Feb. 9, 1965 G. E. MILLER 3,168,755

ARTICLE CLEANING APPARATUS

Filed July 9, 1963 3 Sheets-Sheet 1

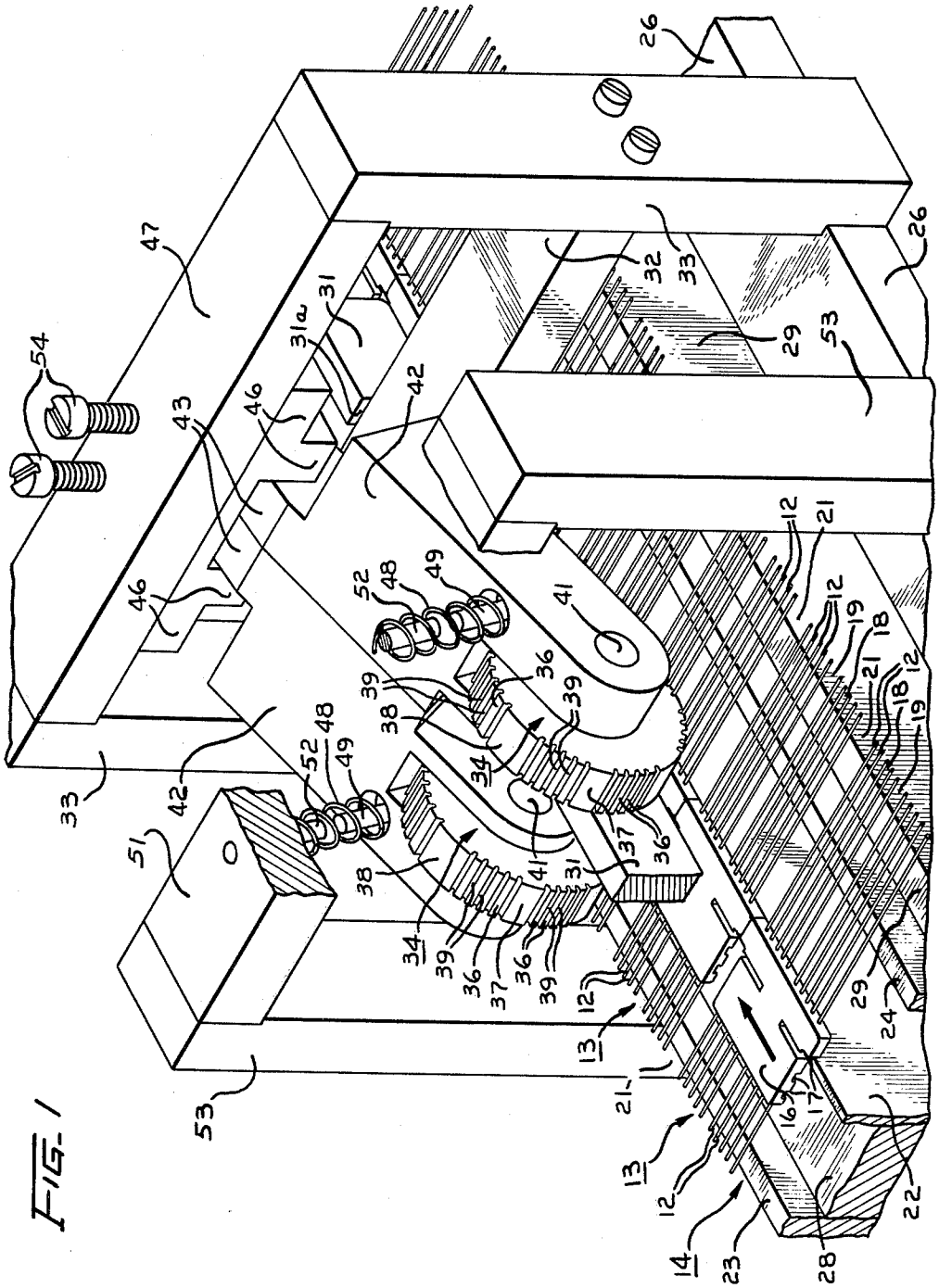


FIG. 1

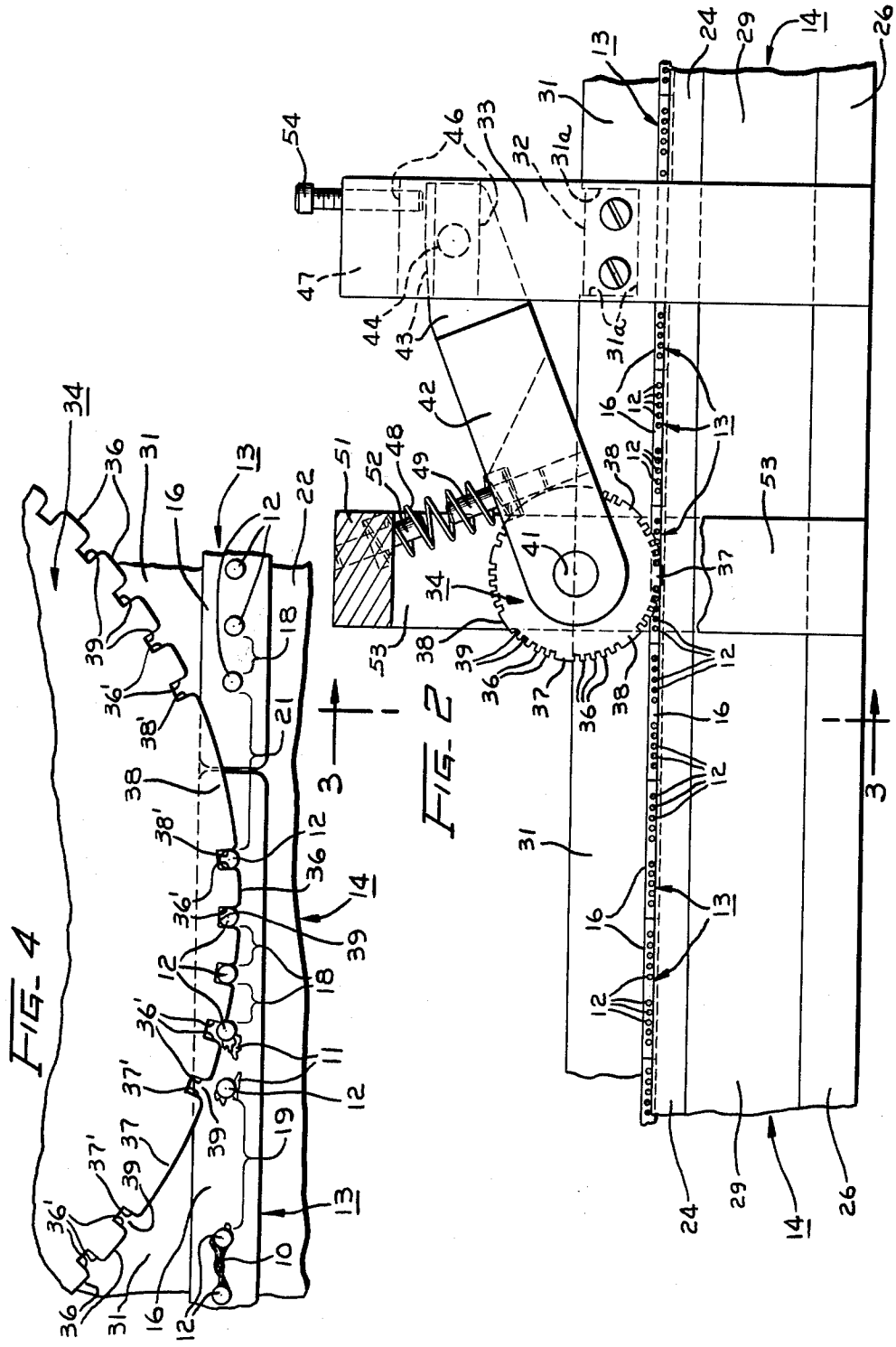
INVENTOR
G.E.MILLER

BY D.D. Gordon
ATTORNEY

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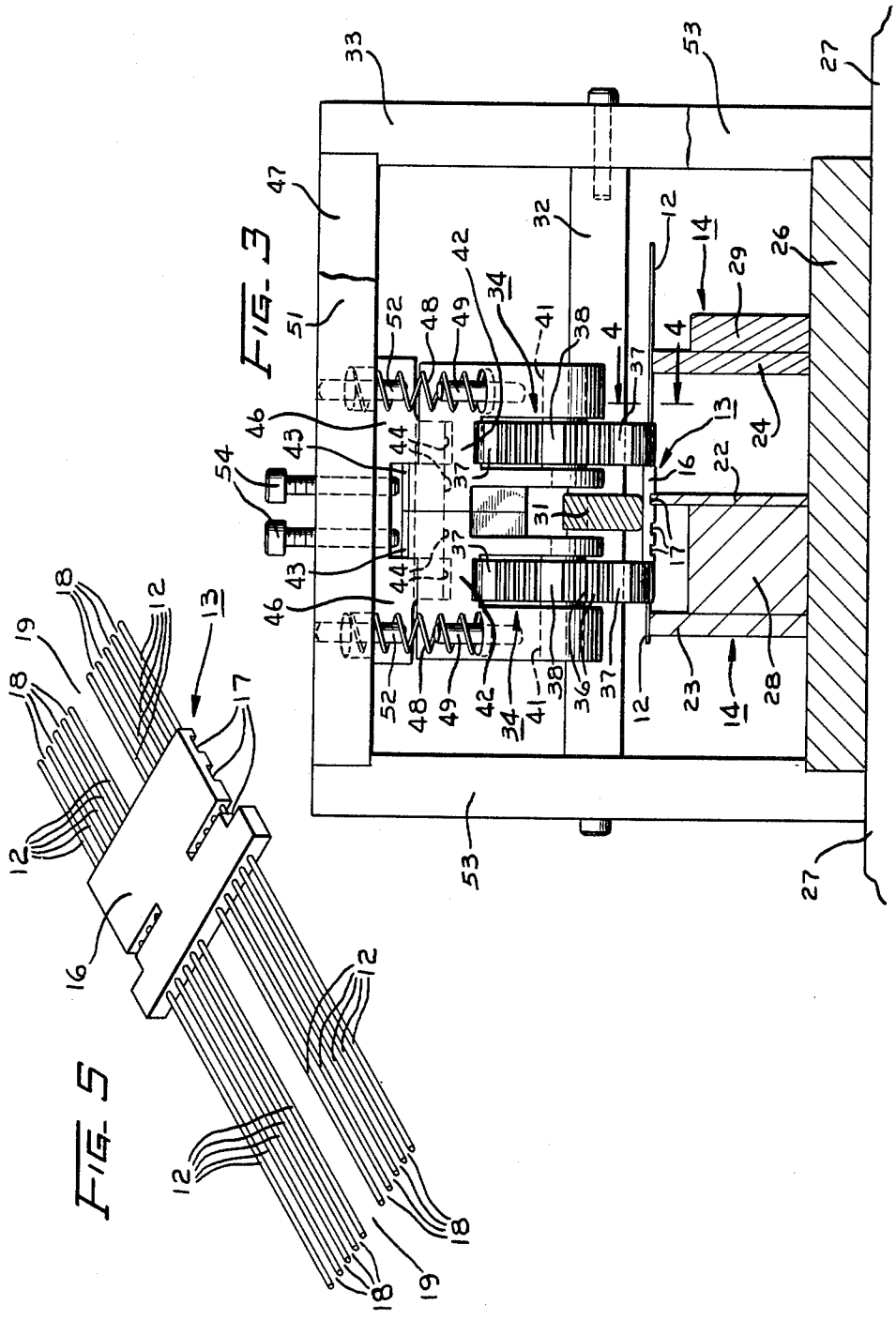
Filed July 9, 1963 3 Sheets-Sheet 2



Feb. 9, 1965 G. E. MILLER 3,168,755

ARTICLE CLEANING APPARATUS

Filed July 9, 1963 3 Sheets-Sheet 3



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ARTICLE CLEANING APPARATUS

Glenn E. Miller, Omaha, Nebr., assignor to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

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This invention relates to article cleaning apparatus, and more particularly to apparatus for removing residue material from between spaced portions of a series of articles being advanced in succession along a predetermined path. It is an object of this invention to provide new and improved apparatus of this character.

