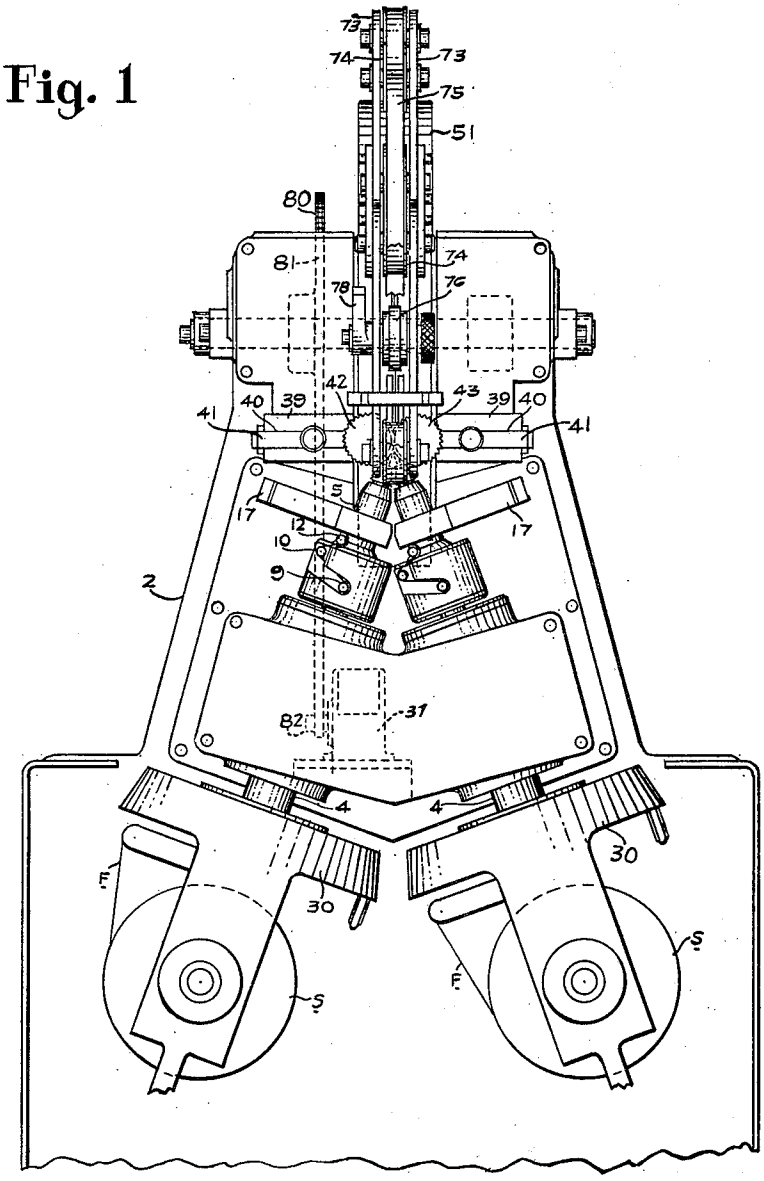
July 27, 1965 W. V. CHERY 3,196,489

COILING MACHINE

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Fig. 1



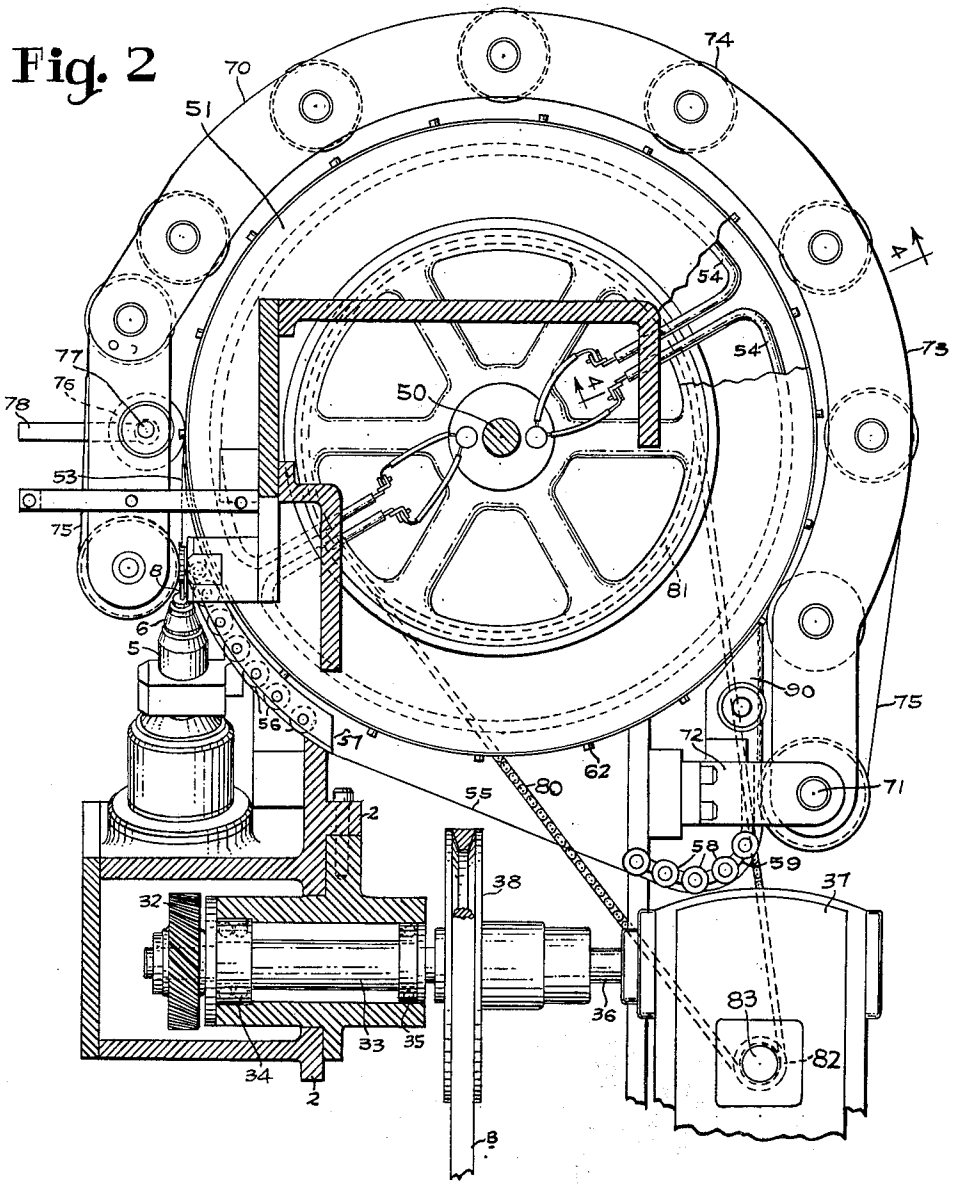
