Jan. 17, 1956 C. W. KIRSCH 2,731,372

METHOD OF REMOVING THE INSULATION FROM THE ENDS OF ASSEMBLED COMMUTATOR WIRES

Original Filed May 6, 1948 3 Sheets-Sheet 1

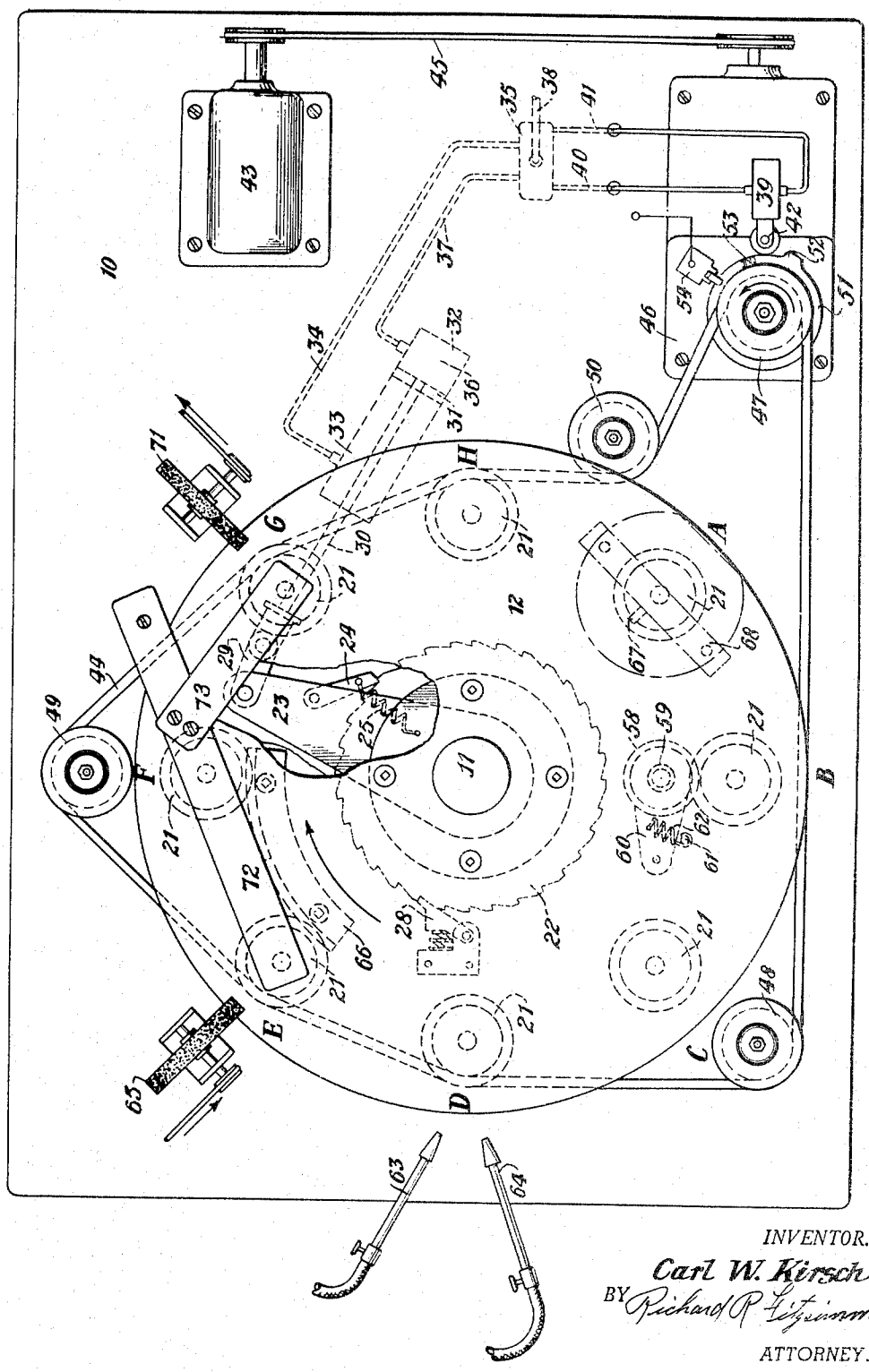


Fig. 1

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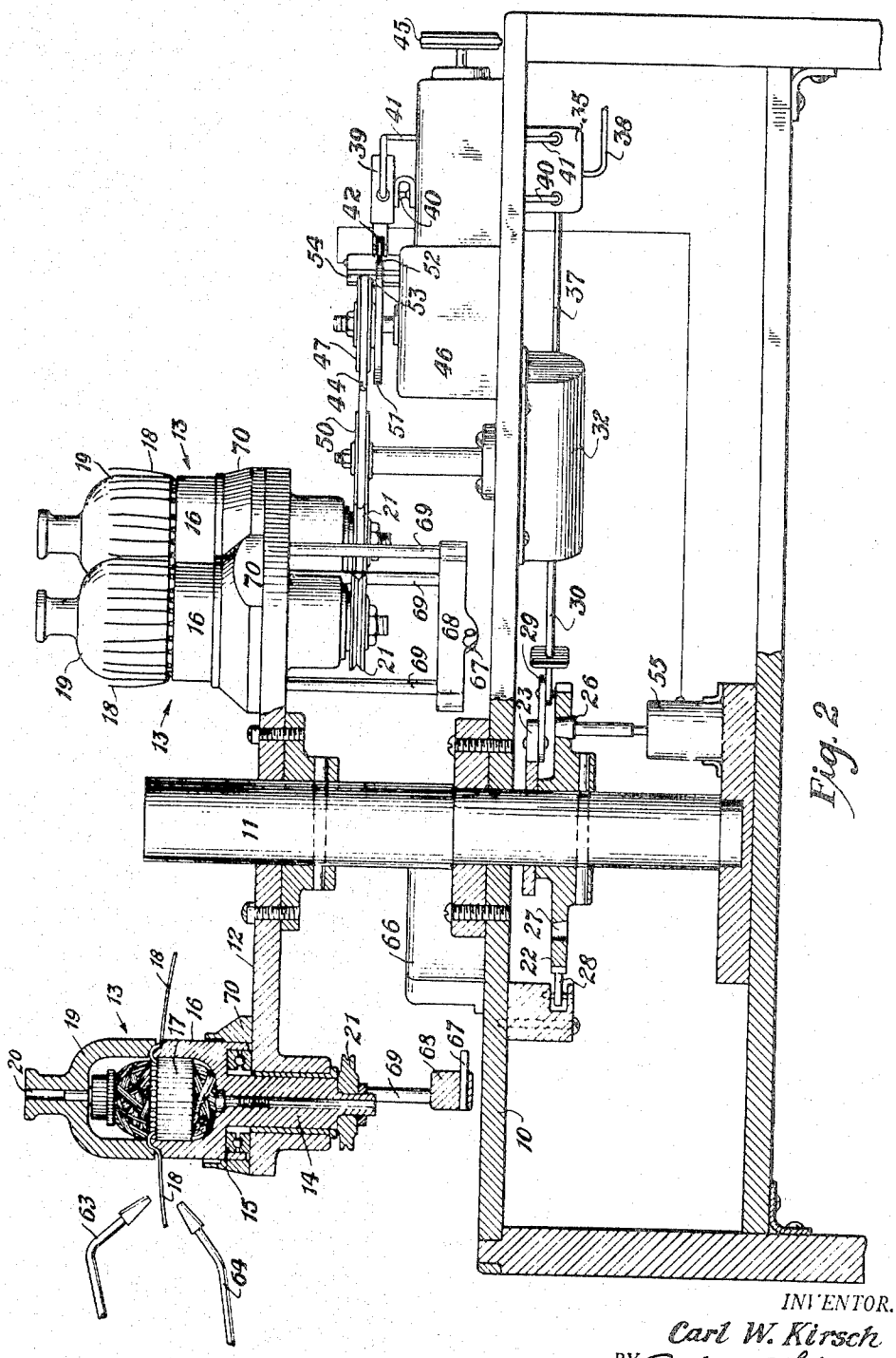