In the manufacture of a wire spring relay comb of the type used in telephone switching equipment, a body member of plastic material is molded about a plurality of parallel wires so that the wires project from opposite sides of the body member. The relay combs subsequently are advanced in succession along a guideway and the wires are grit blasted to remove molding flash therefrom in the areas closely adjacent the body members. Generally, however, particles of grit and flash tend to stick between the wires and therefore the relay combs must be subjected to an additional cleaning operation in which this residue material is removed. In the past this has been accomplished by air jets, or by reciprocating fingers which are movable between the wires to eject the residue material therefrom, both of which arrangements have certain undesirable features.

Air jets are undesirable because they do not always remove the residue material from between the wires, even at relatively high pressures, and because they create dust problems in the surrounding air and require the use of suitable shields and/or ventilating equipment. Further, an air jet arrangement requires considerable other operating apparatus including an air compressor, air lines and valves, and, unless the air jets are constantly operating, a mechanism operable to actuate the air jets in response to one of the relay combs being moved into cleaning position.

A reciprocating finger arrangement in which the cleaning fingers move between the wires of the relay combs, as in the case of an air jet arrangement, is undesirable because it requires considerable associated operating apparatus. For example, an arrangement of this type requires a relatively complicated indexing mechanism which intermittently moves the relay combs into a cleaning position with respect to the fingers, so that each relay comb will have a period of dwell in the cleaning position while the fingers are moving between the wires thereof. Further, this arrangement requires a mechanism for accurately locating each relay comb in the cleaning position with respect to the cleaning fingers, a mechanism for reciprocating the fingers, and relatively complicated electrical circuitry including various sensing devices, as for example, for determining when a relay comb is in the cleaning position and operating the reciprocating mechanism so that it moves the cleaning fingers between the wires of the relay comb, and for reversing the reciprocating mechanism to withdraw the fingers from between the wires so that the relay comb can be advanced to a subsequent station. In addition, in this arrangement if a relay comb is not located properly with respect to the cleaning fingers, or has a slightly bent wire, the fingers may damage the part to such an extent that it must be scrapped.

Accordingly, another object of this invention is to provide new and improved apparatus for positively removing residue material from between wires of wire spring relay combs.

A further object of this invention is to provide new and improved apparatus for positively removing residue material from between wires of wire spring relay combs without damaging the relay combs.

A still further object of this invention is to provide new and improved apparatus for removing residue material from between wires of wire spring relay combs which is relatively simple in construction and operation as compared to prior known apparatus.

Another object of this invention is to provide a new and improved device for positively cleaning residue material from between spaced portions of a series of articles as the articles are being advanced in succession along a predetermined path, which device is operated by the portions as the articles are advanced.

A further object of this invention is to provide a new and improved device for positively cleaning residue material from between portions of a series of articles being advanced in succession along a predetermined path wherein the portions are arranged in a repeated and fixed pattern and at least some of the portions are dissimilar distances apart.

A still further object of this invention is to provide new and improved apparatus for removing residue material from between a plurality of series of spaced portions of articles being advanced in succession along a predetermined path.

Another object of this invention is to provide a new and improved device for positively cleaning residue material from between spaced portions of a series of articles as the articles are being continuously advanced in succession along a predetermined path.

In accordance with the invention, a device for removing residue material from between spaced portions of a series of articles being advanced in succession along a predetermined path includes a substantially cylindrical gear member mounted for rotation adjacent the predetermined path and having peripherally spaced teeth arranged to receive the portions of the articles therebetween in close fitting relationship. Thus, as the articles are advanced the gear member is rotated by the portions and the teeth move into the spaces between the portions to eject the residue material positively therefrom.

In a preferred embodiment of the invention, apparatus is provided for removing residue material from between portions of spaced parallel wires on opposite sides of body members of a series of unconnected articles, such as wire spring relay combs, wherein the articles are being advanced in succession along a guideway and wherein the sizes of the spaces between at least some of the wire portions vary with respect to one another. The apparatus includes a pivoted arm member for the wire portions on each side of the body members and a substantially cylindrical gear member is rotatably mounted on each of the arm members. The gear members are provided with peripherally spaced teeth which have arc lengths corresponding to respective ones of the spaces between the wire portions and which are arranged to receive respective ones of the wire portions in the spaces therebetween in close fitting relationship, with the depth of the spaces being substantially equal to the diameters of the wire portions. Separate resilient mechanisms bias the arms toward the wires within the limits defined by a stop mechanism, to maintain the gear members in meshing engagement with the wire portions as the articles are advanced, and thus the gear members are rotated by the wire portions and the teeth on the gear members move into the spaces between the wire portions to eject the residue material positively therefrom.