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COILING MACHINE

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Fig. 2



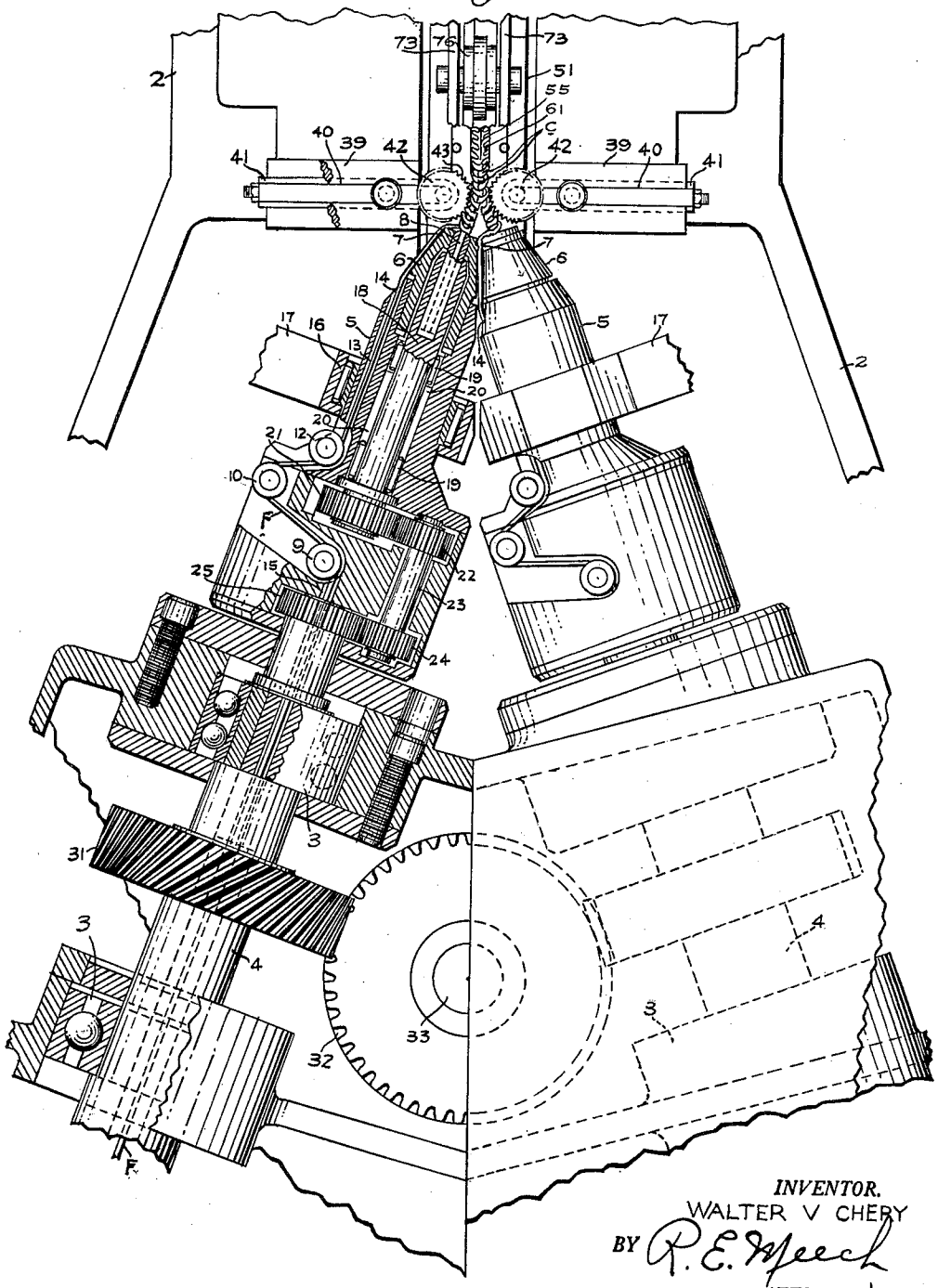
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COILING MACHINE

