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Description

Field of Invention

This invention concerns composite tapes and apparatus for forming composite tapes and in particular relates to apparatus for forming an insulated electrostatic screen for use in electrical coils, e.g. for use in the winding of transformers and the like.

Background to the Invention

It is known to provide electrostatic screens in coil winding, the screen serving the dual purpose of insulating one winding from another and also providing an electrostatic screen to prevent unwanted spurious transfer from one winding to another in a transformer. Whilst the winding of the wire to form a coil has been a rapid process the interleaving of one winding with another by an electrostatic insulating screen has often introduced considerable delays into the process of coil winding particularly where the insulating material and metal foil has had to be interleaved by hand.

It is obviously imperative that the metal foil is fully insulated from both windings and also from itself so that an electrical short circuit does not occur and further delays have been experienced in the past while insulation tests have been carried out prior to continuing winding.

DE—A—2542018 concerns the manufacture of electric cables in which a laminated ribbon is wound round a cable core in a longitudinal direction, with an outer plastics casing extruded around the core and surrounding ribbon. The laminated ribbon is formed by thermally fusing a metal band and a broader plastics band, and then physically turning up and over one or both protruding edge strips of the plastics band.

BE—A—754150 concerns the production of cable in which a series of conductors are sandwiched between two flexible strips, one of which has an inwardly facing self-adhesive layer.

It is an object of the present invention to provide apparatus for forming an insulating electrostatic screen for electrical coils which can be wound directly around a coil during manufacture and which will have reliable insulating properties.

It is another object to provide an improved composite tape.

The Invention

According to the present invention there is provided apparatus for forming composite tape, comprising first roller storage means of metal or metallised foil, second roller storage means of plastics insulating tape which is wider than the width of the foil, first roller means around which both the foil and the plastics insulating tape can be passed with the foil sandwiched between the roller and the insulating tape and located centrally of the tape, second roller means beyond

the first roller means which progressively cause the free edges of the insulating tape on either side of the foil to be turned upwardly and over the foil as it passes through the second roller means, characterised in that the composite tape is insulated electrostatic screen for electrical coils, with the insulating tape being approximately twice the width of the foil, the apparatus further comprising third roller storage means having wound thereon self-adhesive plastics insulating tape, third roller means below which the self-adhesive insulating tape is passed with the self-adhesive surface away from the roller for urging the adhesive surface into contact with the two folded-over edges of the plastics insulating tape to cause the self-adhesive tape to adhere thereto, fourth roller means between which the composite tape is passed for exerting pressure on opposite sides of the composite tape to ensure good adhesion between the adhesive tape and the plastics insulating tape, first braking means associated with the first roller storage means to resist rotation thereof and maintain a degree of tension in the foil, and second braking means associated with the second roller storage means to resist rotation thereof and maintain a degree of tension in the insulating tape.

Preferably two or more roller storage means are provided for the plastics insulating tape to allow one, two or more thicknesses of insulating tape to be employed.

Preferably the width of the plastics insulating tape is just less than twice the width of the metal foil around which it is to be wrapped so that a gap exists between the turned-over edges of the plastics insulating tape along the length of the composite tape so that the self-adhesive surface of the plastics tape which is applied to the turned-over edges makes contact with the exposed surface of the metal foil to more securely anchor the latter in the composite tape.

Means may be provided for adjusting the pressure between the rollers forming the said fourth roller means to compensate for different thicknesses of composite tape.

Preferably means is provided for altering or replacing the rollers of the said third roller means to accommodate different widths of insulating tape.

Preferably means is provided for each of the storage means to resist rotation of the storage means to a slight degree to maintain tension in the tapes and foil. Preferably the braking means so employed is adjustable to increase or decrease the tension so imparted to the tape or foil.

The fourth roller means may be adjustable to accommodate different widths of composite tape.

Preferably the self-adhesive plastics tape is self-coloured and preferably a different colour is used to denote a different standard of manufacture of the composite tape. Thus where a double thickness of insulating tape material has

been used one colour self-adhesive tape may be employed and where only a single layer of insulating plastics tape has been used to form the outer sleeve, another colour of self-adhesive plastics tape may be employed.