Fig. 2

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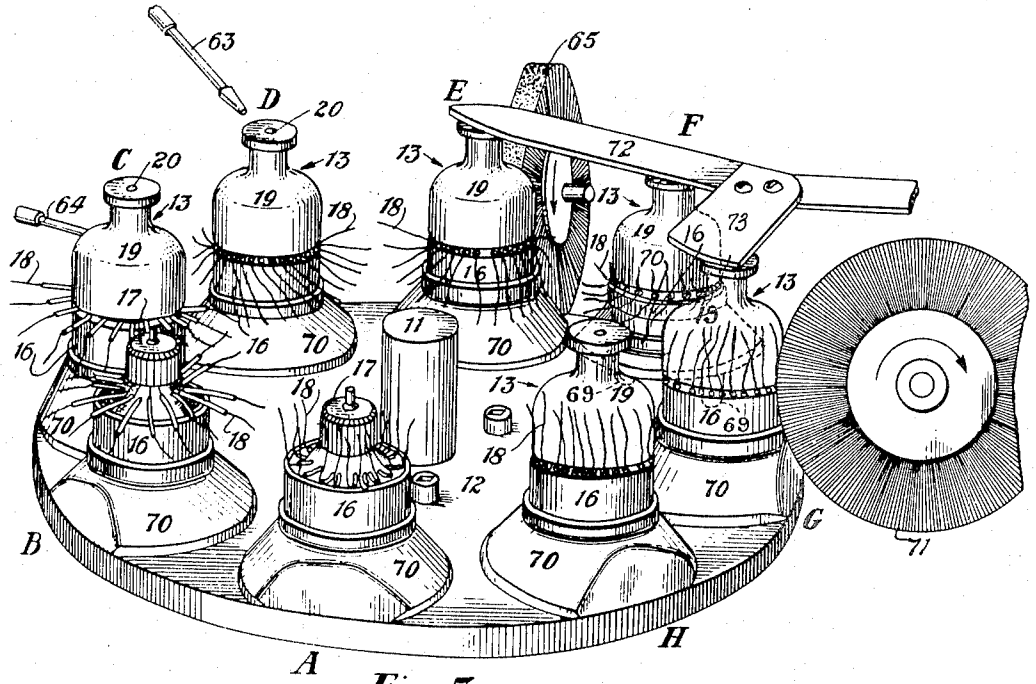


Fig. 3

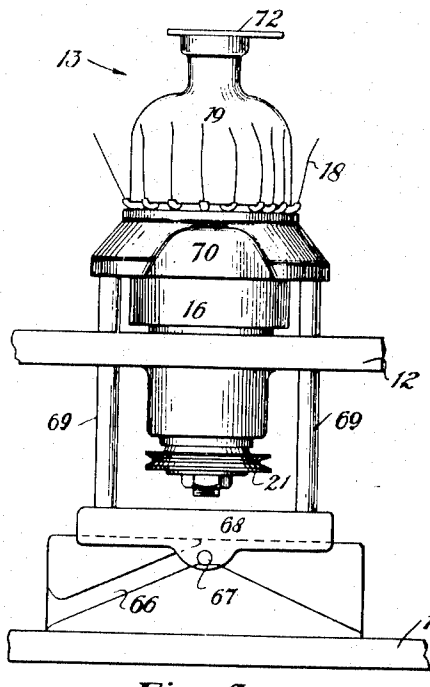


Fig. 4

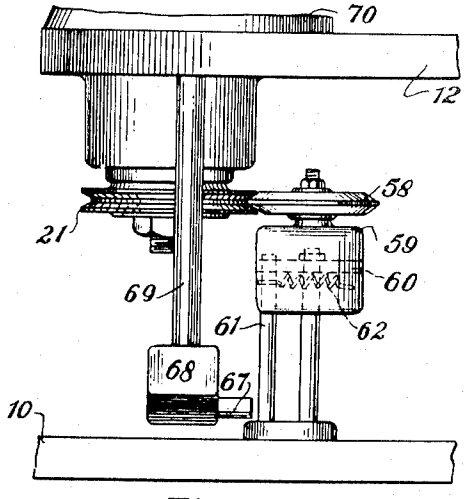


Fig. 5

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United States Patent Office 2,731,372
Patented Jan. 17, 1956

