaches a location approximately on an even plane with the upper conveyor surface, the pulling or drawing action of the conveyor automatically slips off the supported loop from such peg; the loop lands on the conveyor 7 toward the front edge 7a thereof and is carried by belt 7 from hereon forth. The peg 2w continues its downward and forward movement, clearing the belt 7 with ample margin.

It is readily apparent, that from the instant of deposit of the free loop until the instant of deposit of the corresponding supported loop progressively more of the deposited cable length is moved in the direction 8; it is for this reason that the belt 1 is tilted through the angle α; were it not for such tilt, the deposited cable would not extend in the direction of arrow 9, but obliquely thereto. Of course, an oblique array may be acceptable or even desirable; in such case the medium axis of the pulleys 13 and 23 is placed in parallel relation to the vertical plane including lines 24 and 25. Alternatively, the same effect may be produced by suitable adjustment of the conveyor speed relative to the belt speed, as reflected by the rate of conveyor movement relative to the rate of cable deposit. Here B is the distance considered along the direction of motion of belt 7, between the free loop which is just being initially deposited, and the free loop whose corresponding supported loop is just deposited, and A is the distance, measured along the horizontal length of belt 1, separating the aforesaid supported loops corresponding to the free loops joined by line B. It is readily apparent that the conveyor speed to horizontal belt speed ratio is $B:A$.

Further, in order that the cable be deposited in lengths perpendicular to the direction of motion of belt 7, as in Fig. 1, it is necessary that $B=A\cdot\sin\alpha\cdot\cos\beta$, or

$$\frac{B}{A}=\sin\alpha\cdot\cos\beta$$

or that the conveyor speed to belt speed ratio be $\sin\alpha\cdot\cos\beta$. This equation is not satisfied in the showing of Fig. 3, where the speed ratio is greater than $\sin\alpha\cdot\cos\beta$, and consequently the cable lengths are oblique to the direction of the conveyor motion indicated by arrow 9.

Fig. 2 illustrates a modification of the apparatus illustrated in Fig. 1, and also serves simultaneously to indicate further underlying relations that govern the performance of the apparatus. In Fig. 2 the belt 1' is arranged to pass over a plurality of pulleys 10 to 14 inclusive, whose rotational axes are at an acute angle to the direction of the conveyor belt 7 motion. Supply rollers 4' are disposed parallel to the motion of the conveyor belt 7. Assuming a tilt through the angle α (Fig. 3), which may be omitted or included as desired, the pulleys 11, 12, 13 define vertices of a projected isosceles right triangle formed by the belt 1', whose one equal leg 11 to 12 extends below the conveyor belt 7 widthwise thereof and in a plane parallel thereto.

The other equal leg 12 to 13 is perpendicular to leg 11 to 12, and the length 11 to 13 is the hypotenuse of the right triangle, subject to a deviation from a strictly triangular construction occasioned by the additional pulleys 14 and 10. The pulley 14 is located near the point of release of the supported loop, and in cooperation with the engaging pulley 10 bears downwardly on belt 1', thus tipping the instantly cable releasing peg 2w' downwardly to facilitate loop release. The belt 1' engages the lower portion of the periphery of pulley 14 and thereafter passes over pulley 10 downwardly onto pulley 11. The belt 1' thus envelops the conveyor belt 7. This arrangement readily admits of simultaneous deposition of a plurality of cables similar to cable 5; to this end, the belt 1' is wound around the pulleys 10 to 14 at multiple spaced locations, whereas the rollers or pulleys 4' at correspondingly spaced locations feed multiple cables 5.

As the angle β is the base angle of the isosceles right

triangle, it is necessarily 45°. Still assuming proper tilt of the belt 1', let the projected transverse cable length on the conveyor belt be designated by L, and let the vertical distance from the line defining the ends of the deposited free loops to the indicated projection of belt 1' be designated as H.

It is appreciated that the lengths L and H define a similar isosceles right triangle. Corresponding lengths referring to the two intermediate loop supporting pegs 2*a* and 2*b*, are designated by L_1 and H_1, and by L_2 and H_2, respectively. As a cable length of initial height H reaches point 2*a*, the dimension H is divided into a vertical part H_1 and a horizontal part $L—L_1$; similarly at the point 2*b* the division is into a vertical part H_2 and a horizontal part $L—L_2$.

Under conditions of proper tilt and proper relations of peg belt and conveyor belt speeds, as previously described, and upon proper adjustment and correlation of belt speed and cable feed rate, the length of the deposited transverse cable section will be L or H.

It is also possible, in order to deposit several cable lengths onto a conveyor band or like movable support, that belt 1' after its engagement with deviation roll or pulley 10, as depicted in Fig. 2 is guided in upward direction and in similar manner is conducted to a second pair of cooperable supply rollers as hereinafter described in connection with rollers 4'. Finally the cable is led back to the conveyor or transport band 7 and back to the first pair of supply rollers 4'.

Cable 1', which according to Fig. 2 runs only once in inclined position and downwardly via conveyor band 7, would in the above mentioned modification run X times in saw-like fashion downwardly and then vertically in an upward direction with respect to conveyor band 7.

Since the conveyor band 7 supports the cable or like material at a predetermined speed and since the relative speed between the peg belt 1 or 1' and conveyor belt 7 in the direction of arrow 8 is equal or substantially equal to zero, the cable is laid down parallel to line 24. The speed ratio of the peg belt to that of the conveyor belt is in such case *A:B*.

