Feb. 5, 1957 L. J. BRANCATO 2,780,270

DEVICE FOR CONTROLLING THE PITCH OF HELICALLY COILED WIRE

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Fig. 1.

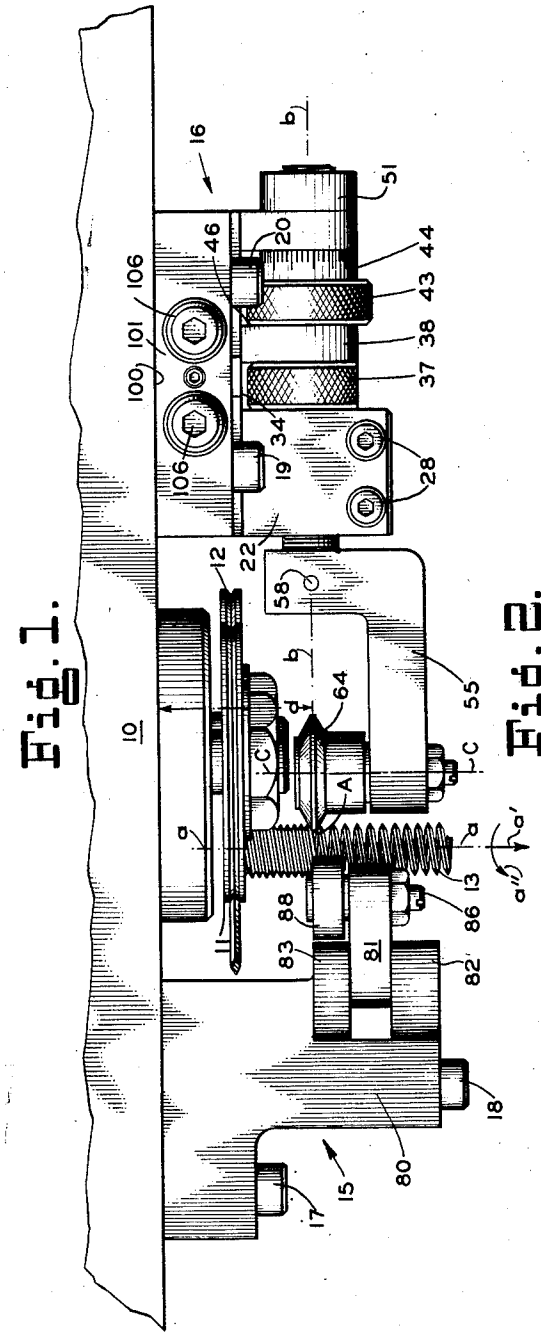
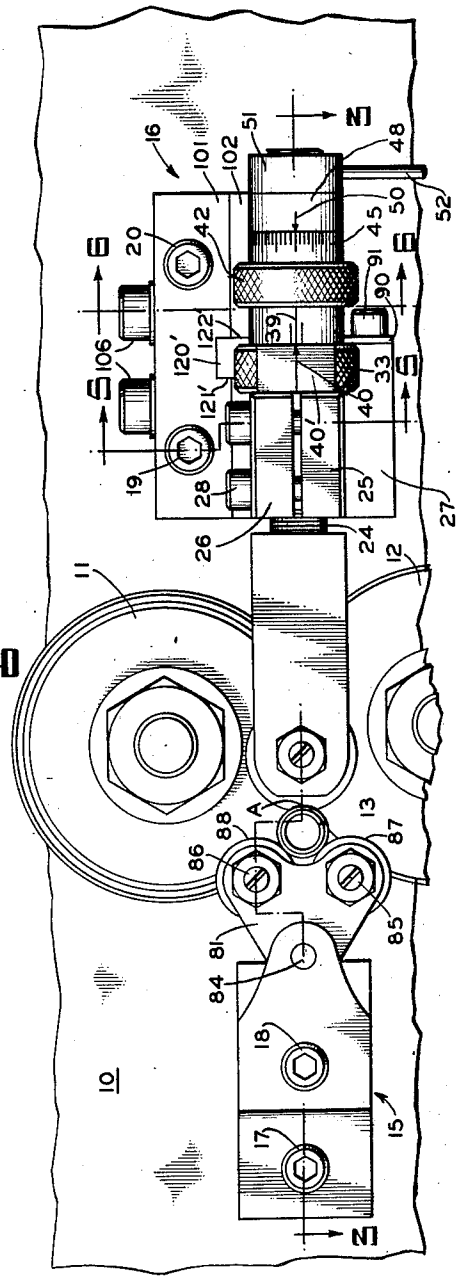


