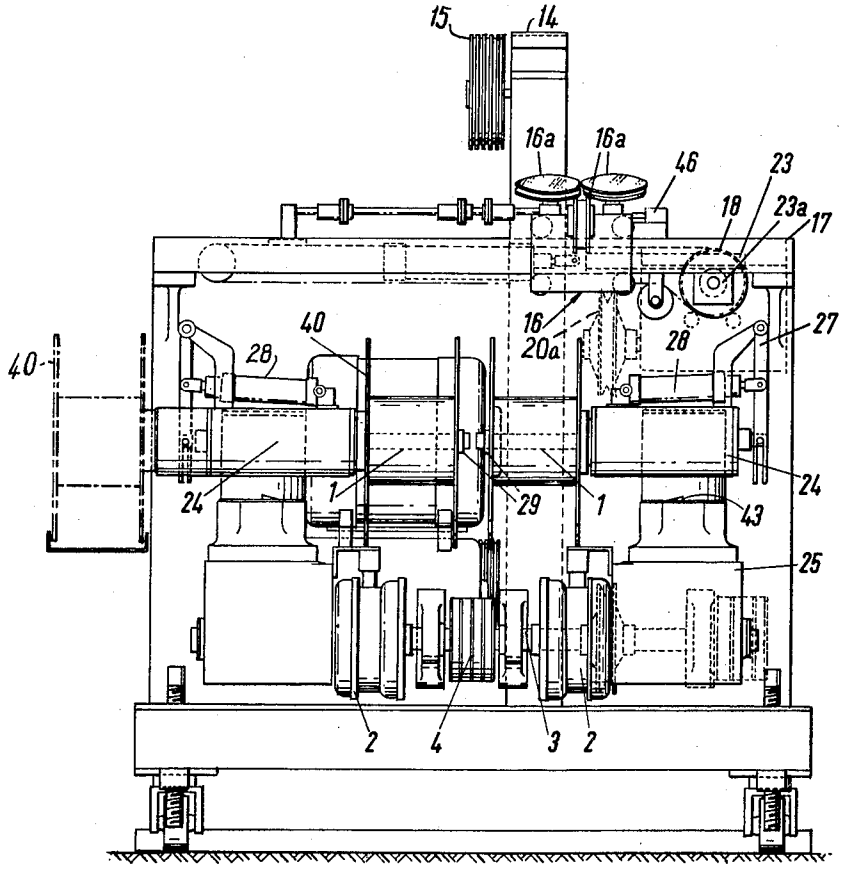
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AUTOMATIC COILING MACHINES