The apparatus can be incorporated directly into a coil winding machine so that the formed composite tape is simply pulled from the fourth roller means as and when required and wound around the coil on the machine. To this end the invention also provides a coil winding machine when fitted with apparatus embodying the invention.

Alternatively the apparatus may include a coil-winding bobbin and drive means for preparing bobbins of composite insulating electrostatic screen which can then be stored on the bobbin either for subsequent use or for sale.

The invention also includes within its scope composite tape when formed by apparatus embodying the invention.

The invention will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a perspective view of apparatus embodying the invention,

Figure 2 is an exploded perspective view of the apparatus shown in Figure 1,

Figure 3 is a perspective view of the apparatus of Figure 1 when fitted with storage drums of the various component tapes to make the composite insulating electrostatic screen with the various component tapes threaded through the apparatus to indicate the mode of operation of the apparatus,

Figure 4 is a plan view of an insulated metal foil screen for use in the winding of transformers and the like with the various component parts peeled away one from the other at the left-hand end of the screen, and

Figure 5 is a cross-section through the tape shown in Figure 4 at the line II—II drawn to an enlarged scale.

Referring to Figure 1 the apparatus comprises a base 10 having an upstanding support flange 12 for carrying various drum storage devices to be described hereinafter.

In line with the support flange 12 is provided a channel support 14 forming the exit for the apparatus through which the formed screen tape is passed and for housing rollers (to be described later) for performing the final forming operation of the composite screen tape.

The base includes fixing holes 16 by which the apparatus can be clamped to a bench or to a coil-winding machine or the like.

As described hitherto the apparatus is self-sufficient in that tape can be pulled directly from the exit at 18 or the apparatus can be combined with a coil-winding machine to allow the screen tape to be pulled from the exit as and when required and wound directly on a coil bobbin or it can be combined with a coil-winding bobbin and drive means for winding bobbins of the insulating electrostatic screen for storing

the screen material in bulk either for subsequent use or for sale.

Referring again to Figure 1, two spindles 20 and 22 extend at the rear of the flange 12 and include backing discs 24 and 26. The spindles are adapted to receive and support reels of tape typically Melinex (Melinex is a Trade Mark) tape to form the electrically insulating outer covering of the composite electrostatic screen tape. The reels are not shown in Figure 1 but the fitting of the reels on the spindles 20 and 22 is arranged to introduce a small degree of friction to resist rotation of the reels as the tape is pulled therefrom to impart a degree of tension into the tape as it is removed.

A take-off roller 28 is mounted on a further spindle 30 which extends from the flange 12 and around which the insulating tape from spools mounted on the spindles 20 and 22 can be passed.

It should be explained at this point that the two spindles 20 and 22 are provided so that two layers of insulating tape can be incorporated into the manufacture of the composite tape. However for some applications only one layer of insulating Melinex tape will be required in which event the tape from only one of the reels mounted on the spindles 20 and 22 is drawn off and passed around the roller 28.

A reel of metallised foil typically copper tape is mounted on a third spindle 32 which also extends from the flange 12 and includes a backing disc 34. Again the reel of metallised foil is preferably mounted on the spindle 32 so that there is a small resistance to rotation on the spindle so as to impart a slight tension to the copper tape as it is pulled therefrom. In practice the resistance to the removal of the copper tape should only be small since the metal tape will not stretch in the same way as will the Melinex.

The metal tape passes around a further roller 36 carried on a spindle 38 which also extends from and is supported by the flange 12. The metal tape is trapped between the roller 36 and the layer or layers of Melinex tape from the roller 28. Further rollers 40 and 42 also formed with side flanges mounted on spindles 44 and 46 respectively and the space in between the side flanges of the rollers 40 and 42 is progressively reduced so that the sides of the Melinex tape which is wider than the metal tape are caused to be turned up and over the metal tape.

This is best seen with reference to Figure 3 in which two reels of Melinex tape at 48 and 50 supply two layers of tape 52 and 54 around the roller 28 (the roller in Figure 3 being shown somewhat diagrammatically). A further reel 56 contains copper foil as shown at 58 which passes around the roller 36 and is trapped between the roller and the two layers of Melinex tape 52 and 54.

The width of the copper foil 58 is approximately half the width of the Melinex tape and as the now composite tape passes between the flanges of rollers 40 and 42 the edges of the

Melinex tape are curled up and over the copper foil as the composite tape passes between the progressively smaller spaced apart flanges.

