

Dec. 1, 1959

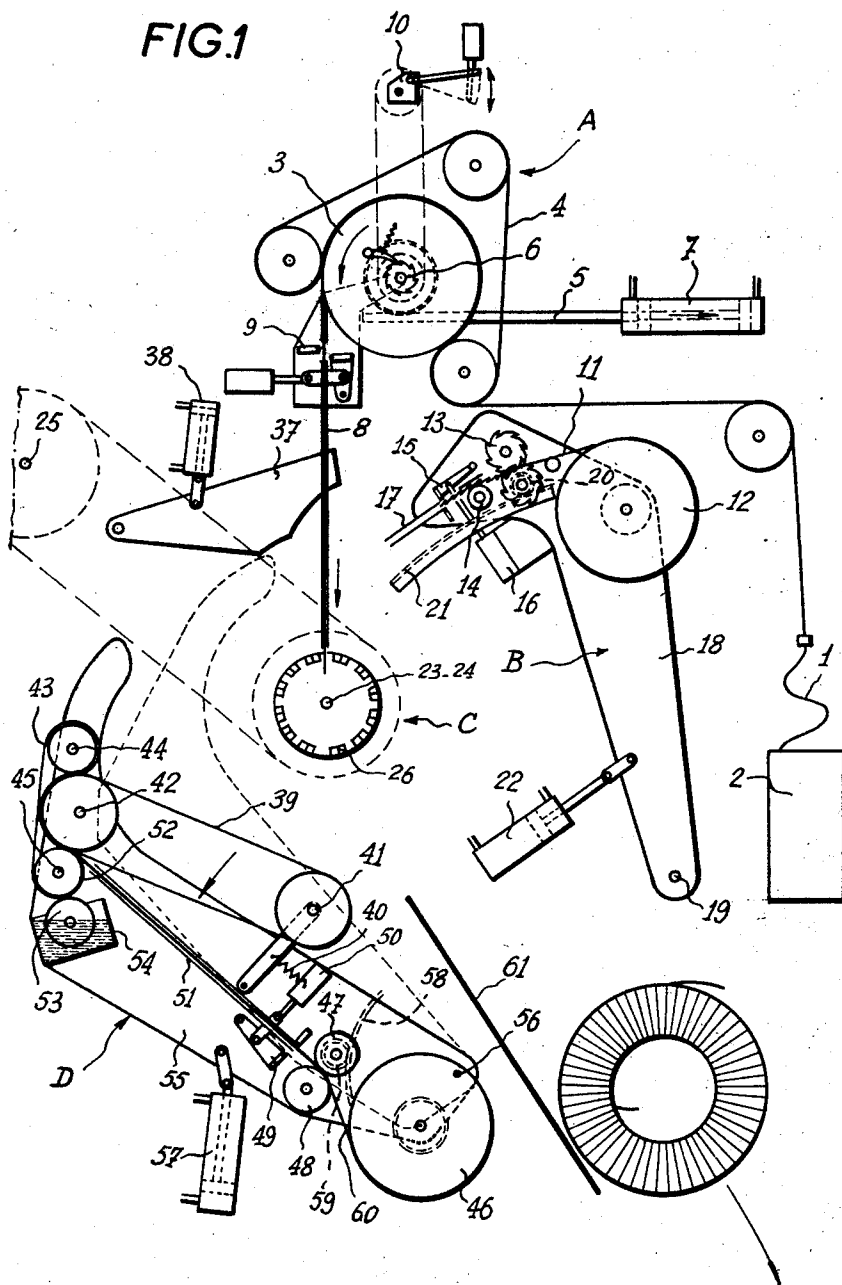
O. HAUGWITZ
MACHINE FOR THE PRODUCTION OF PACKED
COILS OF WIRE AND THE LIKE

2,914,897

Filed Jan. 28, 1957

6 Sheets-Sheet 1

