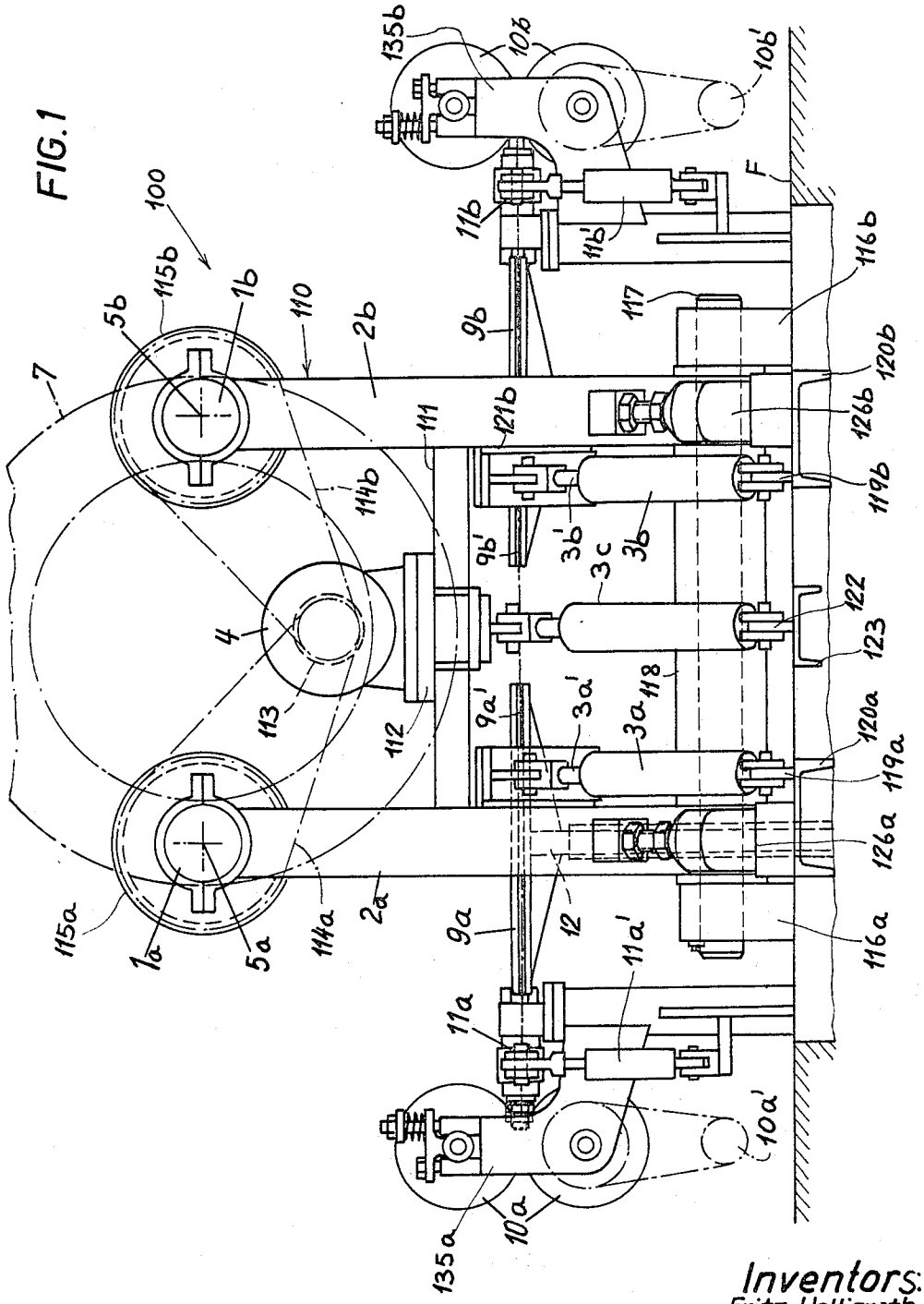
May 21, 1968 F. HELLIGRATH ET AL 3,384,006