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Fig. 3



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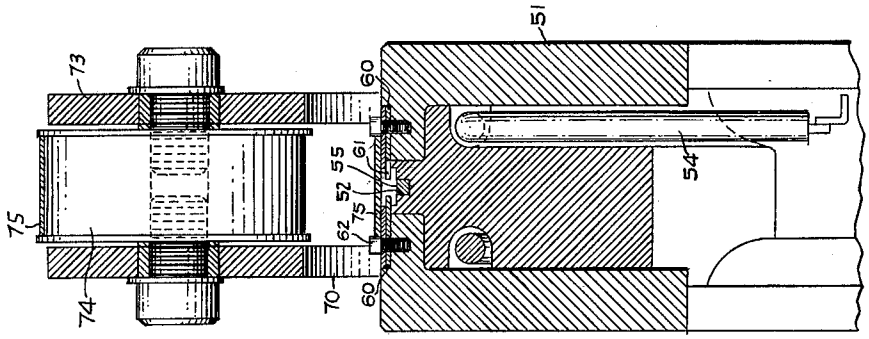


Fig. 4

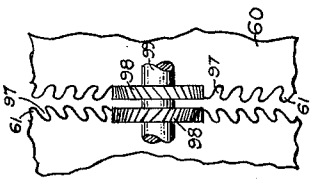


Fig. 10

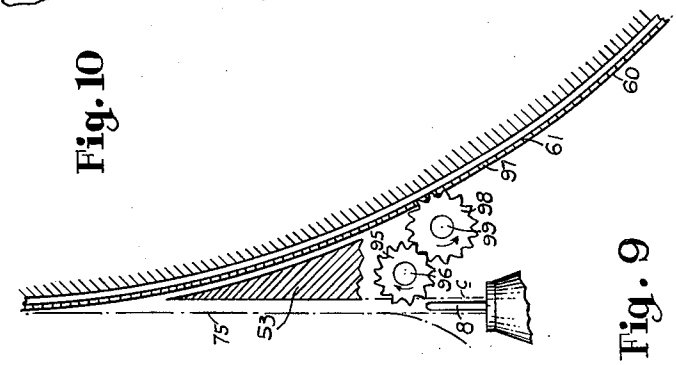


Fig. 9

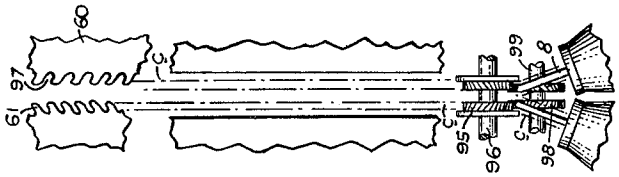


Fig. 8

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COILING MACHINE

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Fig. 5

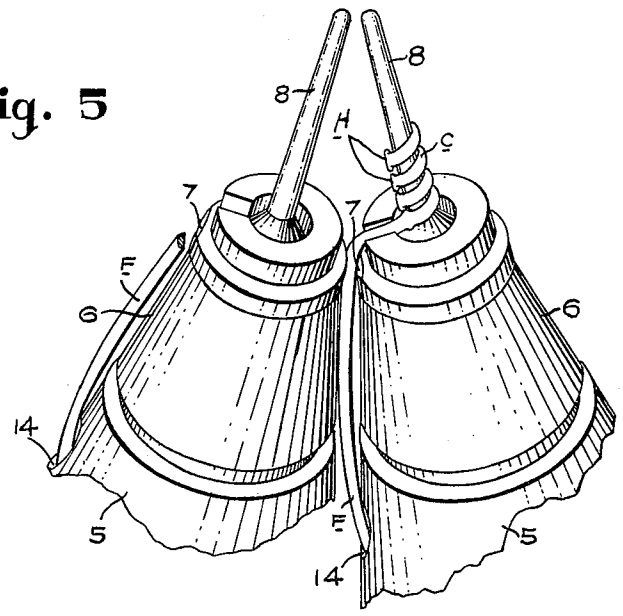


Fig. 7

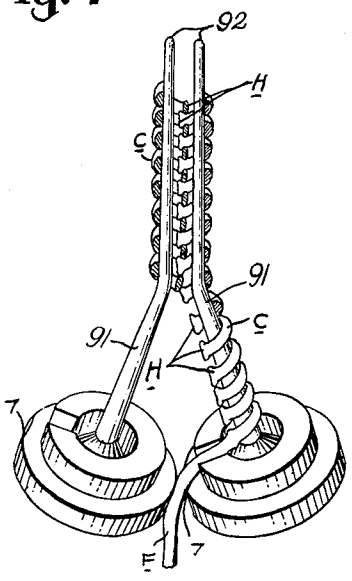
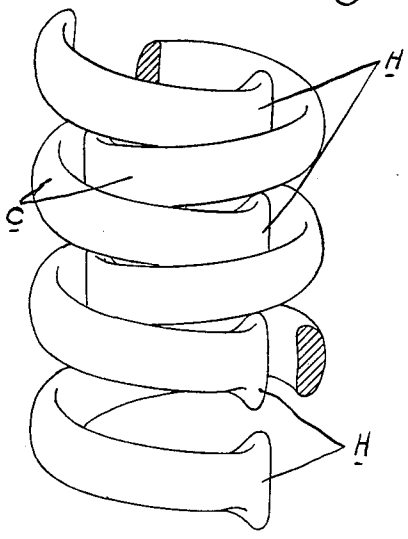


Fig. 6



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United States Patent Office 3,196,489 Patented July 27, 1965

3,196,489

COILING MACHINE

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Filed Apr. 15, 1963, Ser. No. 274,378
21 Claims. (Cl. 18—19)

This invention relates to a machine for making coils from filamentary material, such as nylon and other plastic filaments, and particularly to a coiling machine for making simultaneously a pair of interlocking coils of filamentary material which are particularly adapted for use as interlocking fastener stringers for slide fasteners wherein the opposed loops or convolutions of each of the coils act as interlocking elements.

The coiling machine of the present invention is particularly adaptable for making interlocking slide fastener stringers of the so-called filament type as shown in the U.S. Patent to Nicholas Wahl, No. 2,300,442, issued November 3, 1942. Such stringers are formed of filament usually of nylon or some other plastic material of special cross-section, which are simultaneously formed by winding two filaments in opposite directions around a suitable mandrel. As the two filaments are wound around the mandrel, a coiled filament is formed with the convolutions moved successively along the mandrel to the free end thereof. The two coiled filaments are then intermeshed with each other so as to provide a pair of interlocked coiled filament stringers which are later attached to stringer tapes to provide slide fastener chain in a manner well known to those skilled in the art.