Fig. 2.



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Fig. 3.

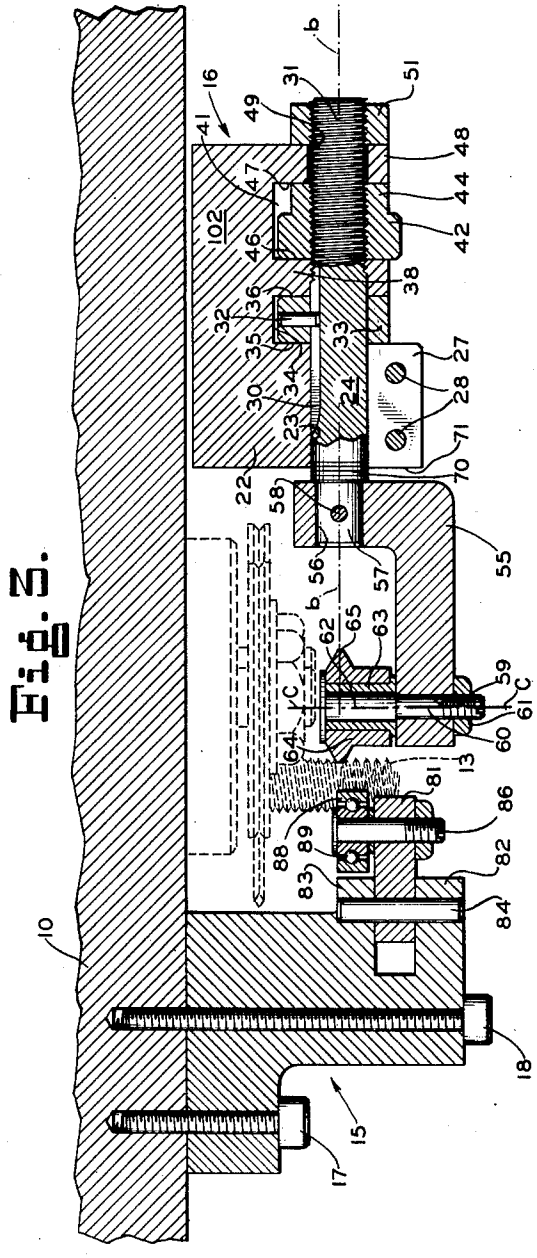


Fig. 5.

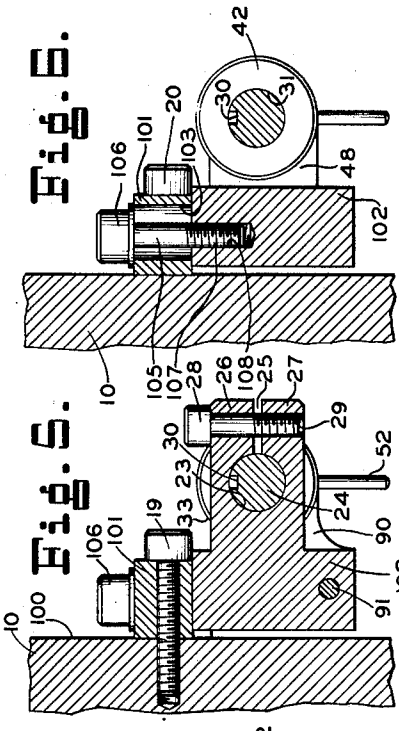
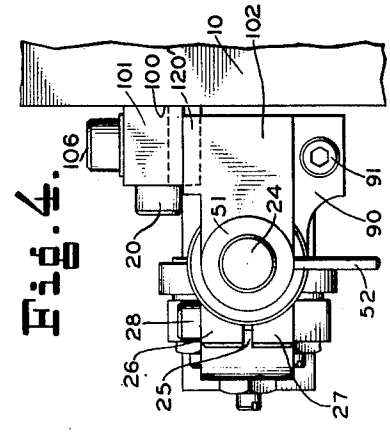