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—FIG. 1.—

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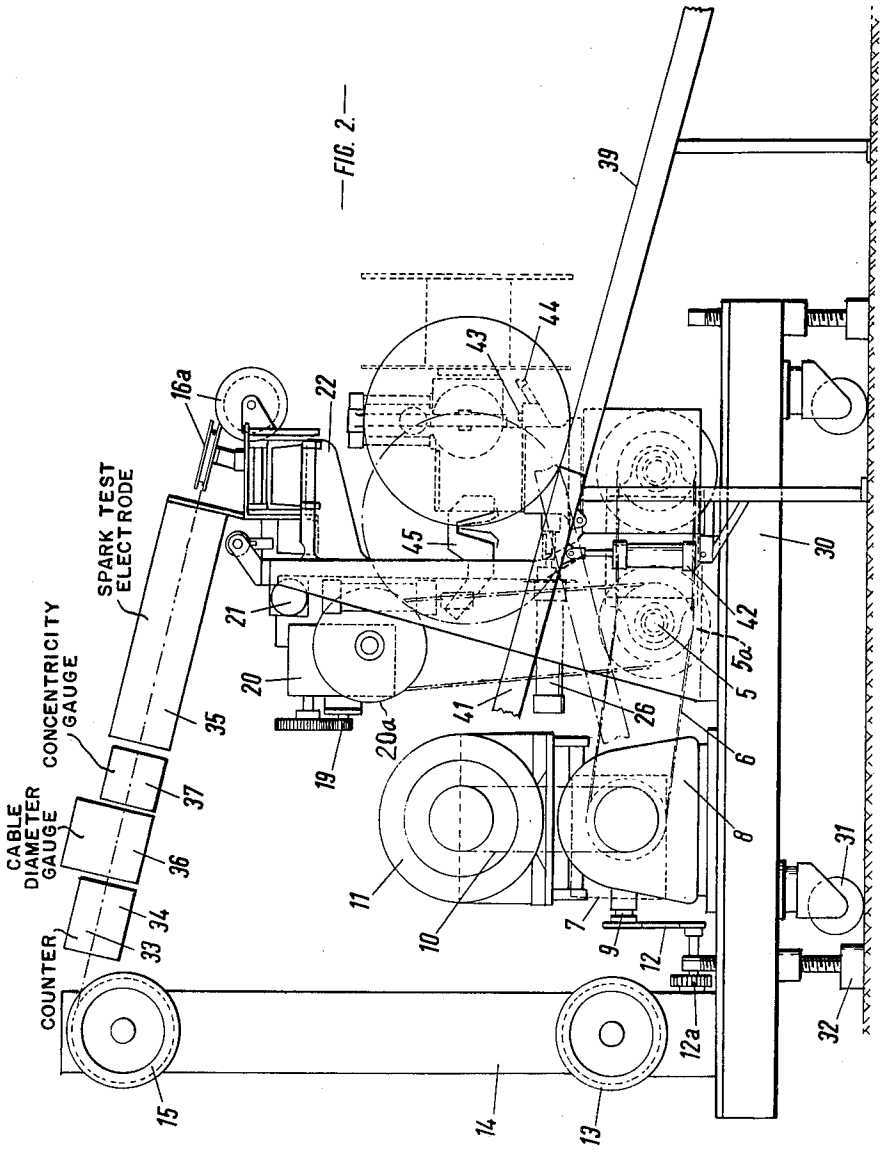
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AUTOMATIC COILING MACHINES

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—FIG. 2.—



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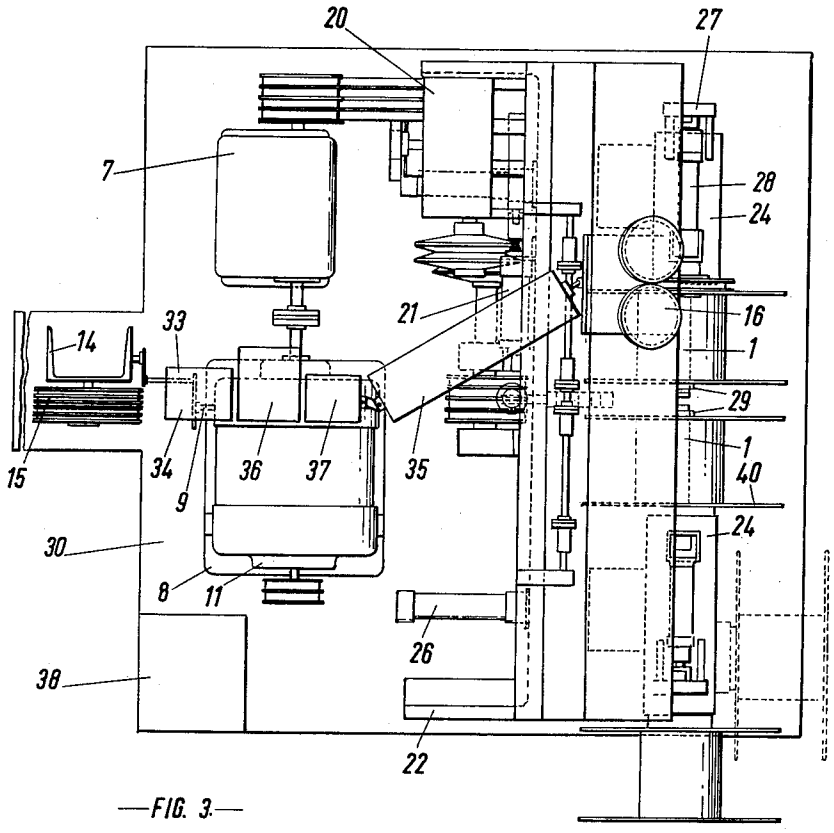
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AUTOMATIC COILING MACHINES