Reverting to Figure 1, a fourth spindle 60 is mounted on the flange 12 again with a backing disc 62 for carrying a reel of self-adhesive tape not shown in Figure 1. The reel is shown in Figure 3 at 64 and the tape is removed as shown at 66 with the adhesive surface on the underside. The tape 66 passes underneath a roller 68 carried in the channel support means 14 and is thereby brought into contact with the turned-over edges of the Melinex tape presented to the underside of the roller 68 by means of another roller 70 also located between the sides of the channel support 14. Both rollers 68 and 70 are freely rotatable.

The composite tape then passes over a block 72 and under a final exit roller 74 forming an exit nip.

Referring to Figure 2 it will be seen that the exit roller 74 is mounted on a spindle 76 which can readily be removed from the channel support 14 by removing the pin 78 and withdrawing the spindle 76 using the knurled end 80. In this way the roller 74 can be removed to allow the composite tape to be threaded over the base 72 and the roller 74 replaced so as to exert the required pressure on the tape.

It will be seen that the channel section 14 can be removed from the base 10 by removing the two screws 82 and can be replaced with a different channel section with different rollers to accommodate different tape sizes or the channel section 14 may be formed from two parts which can be set at different spacings to accommodate different widths of composite tape.

As shown in Figure 4 an insulated metal foil screen for use in the winding of transformers and the like comprises a metal foil 110 typically of copper foil some few thousandths of an inch thick, a first strip of plastics tape 112 the width of which is just less than twice the width of the foil 110 and a second strip or tape of semi-opaque plastics sheet material 114 which is adhesively bonded to the first plastics tape 112 and to the foil 110.

The foil is almost totally enclosed within a sleeve formed by the first plastics tape 112 and to this end the foil 110 is located midway across the width of the tape 112 and the two opposite edges of the tape are folded up and over the foil 110 so as to overlie the upper surface thereof. In Figure 4 the extreme left-hand end of the strip or tape 114 is shown peeled away from the two in-turned edges 116 and 118 of the tape 112 and these in-turned edges 116 and 118 are shown springing upwards away from the foil 110 with the restraining influence of the tape 114 removed.

The tape or strip 114 is self-adhesive plastics tape and for convenience is self-coloured rendering the tape opaque or semi-opaque.

The two turned-in edges of the tape 112 do

not meet but present a gap through which the adhesive tape 114 can adhere to the foil 110 to locate the latter in position.

Preferred materials are copper foil for the screen 110, Melinex tape for the sleeve 112 and PVC self-adhesive tape for the strip 114.

Claims

1. Apparatus for forming composite tape, comprising first roller storage means (56) of metal or metallised foil, second roller storage means (48) of plastics insulating tape which is wider than the width of the foil, first roller means (36) around which both the foil (58) and the plastics insulating tape (52) can be passed with the foil sandwiched between the roller and the insulating tape and located centrally of the tape, second roller means (40, 42) beyond the first roller means which progressively cause the free edges of the insulating tape on either side of the foil to be turned upwardly and over the foil as it passes through the second roller means, characterised in that the composite tape is insulated electrostatic screen for electrical coils, with the insulating tape being approximately twice the width of the foil, the apparatus further comprising third roller storage means (64) having wound thereon self-adhesive plastics insulating tape (66), third roller means (68) below which the self-adhesive insulating tape is passed with the self-adhesive surface away from the roller for urging the adhesive surface into contact with the two folded-over edges of the plastics insulating tape to cause the self-adhesive tape to adhere thereto, fourth roller means (74) between which the composite tape is passed for exerting pressure on opposite sides of the composite tape to ensure good adhesion between the adhesive tape and the plastics insulating tape, first braking means associated with the first roller storage means to resist rotation thereof and maintain a degree of tension in the foil, and second braking means associated with the second roller storage means to resist rotation thereof and maintain a degree of tension in the insulating tape.

2. Apparatus as claimed in claim 1, characterised in that two or more roller storage means are provided for the plastics insulating tape to allow one, two or more thicknesses of insulating tape to be incorporated.