According to the present invention there is provided a machine for coiling two filaments simultaneously having means arranged therewith for deforming the filaments intermittently so that an interlocking head portion is formed on each convolution of each of the coils, means for automatically intermeshing the two coils immediately after they have been formed, and means for heating and curing the coils and delivering them from the machine.

It is the general object of the invention to provide an improved coiling machine having two heads arranged on rotatable members rotatable in opposite directions with a stationary mandrel arranged with each head and extending outwardly therefrom around which the respective filaments are wound and coiled and with means arranged on each of the heads which cooperate with one another intermittently to deform the two filaments at spaced-apart intervals which deformations are adapted to provide an interlocking head portion on each convolution of the coiled filaments.

It is another object of this invention to provide an improved machine for making coils of filamentary material for use as slide fastener stringers which machine can be operated at a much higher speed over much longer periods of time than machines heretofor suggested and used for such purpose, thereby resulting in greatly increased productive capacities.

It is a further object of the present invention to provide an improved machine for making coils of filamentary material for use as slide fastener stringers wherein the filamentary material is coiled and deformed, the coils intermeshed and cured completely in readiness for attachment to stringers tapes without the need for any further operations thereon.

It is still another object of the invention to provide an improved coiling machine for making automatically coiled filament for slide fasteners which is efficient and effective in its use, and at the same time, produces uniform and satisfactory slide fastener stringers.

Various other objects and advantages of this invention will be more apparent in the course of the following specification, and will be particularly pointed out in the appended claims.

In the accompanying drawings, there is shown for the purpose of illustration, an embodiment which my invention may assume in practice.

