ABSTRACT: The "split" ring assembly machine of the present invention comprises a ring feed mechanism operable to feed one spiralled wire "split" ring one at a time to the operating assemblies of the machine; a "split" ring placing means operable to place a "split" ring from the feed mechanism into operative position; a "split" ring holding means operable to hold a "split" ring placed in operative position by the placing means while the ring is being opened to receive other components and accessories to be linked together by the ring, a knifelike means operable to open a "split" ring on the holding means; and a spindle means operable to cause the ring to be turned on the ring holding means in response to rotation of the spindle means and to be opened by the knifelike means in engagement with the ring at which time components and accessories intended to be linked by the ring may be put over the terminal end thereof. During the next succeeding cycle as above described the components and accessories may be linked together on the spiralled "split" ring in response to further rotational movement of the spindle means.
FIG. 10

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[Signature]
FIG. 13
SPLIT RING ASSEMBLY MACHINE

FIELD OF INVENTION

The present invention relates to an assembly machine and more particularly to a machine operable to open rings of the spiralled wire "split" ring type to link together the component assemblies of jewelry, fishing lures and the like to provide a linkage between said component assemblies.

DESCRIPTION OF THE PRIOR ART

"Split" rings as used in the present disclosure relates to rings commonly used to hold a multiplicity of keys together which is usually made by compressing together a spring steel spiral to form the ring. As commonly used, an article having an eyelet, such as a key, is caused to be inserted over one of the terminal ends of the ring spiral that has been sharpened to a point and then to twist the ring through the eyelet until the article such as a key is held within the spiralled ring. Formerly assemblies of such rings to articles to be linked together has been accomplished by the hand operation as aforesaid, and, therefore, split rings could not economically be used in commercial high-speed production. Instead, rings made from a single strand of wire having its terminal ends abutted together have more generally been used to assemble components and accessories to be linked together. Opposing forces exerted on the components or accessories so linked together tend to cause such a link to pull apart. Therefore, it is more desirable to use the split ring for the reason that inadvertent disassembly may not likely occur.

Accordingly it is a very important object to the present invention to provide a machine which may quickly and economically link components and accessories together on a split ring link, and to provide a machine which is simple in its construction and operation. A further object of this invention is to provide in a split-ring assembly machine the combination of means to feed split rings into the operating apparatus, means for placing split rings on a pedestal to be held into position and means for opening the split-ring for fast and easy assembly of accessories and components thereeto.

These and further objects shall become more clearly apparent from the description of the preferred embodiment hereinafter set out, particularly when understood with connection with the drawings forming part of this specification.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front perspective view of the split-ring assembly machine of the present invention as viewed from the top right side thereof showing the machine as it is used in normal operation of assembling split-ring to other components and accessories.

FIG. 2 is a top plan view of the feed mechanism of the present invention.

FIG. 3 is a side elevational view taken from the right side thereof with respect to the position of FIG. 1 of the feed mechanism.

FIG. 4 is a fragmentary side elevational view of the feed mechanism as viewed from the side opposite FIG. 3 showing the repeating-release assembly of the present invention.

FIG. 5 is a top plan view of the split-ring placing arm assembly showing in dotted lines the operational movement thereforefor illustrative purposes.

FIG. 6 is a top plan view of the split-ring holding assembly showing in dotted lines the operational movement thereof for illustrative purposes.

FIG. 7 is a top plan view of the knife arm assembly of the present invention.

FIG. 8 is a fragmentary side elevational view of the split-ring placing arm assembly, the split-ring holding pin arm assembly and a portion of the split ring knife arm assembly.

FIG. 9 is a top plan view of the assemblies shown to advantage in FIG. 8.

FIG. 10 is a fragmentary side elevational view of the spindle ring assembly, the split-ring holding assembly and the split ring knife blade assembly of the present invention and showing in dotted lines for illustrative purposes the upward and downward movement of the knife blade assembly.

FIG. 11 is a side elevational view of the knife blade on the holding pin assembly adjacent the split knife assembly. FIG. 12 is a fragmentary top plan view of the apparatus shown in FIG. 11.

FIG. 13 is a schematic of the driving train of the split ring assembly machine of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings the "split" ring assembly machine of the present invention is shown to advantage in FIG. 1 and is generally designated by the numeral 10. A commonly known vibratory hopper 11 is provided on the machine housing 12. The hopper 11 includes a spiralled track 13 issuing out of a flat bottom pan portion 14. As the hopper 11 is caused to vibrate, "split" rings (not shown) in the hopper 11 are caused to be oriented horizontally on the pan 14 and on the track 13, and to be advanced counterclockwise on the spiralled track 13 in response to the rotational movement of an eccentric vibrating motor commonly known and forming an integral part of the hopper 11. Toward the front terminal end of the track 13, the "split" rings tend to be inclined upwardly by the side of track being more steeply inclined.