3. Apparatus as claimed in claim 1 or 2, characterised in that the width of the plastics insulating tape is just less than twice the width of the metal foil around which it is to be wrapped so that a gap exists between the turned-over edges of the plastics insulating tape along the length of the composite tape so that the self-adhesive surface of the plastics tape which is applied to the turned-over edges makes contact with the exposed surface of the metal foil to more securely anchor the latter in the composite tape.

4. Apparatus as claimed in any of the preced-

ing claims, further characterised by means for adjusting the pressure between the rollers forming the said fourth roller means to compensate for different thicknesses of composite tape.

5. Apparatus as claimed in any of the preceding claims, characterised in that the roller means are adjustable or replaceable to accommodate different widths of insulating tape.

6. Apparatus as claimed in any of the preceding claims, characterised in that each of the first and second braking means is adjustable for changing the tension imparted to the metalised foil and to the insulating tape.

7. Apparatus as claimed in any of the preceding claims, characterised in that the fourth roller means is adjustable to accommodate different widths of composite tape.

8. A coil winding machine comprising apparatus in accordance with any one of the preceding claims.

9. A composite tape when formed by apparatus as claimed in any one of the preceding claims.

Revendications

1. Appareil pour former un ruban composite, comprenant un premier moyen à bobine (56) de stockage de métal ou de feuille métallisée, un deuxième moyen à bobine (48) de stockage de ruban isolant en matière plastique qui est plus large que la largeur de ladite feuille, un premier moyen à galet (36) autour duquel à la fois la feuille (58) et le ruban isolant (52) en matière plastique peuvent passer, ladite feuille étant prise en sandwich entre le galet et le ruban isolant et disposée au centre dudit ruban, un deuxième moyen à galets (40, 42), au-delà du premier moyen à galet, qui oblige les bords libres du ruban isolant, de part et d'autre de la feuille, à subir un cintrage vers le haut et un rabat sur la feuille lorsqu'elle passe à travers ledit deuxième moyen à galets, caractérisé par le fait que le ruban composite est un protecteur électrostatique isolé pour bobines électriques, le ruban isolant correspondant approximativement au double de la largeur de la feuille, l'appareil comprenant en outre un troisième moyen à bobine (64) de stockage sur lequel est enroulé un ruban isolant adhésif (66) en matière plastique, un troisième moyen à galet (68) au-dessous duquel ledit ruban isolant adhésif passe avec sa surface adhésive située à l'écart du galet afin de presser ladite surface adhésive au contact des deux bords repliés dudit ruban isolant en matière plastique, pour que le ruban adhésif y adhère, un quatrième moyen à galet (74) dans lequel le ruban composite est engagé afin d'exercer une pression sur les côtés opposés de ce ruban composite en vue d'assurer une bonne adhérence entre ledit ruban adhésif et ledit ruban isolant en matière plastique, un premier moyen de freinage associé au premier moyen à bobine de stockage afin de résister à la rotation de ce dernier et de maintenir un degré de

tension imposée à la feuille, ainsi qu'un second moyen de freinage associé audit deuxième moyen à bobine de stockage afin de résister à la rotation de ce dernier et de maintenir un degré de tension imposée au ruban isolant.

2. Appareil selon la revendication 1, caractérisé par le fait que deux ou plus de deux moyens à bobines de stockage sont prévus pour le ruban isolant en matière plastique, en vue de permettre l'incorporation d'une, de deux ou de plus de deux épaisseurs de ruban isolant.

3. Appareil selon la revendication 1 ou 2, caractérisé par le fait que la largeur du ruban isolant en matière plastique est légèrement inférieure au double de la largeur de la feuille métallique autour de laquelle il doit être enroulé, de manière qu'un intervalle soit réservé entre les bords relevés du ruban isolant en matière plastique le long de la longueur du ruban composite, afin que la surface adhésive du ruban en matière plastique, qui est appliquée sur lesdits bords relevés, soit en contact avec la surface exposée de la feuille métallique pour assujettir plus fermement encore cette dernière à l'intérieur du ruban composite.

4. Appareil selon l'une quelconque des revendications précédentes, caractérisé en outre par des moyens pour ajuster la pression entre les galets formant ledit quatrième moyen à galets, de manière à compenser des différences d'épaisseur du ruban composite.