2,731,372

METHOD OF REMOVING THE INSULATION FROM THE ENDS OF ASSEMBLED COMMUTATOR WIRES

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Original application May 6, 1948, Serial No. 25,461, now Patent No. 2,671,913, dated March 16, 1954. Divided and this application June 6, 1952, Serial No. 292,173

13 Claims. (Cl. 134—2)

This invention relates to the manufacture of motors and more particularly to a method of removing the insulation from the ends of assembled armature wires preparatory to connecting such ends to the commutator segments.

This application is a division of my copending application for U. S. Letters Patent Serial No. 25,461, filed May 6, 1948, now Patent 2,671,913, dated March 16, 1954.

In the past it has been the practice to individually strip the insulation from the ends of assembled armature wires by hand and to hand clean the stripped ends, which procedure is slow, tedious, and costly. With some of the more recently used insulating materials it is practically impossible to remove the insulation therefrom by hand.

According to this invention the wound armature is placed in a fixture and the machine automatically separates the wire ends, removes the insulation therefrom and cleans the wire.

More specifically according to this invention a plurality of armature holding fixtures are rotatably mounted on an indexing carriage having a plurality of work stations spaced thereabout. The arrangement is such that the carriage is periodically indexed so as to move the fixtures sequentially from one station to the next.

At the first station the wound armatures are placed in the lower section of the fixture, at the second the wire ends are separated and extended radially outwardly over the upper edge of the lower fixture section, at the third section the upper fixture section is placed on the lower so as to clamp the wires between the mating edges of the sections, at the fourth station the insulation of the extending ends is charred by the application of any acetylene flame thereto. At the fifth station the charred insulation on one side of the extending ends is removed and the wire cleaned by the application of the abrading action of a wire or similar brush, at the sixth station the radially extending ends of the wires are pushed upwardly to expose the other side of the wires and at the seventh station the charred insulation is removed from the other side of the extending ends and the wire cleaned by the abrading action of a wire brush.

At the burning and abrading station the fixtures are rotated through at least one revolution so that all of the wires are treated. The indexing mechanism is so controlled that the rotation of the fixtures through one revolution will cause the carrier to be indexed and the fixture to be moved from one station to the next. At the loading, wire clamping, and wire turning stations the fixtures are stationary. At the wire separating station the fixtures are preferably rotated at high speed so that the wire ends are moved to their radial position by centrifugal action.

According to the broadest aspects of one submethod according to this invention the free ends of the wires of a wound armature are extended into a radial position, the insulation thereof charred by the application of heat and the charred insulation removed by an abrasive action.

According to the broadest aspects of another subcombination according to this invention the free ends of a wound armature are separated and extended to a position extending radially of the armature by centrifugal action while rotating the armature at high speed and holding the wire coils in position on the core of the armature.

Other objects and advantages of this invention will become apparent as the description proceeds when taken in connection with the accompanying drawings in which:

Figure 1 is a plan view of a portion of the machine of this invention showing the indexing carriage and the driving and indexing means for the carriage and armature holding fixtures;

Figure 2 is a vertical sectional view of the machine of this invention including a section through one of the fixtures as it appears at the burning station;

Figure 3 is a perspective view of the machine of this invention showing the fixtures as they appear at the various stations;

Figure 4 is a side elevation of a fixture as it appears at the wire turning station; and

Figure 5 is a side elevation of the driving mechanism for the fixtures when positioned at the wire positioning station.