FIG. 1



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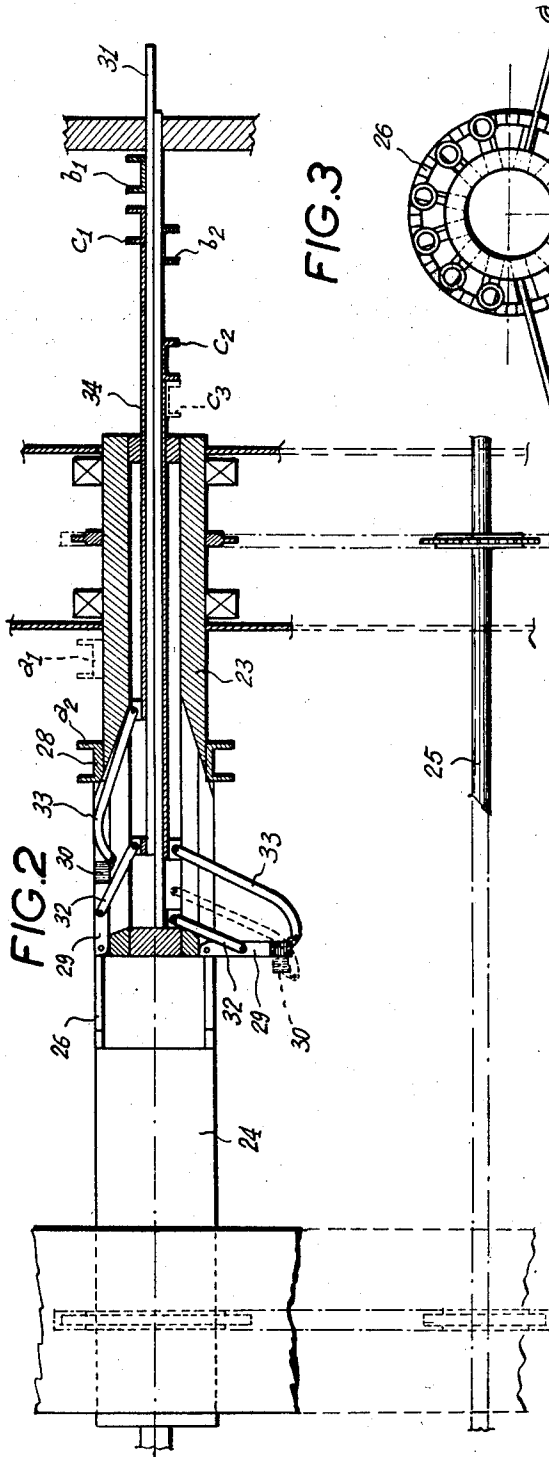
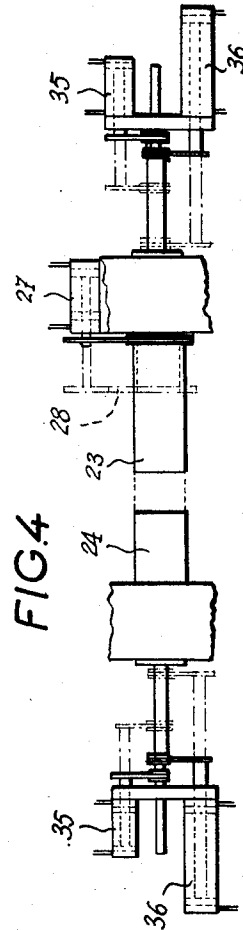
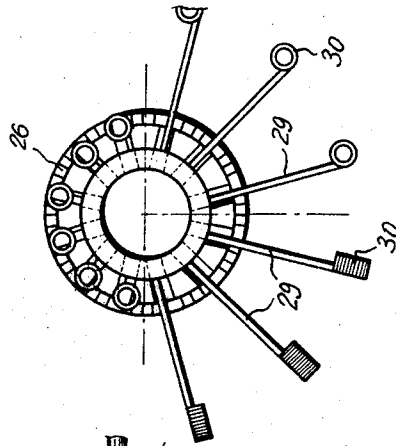