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—FIG. 3.—

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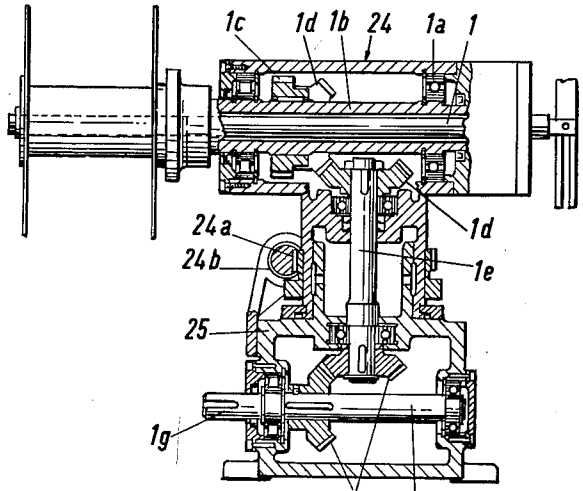
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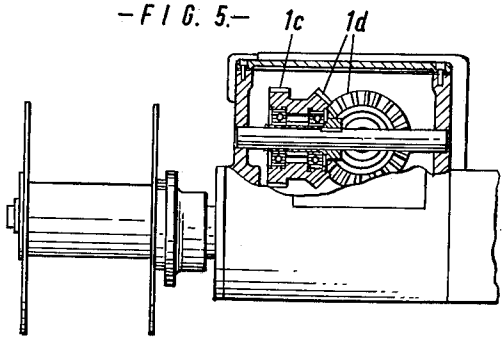
AUTOMATIC COILING MACHINES

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—FIG. 4.

—FIG. 5.—



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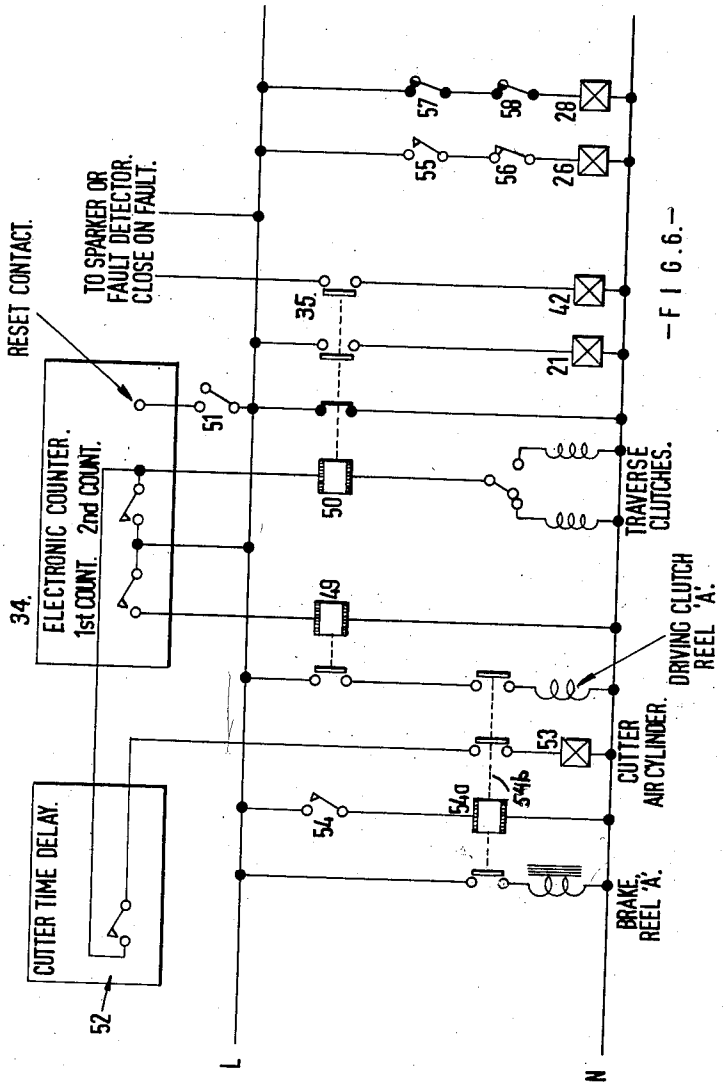