5. Appareil selon l'une quelconque des revendications précédentes, caractérisé par le fait que les moyens à galets sont ajustables ou remplaçables, afin de permettre une adaptation à différentes largeurs de ruban isolant.

6. Appareil selon l'une quelconque des revendications précédentes, caractérisé par le fait que chacun des premier et second moyens de freinage est ajustable en vue de faire varier la tension imposée à la feuille métallisée et au ruban isolant.

7. Appareil selon l'une quelconque des revendications précédentes, caractérisé par le fait que le quatrième moyen à galet est ajustable pour permettre une adaptation à différentes largeurs de ruban composite.

8. Machine d'enroulement de bobines équipée d'un appareil selon l'une quelconque des revendications précédentes.

9. Ruban composite formé par l'appareil tel que revendiqué dans l'une quelconque des revendications précédentes.

Patentansprüche

1. Apparat zum Herstellen eines zusammengesetzten Bandes mit einer ersten Rollenspeichereinrichtung (56) für eine metallische oder metallisierte Folie, mit einer zweiten Rollenspeichereinrichtung (48) für eine isolierende Kunststoffolie, die breiter als die Breite der Folie ist, mit einer ersten Rolleneinrichtung (36), um die sowohl die Folie (58) als auch das isolierende Kunststoffband (52) ge-

führt werden können, wobei die Folie zwischen der Rolle und dem isolierenden Band eingeschlossen ist und zentrisch zu diesem Band liegt, mit einer zweiten Rolleneinrichtung (40, 42) jenseits der ersten Rolleneinrichtung, die beim Lauf der Folie durch die zweite Rolleneinrichtung die freien Kanten des isolierenden Bandes auf beiden Seiten der Folie fortschreitend nach oben und um die Folie biegt, dadurch gekennzeichnet, daß das zusammengesetzte Band eine isolierte elektrostatische Abschirmung für elektrische Spulen ist, wobei das isolierende Band annähernd die zweifache Breite der Folie aufweist, der Apparat weiter eine dritte Rollenspeichereinrichtung (64) mit einem aufgewickelten Selbstklebenden isolierenden Kunststoffband (66) aufweist, eine dritte Rolleneinrichtung (68), unter der das selbstklebende Isolierband mit von der Rolle abgelegener selbstklebender Oberfläche durchgeführt wird, um die Klebende Oberfläche mit den beiden umgefalteten Kanten des isolierenden Kunststoffbandes in Berührung zu bringen, damit das selbstklebende Band anhaftet, eine vierte Rolleneinrichtung (74), zwischen die das zusammengesetzte Band durchgeleitet wird, um auf dessen beide Seiten Druck auszuüben, um eine gute Haftung zwischen dem Klebeband und dem isolierenden Kunststoffband sicherzustellen, eine mit der ersten Rollenspeichereinrichtung zusammenwirkende Bremseneinrichtung, um deren Drehung zu widersehen und um in der Folie ein Maß an Spannung beizubehalten, und eine mit der zweiten Rollenspeichereinrichtung zusammenwirkende zweite Bremseneinrichtung, um deren Drehung zu widerstehen und um in dem Isolierband ein Maß an Spannung aufrecht zu erhalten.

2. Apparat nach Anspruch 1, dadurch gekennzeichnet, daß zwei oder mehr Rolleneinrichtungen für das isolierende Kunststoffband vorgesehen sind, damit eine, zwei oder mehr Stärken an Isolierband einge-

schlossen werden können.

3. Apparat nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Breite des isolierenden Kunststoffbandes gerade weniger als das Doppelte der Breite der Metallfolie ist, um die zu wickeln ist, so daß zwischen den umgelegten Kanten des isolierenden Kunststoffbandes entlang der Länge des zusammengesetzten Bandes ein Spalt besteht, so daß die selbstklebende Oberfläche des Kunststoffbandes, die auf die umgedrehten Kanten aufgesetzt wird, mit der freiliegenden Oberfläche der Metallfolie in Kontakt gerät, um damit die letztere sicher im zusammengesetzten Band zu verankern.

4. Apparat nach irgendeinem der vorhergehenden Ansprüche, weiter gekennzeichnet durch eine Einrichtung zum Einstellen des Druckes zwischen den die vierte Rolleneinrichtung bildenden Rollen zum Ausgleich unterschiedlicher Stärken des zusammengesetzten Bandes.