FIG. 3



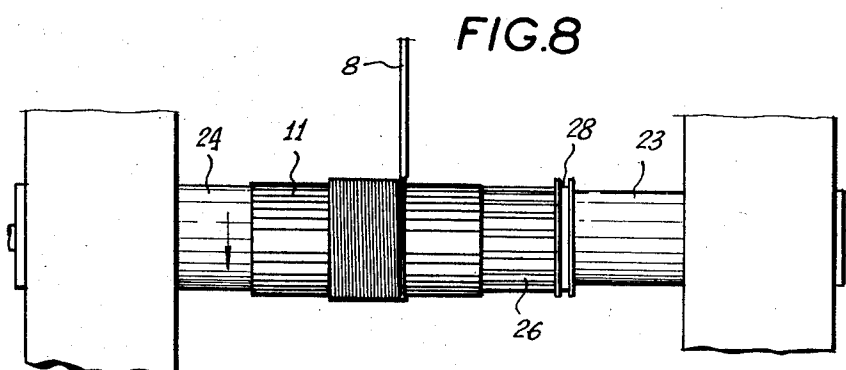
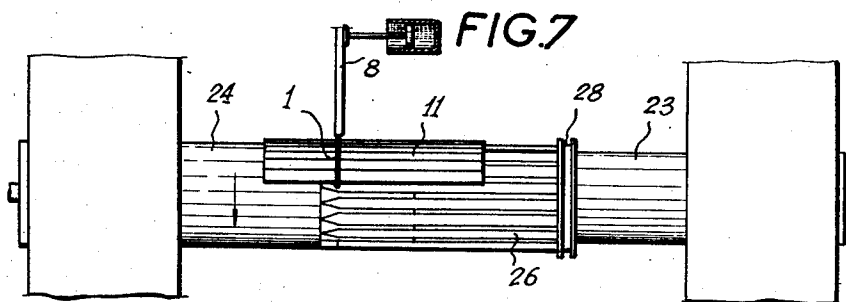
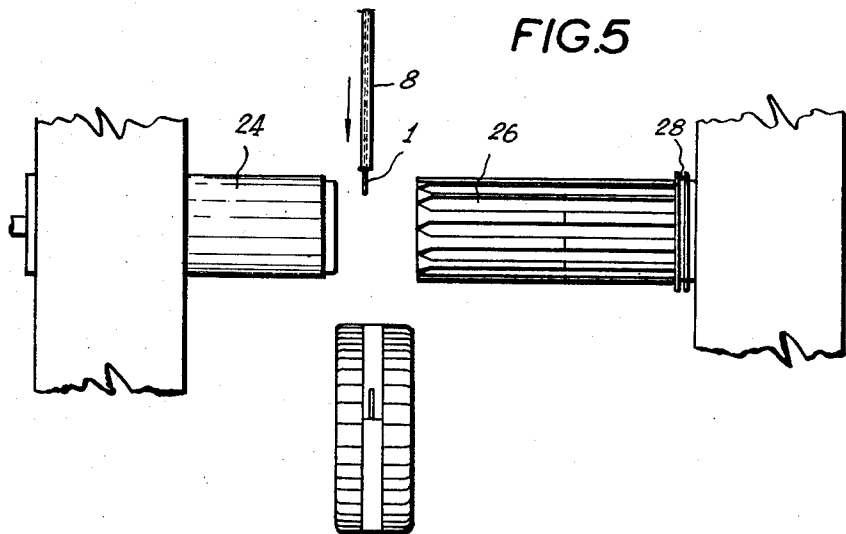
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FIG.6

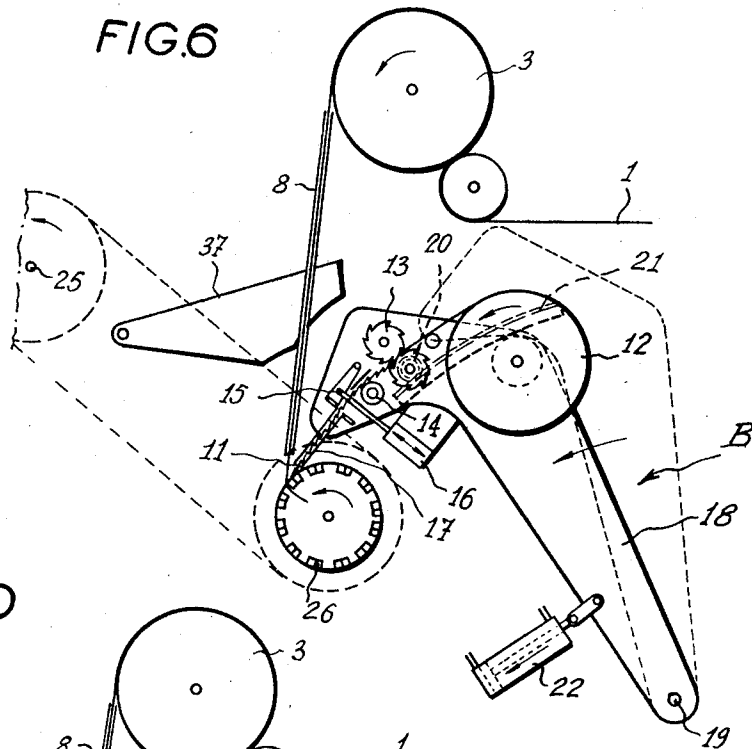
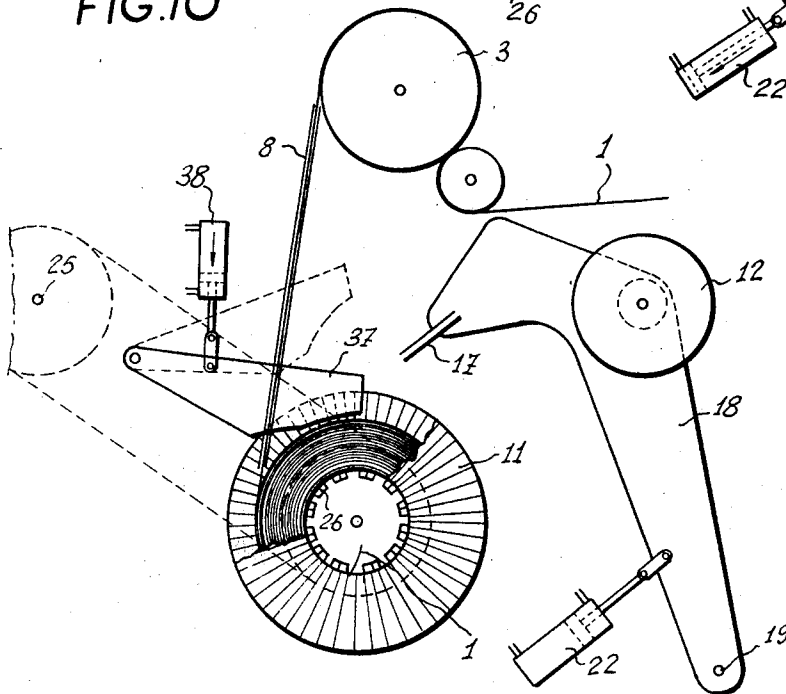