FIG. 1

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United States Patent Office 2,979,275 Patented Apr. 11, 1961

2,979,275

AUTOMATIC COILING MACHINES

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Claims priority, application Great Britain Oct. 15, 1956

8 Claims. (Cl. 242—25)

This invention relates to automatc reel winding or coiling machines for use, for example, with extrusion-insulation machines in the manufacture of insulated electric cable or wire.

There is always a need to run production machinery as fast as possible, consistent with quality, and such extrusion-insulation machines now operates at speeds upwards of 1,000 ft. per minute, some even reaching 1,500 ft. per minute, whilst higher speeds still may reasonably be expected in the future.

One of the problems with such insulation-extrusion machines is the collection of their output. This is effected at present by winding onto large drums, or reels, each capable of holding, for example, 10,000 yards. Thereafter, rewinding is effected, one or more times, during which the cable is tested for insulation faults, concentricity, diameter tolerance etc., and finally measured for length as it is wound into coils, or onto reels, of suitable size for despatch. Any such rewinding device must be capable of working at a high speed, or else more than one machine per extruder would be required. Also, the testing and other operations have to be conducted simultaneously as far as possible for the same reason, for all the above reasons the use of large drums to accept the cable from the extruder, followed by rewinding, has been considered essential or unavoidable.

Hitherto, final insulation testing is always effected on the rewinding and it is known during one rewinding stage to perform all the tests including measurement. However, there are certain well known difficulties with such arrangement, for example the cable is supplied to such machine on large drums for the reasons already given, and also because the use of smaller drums would entail more labour and stoppages for reloading the winder. Such large drums however, a part from the question of storage, introduce certain problems, such as their inertia (or momentum) which affects winding tension and in consequence may prejudice the quality of the product, as excessive winding tension due to high drum inertia can cause a breakage or at least stretch the conductor and thereby introduce a conductivity fault, or produce an insulation fault.

Thus, by the present methods, the cable is always rewound at least once and any spark test that may be effected before rewinding has as its main value to indicate to the extruder driver that an undue number of insulating faults is occuring rather than to the rewinder, who would have both to re-locate and repair such faults. Also, during rewinding the final spark test only serves to indicate at most the approximate position of the fault, except where a stop motion is provided to enable a repair to be effected immediately but this has an obvious disadvantage as regards loss of running time.

The object of the present inventon is an improved means for winding or coiling cable or wire as it is continuously produced or delivered and particularly insulated cable or wire.

The invention comprises apparatus for winding or coiling a metal filament, such as an insulated electric conductor into a plurality of packages from a longer length presented without delivery interruption to correspond with the termination of each package and including testing of the filament including the step of delivering the packages in at least two groups as determined for pass or rejection by at least one of the tests.

The apparatus aforesaid may be characterised in that the cable is presented direct from the extruder.

The invention also comprises the coiler or winder for carrying out the method aforesaid.