This invention, together with further objects and advantages thereof will best be understood by reference to

the following detailed description, taken in connection with the accompanying drawings in which:

FIG. 1 is an isometric view partially broken away of the residue material removing apparatus;

FIG. 2 is a side view of the apparatus, partially in cross-section and partially broken away;

FIG. 3 is a cross-sectional view taken substantially along the line 3—3 of FIG. 2, and partially broken away;

FIG. 4 is an enlarged partial view of the apparatus taken substantially along the line 4—4 of FIG. 3; and

FIG. 5 is an isometric view of a wire spring relay comb.

Referring to the drawings, it is seen that the illustrated embodiment of the invention is designed to clean particles of grit 10 (FIG. 4) and molding flash 11 (FIG. 4) from between laterally adjacent parallel wires 12 of wire spring relay combs 13 of a type used in telephone switching equipment, as the relay combs are being advanced in succession along a guideway 14 from left to right, as viewed in FIGS. 1 and 2.

As is best shown in FIG. 5, in addition to the wires 12, each of the relay combs 13 also includes a body member 16 of plastic material which is molded about intermediate portions of the wires so that they project from opposite sides of the body member, and which has elongated parallel grooves 17 therein. It also can be seen from FIG. 5 that the wires 12 of each of the relay combs 13 are arranged in two sets and that the wires in each set have spacings 18 therebetween which are relatively small, being on the order of $\frac{1}{32}$ of an inch, while the sets of wires have a spacing 19 therebetween which is considerably greater than the spacings 18. Further, as is best shown in FIG. 1, as the relay combs 13 are being advanced in succession along the guideway 14, the leading and trailing wires 12 of the relay combs have spacings 21 therebetween which are greater than either the spacings 18 or the spacings 19.

In the manufacture of the wire spring relay combs 13, after the body members 16 have been molded about the wires 12 the relay combs initially are advanced in succession along a preceding portion of the guideway 14 disposed to the left (FIGS. 1 and 2) of the portion shown in the drawings, and through a grit blasting machine (not shown) which is designed to remove molding flash from the wires in the areas closely adjacent the body members. However, since the above-mentioned particles of grit 10 and molding flash 11 (FIG. 4), hereinafter referred to as residue material, tend to stick between the wires 12, particularly in the relatively small spaces 18, the relay combs 13 must be subjected to an additional cleaning operation to remove this residue material. This cleaning operation, as indicated hereinabove, is performed by the illustrated embodiment of the invention as the relay combs 13 are advanced along the portion of the guideway 14 shown in the drawings, after which the relay combs continue along the guideway to the right (FIGS. 1 and 2) to a subsequent processing station.

As is best shown in FIGS. 1 and 3, the guideway 14 includes a horizontal longitudinally extending rail member 22 which defines a predetermined path of travel for the relay combs 13, and which is designed to have an upper guide portion thereof received in aligned corresponding ones of the grooves 17 in the body members 16 in close fitting relationship as the relay combs are being advanced along the guideway. The guideway 14 also includes a pair of horizontal rail members 23 and 24 extending longitudinally parallel to the rail member 22 on opposite sides thereof, for supporting the opposite outer ends of the wires 12 of the relay combs 13. The bottoms of the guideway rail members 22, 23 and 24 are suitably secured, as by bolts, screws or welding, to a horizontal longitudinally extending base plate 26 mounted on a support table 27, and the rail members are reinforced by horizontal longitudinally extending members 28 and 29. The reinforcing member 28 is suitably secured between the central rail member 22 and the side rail member 23 and the reinforcing member 29 is suitably secured to the side rail member 24, substantially as shown.