FIG.10



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FIG.9

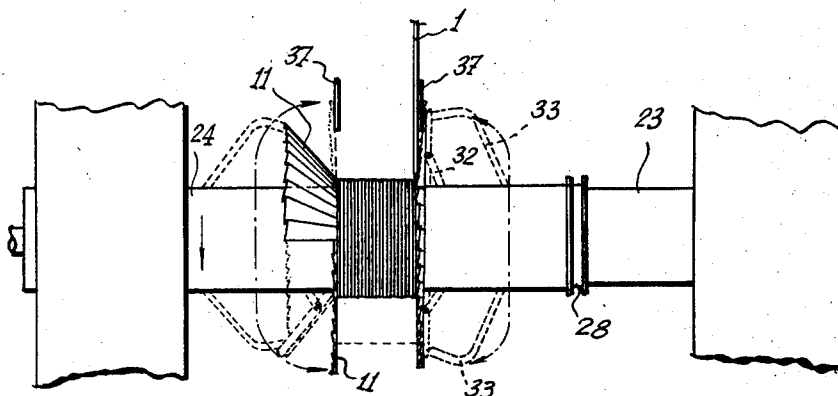
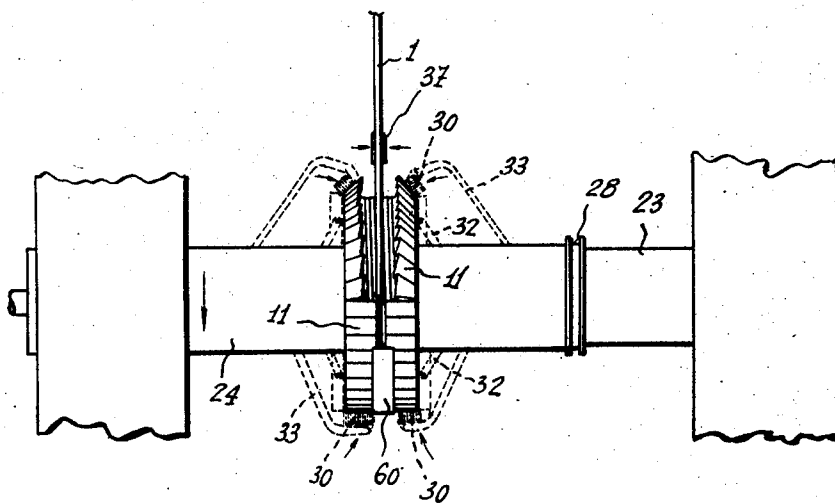