In the accompanying drawings:

Fig. 1 is a front elevation of one example of an automatic reel winding or coiling machine made in accordance with the invention;

Fig. 2 is an end elevation;

Fig. 3 is a plan;

Fig. 4 is a sectional detail view of one of the turrets shown in the other Fig. 1;

Fig. 5 is a part sectional plan of Fig. 4; and

Fig. 6 is a wiring diagram associated with the apparatus.

As shown in the drawings, the winding machine comprises two turret housings **24** (described later) having retractable winding spindles **1**, the turrets being mounted on a gear case housing **25** for turning about a vertical axis to swing the spindles horizontally through approximately 180°, the spindles also having a retractive movement in their turrets **24** described later. The retractable spindles **1** are mounted in bearings **1***a* so that they are free to rotate, and each spindle is separately driven through a sleeve **1***b*, helical pinions **1***c* and spiral bevels **1***d*, one of which is on a vertical shaft **1***e* driven at its lower end by another pair of spiral bevels **1***f* from a horizontal shaft **1***g* through an electric clutch-and-brake unit **2** from a common lay shaft **3**. The spindles can be driven together or separately by selective engagement of their clutches and can be braked together or independently by selective engagement of their brakes. The lay shaft **3** is driven by belt drive **4** from a secondary lay shaft **5**. This secondary lay shaft **5** is driven by belt drive **6** from the output of a six speed gear box **7**. The gear box **7** is driven directly coupled from the output of a variable speed gear **8** fitted with a spindle **9** controlling the output speed of the gear. The variable speed gear **8** is driven by belt **10** from a motor **11**, the horse power being dependent on the size of reels **40** (described later) being handled and the winding speed. The spindle **9** is connected by chain **12** and gear drive **12***a* to a moving or "dancer" pulley assembly **13** slidably mounted on a vertical track **14**. At the upper end of the track **14** is a fixed pulley assembly **15**. These pulleys form an accumulator and speed regulator.

A wire guiding traverse head **16** comprising guide pulleys **16***a* mounted on the head is slidably mounted on a horizontal track **17**. The head **16** is driven by a chain drive **18** from the output of an electrically controlled reversing mechanism **19**. The reversing mechanism **19** is mounted on, and driven from, a reduction gear box **20**. The reduction gear box **20** is driven by variable speed pulleys **20***a* and **5***a* from the lay shaft **5**. An air cylinder **21** is mounted on the frame **22** and also drives the traversing head **16** through a rack **23** and pinion **23***a*. The spindle turrets **24** aforesaid are swingably mounted on gear case housings **25** the turrets **24** each carrying a gear ring **24***a* (Fig. 5) engaging with a rack **24***b* fitted to an air cylinder **26** (Fig. 3) which controls movement of the spindle turrets. The turrets **24** also each carry a swingably mounted lever assembly **27** connected to an air cylinder **28** and to the outer and of the reel shaft **1** in such a manner that the cylinder causes the reel shaft to extend or retract in relation to the turret. At the inner ends of

the reel shafts 1 is mounted a locking device 29 of any known construction to lock a reel 40 onto the spindle as the spindle is threaded through the reel.

The gear casings 25, the traverse head 16, the lay shafts 3 and 5 and the gear box 20 are all mounted from a common frame 22. This frame 22 is mounted on a bedplate 30 which carries the main drives and vertical track 14. Bedplate 30 is mounted on castors 31 and jacks 32. Between the fixed pulley assembly 15 and the traverse head 16 are mounted; a measuring machine 33 driving a counter fitted with automatic reset 34, a spark test electrode 35, a cable diameter checking gauge head 36, a concentricity checking gauge head 37 and any other testing instruments required for the purpose of inspecting cable for faults. A spark tester control unit 38 (Fig. 3) is built onto the main frame 30 and supplies high tension current to the electrode 35. A chute 39 is built onto each side of the frame 30. The top section 41 of each chute being hinged below the reel unloading position and connected by links to an air cylinder 42.