COIL BINDER

Filed April 18, 1966 4 Sheets-Sheet 1

FIG. 1



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COIL BINDER

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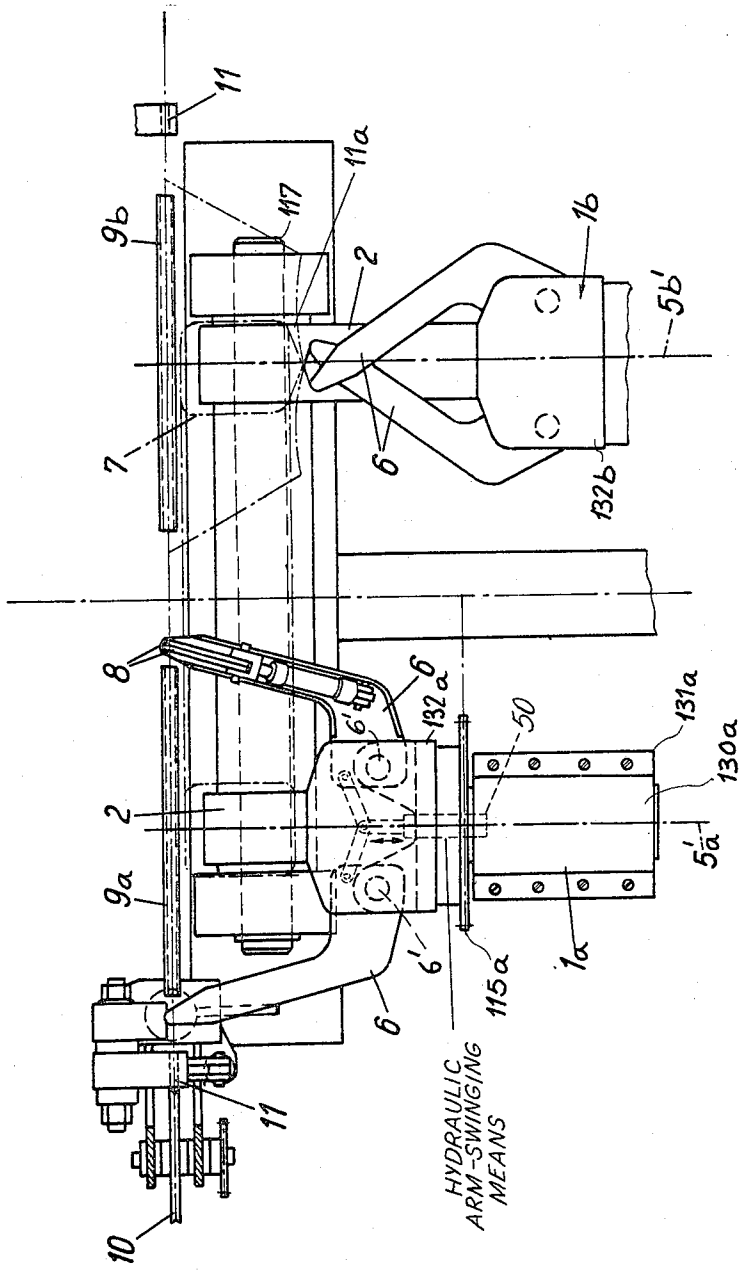
FIG. 2



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COIL BINDER

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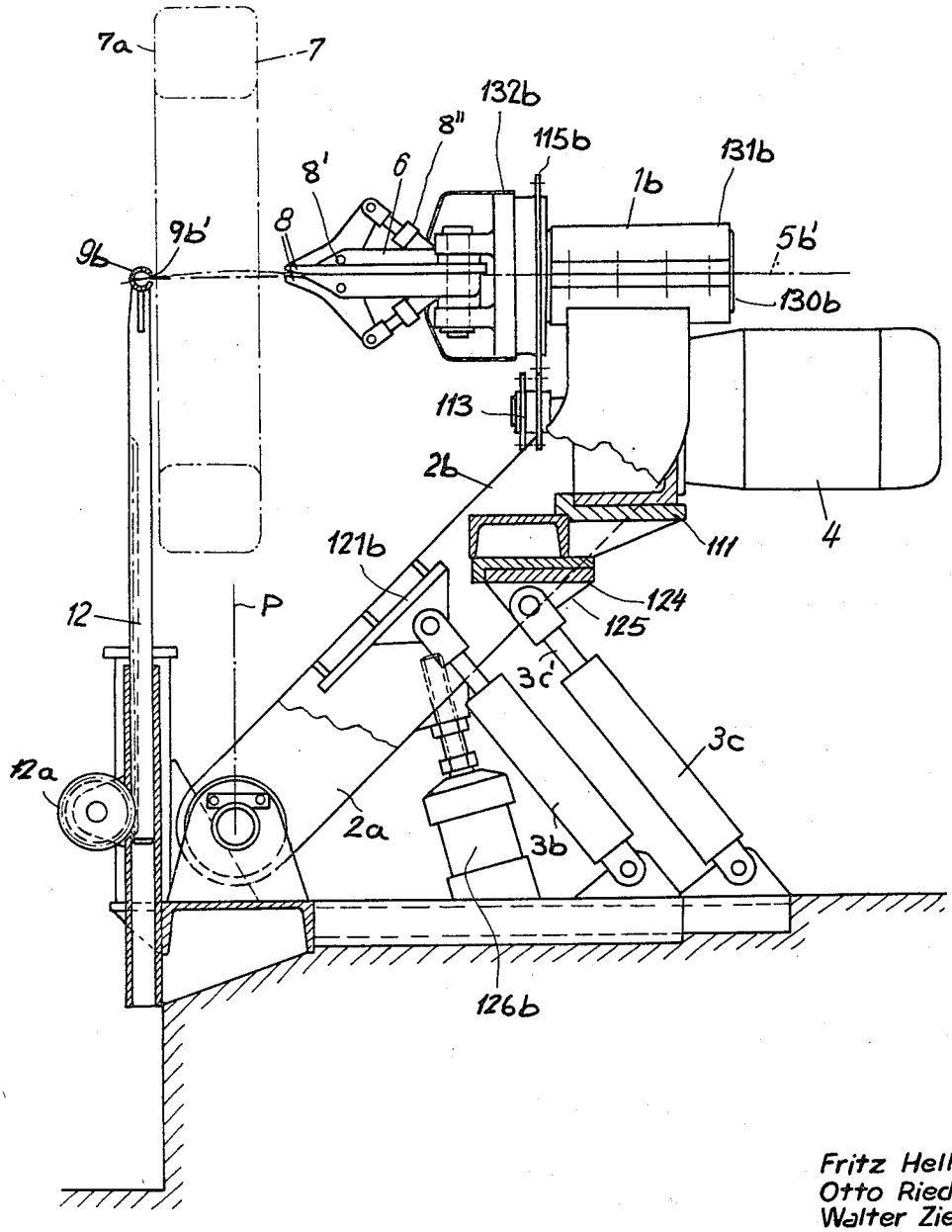
FIG. 3