In these drawings:

FIG. 1 is a front elevational view, partly broken away, of the improved coiling machine in accordance with the present invention,

FIG. 2 is a side elevational view, partly in section, of the upper part of the cooling machine as shown in FIG. 1,

FIG. 3 is an enlarged front elevational view, partly in section, of the intermediate portion of the machine,

FIG. 4 is a sectional view taken on line 4—4 of FIG. 2,

FIG. 5 is an enlarged isometric view of the coiling heads and stationary mandrels showing how the filaments are deformed and wound around the respective mandrels,

FIG. 6 is an enlarged isometric view showing the two coils of filament intermeshed after they have been formed,

FIG. 7 is an enlarged isometric view showing modified types of stationary mandrels which may be used in the coiling machine of the present invention,

FIGS. 8, 9 and 10 are schematic views of mechanism which may be employed for feeding the coiled filaments from the ends of the mandrels to the curing wheel.

Referring more particularly to the drawings, the improved coiling machine of the present invention conisits of a frame 2 in which there is mounted in a pair of suitable bearings 3 carried thereby, a pair of rotatable shafts 4 arranged at an acute angle to one another. On the upper end of each of these shafts 4, there is securely arranged a head 5 which are rotated in opposite directions by the respective shafts. The extreme upper end of each of these heads 5 terminates in a frusto-conical shaped portion 6 which portions are arranged in side-by-side relation. Directly above each of these frusto-conical shaped portions 6 there is carried thereby an annular deforming member 7. Axially of each of these heads 5, there is arranged a stationary mandrel 8 which extends up through the respective frusto-conical shaped portions 6 to a point beyond the annular deforming members 7 of the respective heads. It will be noted that these mandrels 8 are also disposed at an acute angle relative to one another with the extreme free ends being slightly spaced from one another, as more clearly shown in FIGS. 3 and 5 of the drawings.

Within each of the heads 5 there is arranged a plurality of guide rollers or pulleys 9, 10, and 12 around which the filament F is adapted to pass from its source of supply in a manner hereinafter to be described. Directly opposite the upper roller 12, there is arranged in each of the heads 5 a longitudinally extending passageway 13 which opens in the side of the respective frusto-conical shaped portions 6, as at 14. Axially of each of the shafts 4, there is arranged another longitudinally extending filament passageway 15 which opens at its upper end adjacent the lower guide roll 9. Each of the heads 5 is rotatably mounted in a suitable bearing 16 carried by a bracket member 17 mounted on the frame 2.

As more clearly shown in FIGS. 1 and 3 of the drawings, the inner end of each of the mandrels 8 is arranged axially of a spindle-like member 18 to which they are secured and each of these spindle-like members 18 are arranged axially of the respective heads 5 in suitable bearings 19 arranged in the axially hollow portion 20 of the respective heads. On the inner or lower end of each of these spindle-like members 18, there is arranged a gear 21 which meshes with a gear 22 arranged on the upper end of a shaft 23 suitably arranged in the side of the respective heads. On the lower end of each of these shafts 23, there is arranged another gear 24 which meshes with a stationary gear 25. By means of such an

arrangement it will be seen that each of the mandrels **8** are held stationary while the respective heads rotate relative thereto.

On the lower end of each of the shafts **4**, there is secured thereto so as to rotate therewith a yoke-like member **30** in which there is rotatably mounted a spool S on which there is wound a supply of filament F.

Intermediate the length of each of the shafts **4**, there is secured thereto a gear **31** which cooperates with a gear **32** arranged on the outer end of a transversely extending drive shaft **33**. This drive shaft is mounted in a pair of suitable bearings **34** and **35** carried by the frame **2** and the outer end thereof is connected to a shaft **36** of a gear box **37**. There is arranged on the shaft **33**, a pulley **38** around which there is adapted to be disposed a belt B connected to a pulley on a shaft of a motor (not shown) for driving the shaft **33** in a well known manner.

Above each of the heads **5**, there is mounted on the frame **2**, a pair of identical guide blocks **39** with each having a guide groove **40** therein in which there is arranged a slidable member **41**. On the inner end of each of these slidable members **41**, there is arranged preferably a rotatable disc-like member or wheel **42** having teeth **43** arranged around the periphery thereof which wheels cooperate with one another in a manner and for a purpose hereinafter to be described.

In the upper part of the frame **2**, there is arranged a transversely extending shaft **50** on which there is securely mounted a feed and forming or curing wheel **51** having a groove **52** arranged around the periphery thereof. The periphery of the forming wheel is arranged substantially tangential to a plane through the upper free ends of the mandrels **8**, and there is positioned between the free ends of the mandrels and the periphery of this curing wheel **51**, a coiled filament guide member **53**. In each side of this forming wheel, there is arranged preferably an annular electrical heating element **54** which may be heated in any suitable manner.

Within this groove **52** in the periphery of the curing wheel **51**, there is arranged an endless flexible wire-like band **55** which travels with the forming wheel as it rotates. This flexible band **55** is disposed around a series of guide rollers **56** carried by a bracket member **57** mounted on the frame **2** rearwardly of the pair of heads **5** at the front of the machine and around another series of guide rollers **58** carried by another bracket member **59** mounted on the frame at the rear of the machine as more clearly shown in FIG. 2 of the drawings.