Referring to the drawings and particularly to Fig. 1 thereof, the working stations are indicated by the letters A to G, inclusive, the station A being the loading and unloading station, B the wire separating and positioning station, C the wire clamping station, D the burning station, E the first abrading station, F the wire turning station and G the second abrading station.

The machine comprises a suitable supporting frame **10** rotatably carrying a main spindle **11** which in turn carries the indexing carriage **12**. The indexing carriage **12** rotatably carries a plurality of fixtures (at least one for each active station) generally indicated at **13** equally spaced about the periphery of the carriage **12**.

Each fixture **13** comprises a vertical spindle **14** rotatably supported in bearings **15** near the edge of the carriage **12**. Integral with the spindle **14** is a lower fixture section **16** adapted to snugly receive a wound armature with the upper edge of the core adjacent to the upper edge of the lower fixture section **16** so that the free ends **18** of the armature wires can be extended outwardly over the free edges thereof. An upper fixture section **19** is adapted to receive the commutator end of the armature **17** and has an opening **20** to receive the end of the armature shaft so as to rigidly hold the armature **17** within the fixture **13**. The mating edges of the lower section **16** and the upper section **19** have provisions for leading the wire ends **18** radially outwardly between the mating edges of lower section **16** and upper section **19**. A pulley **21** is rigidly attached to the lower end of each spindle **14**.

Rigidly attached to the main spindle **11** is an indexing ratchet wheel **22** which cooperates with an indexing arm **23** pivoted to the spindle **11** and having a pawl **24** held in engagement with the teeth of the ratchet wheel **22** by a spring **25**. The spindle **11** and correspondingly the carriage **12** is normally held against rotation by a pin **26** (Fig. 2) engaging in one of the plurality of openings **27** in the indexing wheel **22** and is held against reverse rotation when the pin **26** is released by a pawl **28** carried by the frame **10** and engaging the ratchet teeth of the indexing wheel **22**.

Connected to the indexing arm **23** by means of a link **29** is the end of a piston rod **30**, the piston **31** of which is adapted to reciprocate in a cylinder **32** suitably supported by the frame **10**. The end **33** of the cylinder is connected by a conduit **34** to a suitable control valve **35**. The end **36** of the cylinder **32** is connected to the control valve **35** by a conduit **37**. The control valve **35** is connected to a source of air under pressure by a conduit **38** and to a bleeder valve **39** by conduits **40** and **41**.

The arrangement is such that when the bleeder valve **39** is in the position shown in Fig. 1 there is a reduced pressure in the end **36** of the cylinder **32** and the piston **31** is held in the position shown in Fig. 1. When the valve actuator **42** is pushed to the right the pressure is raised in the end **36** of the cylinder **32** and reduced in the end **33** so that the piston **31** will be forced to the opposite end of the cylinder **32** to that shown in Fig. 1. Any type of valves **35** and **39** may be used which will produce the above result.

The fixtures **13** are adapted to be rotated at stations D, E, and G by a motor **43** driving an endless belt **44** by means of a belt gearing **45**, reduction gearing **46** and pulley **47**. The belt **44** is threaded over the pulleys **21** at the stations D, E, and G, over the pulley **47** and over the idler pulleys **48**, **49**, and **50** suitably supported by the frame **10**. The pulley **47** is preferably of the same diameter or slightly larger than the pulleys **21** so that the fixtures **13** at the stations D, E, and G will be rotated at least once for each revolution of the pulley **47**.

Rigidly secured to the shaft of the pulley **47** is cam wheel **51** having cams **52** and **53** thereon. Cam **52** actuates the operator **42** of the bleeder valve **39** and the cam **53** actuates an on-off switch **54** adapted to energize and deenergize a solenoid **55** connected to the pin **26**.

At the station B the pulley **21** is adapted to engage a friction wheel **58** (Fig. 5) driven by a high speed electric motor **59**, pivotally secured to the frame **10** by an arm **60** and spring-biased against a stop **61** by a spring **62**. The arrangement is such that as the fixtures **13** are indexed to the station B the friction wheel **58** will engage the pulley **21** under the pressure of spring **62**.

