July 10, 1923. 1,461,228

P. SCHWERIN

METHOD AND APPARATUS FOR COATING MATERIAL

Filed Oct. 17, 1919 2 Sheets-Sheet 1

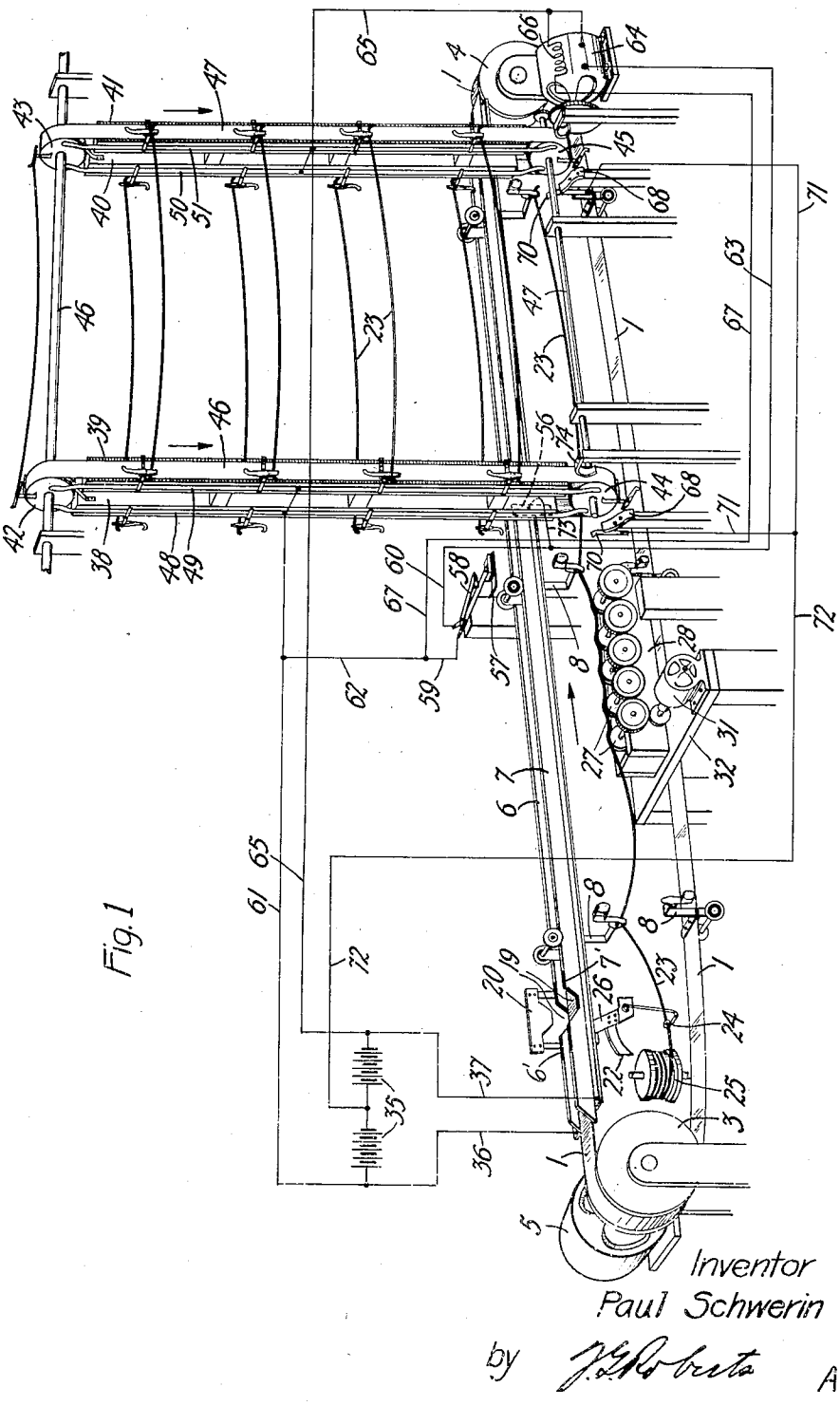


Fig. 1

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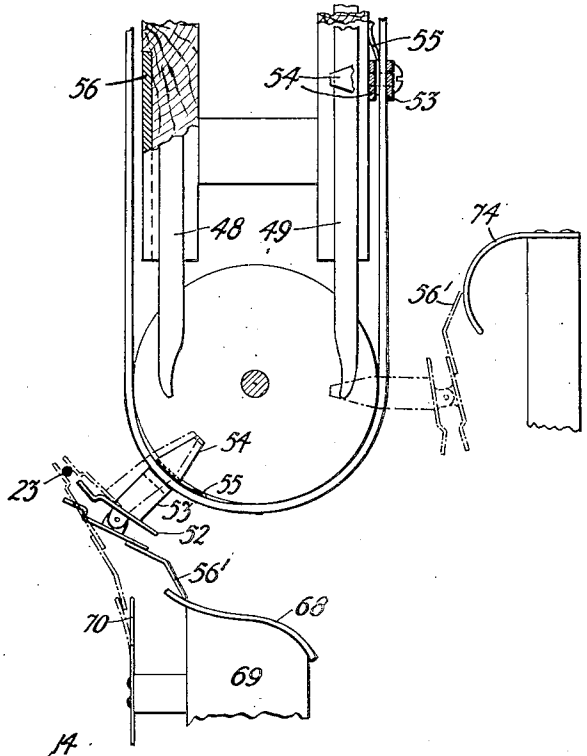


Fig. 2

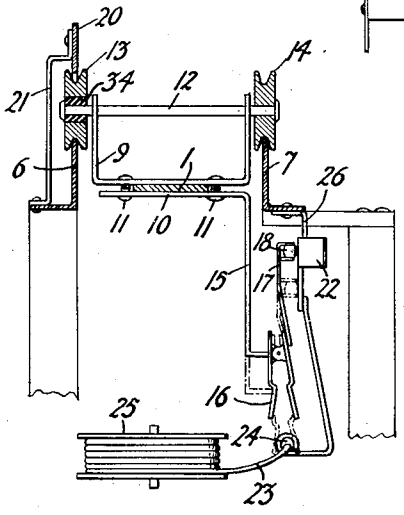


Fig. 3

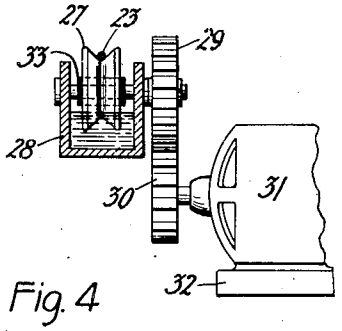


Fig. 4

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UNITED STATES PATENT OFFICE.

PAUL SCHWERIN, OF NEW YORK, N. Y., ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METHOD AND APPARATUS FOR COATING MATERIAL.

Application filed October 17, 1919. Serial No. 331,334.

To all whom it may concern:

Be it known that I, PAUL SCHWERIN, a citizen of the United States, residing at New York, in the county of Bronx, State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Coating Material, of which the following is a full, clear, concise, and exact description.

This invention relates to a method and apparatus for coating material and has particular reference to the coating of filamentary material such as is used for electrodes in vacuum tubes.

An object of the invention is to increase the rate of production of filamentary coated material and to decrease its cost of production.

The invention provides an endless conveyer on which is mounted at suitable intervals a quantity of material grippers. Between one gripper and an adjacent one a definite length of material is gripped and moved along over a bath of coating liquid. This liquid is applied to the material by contact with a plurality of devices to which the liquid is suitably applied. During the time the liquid is being applied, a current is passed through the material to glow it and causes baking of the coating on the material. The plurality of coating devices are spaced apart so that between each coating device and the adjacent one, the current will glow the wire previous to the application of more coating liquid by the next device. The material is then fed along until it is adjacent another conveyer frame which may be called the baking frame. At this instant electrical circuit connections are made which cause this conveyer to be put into motion and means thereon are caused to grip the foremost portion of the material and simultaneously this length of material is severed from the remainder of the material by the application of a potential at the point to be severed thereby causing it to be fused off. The second conveyer then continues to move in a definite manner and for a definite distance until a circuit-breaking mechanism is brought into play to stop the second conveyer in a definite position, whereupon it is in position to receive another length of material to be baked. The conveyer baking frame is capable of receiving a large number of lengths of materials so that each length is on the frame a considerable length of time during which time a current is passed therethrough to heat it and bake the coating thereon. At the end of the travel of each length of material, an automatic release means is operated to cause the release of the material from the drying frame whereupon it drops into a suitable receptacle.