Around the periphery of this forming wheel **51**, as more clearly shown in FIG. 4, there is arranged preferably a pair of removable annular metallic strips **60** with one arranged to each side of the groove **52** therein and preferably having a series of teeth **61** arranged along the opposed edges thereof. These metallic strips are secured to the periphery of the forming wheel **51** preferably by means of a plurality of screws **62**.

Above the forming wheel **51**, there is arranged an arcuate-shaped member **70** having one end thereof pivotally attached, as at **71**, to a bracket member **72** mounted on the frame **2**. This arcuate-shaped movable member **70** consists preferably of a pair of spaced-apart members **73** having a plurality of spaced-apart freely rotatable rollers **74** arranged therebetween. It will be seen that this arcuate-shaped member **70** extends from a point adjacent the free ends of the mandrels **8** in the front of the machine and around the forming wheel **51** to its pivotal point at the rear side of the machine. There is disposed around these rollers **74**, an endless flexible metallic band **75** which is positioned directly opposite the groove **52** in the forming wheel and which is adapted to travel therewith upon rotation of the same. This member **70** is locked in position by any suitable manner so that the flexible band **75** is maintained in frictional contact with the periphery of the forming wheel. In this member **73**

on the front side of the machine opposite the periphery of the forming wheel with which it cooperates, there is arranged preferably a rotatable pressure roller **76** which is rotatably arranged on an eccentric **77** manually manipulated by a handle **78**. At the rear side of the machine and the wheel **51**, there is mounted on the frame **2** preferably a guide member **90** having a series of apertures arranged therein through which an air supply is supplied to this guide member.

The shaft **50**, together with the forming wheel **51**, carried thereby is driven preferably by a chain **80** which is disposed around a sprocket **81** secured to the shaft **50** and a sprocket **82** carried by a shaft **83** of the gear box **37**.

Having described the construction of the improved coiling machine in accordance with the present invention, it functions in the following manner.

In view of the fact that the shafts **4** and the heads **5** together with the mechanism associated therewith are identical only one of these assemblies will be described in detail. It will be assumed that the filaments F to be coiled are positioned in the machine, as shown in FIG. 3 of the drawings in readiness for the coiling operation. In such position it will be seen that the filament F passes from the filament spool supply S, axially up through the shaft **4**, through the passageway **15**, around the rollers **9**, **10** and **12**, through the passageway **13** and out through the opening **14** in the side of the frusto-conical shaped end portion **6**.

The filament F then passes into tangential contact with the annular deforming member **7** and to the mandrel **8** around which it is initially, manually wound adjacent the annular deforming member **7**, as more clearly shown in FIG. 5 of the drawings.

The machine is now being in readiness for operation, it will be understood that one of these shafts **4** together with the head **5** carried thereby rotates in a clock-wise direction and that the other shaft **4** together with the head **5** carried thereby rotates in a counter clockwise direction, i.e., the heads rotate in opposite directions. As the shafts **4** together with the respective heads **5** carried thereby rotate the respective filaments F are wound or coiled around the respective stationary mandrels **8**, as more clearly shown in FIGS. 3 and 5 of the drawings and that the coiled filaments C gradually builds up toward the free ends of the respective mandrels **8** and eventually the convolutions of the coil are successively forced off the free ends of the respective mandrels.

It will be seen that each of the filaments F pass between the annular deforming members **7** upon each revolution of the heads **5** and it will be understood that as they pass therebetween each of the filaments are deformed, as at H, which is one of the most important aspects of the present invention. This deformation H of the filament is adapted to form the interlocking head portion of a finished slide fastener.

It will be understood that as the two coiled filaments C leave the mandrels **8**, they intermesh with one another and pass between the two opposed disc-like members or wheels **42** whereby the convolutions of these two coiled filaments are spaced properly relative to one another so as to be intermeshed with one another and supported, as shown in FIG. 3 of the drawings. The intermeshed coiled filaments then pass into the guide member **53** and thence to the periphery of the feed and forming wheel **51**.

The intermeshed coiled filaments C are then forced into the groove **52** in the periphery of the forming wheel **51** over the top of the flexible wire stripping band **55** therein and between the annular metallic strips **60** by the action of the pressure roller **76**. These coiled filaments are held in such position as they are conveyed around the forming wheel by the flexible metallic band **75** until they reach the rear side of the machine at which point they are removed from the groove **52** and stripped from the forming wheel by the action of the flexible wire band **55**.

It will be understood that the periphery of the forming

wheel 54 is heated by the annular heating members 51 carried thereby, which in turn heat the intermeshed coiled filaments to soften and set the same. In other words, as the filaments pass from the front of the machine and around the forming wheel to the rear side of the machine they are cured and set so as to relieve any tension in the filaments from being coiled and deformed.