FIG.11



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FIG.13

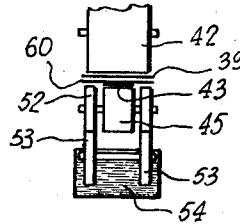
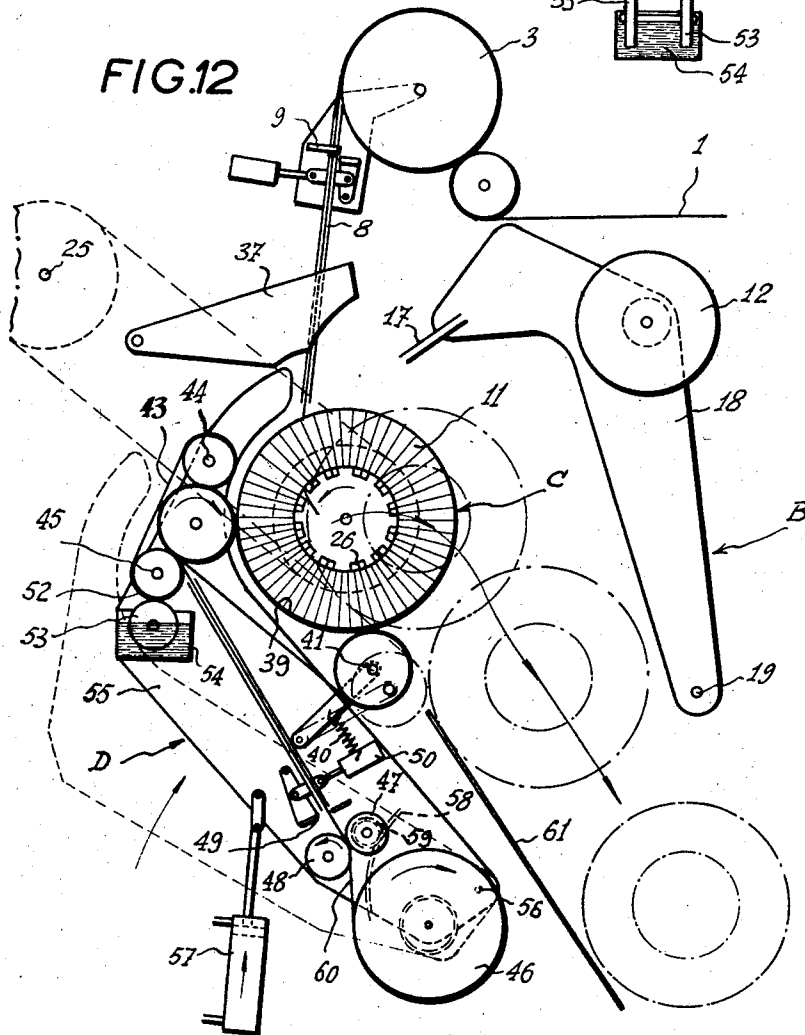


FIG.12



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MACHINE FOR THE PRODUCTION OF PACKED COILS OF WIRE AND THE LIKE

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Application January 28, 1957, Serial No. 636,664

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8 Claims. (Cl. 53—118)

Wires and cables are frequently delivered to the market in the form of coils. Such coils are usually bound at more than one point of the circumference and packed with a tape of e.g. craped paper wound about the coil in overlapping relation. The bonding and frequently also the packing operations are generally performed manually. A drawback of this procedure is that it does not allow fulltime use to be made of the coiling machine owing to the considerable idle periods involved and it requires a continual intervention of manual labour which substantially increases the cost price of the final product.

The present invention sets out to provide a method and machine for automatically manufacturing the final product consisting of a packed coil or hank of wire, cable or similar element, wherein the various functional steps including feeding the element, coiling the element on a support, feeding the appropriately formed packing sheet and applying the latter over the coil, are performed automatically and uninterruptedly by the provision of means for feeding the respective component materials (element to be coiled and packing sheet or the like) over paths which pass through units performing the respective abovementioned functions, the motion of the feeding means being timed with respect to the motions of the function-performing units.

More specifically, the method of the invention may consist of coiling upon a retractible rotary cylinder or mandrel together with the element to be coiled having an end gripped by said rotary cylinder, a packing sheet of appropriate size formed with folds, creases or pleats parallel to the cylinder axis, forcing the ends of said sheet radially outwards after a first layer of the element has been coiled over the sheet so as to provide radial flanges on either side of the coil being formed, then winding a desired length of element at a higher rate, thereafter folding down over the outer surface of the formed coil the extremities of said radial flanges, and finally applying an adhesive tape over the outer circumference of the coil to bond the folded down extremities of the packing sheet.

A machine for automatically performing the sequence of steps according to the above described method may be constructed in a variety of ways, since each elementary step or operation may be carried out by different means. One specific form of embodiment selected from among all the possible embodiments will be described hereinafter by way of a non restrictive example.

In the drawings,

Fig. 1 is a schematic side view of a machine according to the invention;

Fig. 2 shows in detail the coil support or mandrel;

Fig. 3 is a detail of Fig. 2;

Fig. 4 shows the operating means for the elements of Fig. 2;

Figs. 5 to 12 illustrate the same elements as Figs. 1 to 4 in the successive steps of the production of a packed coil of wire; and

Fig. 13 is a detail of Fig. 1.

Referring to Fig. 1, the machine essentially comprises

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four assemblies positioned substantially in a common vertical plane and having their movements correlated with one another by appropriate means. The assembly designated A has as its function to feed the element to be coiled hereinafter called a wire for simplicity. The assembly B has the function of feeding to a coiling assembly C a sheet of packing paper (or other suitable material) suitable conformation. The assembly D serves to bond the packing sheet over a finished coil.