Pegs 2, 2*a*, 2*b* etc. are so arranged on belt 1 or 1', that they are directed horizontally or at an acute angle and toward the loop, when the relative speed in the direction of arrow 8 is equal to zero, yet the speed in the direction of arrow 9, however, assumes a predetermined value, so that the respective peg will be withdrawn from the associated loop. It is further possible to cause the conveyor band 7 to run at a speed larger than the aforesaid ratio *A:B*, so that the loops do not extend at 90° to the edges of the conveyor band but rather at any desirable angle, so that the relative speed between peg belt 1 and conveyor band 7 as seen in the direction of arrow 8 does not amount to zero.

Fig. 4 indicates only for the purpose of comparison how the deposit of the cable and its loops is carried out according to the prior art.

It can thus be seen that there has been provided according to this invention a system for handling and depositing continuous, substantially flaccid strip material in winding formation on a movable, elongated conveyor band for treatment thereon; comprising supply roller means located above and in proximity of the rearward longitudinal edge of said conveyor band for feeding said strip material, and endless transfer means provided with spaced apart projecting pegs arranged to move from a position below said supply roller means toward a position at the forward longitudinal edge of said conveyor band, said supply roller means and said endless transfer means being coordinated to each other and performing a relative movement, so that successive loops of strip material are formed astride and above said pegs and therebelow, of which said loops below said pegs freely depend from the latter for contact with the surface of said conveyor band at the rearward edge thereof, whereas said loops of strip material astride said pegs remain in contact with the latter until stripped off automatically at the forward edge of said conveyor band, thereby to transfer a continuously deposited strip material onto the latter with windings produced adjacent said forward and rearward longitudinal edges of said conveyor band, the speed of said conveyor band relative to the speeds of said strip material fed by said supply roller means and of said transfer means being coordinated in predetermined timed relation, thereby to orient said deposited strip material in winding formation on said conveyor band at a predetermined angle to the direction of its movement.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. A cable depositing apparatus comprising the combination of elongated conveyor means having front and rear longitudinal edges and moving in a substantially horizontal plane at a first predetermined speed, with elongated endless belt means spaced apart from said conveyor means and moving at a second predetermined speed from a predetermined first location, said location being situated at a predetermined height above said conveyor means and generally above said rear edge, means guiding said endless belt means further to a second predetermined location situated slightly above said conveyor means and generally above and forwardly of said front edge, thereby to extend at a predetermined angle of inclination with respect to said conveyor means, a plurality of substantially equidistantly spaced pegs secured to said belt means and extending therefrom at substantially equal predetermined angles therewith, and means for feeding at a predetermined third speed substantially greater than said second speed a continuous length of said cable from above said first location downwardly for engagement with said pegs, successively, said cable by virtue of the difference of said second and third speeds forming a plurality of pairs of cable lengths on each peg, whereby said pairs of cable lengths are looped over each one of said pegs and depend respectively from the rear toward the front edge of said conveyor means, each dependent cable length forming a free loop for deposit adjacent said rear edge of said conveyor means, said pegs carrying said cable lengths looped on said pegs during movement of said belt means downwardly and depositing said cable lengths in parallel and closely spaced relation on said conveyor means at a preselected angle to the direction of movement of said conveyor means, so that the free loops contact the latter and are deposited adjacent said rear edge while the peg-supported loops are deposited adjacent said front edge upon slipping off of their associated pegs at said second location.

2. An apparatus according to claim 1, wherein said second speed is greater than said first speed.

3. An apparatus according to claim 1, wherein said angle of inclination is an acute angle so that the deposited cable lengths extend obliquely with respect to the direction of movement of said conveyor means.

4. An apparatus according to claim 1, said belt means being tilted at a predetermined angle, with the aforesaid second location ahead of said first location as seen in the direction of movement of said conveyor means, whereby the cable lengths are deposited at right angles with respect to the direction of said movement of said conveyor means.

5. An apparatus according to claim 1, wherein said pegs extend from said belt means in their loop-forming location in parallel relation to said conveyor means.

6. An apparatus according to claim 1, wherein each of said three speeds is maintained substantially constant.

7. An apparatus according to claim 1, including further means engaging said belt means in the proximity of said second location and effectuating tipping of said

pegs thereat, whereby deposit of the associated peg-supported loops on said conveyor means is facilitated.

8. A system for handling and depositing continuous, substantially flaccid strip material in winding formation on a movable elongated conveyor band for treatment thereon; comprising supply roller means located above and in proximity of the rearward longitudinal edge of said conveyor band for feeding said strip material, and endless transfer means provided with spaced apart projecting pegs arranged to move from a position below said supply roller means toward a position at the forward longitudinal edge of said conveyor band, said supply roller means and said endless transfer means being coordinated to each other and performing a relative movement, so that successive loops of strip material are formed astride and above said pegs and therebelow, of which said loops below said pegs freely depend from the latter for contact with the surface of said conveyor band at the rearward edge thereof, whereas said loops of strip material astride said pegs remain in contact with the latter

until stripped off automatically at the forward edge of said conveyor band, thereby to transfer a continuously deposited strip material onto the latter with windings produced adjacent said forward and rearward longitudinal edges of said conveyor band, the speed of said conveyor band relative to the speeds of said strip material fed by said supply roller means and of said transfer means being coordinated in predetermined timed relation, thereby to orient said deposited strip material in winding formation on said conveyor band at a predetermined angle to the direction of its movement.

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