5. Apparat nach irgendeinem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Rolleneinrichtung zur Aufnahme verschiedener Breiten von Isolierband einstellbar oder austauschbar ist.

6. Apparat nach irgendeinem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß sowohl die erste als auch die zweite Bremseneinrichtung zum Ändern der der metallisierten Folie und dem Isolierband verliehenen Spannung einstellbar ist.

7. Apparat nach irgendeinem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die vierte Rolleneinrichtung zur Aufnahme verschiedener Breiten des zusammengesetzten Bandes einstellbar ist.

8. Spulenwickelmaschine mit einem Apparat nach Maßgabe von irgendeinem der vorhergehenden Patentansprüche.

9. Zusammengesetztes Band bei Herstellung mit einem Apparat gemäß irgendeinem der vorhergehenden Patentansprüche.

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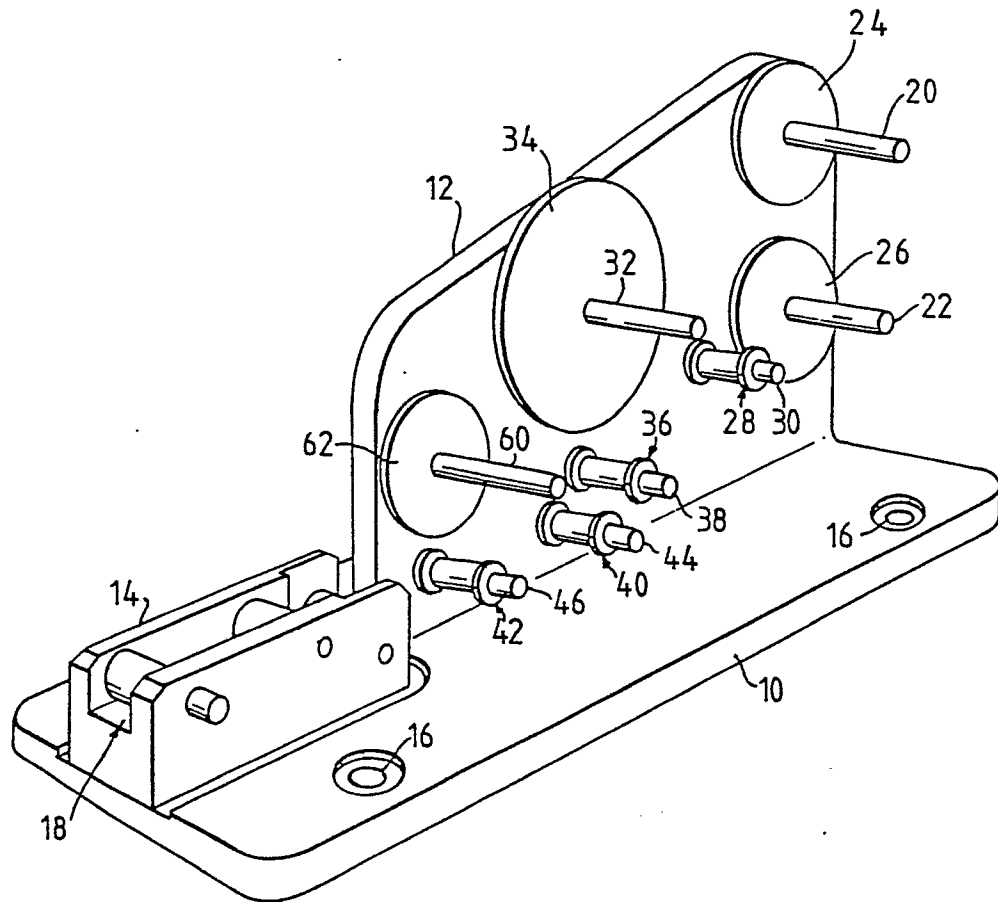


Fig .1.