The wire spring relay combs 13 are advanced along the guideway 14 through the above-mentioned grit blasting machine and the cleaning apparatus shown in the drawings by a suitable mechanism (not shown) located ahead of the grit blasting machine with respect to the direction of travel of the relay combs. For example, the relay combs 13 may be advanced along the guideway 14 intermittently by a step by step indexing device of the type shown in the U.S. Patent 2,861,676 issued to C. R. Rasmussen et al. on November 25, 1958, or of the type shown in the U.S. Patent 2,873,845 issued to W. J. Kross on February 17, 1959, both of which patents are assigned to the assignee of this application. However, as will become apparent subsequently, the nature of the cleaning apparatus of this invention also permits the relay combs 13 to be advanced continuously along the guideway 14, as for example, by a driven roller (not shown) mounted above the guideway for rotation on an axis extending perpendicular to the guideway, and in frictional driving engagement with the top surfaces of the body members 16 for advancing the relay combs along the guideway.

Referring to FIGS. 1, 2 and 3, it is seen that a horizontal hold-down bar 31 extends longitudinally above the guideway 14 so that the bottom of the bar is engageable with the tops of the body members 16 of the wire spring relay combs 13 as they are advanced along the guideway, to maintain the relay combs in engagement with the guideway and in horizontal coplanar relationship with respect to one another. As is best shown in FIGS. 2 and 3, the hold-down bar 31 is provided with an upper cutout portion 31*a* (FIG. 2) which receives a horizontal frame member 32 (FIG. 3) therein, the bar being suitably secured to the frame member and being supported at other points along its length (not shown in the drawings) in a suitable manner. The opposite ends of the frame member 32 are secured by suitable screws to a pair of vertical posts 33 which are suitably secured at their lower ends to the base plate 26 and which, with the frame member 32, form a part of the illustrated embodiment of the invention, now to be described in further detail.

The cleaning of the residue material 10, 11 from between the wires 12 of the wire spring relay combs 13 in accordance with this invention is accomplished by a pair of cylindrical gear members 34 arranged so as to be positionable on opposite sides of the body members 16 closely adjacent thereto as the relay combs are being advanced along the guideway 14. Each of the gear members 34 has a periphery designed to mesh with the wires as the relay combs are being advanced along the guideway 14, so that the residue material 10, 11 is ejected positively from between the wires and so that the wires function in the manner of an advancing rack member to rotate the gear members.

Thus, the periphery of each of the gear members 34 includes peripherally spaced teeth 36, 37 and 38 of different arc lengths, with the arc lengths of the teeth 36 corresponding to the spaces 18 between the wires 12, the arc lengths of the teeth 37 corresponding to the spaces 19 between the sets of the wires, and the arc lengths of the teeth 38 corresponding to the spaces 21 between the trailing and leading wires of successive ones of the advancing relay combs 13. More specifically, as is best shown in FIG. 4, the teeth 36, 37 and 38 include substantially radially extending opposed end surfaces 36′, 37′ and 38′ which define spaces 39 between the teeth for receiving the wires 12 in close fitting relationship with the end surfaces of each tooth being peripherally spaced apart a distance substantially equal to a respective one of the spaces 18, 19 and 21 between the wires 12. In addition, the depth of the spaces 39 between the teeth 36, 37 and 38 is substantially equal to the diameter of the wires 12 to facilitate withdrawal of the wires from between the teeth as the relay combs 13 move beyond the gear members 34 along

the guideway 14. Accordingly, as the relay combs 13 are advanced along the guideway 14 the teeth 36, 37 and 38 receive respective ones of the wires 12 in the spaces 39 between the teeth in close fitting relationship and the teeth move into respetcive ones of the spaces 18, 19 and 21 between the wires to eject the residue material positively therefrom, while the gear members 34 are driven rotatably by the wires.

Each of the gear members 34 is rotatably mounted on an intermediate portion of a pin 41 having its opposite ends force fitted into apertures in laterally spaced legs (FIGS. 1 and 3) at the lowermost end of a pivoted arm 42. The arms 42 are pivoted at their upper ends for movement independent of one another so that if one of the gear members 34 should get out of mesh or synchronism with the wires 12, as for example as a result of a bent wire, the gear member can ride on the tops of the wires until the condition can be corrected by an operator, without causing any twisting of the second arm 42 and the gear member 34 thereon, and thus twisting and possible damage to the relay combs 13.