After the intermeshed coiled filaments are stripped from the forming wheel 51, they pass through the rear guide 90 wherein they are cooled by any suitable manner, preferably by means of an air supply (not shown).

In FIG. 7 of the drawings there is shown a modified form of the stationary mandrels. In this construction the mandrels are rather elongated and have lower tapered portions 91 arranged at an acute angle to one another and straight upper portions 92 arranged substantially parallel to one another which straight portions extend a considerable distance beyond the lower tapered portions so as to aid in guiding the coiled filaments C to the curing wheel 51 and for supporting them while they are being intermeshed with each other.

There is shown in FIGS. 8, 9 and 10, auxiliary mechanism for aiding in moving the intermeshed coiled filaments C from the free ends of the mandrels 8 and feeding them to the curing wheel 51. Such mechanism consists of a pair of spaced-apart sprocket gears 98 arranged on a suitable shaft 99 which gears mesh with the cavities 97 between the teeth 61 of the metallic strip or bands 60 disposed around the curing wheel 51 which rotate the same. These sprocket gears 98 mesh with another pair of spaced-apart sprocket gears 95 arranged on a suitable shaft 96 which in turn mesh with the spaces between the convolutions of the respective coiled filaments C. Thus it will be seen that as the curing wheel 51 rotates, it in turn will rotate the sprocket gears 98 in a counter-clockwise direction, as shown in FIG. 8, and the sprocket gears 95 will in turn be rotated in a clockwise direction so as to move the coiled filaments C away from the free ends of the stationary mandrels 8 and toward the periphery of the curing wheel 51.

As a result of my invention it will be seen that there is provided a coiling machine for making slide fastener elements of the coiled filament type for slide fasteners wherein a pair of filaments are not only coiled but the filaments are automatically and simultaneously deformed so as to provide interlocking head portions on each convolution of each of the coils, and the coiled filaments simultaneously cured to provide completely finished slide fastener elements of the continuously connected type.

While I have shown and described an embodiment which my invention may assume in practice, it will be understood that this embodiment is merely for the purpose of illustration and description, and that other forms may be devised within the scope of my invention as defined in the appended claims.

What I claim as my invention is:

1. In a coiling machine of the class described,
a pair of cylindrical rotatable members arranged in side-by-side relation,
means for delivering a continuous length filament to each of said rotatable members,
a mandrel arranged concentric with each of said rotatable members and extending outwardly therefrom around which each of the respective filaments are adapted to be wound upon rotation of said rotatable members so as to form a coiled filament therearound,
means arranged around the periphery of each of said rotatable members which cooperate with one another to deform each of the filaments at spaced-apart intervals therealong as the respective filaments pass from the rotatable members to the respective mandrels,
means for rotating each of said rotatable members relative to their respective mandrels whereby the respective filaments are coiled around the respective mandrels, and

means arranged beyond said rotatable members for intermeshing said coiled filaments one with the other as they pass therealong.

2. In a coiling machine, the combination as defined in claim 1, wherein the intermeshing means consists of a pair of rotatable disks arranged in side-by-side relation on parallel axes with each having spaced-apart teeth around the periphery thereof which cooperate with one another upon rotation thereof to force the coiled filaments together into intermeshed relation.

3. In a coiling machine, the combination as defined in claim 1, wherein the axes of the rotatable members and the mandrels arranged therewith are arranged at a acute angle to one another.

4. In a coiling machine, the combination as defined in claim 1, including means arranged beyond the intermeshing means for heating the intermeshed coiled filaments as they pass therealong so as to shape the same.

5. In a coiling machine, the combination as defined in claim 1, including a rotatable wheel arranged opposite the mandrels around which the intermeshed coiled filament is disposed and which pulls the coiled filaments from the free ends of the mandrels and through the intermeshing means, and means for guiding the intermeshed coiled filament to and around said wheel.

6. In a coiling machine, the combination as defined in claim 5, including means arranged with the rotatable wheel for heating the intermeshed coiled filament as it passes therearound so as to shape the same.

7. In a coiling machine, the combination as defined in claim 5, including an endless flexible band arranged around the periphery of said wheel and which cooperates therewith to guide and convey the intermeshed coiled filaments therearound.

8. In a coiling machine, the combination as defined in claim 5, including a groove arranged around the periphery of said wheel in which the intermeshed coiled filaments are adapted to be disposed as they are conveyed therearound, and an endless flexible band arranged in said groove around the periphery of said wheel in under said intermeshed coiled filaments and which travels with said wheel upon rotation thereof and which is adapted to move the intermeshed coiled filaments out of said groove and strip them from said wheel at a predetermined point therearound.

9. In a coiling machine, the combination as defined in claim 1, including means arranged coaxial with each rotatable member for receiving and holding a filament supply spool rotatably and coaxially with relation to the axis of the respective rotatable members.