Fig. 4.



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Fig. 8.

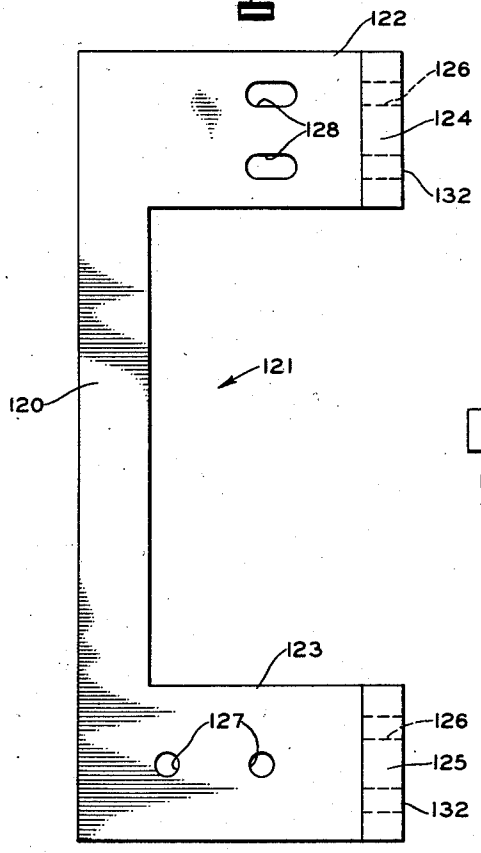


Fig. 7.

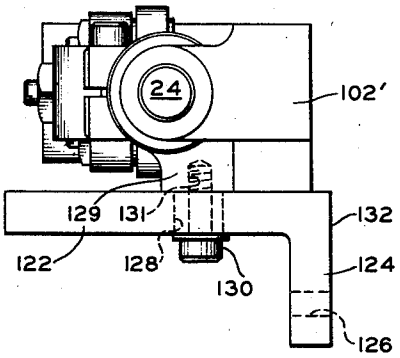
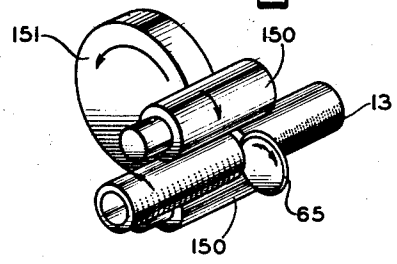


Fig. 9.



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DEVICE FOR CONTROLLING THE PITCH OF HELICALLY COILED WIRE

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Application February 8, 1955, Serial No. 486,790

6 Claims. (Cl. 153—64)

The invention relates to a device for controlling the pitch of coiled wire. The conventional wire coiling machines for continuous operation produce the coils by passing the wire from a stock either between a stationary grooved arbor and a coiling point or between grooved rollers and a rotatable arbor. In both types of machines any desired pitch of the coils is obtained by a stationary pitching tool having a face inclined with respect to the plane in which the wire is coiled. This tool is so positioned that the wire of a convolution just formed engages the inclined face which urges the wire away from the coiling point or roller and thereby spreads the pitch of the coil. Without the pitching tool a coil forms with convolutions tightly pressed on one another.