Mounted on the gear case 25 is a latch assembly comprising a vertically moving taper ended wedge 43 controlled by a lever 44 and spring loaded vertically upwards. The latch assembly is mounted below the spindle housing 24 in such a manner that as the reel spindle 1 swings away from its winding position it can pass the latch freely, and on its return to the winding position it is arrested by the latch.

In operation the machine is wheeled into position at the take-up end of the extrusion line and raised on its jacks 32. The cables are threaded around the fixed and moving pulleys 15 and 13 respectively, through the measuring machine 33, the electrode 35 and any other testing equipment included, over the pulleys on the traverse head 16 and then onto the reel 40.

There are two automatically resetting counters on the counter unit 34; the first counter is set to approximately ten feet short of the required length and the second counter is set to the required length of cable to be wound on each reel. The first reels to be wound are manually loaded, the reel shaft 1 being brought into the loading position (shown dotted) by push-button control.

Assuming that all controls are correctly set reel A is to be wound. The extruder and capstan are set in motion, the moving pulley assembly 13 will begin to slide down the track 14 (due to slackening of the wire holding it in position) firstly switching on the motor 11 and gradually increasing the speed of the reel being wound through the variable speed gear 8 until extruder speed is attained at the winding diameter.

The reel is wound at a constant wire speed and approximately constant tension. When the first counter on the counter unit 34 completes its count it operates a switch 49 to start reel B rotating by energising the electric clutch 2 coupled to drive the reel B. As the required length is reached the second counter operates and declutches traverse head 16 by de-energising the clutches on the reversing mechanism 19 at the same time allowing air to be supplied to air cylinder 21 which drives the traverse head through a rack and pinion across the track 17 from left to right until the traverse head hits buffer 46. As the traverse head 16 hits buffer 46 a switch 51 is operated which exhausts cylinder 21 and energises the reversing mechanism clutches causing normal traverse to take control of traverse head 16 again. At the same time both counters are automatically reset.

The traverse head 16 travels in the reverse direction of the quick traverse (i.e. in this case right to left) in order to lock the cable onto the reel B by the starting turns thereof.

Another action of the second counter is to isolate the sparker 35 from chute 41 on the unloading side of reel A so that the chute 41 relating to reel A will not be dropped for a fault on reel B. The second counter also starts a preset time-delay switch 52 which after allowing time for the cable to lock onto reel B brings the knife 45 into cutting position, thus parting the cable. During the cutting action movement of the knife blades actuates a microswitch 54 for solenoid 54*a* of a switch 54*b* which de-energises the driving clutch 2 to reel A and applies the brake 2 to reel A. This switch also withdraws the knife from the cutting position. The knife on being fully withdrawn operates a switch 55 which starts the unloading sequence for reel A.

Air is supplied to cylinder 26 which through the rack and pinion swings the reel shaft 1 through 180° to its unloading position shown in chain line overriding trip 43. At the unloading position a switch 57 is operated which allows air to be supplied to cylinder 28 retracting the reel shaft 1 by means of the lever 27 allowing the reel A to fall onto section 41 of the chute.

If there has been a fault signalled on this reel, the sparker or one or other of the cable checking devices will have caused the air cylinder 42 to pull down the chute section 41 thus the reel will roll to the back of the machine to be collected either manually or automatically for repair and rewind. If there has been no fault signalled the section 41 will be in normal position and thus the reel will roll down forward section 39 to storage. Thus the reels are selectively separated depending on whether the cable they contain is faulty or not, this separation being carried out automatically by the machine.

As the spindle or reel shaft 1 is fully withdrawn a switch 56 is actuated which reverses the air supply to the cylinder 26 thus swinging the turret 24 with the spindle 1 still retracted, towards the running position. After swinging through 90° to the loading position as shown dotted in Fig. 2, the travel of the turret is arrested by the trip 43. The trip 43 is pivoted so that as the turret strikes the trip a switch 58 is operated which reverses the air supply to the cylinder 28 thus extending the spindle 1. As the spindle 1 extends a new reel is loaded manually or automatically. After loading, the trip 43 is withdrawn and reel A continues its travel to the running position.