Preferably the motor **59** rotates continuously when the machine is in operation but a separate control switch may be provided. The motor **59** may also if desired be automatically energized upon the engagement of the friction wheel **58** with the pulley **21**. For example, an on-off switch could be actuated by the movement of the arm **60** as the wheel **58** engages the pulley **21**.

At the station D are a plurality of acetylene burners **63** and **64** positioned above and below the wire ends **18** as shown in Fig. 2. At station E is a rotating wire brush **65** which is continuously rotated downwardly in the direction of the arrow as indicated in Fig. 3. At station F a cam **66** (Fig. 4) suitably supported on the frame **10** engages a pin **67** carried by the plate **68** connected by rods **69** to a sleeve **70** slidably mounted about the lower fixture section **16** for a purpose which will be described presently. At station G is a brush **71** which is continuously rotated upwardly as shown by the arrow of Fig. 3. The station H is idle but the fixture **13** is being rotated. If desired the fixture could be made stationary at this station and it could then be made the unloading station.

Positioned to engage the top of the upper fixture section **19** at the stations E, F and G are cam plates **72** and **73** which automatically engage the top section **19** as the carriage **12** is indexed to tightly hold the sections **19** and **16** together so that the wire ends **18** will be tightly clamped. The plates **72** and **73** may be fixed to the frame **10** in any suitable manner.

Operation

A wound armature **17** is placed in the lower fixture section **16** at station A and the motor **43** started which will cause the pulley **47** to rotate in unison with the fixtures **13** at the stations D, E and G. The cam **52** will eventually engage the operator **42** for the bleeder valve **39** so as to increase the pressure in the end **36** and decrease it in the end **33** of the cylinder **32** causing the piston **31** to move to the left and move the indexing arm **23** counter-clockwise as viewed in Fig. 1. Shortly after the engagement of the cam **52** with the actuator **42** the cam **53** will engage the actuator for the switch **54** to energize the solenoid **55** and withdraw the pin **26** from the opening **27** in which it is then positioned to free the carriage **12** for indexing movement. During the counter-clockwise

movement of the indexing arm **23** the pawl **24** will ride freely over the teeth of the indexing wheel **22** since the wheel is held against counter-clockwise movement by the pawl **28**.

As the cam **52** rides free of the control arm **42** of the bleeder valve **39**, high pressure will be reestablished in the end **33** of the cylinder **32** and the end **36** will be vented to low pressure. This will cause the piston **32** to move to the right and move the indexing arm **23** clockwise as viewed in Fig. 1. The pawl **24** will engage the teeth of the indexing wheel **22** and index the carriage **12** so that the fixture containing the wound armature will be moved to station B. By this time the cam **53** will have disengaged the control of the switch **54** to deenergize the solenoid **55** whereby the pin **26** which is spring-biased upwardly will snap into the next aperture **27** as the fixture reaches the station B so as to rigidly lock the carriage **12** against movement.

As the fixture **13** approaches station B the pulley **21** will engage the friction wheel **58** and pivot the motor **59** counterclockwise as viewed in Fig. 1 against the bias of spring **62** until the wheel **58** and pulley **21** are in good driving relationship with each other. This will cause the armature **17** to be rotated rapidly so that the wire ends **18** will be separated and moved to a radial position overlying the upper edge of the lower fixture section **16** by centrifugal action. This result is shown at station B in Fig. 3.

It is to be understood that it is within the concept of this invention to move the wire ends **18** into their radial position by hand at station B but it is preferable that this be done by centrifugal action as above described.

During the movement of the wire ends **18** to the radial position the cam wheel **51** has been continuously rotating and eventually will render the indexing mechanism operable to index the carriage **12** another step to bring the fixture **13** with the armature **17** therein to the station C. At the station C the upper fixture section **19** is merely placed over the commutator end of the armature **17** so as to position the wire ends **18** between the mating edges of the fixture sections **16** and **19**.