However, the conventional manner of procuring the desired pitch has severe drawbacks. On the one hand, the frictional force on the wire due to its contact with the stationary pitching tool tends to expand the coil and thereby to increase the coil diameter. Consequently a change in pitch produced by an adjustment of the pitching tool also results in an undesirable change of the diameter of the coil. When this occurs, the coiling point must be readjusted or the coiling arbor must be modified in order to obtain the desired diameter. On the other hand, the stationary pitching tool must be positioned directly in succession of the coiling rollers or the coiling point because the spreading force of the pitching tool must be opposed by the confinement of the wire in the grooves of the coiling point or rollers. The spreading force, however, tends to twist the wire out of the plane of these grooves, and this tendency causes the wire to be marred or ridged by the edges of the grooves.

The invention aims to avoid the mentioned drawbacks and to provide a pitching device which may be a part of or an attachment to a continuously coiling machine, or which may be designed as a separate self-contained unit. The term "continuously coiling machine" is used herein to denote a type of machine by means of which a continuous coil can be formed from a wire stock regardless whether or not the actual coiling operation of the machine is temporarily stopped at intervals for other operations on the coiled wire.

Another object of the invention is the provision of a pitching device whereby the pitch of a continuous coil can be varied and infinitely finely adjusted and wherein the adjustment of the pitch may be accomplished without stopping the operation.

According to the invention a freely rotatable roller with a substantially roof or V-shaped periphery, hereinafter called the "pitching roller," is so journaled that it can engage with its periphery between two adjacent convolutions of a continuous coil which, opposite the pitching roller, is supported by two additional rollers, whereby the pitching roller will urge the engaged convolutions apart while the two additional or supporting rollers take up the thrust of the pitching roller. If, during the operation of the device, the coil is rotated about its axis while it is free or caused to move in the axial direction, the pitching roller will continuously spread the convolutions apart and thereby impart a desired pitch to the coil, depending on the depth to which the pitching roller periphery enters between the adjacent coil convolutions.

Further, according to the invention, means may be provided to adjust the depth of engagement of the pitching roller and also the angle between the plane of the pitching roller and the coil axis so that this plane contains the tangent of the coil helix at the point of the roller engagement.

Further objects and details of the invention will be apparent from the description given hereinafter and the accompanying drawing illustrating an embodiment thereof by way of example.

In the drawing,

Fig. 1 is a top plan view of a pitching device according to the invention,

Fig. 2 is a front elevation thereof,

Fig. 3 is a section along line 3—3 in Fig. 2,

Fig. 4 is a side elevation thereof,

Figs. 5 and 6 are sections along lines 5—5 and 6—6, respectively, of Fig. 2,

Fig. 7 is a rear-end-view of a modification,

Fig. 8 is a bottom plan view of a base plate of the modification of Fig. 7, and

Fig. 9 is a diagrammatic perspective view of a modified drive for the coil.

Referring now to the drawing, Figs. 1 to 6 illustrate a pitching device directly attached to a continuously coiling machine which is of a conventional type, and per se, no part of the present invention.

A frame plate 10 and two rollers 11 and 12 being elements of the coiling machine are visible in the drawing. The rollers 11 and 12 belong to those which coil wire from a stock so as to produce a continuous wire coil in general denoted by 13. Owing to the fact that the coiling occurs in one plane and the wire portions leaving the coiling rollers will be slightly urged out of this plane by the succeedingly coiled portions, a continuous helical wire coil will be formed the convolutions of which bear more or less tightly upon one another while the coil progresses in the axial direction of the arrow *a'* and simultaneously turns about its axis, *a—a*.

The pitching device comprises two brackets in general denoted by 15 and 16 and secured to the coiling machine frame plate 10 by means of screws 17 and 18 and 19 and 20, respectively.