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COIL BINDER

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FIG. 4

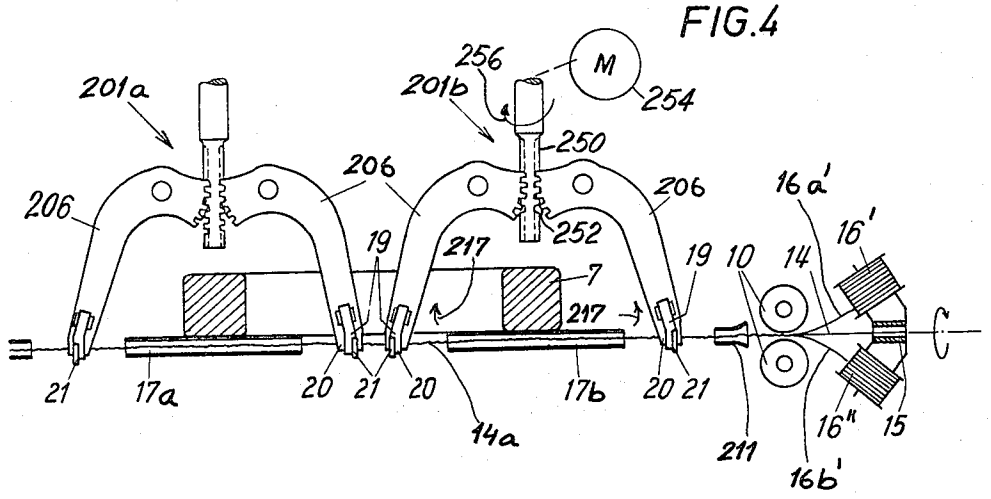


FIG. 6

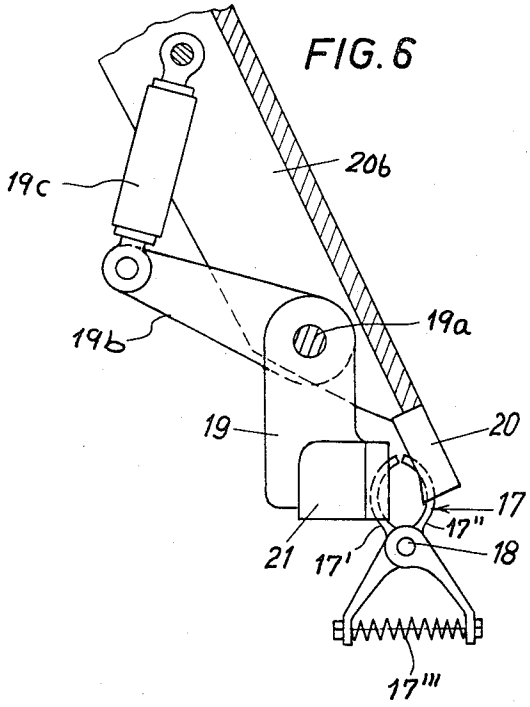
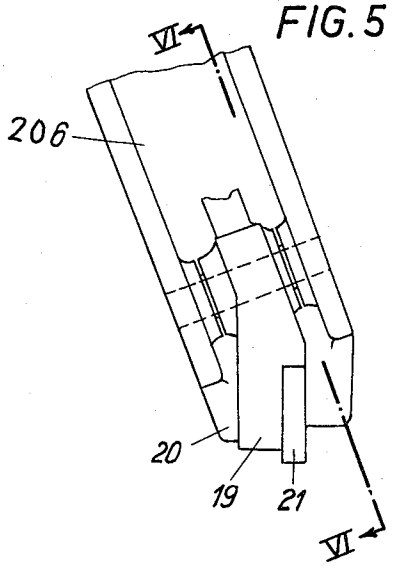