The cam wheel **51** will again render the indexing mechanism operative and the carriage **12** will again be indexed to bring the fixture with the wires extending through the walls to station D. As the pulley **21** approaches station D it will engage the endless belt **44** so that the fixture **13** will be rotated in unison with the cam wheel **51**. This will bring the wire ends **18** with the insulation thereon into the flames from the burners **63** and **64**. As the fixture **13** is rotated the insulation on both sides of one after the other of the wire ends **18** will be charred. During this action the fixture **13** will protect the insulation of the main part of the windings of the armature **17** from the heat of the flame so that only the insulation on the extending ends **18** will be charred. By the time the fixture **13** at the station D has made one complete revolution the cam wheel **51** will again cause the indexing mechanism to index the carriage **12** another step to bring the fixture **13** having the insulation of the ends **18** charred on both sides to the station E.

As the fixture **13** approaches the station E top section **19** will move beneath the plate **72** so as to tightly clamp the wire ends **18** between the two sections of the fixture. At the station E the fixture is also rotating in unison with the cam wheel **51**. The continuously rotating brush **65** will brush the wire ends **18** downwardly against the lower section **16** of the fixture **13**, one after the other as the fixture **13** is rotated. The abrasive action of the wire brush **65** will remove the charred insulation from the top side of the wire ends **18** and will clean and polish the metal of the wires. By the time the fixture **13** has made a complete revolution at station E the cam wheel **51** will again cause the indexing mechanism to operate and move the fixture to station F where the wire ends **18** are still tightly clamped between the fixture sections by

reason of the engagement of the top section **19** with the plate **72**.

As the fixture leaves the station E the pulley **21** will disengage from the belt **44** so that the fixture will be stationary as it approaches and leaves the station F. Also as the fixture **13** approaches the station F the pin **67** will engage the cam **66** and raise the sleeve **70** upwardly about the lower section **16** of the fixture **13** so as to bend the wire ends **18** upwardly against the top section **19**. The cam wheel **51** will again cause the indexing mechanism to operate and move the fixture to station G. As the fixture leaves the station F the pin **67** will ride over the cam **66** and the sleeve **70** will return to its downward position.

As the fixture **13** approaches station G the pulley **21** will again come into contact with the belt **44** and the fixture will be rotated at station G. The wire brush **71** will sweep upwardly over the lower sides of the wire ends **18** and brush them against the upper fixture section **19**. The abrasive action of the brush **71** will remove the charred insulation from the lower sides of the wire ends **18** and clean the metal of the wire, one after the other as the fixture **13** is rotated as shown at station G of Fig. 3. At station G the wire ends are tightly clamped by the engagement of the upper section **19** with the plate **73**.

The indexing mechanism will continue to operate periodically until the fixture **13** with the stripped armature thereon again reaches the station A. The attendant then removes the stripped armature and replaces it with an unstripped one.

While in the above description, for reasons of clarity, the operation has been described in connection with a single fixture advancing step-by-step from station to station, the actual operation of the machine is continuous. As soon as one fixture **13** leaves station A another is moved into position and an unstripped armature is placed therein. When all of the fixtures are loaded the machine will be operating simultaneously at each station as above described and the attendant will have to continuously remove a stripped armature at station A and replace it with an unstripped one.

From the foregoing it can be seen that this invention provides an apparatus and method whereby the insulation may be continuously stripped from the free ends of the wires of an assembled armature and the wires cleaned and polished automatically without manual operation except the loading and unloading at station A and the placing of the upper fixture section **19** over the armature at station C.

While I have shown but a single modification of my invention it is to be understood that this modification is to be taken as illustrative only and not in a limiting sense. I do not wish to be limited to the particular structure and method shown and described but to include all equivalent variations thereof except as limited by the scope of the claims.