In a portion 22 of bracket 16, which faces the bracket 15, a sleeve 23 is formed about shank 24. Preferably, portion 22 is slotted at 25 in a radial plane so as to form two clamping lips 26 and 27. Screws 28 are passed through portion 26 and engage in threads 29 of portion 27 so that by tightening the screws 28 the shank 24 can be secured by clamping in any desired axial or peripheral position in the sleeve. In order to adjust the shank, it is provided with a longitudinal groove 30 and with an external screw thread 31 extending a substantial distance forward from its rear end. A pin 32 secured in a ring 33 which fits slidingly on the shank 24, engages into the grooves 30. Ring 33 is located in a recess 34 of bracket 16 so that it is prevented by the flanks 35 and 36 of the recess from moving axially. The ring 33 is splined to the shank 24 for common turning about the shank axis *b—b* but the shank is free to be shifted lengthwise. A major portion of the periphery of ring 33 projects outwardly from the recess 34. In order to facilitate the turning of ring 33 and with it shank 24, the ring periphery may be knurled as indicated at 37. The portion 38 of the bracket adjacent the flank 36 may be provided with a scale 39 opposite a mark 40 on a flat face portion 40' of the periphery of ring 33 to indicate the peripheral position of the shank 24 in the sleeve 22. Means may be

provided to resist an undesired turning of ring **33**. For this purpose, a resilient piece **90** may be fixed to the bracket by means of a screw **91** so as to bear sideways against the ring in order to resist by friction a certain torque to which the ring may be subjected. Another recess **41** on the other side of the portion **38** accommodates a nut **42** which engages the thread **31** of the shank **24**. This nut has also a knurled periphery **43**, and, furthermore, a portion **44** of a reduced diameter with a scale **45** thereon. The nut is confined in the axial direction by flank **46** of the bracket portion **38** and flank **47** of an end portion **48** of the bracket. The portion **48** is provided with a bore **49** through which the rear portion of shank **24** extends, and is further provided with a mark **50** adjacent the scale **45**. Another nut **51** with a wing or arm extension **52** forming a grip is screwed on the ultimate end of shaft **24** and bears against the end face of the bracket portion **48** to secure the shaft relatively to the nut **42**.

An L-shaped piece **55** with a bore **56** through one of its legs is fixed to the front end **57** of the shank **24** by means of a pin **58**. The other leg of piece **55** is also provided with a bore **59** in which a pivot pin **60** with axis *c—c* is fastened by means of a nut **61** so as to project with a headed portion **62** at right angles to the shank axis *b—b*. Both the axis *c—c* and the axis *b—b* define a plane which is turnable about the last mentioned axis. A bearing sleeve **63** is mounted on portion **62**, and a roller **64** which constitutes the pitching roller is freely rotatable on sleeve **63**. Roller **64** has a substantially roof-shaped periphery **65** of a preferably 60° angle in cross-section for a reason to be explained hereinafter. The arrangement is preferably such that regardless how the L-shaped member **55** is turned about the shank axis *b—b*, the latter always coincides with a maximum diameter of the roller **64**, i. e. a diameter through extreme opposite points of the roof-shaped periphery, and intersects the coil axis at right angles.

Now it will be clear that, after the nut **51** and the screws **28** have been loosened, the shank **24** can be turned by turning the knurled ring **33**, thereby changing the inclination of the plane of the roller **64**. This turning does not change the relative position of the shank **24** and nut **42** wherefore no shift in the axial direction occurs. On the other hand, if the ring **33** is held stationary in relation to the bracket either by hand or owing to the frictional resistance set up by the piece **90**, while simultaneously nut **42** is turned the shank and, thus, roller **64** will be moved axially back or forward, as the case may be, without turning the shank. Marking lines **70** on shank **24** may be read against the bracket edge **71** to define the axial position of the shank and the pitching roller.