A "split" ring feed mechanism 15 is provided on the housing 12, having one of its terminal ends suitably fastened to the housing adjacent an outlet opening 16 of the hopper 11 provided at the terminal end of the track 13. The feed mechanism 15 is inclined downwardly from the hopper 11 on the housing 12 and is cantilevered over the housing at the terminal end opposite the hopper. The feed mechanism 15 is operable to cause "split" rings received from the hopper 11 to be fed through the mechanism by gravity as hereinafter later described. The feed mechanism 15 comprises a horizontally disposed bed portion 17, a pair of parallel, upstanding guide members 18 and 19 suitably fastened to bed 17 and spaced apart to provide a trough in which the "split" rings may travel downwardly in the feed mechanism 15; a "split" ring retaining-release assembly 20; and a stop portion 21. The bed 17 is provided with a "split" ring exitway 22 at the terminal end opposite the end thereof adjacent the hopper outlet opening 16.

FIGS. 2 and 3 show to advantage the detailed construction of feed mechanism 15. The components thereof identified above are identically numbered in the drawings. The "split" ring retaining-release assembly 20 is pivotedly mounted to and carried by the underportion of the bed 17 and is disposed between the bed 17 and a mounting block 23 provided on the housing 12 to carry feed mechanism 15. The retaining-release assembly 20 comprises a U-shaped body portion 24 issuing upwardly at 90°, more or less, to a stop mounting block portion 25, the stop-mounting block portion 25 having a knife-like "split" ring stop-release blade 26 suitably fastened to one of the faces thereof; and a retaining stud-mounting block 27 slidably mounted on the body portion 24 on the side opposite the stop-mounting block portion 25. The retaining stud-mounting block 27 is provided with a retaining stud portion 28 which is engageable with a slotted opening 29 provided in the guide member 18. A spring 30 is disposed between the U-shaped body portion 24 and mounting block 23 on the side of the body portion 24 adjacent the stop-mounting block portion 25 and is operable to normally urge the body portion 24 and the "split" ring stop release blade 26 forwardly so that "split" rings in the trough formed by the guide members 18 and 19 may not pass the blade 26. When the retaining-release assembly 20 is caused to pivot on its axis in response to movement of an electric solenoid (not shown) the blade 26 is caused to be articulated out of the path of the "split" rings in the trough and the retaining stud portion 28 is simultaneously
caused to accurately move through the slot 29 of the guide portion 18 and into engagement with the next succeeding "split" ring in the trough. In this manner only one "split" ring is released in response to each movement of the retaining-release assembly 20. The "split" ring thus released may then travel by gravity down the trough formed by guide members 18 and 19 to the "split" ring exitway 23 in the bed 17 of the feed mechanism 15 and drop therethrough. It should be particularly pointed out that the retaining stud portion 28 may be adjusted for various sizes of "split" rings by moving the block 27 forwardly or rearwardly on the block 24 and consequently moving the stud 24 in the slot 29.

Referring again to FIG. 1, the feed mechanism 15 is mounted on the housing 12 so that the mechanism 15 is downwardly inclined from the hopper 11 and cantilevered over a "split" ring placing arm assembly 31 and a spindle assembly 32 provided on the housing. A holding pin assembly 33 is provided in the housing adjacent the spindle assembly 32 and adjacent the pin arm and spindle assemblies, as well as a knife arm assembly 34 adjacent to the spindle assembly 32. Although, each of the above-identified assemblies are operated sequentially in cooperative engagement with each other, a clearer understanding may be had of the invention when a separate and independent understanding of the construction and operation of each of the assemblies is had before describing the combined integral relationship and construction of the assemblies.

Referring now more particularly to FIG. 5 which shows to advantage the detailed construction and operation of the "split" ring placing arm assembly 31, the placing arm assembly is pivotally carried by a shaft 36 journaled for rotation in the housing 12 and is disposed between the feed mechanism 15 and the spindle assembly 32 and is contiguous with one of the faces of the spindle. The placing arm assembly 31 comprises a flat, platelike arm portion 36 having an eyelet 37 in one of the terminal sides thereof being normally positioned and operable to receive a "split" ring from the exitway 22 of the feed mechanism 15; a guide bracket 38 suitably fastened to the shaft 35, the bracket 37 including an upstanding rollerlike guide member 39; and a placing arm cam 39 carried by a rotatable shaft 40. A spring 41 is provided in a recess portion in the housing 12 to constant urge the bracket 37 and consequently the rollerlike guide member 38 against the cam 39. In response to the tracking movement of the guide member 38 as the cam 39 is rotated, the placing arm 36 is caused to move across the face of the spindle assembly 32. A "split" ring received from the exitway 22 of the arm 36 is carried across and over the face of the spindle assembly 32 onto the holding pin assembly 33 adjacent to the spindle assembly 32 as hereinafter described. Movement of the placing arm assembly 31 is shown in dotted lines in the FIG. 5.