I claim:

1. The method of removing the insulation from and cleaning the ends of assembled armature wires preparatory to securing the ends to the commutator segments comprising, the steps of applying a flame ot the insulation on the ends of the wires to char the insulation at the ends while protecting the insulation on the remainder of the wires from the heat of the flame, applying a rotative abrasive brushing action downwardly against the ends of the wires to remove the charred insulation from one side of the wires and to polish one side of the wires, moving the ends of the wires upwardly to expose the other side of the wires and applying a rotative abrasive brushing action upwardly against the exposed ends of the wires to remove the charred insulation from the other side of the ends of the wires and to polish the ends of the wires, the foregoing steps being carried out in sequence.

2. The method according to claim 1 in which the first, second, and fourth steps are carried out while the armature is being rotated about its axis through at least one revolution.

3. The method of removing the insulation from the loose ends of the wires of a wound armature preparatory to connecting the loose ends to the commutator segments comprising, rotating the armature at high speed to separate the loose ends and move them to a position extending radially of the armature by centrifugal action, applying intense heat to the radially separated loose ends to char the insulation thereof, applying an abrasive action to the one side of the loose ends to remove the charred insulation therefrom, moving the loose ends axially to expose the under side thereof and applying an abrasive action to the other side of the loose ends to remove the charred insulation therefrom.

4. The method of removing the insulation from and cleaning the ends of assembled armature wires preparatory to securing the ends to the commutator segments comprising, rotating the armature at high speed to separate the ends of the wires and move them to a position extending radially of the armature by centrifugal action, applying intense heat to the radially separated ends to char the insulation thereof while protecting the armature proper from the intense heat, applying an abrasive action to one side of said ends of sufficient intensity to remove the charred insulation therefrom and to clean the wire, moving the ends axially of the armature to expose the other side of said ends and applying an abrasive action to the other side of said ends of sufficient intensity to remove the charred insulation therefrom and to clean the wire.

5. The method according to claim 4 in which the burning and abrading steps are carried out while the armature is rotated through at least one revolution.

6. The method of removing the insulation from and cleaning the ends of assembled armature wires comprising, moving said ends to a position extending radially of the armature, charring the insulation of the radially extended ends by applying heat thereto while protecting the armature proper from said heat and abrading said ends to remove the charred insulation therefrom and to clean the wire ends and rotating the armature through at least one revolution during the charring and abrading steps.

7. The method of removing the insulation from and cleaning the ends of wires of a wound armature preparatory to securing the ends to the commutator segments comprising, rotating the armature at high speed to separate the wire ends and move them to a position extending radially of the armature by centrifugal action while maintaining the wires in position with respect to the core, subjecting the insulation of the radially extending ends to heat of sufficient intensity to char the insulation thereof while protecting the remainder of the armature from the heat and applying an abrading action to the wire ends to remove the charred insulation therefrom and clean the wire while holding the wires from being pulled from the armature by the application of the abrading action.

8. The method of removing the insulation from the loose ends of the wires of a wound armature preparatory to connecting the loose ends to the commutator segments comprising, separating the loose ends of the wires from each other, clamping the separated loose ends of the wires in a fixed position, charring the insulation on the ends of the wires, brushing the charred insulation from one side of the wire ends while supporting the other side against a fixed support and brushing the charred insulation from the other side of the wire ends while supporting the cleaned side against a fixed support.

9. The method according to claim 8 in which the separating step is carried out by rotating the armature at a high speed sufficient to separate the loose ends of the wires by centrifugal action.

10. The method according to claim 9 in which the charring and brushing steps are carried out while the armature is rotated at a comparatively slow speed through at least one revolution.

11. The method of removing the insulation from the loose ends of the wires of a wound armature preparatory to connecting the loose ends to the commutator segments comprising, charring the insulation on the wire ends, brushing the charred insulation from one side of the wire ends while supporting the other side against a fixed support and brushing the insulation from the other side of the wire ends while the cleaned side is supported against a fixed support.

12. The method according to claim 11 in which each step is carried out while the armature is being slowly rotated through at least one revolution.

13. The method according to claim 11 in which the wire ends are clamped inwardly of their ends during each of the brushing steps.

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