Assembly A (Fig. 1).—The wire 1 to be coiled stored e.g. in a barrel-shaped container 2 is passed through a tension device comprising a grooved pulley 3, the wire being applied against the bottom of the groove of pulley 3 by an endless belt 4. The pulley 3 may be driven by a reciprocating rack 5 cooperating with a free-wheel drive 6 and reciprocated by a compressed-air piston 7. The wire is forced with the assistance of its own weight into and through a guide tube 8 having interposed along its length a cutter device such as shears 9 actuated by a compressed-air piston. A metering device 10 connected to the pulley 3 serves to control the length of wire in each coil. The assembly comprising the wire-feeding device and the wire guide 8 is bodily reciprocated parallel to the axis of pulley 3 so as to impart the desired to-and-fro motion to the wire across the coil, so as to achieve an even distribution of turns. The said assembly moreover may be rocked about the axis of the pulley 1.

Assembly B (Fig. 1).—The device for pleating and feeding the craped paper tape 11 comprises a feed roll 12, a pair of pleater wheels 13 having saw-teeth thereon, a driven roll 14, shears 15 operated by a piston 16, a tape-guide 17 in the form of a projecting beak, all the above components being mounted on a rocking support 18 pivoted at 19. One of the toothed pleater wheels 13 includes a free-wheel hub 20 which meshes with a rack 21 causing the tape to be advanced one step as the support is rocked forwardly but preventing the tape from being displaced with it on the rearward return movement. The motion is imparted by a compressed air piston 22.

Assembly C (Figs. 2, 3 and 4).—This assembly comprises a tubular shaft divided in two sections 23 and 24 coaxially aligned and spaced by a distance corresponding to the thickness of the coil to be made. Both ends of the shaft sections are simultaneously driven from an intermediate shaft 25. Slidably mounted on the section 23 is a sleeve 26 formed with sharp teeth and forming a mandrel in the shape of a squirrel-cage. Reciprocation of the mandrel is produced e.g. by a compressed air piston 27 (Fig. 4) acting through a drive abutment 28. In the advanced position the teeth engage with corresponding notches formed on the other shaft section 24 as shown in Fig. 2 at the full-line position a2.

The two shaft sections 23 and 24 at their ends carry a plurality of spider arms 29 which terminate in coil springs 30, said arms being pivoted in such a manner that they will be able either to engage into recesses of the shaft sections to a fully retracted position (as shown at the top of Figs. 2 and 3) or spread out to a radial position (as at the bottom of Fig. 2 and the lower left of Fig. 3). The arms are moved between their retracted and expanded positions by means of a central sliding rod 31 connected to arms 29 by links 32.

The ends of springs 30 are connected by links 33 to a tube 34 slidable on the rod 31 and are able to assume positions perpendicular to the arms 29 and parallel to the shaft (see Fig. 2, bottom, in dotted lines and Fig. 3, lower right). The ends of the rod 31 and of the tube 34 are provided with stops through which the movements can be imparted from outside, and during operation of the machine, e.g. with compressed-air pistons 35

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and 36 (Fig. 4) so as to impart various positions (as in Fig. 2 positions *b*1, *b*2 and *c*1, *c*2, *c*3 respectively for rod 31 and tube 34).

As will be seen from Figs. 1, 9 and 11, a pair of rocking guide flanges 37 operated by a piston 38 are disposed on opposite sides of the coil of wire.

Assembly D (Fig. 1).—This assembly functions to wind an adhesive binding strip or tape around the periphery of the finished and packed coil. The assembly comprises a flat belt 39 tensioned between the pulleys 41 and 42 by a spring 40. Applied against this belt is another and narrower belt 43 which is stretched between pulleys 44 and 45. The adhesive tape 60 fed from a roll 46 extends between a pair of cylindrical rollers 47 and 48, past cutter shears 49 operated by a piston 50 and then into a guide member 51 the outlet end of which is positioned near to the point where both belts 39 and 43 meet. As shown in detail in Fig. 13, the shaft of pulley 45 at its ends carries rollers 52 each of which has its periphery wetted by rollers 53 dipping into a water tank 54. The assembly is mounted on a rocker support 55 pivoted at 56 and operated by a piston 57. When the support is rocked a rack 58 rotates the roller 47 through a free-wheel device 59 and the tape 60 is forced into and through its guide 51 until it emerges therefrom and is gripped between the belts 39 and 43. On the rearward rocking movement of support 55, the adhesive tape is not displaced owing to the action of free wheel device 59.