As reel B is wound to length the sequence is repeated, change-over being in the opposite direction. The operation is controlled by stepping relays and so interlocked that is is impossible for any reel to enter into unloading sequence if still being wound.

The expression "winding" is used herein to include not only winding on a bobbin but coiling on a former.

We claim:

1. Apparatus for winding a metal filament such as an insulated electric conductor into a plurality of packages from a longer length presented without delivery interruption to correspond with the termination of each package, comprising an accumulator with tensioning apparatus to receive and re-deliver the filament, a plurality of winding heads adapted to receive and wind the filament means for moving each winding head into at least a winding and an unloading position, variable speed means for driving each head when in the winding position, means for severing the wire after the commencement of each new package, a control member for the variable speed driving means coupled for positional control by the accumulator tensioning apparatus, testing apparatus for applying at least one test to the filament before winding, means adjacent the unloading positions of the winding head operably connected with said testing apparatus for the filament for delivering the packages in at least two groups according to the result of the test by said testing apparatus.

2. Apparatus according to claim 1 characterised by means for braking the winding head of a completed package and control means for such brake operable with the severing means whereby rotation of the package can be stopped before centrifugal force and severance causes unwinding, and whereby high winding speeds can be used.

3. Apparatus according to claim 1 characterised in that the means for delivering the finished packages from the unloading positions comprises an articulated chute and means for altering the inclination of the upper end of the chute to change the direction of gravity delivery and means coupled to at least one of said testing apparatus for the filament for actuating such change of inclination for acceptance or rejection of a package.

4. Apparatus for winding a metal filament, such as an insulated electric conductor, into a plurality of packages from a longer length presented without delivery interruption to correspond with the termination of each package, comprising an accumulator with tensioning apparatus to receive and redeliver the filament, at least two heads adapted to receive and wind the filament, means for driving each head, testing apparatus for the filament and means adjacent the heads operably connected with at least one of said testing apparatus for the filament for delivering the packages in at least two groups according to the result of the test by the testing apparatus.

5. Apparatus for winding a metal filament, such as an insulated electric conductor, into a plurality of packages from a longer length presented without delivery interruption to correspond with the termination of each package, comprising an accumulator with tensioning apparatus to receive and redeliver the filament, at least two heads adapted to receive and wind the filament, means for moving each head into at least a winding and an unloading position, means for driving each head, testing apparatus for the filament and means adjacent the heads operably connected with at least one of said testing apparatus for the filament for delivering the packages in at least two groups according to the result of the test by the testing apparatus.

6. Apparatus for winding a metal filament, such as an insulated electric conductor, into a plurality of packages from a longer length presented without delivery interruption to correspond with the termination of each package, comprising an accumulator with tensioning apparatus to receive and redeliver the filament, at least two heads adapted to receive and wind the filament, means for moving each head into at least a winding and an unloading position, means for driving each head, testing apparatus for the filament and means adjacent the unloading positions of the heads operably connected with at least one of said testing apparatus for the filament for delivering the packages in at least two groups according to the result of the test by the testing apparatus.

7. Apparatus for winding a metal filament, such as an insulated electric conductor, into a plurality of packages from a longer length presented without delivery interruption to correspond with the termination of each package, comprising an accumulator with tensioning apparatus to receive and redeliver the filament, at least two heads adapted to receive and wind the filament, means for driving each head, means for severing the filament after the commencement of each new package, testing apparatus for the filament, and means adjacent the heads operably connected with at least one of said testing apparatus for the filament for delivering the packages in at least two groups according to the result of the test by the testing apparatus.

8. A device according to claim 4 wherein said driving means is coupled for positional control by the accumulator tensioning apparatus.

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