The invention is illustrated in the drawing in which Fig. 1 represents a schematic view of the apparatus; Fig. 2 shows a detail of the lower end of the baking frame and, in particular, the manner of operation of the material gripping means on the drying frame; Fig. 3 represents a section taken through the main conveyer showing, in detail, the structure of the material gripper, and Fig. 4 is a detailed view of the relation between the coating mechanism and the mechanism which drives the same.

The invention as shown in the drawings comprises an endless conveyer belt 1, which passes at each end over rollers 3 and 4. Power to drive the conveyer belt 1 is received from a suitable motor 5 attached to the roller 3. Adjacent the edges of the belt 1 are tracks 6 and 7 formed of angle iron beams along which a plurality of pairs of pulley frames 8 are adapted to move. These pulley frames comprise (see Fig. 3) an upper bar 9 and a lower bar 10, suitably fastened together with the belt 1 between them, by means of screws 11. The upper bar 9 is adapted to receive a shaft 12 having at its ends the pulleys 13 and 14. These pulleys travel along the upper edges of the tracks 6 and 7. The lower bar 10 has a downwardly extended portion 15 which is connected to a gripper or clip 16. One side of this gripper or clip 16 is provided with an arm 17 which has on its upper end a roller 18.

The tracks 6 and 7 are cut away at a point 19 and adjacent this cut-away portion is a vertical frame 20 which has a lower surface corresponding in outline to the cut-away portion 19 of the tracks. The distance between the lower surface of its frame 20 and the nearest cut-away portion of the tracks 6 and 7 is equal to the diameter of one of the pulleys 13 and 14. The function of this arrangement is to provide that when pulley frame 8 moves along the tracks and reaches this cut-away portion, it will move downward into the cut-away portion and be

prevented by the frame 20 from being moved upwardly in an undue manner. The frame 20 is mounted on the platform 2 by means of a suitable upright 21 fastened to track 6. A cam surface 22 is located underneath the platform 2 at a point in the travel of the pulley frame 8, prior to its passage into the cut-away portion 19 and this cam surface 22 is adapted to engage the rollers 18 to force the same backward and by doing so to open the material grippers 16. Immediately after this happens the pulley frames 8 descend into the cut-away portion 19 of the tracks 6 and 7, but the grippers 16 are still maintained open by reason of the fact that the rollers 18 continue to contact with a forward portion of the cam 22. In this lowermost portion the grippers are open and in a position to grip the filamentary material 23 which is fed through a guide loop 24 from a reel 25. The cam 22 is attached to the track 7 by means of a bracket 26.

As the pulley frames 8 continue to advance the forward edge of the cut-away portions 19 are encountered which cause the pulley frames to ascend. Just prior to the time the pulley frames begin to ascend, the roller 18 moves off the front edge of the cam surface 22 thereby permitting the grippers 16 to close and grip the filamentary material 23. The material is thereupon continuously and slowly moved forward, another pulley frame, a desired length of time thereafter, being caused to grip and lift the filamentary material a definite distance behind the one previously mentioned. In Fig. 1 it will be noted that sections of the rails 6 and 7 are insulated as at 6′ and 7′ so that potential is not applied to the grippers until after the material is gripped and thus prevents fusing the material due to imperfect contact.