The machine as described operates as follows. After completion of a coil (Fig. 5), the mandrel 26 moves rightward under the action of its drive abutment which is shifted from the position *a*2 to the position *a*1 (Fig. 2) and the completed coil is discharged by gravity. The mandrel 26 then moves back leftward, the drive abutment is restored to its *a*2 position and in so doing the extremity of the wire 1, which at that time is positioned near the shaft section 24 owing to the action of a device, e.g. compressed-air piston, which restores the wire-guide 8 to its initial position, said extremity of the wire is gripped or jammed between two teeth of the mandrel 26. The shaft sections 23 and 24 then begin rotating. Simultaneously, under the action of piston 22 (Fig. 6) the support 18 of assembly B rocks towards the mandrel 26. In so doing the toothed creasing wheels 13 are displaced and fold the paper sheet and feed it into the nip between roll 14 and tape-guide 17, the roller forcing the sheet downwards while the sheet is simultaneously pressed upwards by the retarding action of the sheet guide so as to form transverse folds, creases or pleats in the sheet. The pleated sheet is then forced into the tape guide 17 and emerges from the outlet end of it. The length of the sheet guide 17 is made to correspond with the circumferential length of the mandrel 26 plus a predetermined overlap. When the mandrel 26 has completed about a quarter revolution the creased sheet enters tangentially in between the wire 1 clamped by the teeth of mandrel 26, and the mandrel. The wire then grips the paper sheet while the cutters 15 actuated by piston 16 cut the pleated sheet to the desired length. The pleated sheet gripped by the wire 1 is wound about the mandrel 26 as shown in Figs. 7 and 8. The support 18 of assembly B is then restored to its idle position.

After the initial layer of wire has been coiled (Fig. 8) all of the spider arms 29 are simultaneously forced to their spread-out position by the rods 31, the drive abutment of which shifts from position *b*1 to position *b*2 (Fig. 2) so as to spread the paper radially in a nearly instantaneous manner (see Fig. 9 where the left side shows an intermediate position of the arms 29). Flanges 37 moved by piston 38 are moved into position to spread apart the flanges forced by the paper sheet 11 at the point where the wire 1 arrives, so as to prevent the wire from fouling the folds in the sheet (Fig. 9). The wire is

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then coiled at increased velocity until the desired length of wire has been fed, e.g. 100 yards (Fig. 10).

After the desired length of wire has been coiled up, the piston 36 (Fig. 4) forces the tube 34 by means of a drive abutment which shifts from position *c*2 to *c*3 (Fig. 2). The springs 30 are thus forced by the links 33 into a position parallel to the axis of squirrel cage 26, thus bending the pleated sheet about the outer part of the coil (Fig. 11). The wire-guide 8 is simultaneously restored to the midpoint of the coil by the device 37, the end of which forms an angle as it recedes (Figs. 11 and 12). The support 55 rocks so as to apply the flat belt 39 against the coil so that the latter's rotation advances the belt. The adhesive tape, which is wetted on its lateral parts only by rollers 53 and 52, is fed in between the belts 39 and 43 and is in turn applied about the exterior of the coil between the flat belt and the pleated packing sheet. Since only the sides of the tape are wetted the tape will only adhere at its sides, thus bonding the two edges of the packing sheet so as to seal the coil completely. The central part of the tape is dry and does not adhere to the belt or the coil. It will be understood that adhesive tapes of the type that do not require wetting may alternatively be used.

The device serving to reciprocate or shift the wire laterally being at this time at the midplane of the coil, the ultimate turn of wire is coiled at the same time as the adhesive tape which is cut by cutters 49 to a length corresponding to the circumference of the coil plus an overlap. The wire 1 is likewise automatically cut by cutter 9 to the requisite length and the coiling machine stops operating as the end of the wire emerges from guide 8. The end of the adhesive tape on the coil leaves the extremity of the wire freely accessible. The support 55 recedes to its idle position. The mandrel 26 retracts and the completed packed coil drops into the chute 61. Then the operating cycle begins over again.

For controlling the timing of the various operations in the desired sequence and with a predetermined speed, any suitable means may be used, e.g. camshafts imparting the requisite motions directly or indirectly through electric contacts, valves, servomotors, electromagnets, compressed air or fluid power devices and the like.

In cases where the coiling machine is to be operated in series with a machine for continuously feeding the wire or cable, there may be provided a wire storage device which will take up the slack in the wire during the idle periods of coiling machine. A warning signal may be provided for indicating the termination of a sheet or tape, and/or means may be provided for continuously feeding the sheet and tape to the coiling machine, using a pair of alternately operating and alternately charged feeding units.

Yet other modifications may be applied. Thus, the packing sheet used may be of any expansible type possessing tensile elasticity, such as corrugated, crimped or craped paper or plastic sheet, in which case the creasing or pleating mechanism illustrated may be omitted.

Likewise, means other than adhesive tape may be used for bonding the folded flanges of packing sheet in their folded position.