FIG. 5



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3,384,006

COIL BINDER

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Claims priority, application Germany, Apr. 30, 1965, B 81,688
8 Claims. (Cl. 100—10)

ABSTRACT OF THE DISCLOSURE

A coil-tying device wherein the binder tongs are supplied with a binder wire and are pivotally mounted upon a rotatable support and have cutters adapted to sever lengths of the binder wire which is guided through tubes between the binder tongs, the pairs of tongs being swingable on an arm jointly toward and away from the coil of wire.

Our present invention relates to a device for the binding of coils of wires with elongated tie elements such as tie wires into compacted packages with the aid of binder tongs adapted to affix the ends of a binder wire about the coil.

It has been proposed heretofore to provide binder-tong arrangements of this general type (i.e. wherein the binder tongs are adapted to draw a tie wire around the coil and, for the most part, the binder tongs co-operate with clamping means or the like to compact the turns of the coils and the strands thereof during the binding operation. While it has been proposed to accelerate and simplify the binding operation by the provision of binder tongs of certain constructions designed to effect a compaction of the coil concurrently with tying or with the aid of the tie wire stretched therearound. Most systems are relatively slow and unreliable.

It is, therefore, the principal object of the present invention to provide an improved device for the tying of wire coils with binder elements such as tie wires which operates in a simplified manner by comparison with earlier systems, is free from breakdowns and requires a minimum of attention and supervision.

A further object of this invention is to provide a binder device for tying wire coils which is capable of accelerating the coil-tying process.

These objects and others which will become apparent hereinafter, are attained in accordance with the present invention, by the provision of two pairs of binder tongs having respective axes generally parallel to the axis of the coil and parallel to one another for joint displacement relatively to the wire coil and to a tie-wire feed means at opposite sides of the coil. This arrangement, wherein the pairs of binder tongs are displaceable toward and away from the coil to engage the tie wires, draw them around the coil at these diametrically opposite locations and twist or otherwise fasten the respective ends of the wires, has the advantage that the coil is bound at diametrically opposite locations simultaneously and that the apparatus is greatly simplified by the use of a common swingable support means for both sets of binder tongs. Thus, in accordance with the principles of the present invention, the swingable support for the binder tongs is pivotally mounted for displacement about an axis parallel to the plane of the axis of the binder tongs and the plane of the coil to advance the pairs of binder tongs toward and away from the latter. A coil-binding operation can then be effected in a single step. The fastening operation can be carried out by rotating the pairs of binder tongs about their respective axes to twist

the ends of the tie wires together or by welding these ends to one another with the aid of electrodes carried by the arms of the binder tongs. For the twisting action, the pairs of binder arms are advantageously provided with respective shafts extending generally perpendicularly to the plane of the coil and parallel to one another and connected via suitable transmissions to a common drive mechanism. This arrangement ensures a simplicity of construction and operation, especially when the common support for the pairs of binder tongs also carries a drive motor for rotating the shafts of these arms and intertwining the ends of the respective tie wires. It has been found to be of special advantage to form the arms of each pair of binder tongs so that they overlap or crossover in the closed position, especially when each arm is provided with a clamping device for gripping the respective end of the tie wire. Thus, prior to rotation of the pairs of binder tongs about their respective axes, the ends of the tie wire held by the arms of each pair of tongs are closed to facilitate the twining operation. The twist imparted to the ends of the tie wires is thus relatively neat and free from difficulties.

According to a further feature of this invention, the feed means for supplying the tie wires to the respective pairs of binder tongs are constituted by a pair of linearly extending guides which define paths for the respective length of the tie wire parallel to the plane of the coil and perpendicular to the axes of the pairs of binder tongs and thus also parallel to the axes about which the support means for the pair of binder tongs is swingable. The guide path for the tie wires can thus lie along a diameter of the coil and can consist of two guides adapted to feed respective lengths of the tie wire from opposite sides of the coil along a common diameter thereof, corresponding to the intersection of the plane through the axes of the binder-tong shafts and a plane parallel to the coil. Each of the tubular guides can be aligned with the respective pair of binder tongs and is advantageously slotted or open longitudinally in the direction of the binder tongs whereby the arms thereof can seize the respective length of the tie wire and draw them around corresponding but diametrically opposite portions of the coil. The guide tubes are advantageously disposed just behind the coil to facilitate the grasping of the tie wires by the arms of the binder tongs.