FIG. 6 shows to advantage the detailed construction and operation of the split-ring-holding pin assembly 33 of the present invention. The pin assembly 33 comprises a pin-spacing adjusting arm 42 having an upstanding "split"-ring-holding pin portion 43 at one of its terminal ends and a pair of accurately shaped slots 44 and 45 in the body portion of the arm 42 toward the terminal end opposite the portion 43; a guide arm assembly 46 pivotally carried by the arm 42 including a pair of downwardly projecting studs 47 and 48 which are in engagement with the slots 44 and 45 respectively; and including an upstanding rollerlike guide member 40 below the placing arm cam 39. An adjusting screw 51 is laterally threaded into the body of the adjusting arm portion 42 and into the slot 44, one of the terminal ends of the screw 51 being operable to urge against the stud 47. In response to tightening or loosening of the screw 51, the arm 42 and consequently the holding pin portion 43 carried thereby may be moved toward or away from the spindle assembly 32 to provide means of adjustment for various sizes of "split" rings. A spring 52 is provided in a recess portion of the housing 12 to constantly urge the arms 42 and 46 including the rollerlike guide member 49 into engagement against the cam 50. In response to the tracking movement of the guide member 49 as the cam 50 is caused to rotate, the "split"-ring holding pin portion 43 is caused to be moved toward or away from the spindle assembly 32. When the pin portion 43 is moved away from the spindle assembly 32, a "split" ring may be received on the pin portion 43 from the eyelet 37 on the arm portion 36 of the "split"-ring-placing arm assembly 31. When the holding pin portion 43 is on its normal position adjacent the spindle assembly 32, a "split" ring on the pin portion 43 is urged against a fixed peripheral sidewall portion of the spindle assembly 31 to be diametrically rotated by the spindle assembly 31 on the holding pin portion 43 as hereinafter later described. Movement of the holding pin assembly 33 away from the spindle assembly 32 is shown in dotted lines in the drawings.

FIG. 7 is a plan view of the knife arm assembly 34 of the present invention, while FIG. 11 shows the advantage the assembly 34 in a side elevational view as it may be observed from the right side of housing 12. The knife arm assembly 34 comprises a crank arm 35 pivotally mounted in the housing 12, a knife-holding chuck 54 carried at one of the terminal ends of the crank arm 35, a knife 55 carried by the chuck 54, a horizontally disposed rollerlike guide member 56 carried by the arm 35 at the terminal end opposite the chuck 54, and a knife arm cam 57 carried on the rotatable shaft 40 below the pin arm cam 50. The crank arm 53 is provided with a downwardly projecting arm-retaining member 58. A spring 59 is provided in a recess portion of the housing 12 to constantly urge the retaining member 58 and consequently the crank arm 53 with the guide member 56 upwardly against the cam 57. In response to the tracking movement of the guide member 56, the crank arm 53 and consequently the chuck 54 and the knife 55 are caused to be moved upwardly and downwardly with respect to the spindle assembly 32 to permit the loading of a "split" ring onto the pin 43 as above described. The assembly of the placing arm assembly 31, the holding pin assembly 33 and the knife arm assembly 34 upon the shaft 40 is shown to advantage in FIGS. 8 and 9. The shaft 40 is journaled for rotation as one of its terminal ends in the base portion of housing 12. A commonly known electric clutch 60 is provided on the shaft 40 and includes a gear-engaging portion 61. A driven gear 62 is journaled for rotation on the shaft 40, and is disposed above the electric clutch 60.

In operation, the electric clutch 60 is energized from a suitable power source to cause the gear-engaging portion 61 to engage the driven gear 62 during one complete revolution of the gear 62. In response to the rotation of the gear 62 the shaft 40 is caused to turn carrying with it the "split" ring placing cam 39, the "split" ring holding pin cam 50, and the knife arm cam 57. The solenoid in operative engagement with retaining-release assembly 20 of the "split" ring feed mechanism 15 is electrically interconnected with the power source and electric clutch 62 so that when the clutch 60 is energized the solenoid is simultaneously caused to operate the retaining-release assembly 20.