It is further to be noted, that the continuation of the axis *b—b* should intersect the coil axis at right angles and the coil periphery in a point A exactly or at least approximately in the middle between two adjacent coil convolutions. This requires that the coil is held at a predetermined level at least as to the cross-section where the pitching tool operates. Means to accomplish this will be described hereinafter. However, point A also varies with the thickness of the coiled wire as to its distance from the coiling roller **11** and thus, as to its distance *d* from the frame plate **10** or from its face of attachment **100**. Even with a wire with a given thickness it will be difficult to predetermine at what distance the point A will be actually located. In consequence, it is advisable to make the distance of the axis *b—b* from the frame plate adjustable within the limits of the thickness of the thickest coil wire to which the pitching device is to be applied. For this purpose, the bracket **16** of the illustrated embodiment is made of two pieces **101** and **102**. Piece **101** is of rectangular cross-section and affixed to the frame plate by means of the aforementioned screws **19** and **20**. It is further provided with two oblong bores **103** (Fig. 6) in planes at right angles to the plane in which the screws **19** and **20** are located, so that the shaft **105** of a screw **106** can be shifted in the hole **103** engaged by it, closer to or more away from the plate **10**. The screws **106** engage with their threaded end portions **107** in internal threads **108** in the bracket part **102** which comprises the aforementioned parts **22**, **26**, **27**, **38** and **48**. Thus, the bracket part **102** and with it axis *b—b* can be adjusted as to their distance from the frame plate **10** or face **100** as far as the longitudinal extension of the bores **103** allows. In order to ensure parallelism of the parts **101** and **102**, a key **120'** is provided which engages in grooves **121'** and **122'** in parts **101** and **102** as clearly shown in Figs. 2 and 4.

The other bracket **15** secured to the frame plate **10** by screws **17** and **18** has a fork-shaped portion **80** which projects towards the bracket **16**. A substantially triangular piece **81** engages with its one corner portion between the fork-forming portions **82** and **83** and is pivoted on a pin **84** extending through these portions. The opposite corners of the piece **81** carry pivot pins **85** and **86**, respectively, on which supporting rollers **87** and **88**, respectively, are rotatably mounted with antifriction bearing **89**. The rollers **87** and **88** have flat outer surfaces, and are so located that they are opposite the periphery **65** of the pitching roller **64** regardless of the distance *d* to which the *axis b—b* is adjusted. Hence, the rollers **64**, **87** and **88** form for the coil a passage with a cross-section in a plane with which the axis *b—b* coincides and which is at right angles to the axis *a—a* However, it is essential that the axis of the pivot pin **84** is at right angles to the axis *b—b* so that the thrust from roller **65** does not produce a turning moment.

In using the device according to the invention, the brackets **15** and **16** are fixed in such a position relatively to a continuous coil **13** which moves in the direction of arrow *a'*, that rollers **87** and **88** can rotate in a plane at right angles to that direction while the coil bears sideways against the rollers, and that the pitching roller **64** can engage the coil substantially at the point A. No great difficulties will be encountered in correctly positioning the brackets **15** and **16** as the closely wound coil is released from the coiling machine in a very definite position and behaves almost like a rigid body. The fine adjustment of the pitching device will be accomplished at the bracket **16**. After the part **101** has been secured to the frame plate **10** and screws **106** are loosened, part **102** will be so set that the axis *b—b* is spaced the correct distance *d* from the plate **10** whereupon screws **106** will be tightened.

Thereafter, the pitching roller will be so shifted in the direction of the axis *b—b* as hereinbefore described that the roof-shaped periphery **65** of roller **64** engages between two adjacent convolutions of the coil. In adjusting roller **64**, the roller plane will be so inclined that it coincides with the tangent to the desired coil helix at the point of engagement A of the roller, and the roller will be so far projected that the roof-shaped periphery urges the convolutions as far apart as commensurate with the desired pitch. The rollers **87** and **88** act as supporting rollers to take up the thrust from the pitching roller. Owing to the fact that the carrier **81** of rollers **87** and **88** is pivoted at **84**, these rollers will automatically take the proper position relatively to the location of the coil axis *a—a*.