Each of the guide tubes is provided, in accordance with this invention, with means for advancing the respective tie wires therethrough, the guide tubes being spaced apart so that respective arms of the binder tong can engage the free extremities of the tie wires as they emerge from the respective tubes longitudinally within the window defined by the interior of the coil. The feed means is, moreover, provided with means (e.g. for raising and lowering the guides) whereby the other arms of each pair of binder tongs can engage the corresponding end of the tie wire. The guides are, moreover, preferably disposed at a receiving surface for the coils so that they lie against the rear surface of a coil to be tied opposite that side of the coil upon which the binder tongs are disposed. This arrangement has been found to greatly facilitate the supply of the tie wire to the binder tongs when the latter must, as a consequence of the cross-sectional area or width of the region of the coil to be tied, be open to such extent that the coplanarity of the tongs would be affected.

According to a further feature of this invention, the tie-wire guide means comprises a pair of half shells spring-loaded against one another and coupled together via swinging or pivoted links so that the link axes are parallel to the tie wire and the guide path thereof. The spring-loaded half shells permit the automatic removal of the tie wire by the binder tongs and also allow the length of binder wire to be severed from a supply coil with the aid of clamping and/or cutting means upon the binder arms. Thus, in accordance with this invention, each of the arms of the binder tongs are provided with a pair of clamping

jaws engageable with the respective ends of the tie wire and cutting surfaces outwardly of these clamping jaws at least on the side of the guide path proximal to the supply reel for severing the length of wire for the particular binding operation. The provision of the cutting means upon the clamping jaws of the binder tongs ensures that bending of the wire during a severing operation will be minimized and, if it occurs, cannot influence the twisting or tying step. Moreover, the length of the tie wire is always determined by the opening of the binder arms and thus corresponds to the length of the tie wire required for the particular operation.

Still another feature of the present invention resides in the provision of a plurality of supply reels for at least two tie-wire strands which, rearwardly of the guide tube, are twisted together in order to strengthen the binder element used for tying the coil and constituting same of a plurality of strands. For this purpose, the plurality of supply reels, which can thus supply relatively thin and weak strands, can be spun upon a common holder about an axis centered on the feed path to yield a twisted tie wire on increased tensile strength, bending resistance, etc.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a front-elevational view, partly in diagrammatic form, of a wire-tying device in accordance with the present invention;

FIG. 2 is a plan view of the device, partly broken away;

FIG. 3 is a side-elevational view, partly broken away and partly in section of the apparatus of FIGS. 1 and 2;

FIG. 4 is a diagram of the binder tongs of a modified coil-tying device with the coil in a horizontal or prone position;

FIG. 5 is an enlarged detail view of the clamping portion of one of the binder arms of the device of FIG. 4; and

FIG. 6 is a view taken generally along the line VI—VI of FIG. 5.

In FIGS. 1–3, we show a coil-tying device **100**, comprising a pair of binder-tong arrangements **1***a* and **1***b* mounted upon a common support **110**, comprising a pair of upright arms **2***a* and **2***b* respectively carrying the binder tongs **1***a* and **1***b* at their upper ends and connected together by a cross bar **111** forming a pedestal **112** for a motor **4** whose drive pulley **113** is connected by belts **114***a* and **114***b* with the driven pulleys **115***a* and **115***b* of the shafts **5***a* and **5***b* of the respective binder tongs whose axes are represented at **5***a'* and **5***b'* in FIGS. 2 and 3. The support **110** is swingably mounted via its arms **2***a* and **2***b* between a pair of trunnions **116***a* and **116***b* via the pin **117** extending in a plane P (FIG. 3) of the coil **7** which is held in place by support means not shown. Such support means can consist of a clamping device or hanging conveyor from which the coil **7** is suspended from above so that its rear surface **7***a* lies against the guide tubes **9***a* and **9***b* (FIGS. 2 and 3) which are described in greater detail hereinafter. The arms **2***a* and **2***b* are interconnected between the trunnions **116***a* and **116***b* via a sleeve **118** through which the pin **117** passes.

The means for displacing the support **110** and the binder tongs **1***a* and **1***b* carried thereby includes a pair of hydraulic cylinders **3***a* and **3***b* respectively hinged at their lower extremities to lugs **119***a* and **119***b* of channel irons **120***a* and **120***b* embedded in the foundation F of the device. The pistons **3***a'* and **3***b'* of the hydraulic cylinders **3***a* and **3***b* are pivotally connected to plates **121***a*, **121***b* fixed to the arms **2***a* and **2***b* (FIGS. 1 and 3) while a further hydraulic cylinder **3***c* is swingably mounted at **122** to a channel iron **123** disposed between the channel irons **120***a* and **120***b* in the foundation F of the device. A connection plate **124** depends from the cross bar **111** and is formed with a lug **125** to which the piston rod **3***c'* is articulated. Fluid-operated dampers **126***a* and **126***b* support the arms **2***a* and **2***b* against clockwise movement (FIG. 3) during the return stroke of the device.