The operating cycle of the "split" ring assembly machine commences with the "split" rings being placed into the vibratory hopper 11 and being caused to travel up the spiralled track 13 and through the hopper outlet opening 16 into the trough formed by the upstanding guide members 18 and 19 of the feed mechanism 15 to the retaining-release assembly 20 of the feed mechanism 15. When energy is supplied concurrently to the solenoid associated with retaining-release assembly 20 of the feed mechanism 15 and to the electric clutch 60 on shaft 40, the retaining-release assembly is caused to pivot on its axis in response to movement of the electric solenoid to cause the blade 26 to be articulated out of the path of "split" rings in the trough formed by the guide members 18 and 19 of the feed mechanism 15 and to cause the retaining stud portion 20 to arcuately move through the slot 29 of the guide portion 18 and into engagement with the next succeeding "split" ring in the trough with the feed mechanism 15 and to through the exitway 22 of the feed mechanism 15 and into the eyelet.
Having thus described a preferred embodiment of the invention which includes the teachings and principles therefor, it is to be appreciated and will be apparent to those skilled in the art that many physical changes could be made in the invention without altering the inventive concepts embodied therein. Hence, it is intended that the scope of the invention be limited only to the extent indicated by the appended claims.

1. CLAIM

1. In an assembly machine for machining components and accessories to be linked together by a spiralled wire split ring, the combination of a housing, a feed means carried by said housing; a ring-holding pin means mounted in the housing and below the lowermost terminal end of said feed means, said ring-holding pin means being operable to receive a ring from said feed means; a disclike spindle means including a knurled sidewall journaled for rotation in said housing and being disposed adjacent said ring-holding means; means selectively driving said disclike spindle means; means urging said ring-holding pin means toward said spindle means, said holding pin means being operable to urge a ring on said ring-holding pin means against the knurled sidewall of said spindle means, said spindle means and said ring-holding pin means being operable to rotate said ring in response to the rotation of said spindle means; a knifelike ring opening means pivotally mounted in said housing for upward and downward movement with respect to said housing, said knifelike ring opening means being operable to open a spiralled wire split ring on said holding pin means in response to rotational movement of said ring.

2. The apparatus of claim 1 in which said feed means includes a ring-retaining release means carried thereby being operable to eject one ring at a time from said feed means and to retain other rings in said feed means in response to movement of said retaining-release means.

3. The machine of claim 2 including a ring-placing means mounted in the housing intermediate said feed means and said ring-holding pin means being operable to receive a ring from said feed means and guide said ring onto said ring-holding pin means.

4. The article of claim 3 including a vibratory hopper means adjacent said feed means, said hopper means having an opening adjacent the entranceway of said feed means, said hopper means being operable to feed rings one at a time into said feed means.

5. In an assembly machine for machining components and accessories to be linked together by a spiralled wire split ring, the combination of a boxlike housing; a vibratory hopper on the housing having an eccentric rotationally driven vibrating driving means, said hopper including an upwardly spiralled track disposed therein and a hopper opening at the uppermost terminal end of said track in the sidewall of said hopper, the hopper being operable to cause rings placed in the hopper to be oriented and moved upwardly on said spiralled track and out of said hopper opening in response to eccentric rotational vibrating movement of said hopper, a downwardly inclined feed means suitably fastened to the housing and having its uppermost terminal end cooperatively disposed contiguous to said hopper opening, the opposite terminal end thereof being cantilevered over said housing, said feed means including a troughlike guide portion operable to carry rings in their vertical upstanding position downwardly in said trough by gravity, a pivotally mounted retaining-release means carried by said feed means and including a pawl normally in said trough means and operable to retain rings in said trough and a stud opposite said pawl normally out of the path of rings in said trough, said retaining-release means being operable to release a ring in said trough when said pawl is pivotally moved out of the path of said trough and to simultaneously pivotally move said stud into the path of the next succeeding ring in said trough, and an exway in the lowermost terminal end of said feed means to permit a ring released by said retaining-release means to pass therethrough; a disclike spindle means including a knurled side peripheral wall portion and being journaled.
for rotation in said housing and being disposed below the
lowermost terminal end of said exitway of said feed means;
means driving said spindle means; a ring-placing arm disposed
between the lowermost terminal end and said exitway of said
feed means and being pivotally mounted in said housing; said
ring-placing arm means including an eyelet portion operable
to receive a ring from said exitway of said feed means; a ring-
holding pin means pivotally mounted in said housing adjacent
to said spindle means; said ring-placing arm means being opera-
table to move a ring in the eyelet thereof across and over said
spindle means and onto said ring-holding pin means in re-
response to pivotal movement of said ring-placing arm means
and said ring-holding pin means; a knifelike ring-opening
means pivotally mounted in said housing for movement up-
wardly and downwardly with respect to said housing, said

knifelike ring-opening means being disposed in said housing
adjacent said ring-holding pin means, said holding pin means
being operable to urge a ring against the knurled sidewall of
said spindle means, said spindle means being operable to turn
said ring on said ring-holding pin means in response to rota-
tion of said spindle means, said knifelike ring opening means
being operable to open a spiralled wire “split” ring on said
pin-holding means in response to the rotation of said ring; cam
means engageable with said ring-placing arm means, said ring-
holding pin means and said knifelike opening means mounted
on a shaft journaled for rotation in said housing and including
driving means operable to drive said shaft; driving means
operable to selectively drive said spindle means.