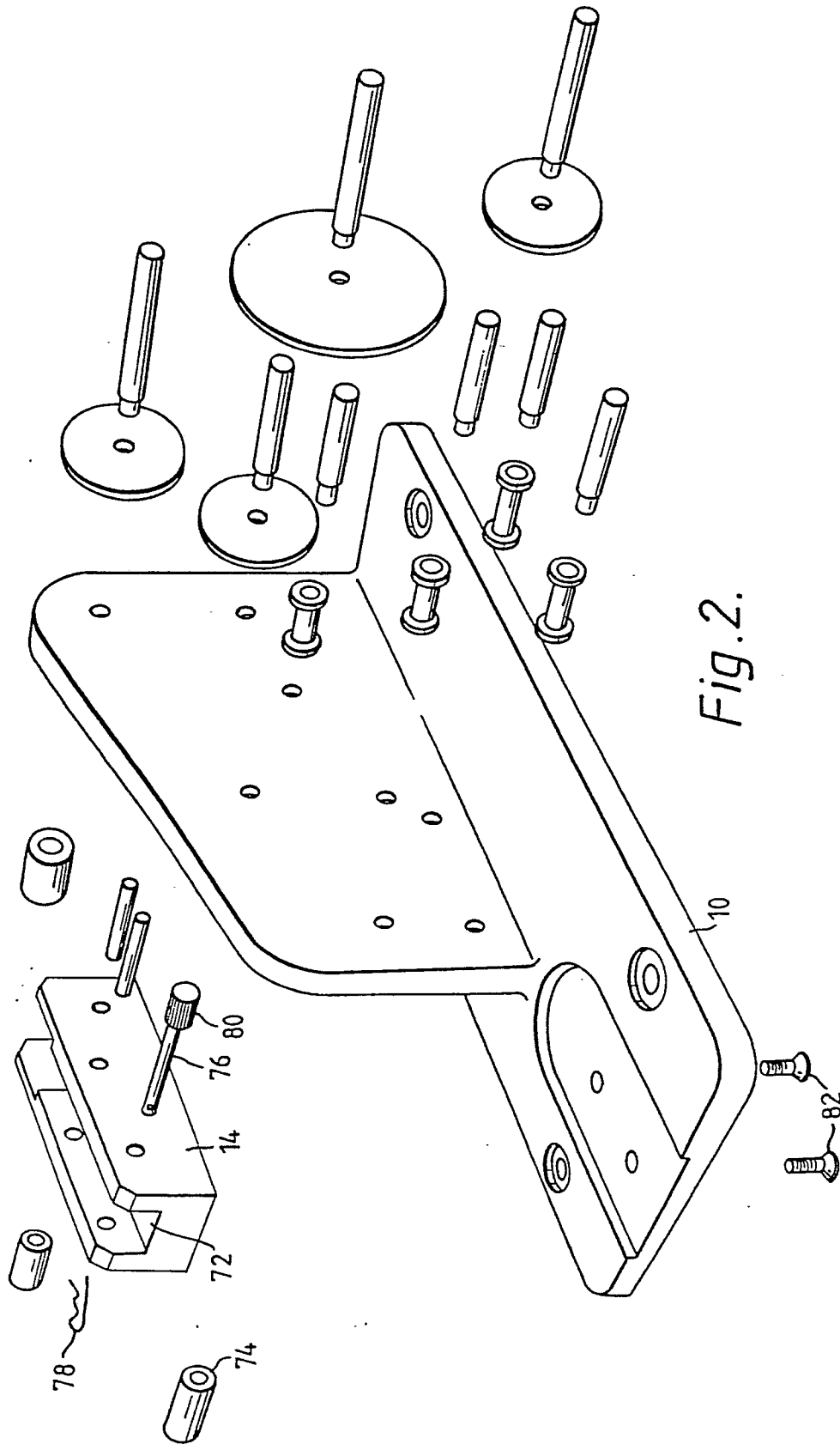


Fig. 2.