Referring now to FIGS. 2 and 3, it will be seen that each of the binder tongs **1***a* and **1***b* comprises a respective shaft **130***a* and **130***b* received rotatably in respective bearings **131***a* and **131***b* and carrying the pulleys **115***a* and **115***b* respectively. The pulleys **115***a* and **115***b* are each mounted upon a rotatable head **132***a*, **132***b* in which the arms of the binder tongs are pivotally mounted. Thus, the binder-tong arms, represented generally at **6**, are each swingably connected at **6'** to the respective head and, as indicated at the right-hand side in FIG. 2, showing the outlines of these arms, can overlap in their closed condition to cross the binder wire **14***a* prior to the twisting operation. Upon the upper side of one of the arms **6'** and the underside of the other arm of each of the binder tongs, we provide clamping jaws **8** which are articulated to the respective arm **6** at pivots **8'** and co-operate with the tips of these arms so that the latter constitute the counterjaws of a pincer-type clamping device. The jaws **8** are actuated by hydraulic cylinders **8''** carried by the arms and may be formed with cutting edges as described in greater detail in FIGS. 4–6. The arm **6** can be swung by a rack or worm arrangement (see FIGS. 4–6 wherein a worm **250**, driven at **254** by conventional means, meshes with rack teeth **252** of the arms **206** and, upon rotation of the worm (arrow **256**) swings the arms) or via hydraulic means **50** as desired about their respective pivots **6'**.

The tie-wire feed system comprises a pair of channel-shaped guide tubes **9***a* and **9***b* open in the direction of the respective binder tongs **1***a* and **1***b* and lying along the rear surface **7***a* of the coil **7**. The tubes **9***a* and **9***b*, which are mutually aligned, are thus disposed along an axis of the coil **7** and are parallel to the pivot shaft **117** but perpendicular to the axes **5***a* and **5***b* of the binder tongs **1***a* and **1***b*. The tie wires are supplied to the tubes **9***a* and **9***b* whose slots are represented at **9***a'*, **9***b'*, by means of feed rollers **10***a* and **10***b* driven by motors **10***a'* and **10***b'* and carried by supports **135***a* and **135***b*. Between the pairs of drive rollers **10***a*, **10***b* and the respective guide tubes **9***a*, **9***b*, we provide a respective severing arrangement **11***a*, **11***b*. As can be seen in FIG. 1, the severing devices **11***a* and **11***b* are each actuated by a respective hydraulic cylinder **11***a'*, **11***b'* on the respective support **135***a* and **135***b*.

The rollers **10***a* and **10***b* advance the respective tie wires from suitable reels (not shown) through the respective guide tubes **9***a* and **9***b* until the free ends of these tie wires are exposed centrally of these guide tubes. The wire-feed device is then elevated via a rack **12** and a pinion **12***a* (FIG. 3) until the tubes **9***a* and **9***b* lie along the diameter of the coil **7** (FIG. 3). The support **110** is then advanced by the hydraulic cylinders **3***a*–**3***c* in the counterclockwise direction (FIG. 3) with the binder tongs in their open condition (left-hand side of FIG. 2) until the arms **6** engage the respective tie wires at the opposite ends of the respective guide tubes. The clamps **8** of these arms then grip the tie wires, the severing devices having cut the respective lengths in the lower positions of the guide tubes so that the free ends of the tie wires extend from the tubes when they are elevated and the cutting devices cannot encumber the gripping procedure. With the ends of the respective tie wire grasped by the clamping devices **8**, the support **110** is swung in the clockwise sense (FIG. 3) to draw the tie wires from the respective tubes around the coil **7**. The arms **6** are then closed until they overlap or cross over (right-hand side of FIG. 2) and the pairs of binder tongs are then rotated via motor **4** about the respective axis **5***a'* and **5***b'* to twist the ends of the tie wires. The tubes **9***a* and **9***b* carried by the racks **12** are then lowered to receive fresh lengths of tie wire while the coil **7** can be carried off by an overhead conveyor or the like.