What I claim is:

1. In apparatus for coiling and packing a flexible elongated element, in combination: a rotatably mounted generally cylindrical support, means feeding the element to the support and means for rotating the support with one end of the element attached thereto so as to coil the element around the support, means measuring off predetermined lengths of element as it is fed and means cutting said lengths, means feeding a creased sheet of packing material to the support for application around the circumference thereof with the creases parallel to the axis of the support, camming means operable to engage end portions of the applied sheet and cam them off the surface of the support thereby to provide radial flanges, fold-

ing means operable thereafter to engage outer peripheral portions of said flanges and fold said portions axially inwards over a coil of said element means operable to bond said portions in folded condition, means actuating said element-feeding means, said actuating means, said measuring and cutting means, said sheet feeding means, said camming and folding means and said bonding means in timed relationship so as to cam said sheet end portions after an initial number of turns of the element have been coiled and to fold down said outer flange portions after said predetermined length of element has been coiled, and for thereafter bonding said folded-down flange portions.

2. In apparatus for coiling and packing a flexible elongated element, in combination: a rotatable mandrel, means operable to apply an expansible sheet of packing material circumferentially about the mandrel, means operable to coil a predetermined length of the element around the support over an intermediate section of the circumferentially applied sheet, means operable to apply an outward force to each end portion of said sheet from the radially inner surface thereof to form expanded radial end flanges of said sheet, means operable thereafter to apply an axially inward force to outer peripheral portions of said flanges to fold back said portions inwards over a coil of said element, means operable to bond said portions in folded condition, and means operating said respective means in timed sequence so as to form said radial end flanges after an initial set of turns of the element have been coiled and to fold down and bond said outer flange portions after said predetermined length has been coiled.

3. In apparatus for coiling and packing a flexible elongated element, in combination: a rotatable mandrel, means operable to coil said element around the mandrel, a first support rockable towards and away from the mandrel and supporting a supply of packing sheet material thereon, a second support rockable towards and away from the mandrel and supporting a supply of adhesive tape material thereon, means on the respective supports for feeding predetermined lengths of said respective materials from said supplies and winding said lengths about said mandrel on rocking movement of the respective supports towards the mandrel, force-applying means adjacent the opposite ends of the mandrel operable to spread out opposite end portions of said sheet material wound on the mandrel to form radial end flanges thereof and operable thereafter to bend outer peripheral portions of said flanges axially inwards, and means operating said coiling means, said rocking supports and said force-applying means in timed sequence.

4. In apparatus for coiling and packing a flexible elongated element, in combination: a rotatable mandrel, means operable to coil said element around the mandrel, a support rockable towards and away from the mandrel and supporting a supply of packing sheet material thereon, means on said support for creasing said material and for feeding a predetermined length of the creased material from said supply and winding said length about said mandrel on rocking movement of the support towards the mandrel with the creases generally parallel to the axis of

the mandrel, force-applying means adjacent the opposite ends of the mandrel operable to spread out opposite end portions of said wound sheet to form radial end flanges thereof and operable thereafter to bend outer peripheral portions of said flanges axially inwards, and power means operating said coiling means, said rocking support and said force-applying means in timed sequence.

5. Apparatus according to claim 1, wherein said cylindrical support is supported in an operative position for rotation with a pair of aligned axially spaced shafts and is axially retractible to clear the axial space between said shafts in a coil-discharging position.

6. In apparatus as claimed in claim 1, a rocking support pivoted on an axis parallel to the axis of the cylindrical support, a supply of said packing sheet material mounted on the rocking support, a pair of cooperating toothed creasing wheels journaled on said rocking support for gripping said sheet fed from said supply between the cooperating teeth thereof, a sheet guide secured on said rocking support adapted to guide the sheet towards said cylindrical support, sheet cutter means on said rocking support, means for rocking the rocking support towards and away from the cylindrical support, and drive means including a free wheel drive for rotating the feed roller and creasing wheels on rocking of the rockable support towards the cylindrical support so as to force a predetermined length of creased sheet material through said guide and into engagement with the cylindrical support, and for actuating the sheet cutter means to cut off said predetermined length.

7. Apparatus as claimed in claim 1, wherein said camming means comprise peripheral sets of arms pivoted adjacent opposite ends of the cylindrical support for movement between a retracted condition and a spread-out condition in which said arms force said sheet end portions outwards, and wherein said folding means comprise spring elements attached to the outer ends of said arms and deflectable for engagement over said peripheral portions of the flanges when said arms are in the spread-out conditions.

8. Apparatus as claimed in claim 1, wherein said element feeding means comprise a supply of said element, a pulley, endless belt means engaging part of the periphery of the pulley for applying thereagainst said element as it is fed from the supply, a guide tube for directing said element from the pulley towards the cylindrical support, drive means including a free-wheel drive for intermittently rotating the pulley and means for reciprocating said element-feeding means including the guide tube in a direction parallel to the axis of the cylindrical support for distributing the turns of said element evenly across the length of said cylindrical support.

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