The proper operation of the device requires, as stated hereinbefore, that the coil progresses helically, this means lengthwise in the direction of the arrow *a'* and simultaneously turning about its axis as indicated by the arrow *a''*. This is the manner in which the continuous coil is formed and delivered by the coiling machine so that no additional means are required if the device according to the invention is an integral part of or attached to the coiling machine as shown. Otherwise suitable feeding means should be provided and applied e. g. in order to move a prefabricated coil wound with convolutions which are not or insufficiently spaced from one another in the required manner and to lead it between the supporting rollers **87**

and 88 and the pitching roller 64. Such feeding means is diagrammatically illustrated in Fig. 9. According to this figure, the closely wound coil taken from a stock not shown is engaged by a pitching roller 65 of the type hereinbefore described. Opposite the pitching roller 65 two back-up rollers 150 are arranged which are engaged and turned both in the same direction by a drive gear 151 rotated by any suitable prime moving means not shown. In consequence, the driven backup rollers will take the coil along by turning it about its axis, and owing to the fact that the pitching roller engages between two adjacent convolutions, the coil will be caused to perform a helical movement while simultaneously the pitching roller spreads the convolutions apart as desired. Of course, any other suitable means may be used for the indicated purpose.

It has been stated that the preferred angle of the periphery of the pitching roller is 60°. This angle is so selected as the device, according to the invention, is essentially destined for use in the manufacture of screw thread wire coil inserts where, in most instances, the wire cross-section has an outer angle of 60°. However, it is to be understood that the same pitching roller can also be used for coils having other wire cross-sections, and that the device is also advantageously applicable to wire coils other than screw thread inserts, wherever exactness of the pitch within narrow tolerances is required.

Figs. 7 and 8 show a modification which differs from the precedingly described embodiment in that the brackets carrying the rollers are not directly attached to a frame plate of a coiling machine, but are secured to a base plate. This structure renders it possible to secure the pitching device as a unit to a coiling machine or even to use the pitching device independently from such machine if it is e. g. intended to increase the pitch of a pre-fabricated coil. In this modification the base plate is denoted by 120. It is substantially of U-shape in the plan view of Fig. 8 so that there is a deep recess 121 between the portions 122 and 123 in order to provide for the required space for the operation of pitching roller and supporting rollers of the type shown in Figs. 1 to 6. The portions 122 and 123 may be provided with downwardly extending flanges 124 and 125, respectively, which may be secured to a suitable wall such as the frame plate 10 e. g. by screws for which holes are indicated at 126. The portion 123 is provided with holes 127 for screws to secure the bracket 15 of Figs. 1 to 6 thereto. The plate portion 122 is also provided with screw holes 128 which, however, are oblong similarly to the holes 103 in Fig. 6.

To the plate portion 122, a bracket part 102′ is secured which, except for the reinforced portion 129, is similar to the bracket 102. Screws 130 extend through the holes 128 and engage in threaded bores 131 of the bracket portion 102′. Thus, the bracket portion 102′ and with it the shank 24 can be adjusted as to their spacing from the faces 132 of the flanges 124 and 125 which are located in one plane. In all other respects the modification of Figs. 7 and 8 is similar to the embodiment illustrated in Figs. 1 to 6. In this modification brackets 15 and 102′ together with the base plate 120 constitute a unit which as such may be attached to or used independently from a coiling machine.

It will be apparent to those skilled in the art that many alterations and modifications of the structure shown and hereinbefore described can be made without departure from the essence and spirit of the invention which for that reason shall not be limited but by the scope of the appended claims.

I claim:

1. In a coiling machine including elements for forming from a wire stock, a continuous coil progressing from said elements in the direction of the coil axis and rotating during its progression, a device for applying a predetermined pitch to the progressing coil, said device comprising a pair of supporting rollers rotatable in a plane at right angles to said axis and pivoted so as to bear against the progressing coil at spaced peripheral portions thereof, a pitching roller having a substantially roof-shaped periphery and being adapted to engage with said roof-shaped periphery between two adjacent coil convolutions diametrically opposite a point intermediate of said supporting rollers, a pivot pin for said pitching roller, a holder for said pivot pin including a shank, a bearing for said shank in a stationary part of said device, said shank being peripherally adjustable in said bearing, the axis of said shank passing through the center of the outermost periphery of said pitching roller, and means for adjusting the spacing of the pitching roller axis from said coil axis.