In FIGS. 4–6, we show a modified wire-feed system which, it will be understood, can be used in conjunction with the binder tongs of FIGS. 1–3 and, conversely, a set

of binder tongs which may be employed with the feed device of the latter figures. Thus, it can be seen that the feed device of FIGS. 4–6 comprises a pair of reels **16'** and **16''** from which the strands of the tie wire **16***a'* and **16***b'* are passed between the feed rollers **10** which correspond to the rollers **10***a* and **10***b* of FIGS. 1–3. The reels **16'** and **16''** are rotatable about their respective axes upon a reel carrier **15** which is journaled upon an axis **14** corresponding to the path of the twisted wires. As the strands **16***a'* and **16***b'* are passed between the rollers **10**, they are twisted together and are led by a guide **211** into the tubes **17***a* and **17***b* assigned to the binder tongs **201***a* and **201***b* respectively. The guide tubes **17** (as represented in FIG. 6 for either of the tubes) each include a pair of half-shells **17'** and **17''** in a scissor linkage which are urged toward one another by a spring **17'''**, the half-shell **17'** and **17''** being pivotally connected at **18** for swinging movement parallel to the tie wire **14***a* passing therethrough. The arms **206** of the binder tongs are provided with clamping shoes **19** and **20** engageable with the tie wire **14***a* as indicated in FIG. 4. The clamping shoe **19** which is constituted as a jaw, is swingably mounted upon a pivot **19***a* on the arm **206** and has a level **19***b* coupled with a hydraulic cylinder **19***c* for actuating this jaw. Counterclockwise rotation of the jaw **19** about its pivot **19***a* by the hydraulic cylinder **19***c* brings the jaw **19** toward the counterjaw **20** of the arm for the clamping operation. To sever the desired length of tie wire from the twisted strand **14***a*, each clamp **19**, **20** is provided with a stamping blade **21** outwardly of the respective tube **17***a* or **17***b* and adapted to sever the tie wire just prior to engagement of the jaw **19** and **20** therewith. Thus, the proper length of tie wire is retained between the arms **206** of the binder tongs and can be drawn about the coil **7** without difficulty. The rollers **10** can then advance the twisted strands through the guide tube **17***a* and **17***b* which spring closed after the respective length of tie wire has been withdrawn therefrom in the direction of arrows **217**. The remainder of the tying operation is effected in a manner previously described.

The invention described and illustrated is believed to admit of many modifications within the ability of persons skilled in the art, all such modifications being considered within the spirit and scope of the appended claims.

We claim:

1. A device for tying coils at diametrically opposite locations, comprising:

a support;

two pairs of spaced-apart binder tongs mounted upon said support and adapted to draw respective lengths of tie wire about a coil confronting said binder tongs at diametrically opposite locations of said coil, said pairs of binder tongs having mutually parallel axes generally perpendicular to the plane of said coil;

feed means for supplying respective lengths of tie wire to said binder tongs;

means for advancing said support means and both pairs of binder tongs toward and away from said coil for simultaneous fastening of the respective lengths of tie wire therearound, said pairs of binder tongs having respective shafts rotatable about the respective axes of said binder tongs and at least one pair of openable and closable arms mounted upon each shaft;

common drive means on said support and coupled with said shafts for concurrently rotating same to twist the respective length of tie wires around said coil at said location upon closure of the respective arms, said support including a pivot extending generally parallel to said plane; and further comprising hydraulic means coupled with said support for swinging same about said pivot.

2. A device as defined in claim **1** wherein each of said arms is provided with a respective clamping jaw engageable with the corresponding end of the respective length of tie wire and the arms of each pair of binder tongs are pivotable about mutually parallel axes in overlapping relationship for crossing the respective ends of the respective lengths of tie wire prior to rotation of the respective shaft to twist the ends together.

3. A device as defined in claim **1** wherein said feed means includes at least one guide tube respectively confronting each of said binder tongs and extending perpendicularly to the respective binder-tong axis but parallel to said plane and behind said coil for receiving a respective length of tie wire with the ends thereof projecting beyond each tube for engagement by respective arms of each pair of binder tongs, said tubes having longitudinal outlets for said lengths of tie wire facing said binder tongs, and mechanism for advancing the tie wire through said tubes.

4. A device for tying coils at diametrically opposite locations, comprising:

a support;

two pairs of spaced-apart binder tongs mounted upon said support and adapted to draw respective lengths of tie wire about a coil confronting said binder tongs at diametrically opposite locations of said coil, said pairs of binder tongs having mutually parallel axes generally perpendicular to the plane of said coil;

feed means for supplying respective lengths of tie wire to said binder tongs;

means for advancing said support means and both pairs of binder tongs toward and away from said coil for simultaneous fastening of the respective lengths of tie wire therearound, said pairs of binder tongs having respective shafts rotatable about the respective axes of said binder tongs and at least one pair of openable and closable arms mounted upon each shaft;

common drive means on said support and coupled with said shafts for concurrently rotating same to twist the respective length of tie wires around said coil at said location upon closure of the respective arms, said feed means including at least one guide tube respectively confronting each of said binder tongs and extending perpendicularly to the respective binder-tong axis but parallel to said plane and behind said coil for receiving a respective length of tie wire with the ends thereof projecting beyond each tube for engagement by respective arms of each pair of binder tongs, said tubes having longitudinal outlets for said lengths of tie wire facing said binder tongs, and mechanism for advancing the tie wire through said tubes,

cutting means on each of said arms for severing the respective length of tie wire upon engagement with the wire passing through the respective tube.