10. In a coiling machine of the class described,
a pair of rotatable members arranged in side-by-side relation on axes arranged at an acute angle relative to one another,
means for delivering a continuous length filament to each of said rotatable members,
each of said rotatable members having a frusto-conical shaped end portion,
a mandrel arranged axially of each of said rotatable members extending outwardly from the end of each of said frusto-conical end portions at an acute angle to one another,
means arranged around the periphery of each of said frusto-conical shaped portion which cooperate with one another to deform each of the filaments at spaced-apart intervals therealong as the respective filaments pass from the rotatable members to the respective mandrels,
means for rotating each of said rotatable members relative to their respective mandrels whereby the respective filaments are wound and coiled around the respective mandrels,
means arranged beyond said rotatable members for intermeshing said coiled filaments one with the other as they pass therealong, and

means arranged beyond the intermeshing means for heating the intermeshed coiled filaments as they pass therealong so as to shape the same.

11. In a coiling machine, the combination as defined in claim **10**, wherein the intermeshing means consists of a pair of rotatable disks arranged in side-by-side relation on parallel axes with each having spaced-apart teeth around the periphery thereof which cooperate with one another upon rotation thereof to force the coiled filaments together into intermeshed relation.

12. In a coiling machine, the combination as defined in claim **10**, including a rotatable wheel arranged opposite the mandrels around which the intermeshed coiled filament is disposed and which pulls the coiled filaments from the free ends of the mandrels and through the intermeshing means, and means for guiding the intermeshed coiled filament to and around said wheel.

13. In a coiling machine, the combination as defined in claim **12**, including an endless flexible band arranged around the periphery of said wheel and which cooperates therewith to guide and convey the intermeshed coiled filaments therearound.

14. In a coiling machine, the combination as defined in claim **12**, including a groove arranged around the periphery of said wheel in which the intermeshed coiled filaments are adapted to be disposed as they are conveyed therearound, and an endless flexible band arranged in said groove around the periphery of said wheel in under said intermeshed coiled filaments and which travels with said wheel upon rotation thereof and which is adapted to move the intermeshed coiled filaments out of said groove and strip them from said wheel at a predetermined point therearound.

15. In a coiling machine, the combination as defined in claim **10**, including means arranged with the rotatable wheel for heating the intermeshed coiled filament as it passes therearound so as to shape the same.

16. In a coiling machine, the combination as defined in claim **10**, including means arranged coaxial with each rotatable member for receiving and holding a filament supply spool rotatably and coaxially with relation to the axis of the respective rotatable member.

17. In a coiling machine of the class described,

a pair of rotatable shafts arranged at an acute angle relative to one another,

a head securely arranged on the outer end of each of said shafts directly next to one another,

means for delivering a continuous length filament to each of said heads,

each of said heads having a frusto-conical shaped end portion,

a stationary mandrel arranged axially of each of said shafts and the respective heads and extending outwardly from said frusto-conical shaped end portion and around which the respective filaments are adapted to be wound upon rotation of said heads so as to form a coiled filament therearound,

annular means arranged around the periphery of each of said frusto-conical shaped end portions which cooperate with one another to deform each of the filaments at spaced-apart intervals therealong as the respective filaments pass from the heads to the respective mandrels,

means for rotating said shafts together with the heads carried thereby relative to their respective mandrels whereby the respective filaments are wound and coiled around the respective mandrels,

means arranged beyond said rotatable heads for intermeshing said coiled filaments one with the other as they pass therealong,

a rotatable wheel arranged opposite said mandrels around which the intermeshed coiled filament is disposed and which pulls the coiled filaments from the free ends of said mandrels and through the intermeshing means,

an endless flexible band arranged around the periphery of said wheel and which cooperates therewith to guide and convey the intermeshed coiled filaments therearound, and

means for rotating said wheel so that said endless flexible band is moved therewith.

18. In a coiling machine, the combination as defined in claim **17**, including means arranged with the rotatable wheel for heating the intermeshed coiled filament as it passes therearound so as to shape the same.

19. In a coiling machine, the combination as defined in claim **17**, wherein the intermeshing means consists of a pair of rotatable discs arranged in side-by-side relation on parallel axes with each having spaced-apart teeth around the periphery thereof which cooperate with one another upon rotation thereof to force the coiled filaments together into intermeshed relation.

20. In a coiling machine, the combination as defined in claim **17**, including a groove arranged around the periphery of said rotatable wheel in which the intermeshed coiled filaments are adapted to be disposed as they are conveyed therearound, and an endless flexible band arranged in said groove around the periphery of said wheel in under said intermeshed coiled filaments and which travels with said wheel upon rotation thereof and which is adapted to move the intermeshed coiled filaments out of said groove and strip them from said wheel at a predetermined point therearound.

21. In a coiling machine, the combination as defined in claim **17**, including means arranged coaxial with each head for receiving and holding a filament supply spool rotatably and coaxially with relation to the axis of the respective heads.

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