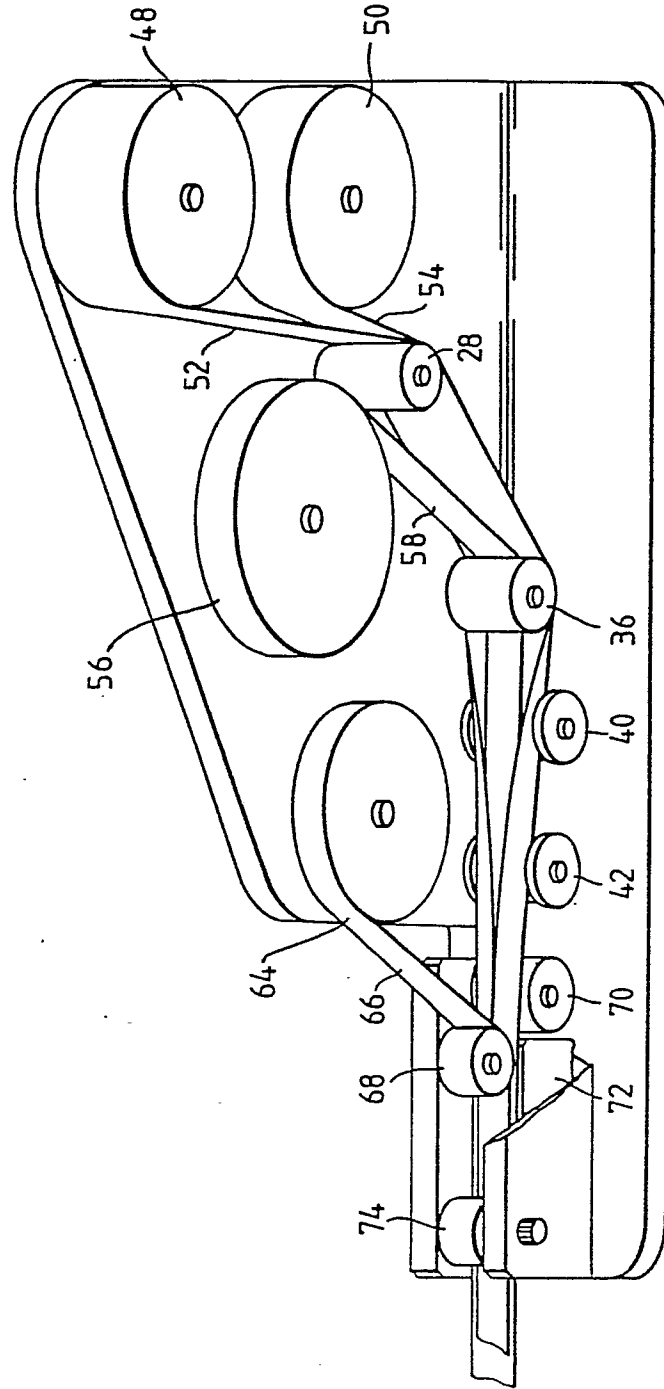


Fig. 3.

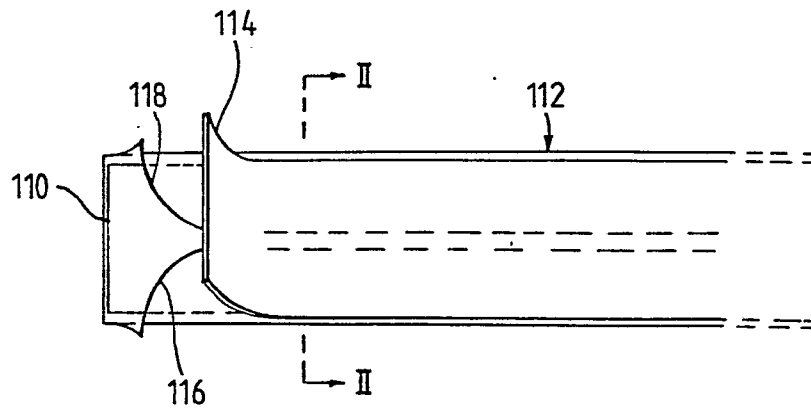


Fig .4.

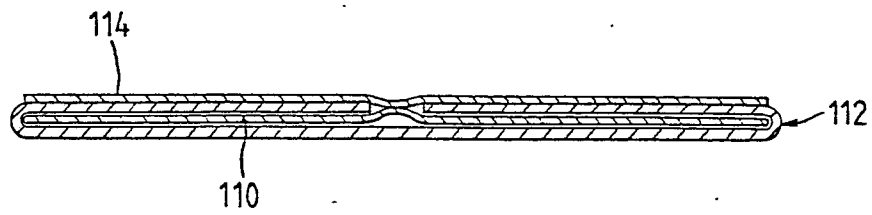


Fig .5.