5. A device as defined in claim **4** wherein each of said tubes is formed from a pair of half-shells springloaded for closure of the respective outlet.

6. A device for typing coils at diametrically opposite locations, comprising:

a support;

two pairs of spaced-apart binder tongs mounted upon said support and adapted to draw respective lengths of tie wire about a coil confronting said binder tongs at diametrically opposite locations of said coil, said pairs of binder tongs having mutually parallel axes generally perpendicular to the plane of said coil;

feed means for supplying respective lengths of tie wire to said binder tongs;

means for advancing said support means and both pairs of binder tongs toward and away from said coil for simultaneous fastening of the respective lengths of tie wire therearound, said pairs of binder tongs having respective shafts rotatable about the respective axes of said binder tongs and at least one pair of openable and closable arms mounted upon each shaft; and

common drive means on said support and coupled with

said shafts for concurrently rotating same to twist the respective length of tie wires around said coil at said location upon closure of the respective arms, said feed means including at least one guide tube respectively confronting each of said binder tongs and extending perpendicularly to the respective binder-tong axis but parallel to said plane and behind said coil for receiving a respective length of tie wire with the ends thereof projecting beyond each tube for engagement by respective arms of each pair of binder tongs, said tubes having longitudinal outlets for said lengths of tie wire facing said binder tongs, and mechanism for advancing the tie wire through said tubes, said mechanism including at least two reels for respective tie-wire strands, common support means for said reels rotatable about an axis for twisting the strands paid off said reels, and supply means between said reels and said tubes for advancing twisted strands from said reels into said tubes.

7. A device for typing coils at diametrically opposite locations, comprising:

a support;

two pairs of spaced-apart binder tongs mounted upon said support and adapted to draw respective lengths of tie wire about a coil confronting said binder tongs at diametrically opposite locations of said coil, said pairs of binder tongs having mutually parallel axes generally perpendicular to the plane of said coil;

feed means for supplying respective lengths of tie wire to said binder tongs;

means for advancing said support means and both pairs of binder tongs toward and away from said coil for simultaneous fastening of the respective lengths of tie wire therearound, said pairs of binder tongs having respective shafts rotatable about the respective axes of said binder tongs and at least one pair of openable and closable arms mounted upon each shaft;

common drive means on said support and coupled with said shafts for concurrently rotating same to twist the respective length of tie wires around said coil at said location upon closure of the respective arms, said feed means including at least one guide tube respectively confronting each of said binder tongs and extending perpendicularly to the respective binder-tong axis but parallel to said plane and behind said coil for receiving a respective length of tie wire with the ends thereof projecting beyond each tube for engagement by respective arms of each pair of binder tongs, said tubes having longitudinal outlets for said lengths of tie wire facing said binder tongs, and mechanism for advancing the tie wire through said tubes, said mechanism being disposed at a location offset from the regions at which said tongs engage the respective lengths of tie wire; and

means for shifting said tubes between positions of alignment with said mechanism and with the respective tongs.

8. A device for typing coils at diametricaly opposite locations, comprising:

a support;

two pairs of spaced-apart binder tongs mounted upon said support and adapted to draw respective lengths of tie wire about a coil confronting said binder tongs at diametrically opposite locations of said coil, said pairs of binder tongs having mutually parallel axes generally perpendicular to the plane of said coil;

feed means for supplying respective lengths of tie wire to said binder tongs;

means for advancing said support means and both pairs of binder tongs toward and away from said coil for simultaneous fastening of the respective lengths of tie wire therearound, said support comprising a pivot parallel to said plane and disposed in the region thereof, a support member mounted upon said pivot for swinging movement about an axis parallel to said plane and perpendicular to the axes of said binder tongs, hydraulic means for swingably displacing said support member about the axis of said pivot, and bearing means on said support member rotatably receiving said pairs of binder tongs, said pairs of binder tongs having respective shafts journaled in said bearing means;

a drive motor mounted upon said support member;

transmission means respectively coupling said drive motor with said shafts for joint rotation, each of said shafts having a respective head and a pair of binder tong arms carried by the respective head and pivotable thereon about mutually parallel axes for swinging movement thereabout between open positions in which the arms of each head straddle said coil at the respective tying location and closed positions in which the arms of each head are crossed over, said arms each being provided with a respective clamping jaw engageable with a respective extremity of a length of tie wire for drawing same about said coil at the respective tying location, said feed means including a pair of guide tubes open in the direction of the respective pair of binder tongs and disposed behind said coil, said tubes being shiftable from a position wherein they lie substantially along a diameter of said coil connecting said locations into a position in which said tubes are remote from said tying locations; and

mechanism for feeding a tie wire to said tubes at the last-mentioned position thereof.

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