The pivotal mounting of each of the gear carrying arms 42 includes a longitudinally extending lug portion 43 at its upper end. A horizontal pin member 44 (FIGS. 2 and 3), which provides a common support for both of the arms 42, extends through aligned apertures in the lug portions 43 so that the arms are freely movable on the pin member independent of one another, and the opposite ends of the pin member are force fitted into apertures in depending lugs of a horizontal bracket member 46. The bracket member 46 is suitably secured to the underside of a horizontal frame member 47, and the frame member is suitably secured at its opposite ends to the upper ends of the vertical posts 33.

As viewed in FIGS. 1 and 2, the gear carrying arms 42 are biased counterclockwise and downward toward the guideway 14 independently of one another by a pair of coil springs 48, to maintain the gear members 34 in proper meshing engagement with the wires 12 of the relay combs 13 as the relay combs are advanced along the guideway. The lower end of each of the coil springs 48 is disposed in a recess in its associated arm 42 and encircles the upper portion of a first support rod in the form of a dowel pin 49 having its lower end force fitted into an aperture in the arm. Similarly, the upper end of each of the coil springs 48 is disposed in a recess in a horizontal frame member 51 and encircles the lower portion of a second support rod in the form of a dowel pin 52 having its upper end force fitted into an aperture in the frame member. The opposite ends of the frame member 51 are suitably secured to the upper ends of spaced vertical posts 53 suitably secured at their lower ends to the base plate 26.

The movement of the gear carrying arms 42 by the coil springs 48 is limited by stop mechanisms in the form of vertical screws 54 threaded through the frame member 47 and the bracket member 46 so that their lower ends engage top surface portions (FIG. 3) of respective ones of the mounting lugs 43 of the arms 42.

In operation, an operator positions the gear members 34 in proper meshing engagement with the wires 12 of the wire spring relay combs 13 and the relay combs are advanced along the guideway 14 to the right, as viewed in FIGS. 1 and 2. During this movement of the relay combs 13 they are retained on the guideway 14 in horizontal coplanar relationship with respect to one another by the hold-down bar 31, which is engaged with the tops of the body members 16 thereof, and the coil springs 48 urge the gear carrying arms 42 and the gear members 34 thereon toward the wires 12 to maintain the gear members in meshing relationship with the wries. Thus, as the relay combs 13 advance along the guideway 14, the teeth 36, 37 and 38 of the gear members 34 receive the wires 12 in the spaces 39 between the teeth in close fitting relationship and the teeth move into the spaces 18, 19 and 21 between the wires to eject the residue material 10, 11 positively therefrom, with the wires operating in the manner of an advancing rack member to rotate the gear members.

In the event that one of the gear members 34 gets out of mesh or synchronism with the wires 12, as for example as the result of a bent wire, the operator readily can correct the condition by repositioning the gear member back in proper meshing engagement with the wires. After the relay combs 13 have been cleaned by the gear members 34, they continue along the guideway 14 to the right (FIGS. 1 and 2) to a subsequent processing station.

While one embodiment of the invention has been disclosed many modifications will be apparent and it is intended that the invention be interpreted as including all modifications which fall within the true spirit and scope of the claims.

What is claimed is:

1. In combination with apparatus in which articles are advanced in succession along a predetermined path, mechanism for removing residue material from between spaced portions of the articles which comprises:

a substantially cylindrical gear member mounted for rotation adjacent the predetermined path of the articles for continuous engagement with the advancing articles; and

peripherally spaced teeth on said gear member arranged to receive the portions of the articles therebetween continuously and in close fitting relationship so that as the articles are advanced the gear member is rotated by the portions and said teeth move into the spaces between the portions to eject the residue material therefrom.

2. In combination with apparatus in which a plurality of distinct articles are advanced in succession along a guideway, mechanism for removing residue material from between spaced portions of the articles, which comprises:

a substantially cylindrical gear member mounted for rotation adjacent the guideway;

peripherally spaced teeth on said gear member arranged to receive the portions of the articles therebetween continuously and in close fitting relationship; and

resilient means biasing said gear member into continuous meshing engagement with the portions of the articles so that as the articles are advanced said gear member is rotated by the portions and said teeth move into the spaces between the portions to eject the residue material therefrom.