2. A pitching device attachable to a coiling machine including elements for forming, from a wire stock, a continuous coil progressing from said elements in the direction of the coil axis and rotating about said axis during its progression, said device comprising a first and a second bracket adapted to be secured to a stationary part of said machine, two supporting rollers carried by said first bracket and rotatable in a plane at right angles to said coil axis and pivoted so as to bear against the progressing coil at spaced peripheral portions thereof, a pitching roller carried by said second bracket and having a substantially roof-shaped periphery and being adapted to engage with said roof-shaped periphery between two adjacent coil convolutions diametrically opposite a point intermediate of said supporting rollers, a pivot pin for said pitching roller, a holder including a shank for said pivot pin, a bearing for said shank in said second bracket, said shank being peripherally adjustable in said bearing, the axis of said shank passing through the center of the outermost periphery of said pitching roller, and means for adjusting the spacing of the pitching roller axis from said coil axis.

3. A pitching device for a wire coil progressing in the direction of and simultaneously turning about the coil axis, comprising two supporting rollers and a pitching roller having a roof-shaped periphery opposite said supporting rollers so as to define a passage for said coil between said three rollers in a plane at right angles to said coil axis, a first bracket laterally of said passage and carrying said supporting rollers freely rotatable, a second bracket laterally on the other side of said passage, means to secure said brackets stationarily in relation to each other, a pivot pin for said pitching roller, a holder for said pivot pin including a shank having an axis coincident with the plane of said passage and passing through the center of the outermost periphery of said pitching roller, a bearing formed in said second bracket in which said shank is movable, means to shift said shank along its axis, a member turnable in said bracket but held therein immovable in the direction of said shank axis, said shank being connected to said member for common rotation but free therefrom in the axial direction, and means to secure said shank in an adjusted peripheral and axial position.

4. A pitching device for a continuous wire coil progressing in the direction of and simultaneously turning about the coil axis, two supporting rollers and a pitching roller having a substantially roof-shaped periphery opposite said supporting rollers so as to define a passage for said coil between said rollers, a first bracket laterally of said passage and carrying said supporting rollers freely rotatable, a second bracket laterally on the other side of said passage opposite said supporting rollers, means to secure said brackets stationarily in relation to each other, said second bracket forming at its end adjacent said passage a bearing having its axis at right angles to and in substantially one plane with the axis of said coil passage, said second bracket having two recesses between said bearing and the other end of said second bracket, a shank

rotatable and axially movable in said bearing and extending through said recesses, a pivot for said pitching roller rigidly connected to the forward shank end projecting from said bearing to said passage, said shank provided with a longitudinal groove in the forward portion and with a screw thread in the rear portion, a ring laterally confined in the first one of said recesses and splined to the grooved shank portion for common rotation with freedom of the shank to move in the axial direction, a nut on said threaded shank portion and confined in said second recess against axial movement, and means to secure said shank in an adjusted position.

5. A device as claimed in claim 3, said holder comprising an L-shaped body and a shank, the pivot pin of said pitching roller being secured to the free end portion of the one leg of said body so as to extend substantially parallel to and towards the same side as the second leg of said body, and said shank extending from the free end portion of said other leg away from said first leg with its axis intersecting the axis of said pivot pin at right angles and coinciding with the plane of the maximum periphery of said pitching roller.

6. A device as claimed in claim 3, said second bracket

comprising two parts, the first one of said bracket parts being adapted to be secured stationarily in relation to said first bracket, said second part including said bearing and being adjustable with respect to said first part in a direction at right angles to said plane of said passage, and means in engagement with said first and said second part to ensure a shift of said shank parallel to itself during an adjustment of said second part, and means to secure said second part to said first part in an adjusted position.

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