3. In combination with apparatus in which articles are advanced in succession along a predetermined path, mechanism for removing residue material from between portions of the articles wherein the portions are arranged in a repeated and fixed pattern and at least some of the portions have dissimilar spaces therebetween, which mechanism comprises:

a substantially cylindrical gear member mounted for rotation adjacent the predetermined path of the articles for continuous engagement with the advancing articles; and

teeth on the periphery of said gear member having surfaces which define spaces between the teeth for receiving the portions of the articles continuously and in close fitting relationship, with certain of the space defining surfaces being peripherally spaced apart dissimilar distances corresponding to respective ones of the dissimilar spaces between the portions, so that as the articles are advanced said gear member is rotated by the portions and said teeth move into the spaces between the portions to eject the residue material therefrom.

4. In combination with apparatus in which a plurality of articles are advanced in succession along a predetermined path, mechanism for removing residue material from between portions of the articles wherein the por-

tions are arranged in a repeated and fixed pattern and at least some of the portions have dissimilar spaces therebetween, which mechanism comprises:

a substantially cylindrical gear member mounted for rotation adjacent the predetermined path of the articles for continuous engagement with the advancing articles; and

teeth on the periphery of said gear member defining spaces therebetween for receiving the portions of the articles continuously and in close fitting relationship, with certain of said teeth having dissimilar arc lengths corresponding to respective ones of the dissimilar spaces between the portions, so that as the articles are advanced said gear member is rotated by the portions and said teeth move into the spaces between the portions to eject the residue material therefrom.

5. In combination with apparatus in which articles are advanced in succession along a predetermined path, mechanism for removing residue material from between spaced portions of the articles wherein the spaced portions are disposed in a plurality of separate series, which mechanism comprises:

a plurality of supports, one for each of the series of article portions, mounted for movement independent of one another; and

substantially cylindrical gear members rotatably mounted on said supports for continuous engagement with the advancing articles and having peripherally spaced teeth arranged to receive the article portions continuously and in close fitting relationship therebetween, so that as the articles are advanced said gear members are rotated by the portions and the teeth on said gear members move into the spaces between the portions to eject the residue material therefrom.

6. In combination with apparatus in which a plurality of distinct articles are advanced in succession along a guideway, mechanism for removing residue material from between spaced portions of the articles wherein the spaced portions are disposed in a plurality of separate series, which mechanism comprises:

a plurality of supports, one for each of the series of article portions, mounted for movement independent of one another;

substantially cylindrical gear members rotatably mounted on said supports and having peripherally

spaced teeth arranged to receive the article portions continuously and in close fitting relationship therebetween as the articles are advanced; and

separate resilient means biasing said supports toward the guideway to urge said gear members into continuous meshing engagement with the article portions, so that as the articles are advanced said gear members are rotated by the portions and the teeth on said gear members move into the spaces between the portions to eject the residue material therefrom.

7. In combination with apparatus in which a plurality of distinct articles are advanced in succession along a guideway, mechanism for removing residue material from between portions of spaced parallel wires on opposite sides of body members of the articles wherein the wire portions are arranged in repeated and fixed patterns and at least some of the wire portions have dissimilar spaces therebetween, which mechanism comprises:

a pair of arm members, one for the wire portions on each side of the body members and each mounted adjacent one of its ends for pivotal movement independent of the other arm member;

substantially cylindrical gear members rotatably mounted on said arm members adjacent the other ends thereof;

teeth on the peripheries of said gear members defining spaces therebetween for receiving respective ones of the wire portions in continuous and close fitting relationship, certain of said teeth having dissimilar arc lengths corresponding to respective ones of the dissimilar spaces between the wire portions and the depth of the spaces between the teeth being substantially equal to the diameters of the wire portions;

separate resilient means biasing said arms toward the guideway to urge said gear members into continuous meshing engagement with the wire portions so that as the articles are advanced said gear members are rotated by the wire portions and said teeth on said gear members move into the spaces between the wire portions to eject the residue material therefrom; and

stop means for limiting the movement of said arm members by said resilient biasing means.

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