As the material is fed forward in a somewhat slack loop form, it passes over and contacts with the upper surfaces of a plurality of grooved rollers 27 which are suitably journalled in a tank 28 containing coating liquid and under which suitable heating means (not shown) is placed. These rollers are driven by gears 29 and 30 from a motor 31. The tank and the motor are mounted on a platform 32. The rollers 27 are so positioned that their lower surfaces dip in the coating liquid and their rotation causes this liquid to be rubbed on to the filamentary material as it passes over the rollers. It will be noted that an insulating sleeve 33 (Fig. 4) is provided on each roller 27, the purpose of which will later be apparent. One wheel of each pulley frame 8 is provided with an insulating bushing 34 for a purpose which will hereafter be apparent. Alternate wheels in the pulley frames are thus insulated. A battery 35 of suitable strength is connected to the tracks 6 and 7 by means of wires 36 and 37. It will be apparent therefore that as shown in Fig. 1 the section of filamentary material held between the two pulley frames 8 and passing over the coating rollers is subjected to the potential of the battery 35 in the following manner:

From battery 35, through wire 37, track 7, a wheel of a pulley frame 8, a gripper 16, the filamentary material 23, through another gripper 16, a wheel of another pulley frame 8, track 6, wire 36 and back to the opposite side of the battery 35. The application of this voltage to the wire causes the passage of a desired current therethrough to heat it. The rollers 27 are spaced a suitable distance from each other so that after a portion of the coating has been applied by one roller the current will glow the wire between that roller and the next one so that the filamentary material is alternately coated and glowed a plurality of times before the operation is complete.

Adjacent the forward end of the conveyer belt 1, is another conveyer or baking frame. This frame comprises a plurality of vertical standard portions 38, 39, 40 and 41, at the upper ends of which are pulleys 42 and 43 and at the lower ends of which are pulleys 44 and 45. Over these pulleys conveyer belts 46 and 47 are adapted to pass. These belts move along the outer faces of the uprights 38 to 41, inclusive. Pulleys 42 and 43 are mounted on a shaft 46 and the pulleys 44 and 45 are mounted on a shaft 47. These shafts are rotated in any suitable manner, not shown. Extending longitudinally and vertically on each side of the standards 38 to 41, inclusive, are a plurality of electrically conductive bars, of which four are shown—Nos. 48, 49, 50 and 51. The ends of these bars extend beyond the ends of the standard portions and to the middle of the side faces of the pulleys 42 to 45, inclusive. These conducting bars provide an electrical contact surface for a plurality of material gripping devices mounted on the conveyer belts 46 and 47. These gripper devices are somewhat similar in form to the ones previously mentioned with respect to the conveyer belt 1 and comprise a gripper 52 (see Fig. 2) mounted on a bracket 53 which is suitably fastened by screw means to the conveyer belts 46 and 47. The bracket portion 53 is provided with portions 54 which are adapted to extend inwardly on each side of the standard portions to make contact with the conductive bars above mentioned. In addition each bracket is provided on one side with a contact clip 55 (see Fig. 2) which is adapted to make contact with a plate 56 on the standards as will be hereafter explained. Each of the grippers 52 is pro-

vided with a trailing portion 56′ at its lower end.

As the filamentary material is being fed forward by the main conveyer belt 1, a point is reached where a section of this material has been fed beyond the coating device and is in a position adjacent the lower end of the above mentioned baking conveyer to be severed from the main body of the material and carried by the frame until the coating liquid on the material has been properly baked and dried. In order to effect this result, at the instant the forward portion of the material is in the position just described, one of the pulley frames 8 will be in position about to make contact with a cam surface 57 which cam surface controls the actuation of an electrical switch 58. This switch controls the energization of wire 59 and wire 60. When this cam 57 is operated the following circuit is closed:

From battery 35, through wire 61, wire 62, wire 59, switch 58, wire 60, wire 63, the armature of a motor 64, wire 65, back to the other side of the battery 35. A field winding 66 of the motor 64 is connected on one side to the wire 65 and on the other side through wire 67 to wire 62 and from this connection it is apparent that the field winding is always in direct connection with the battery 35. When the switch 58 is closed therefore the motor 64 is started and slowly moves the conveyer belts 46 and 47 in the direction indicated by the arrows in Fig. 1 with respect to these belts. Therefore, the gripping devices on these belts which are in position adjacent the coated material are moved forward. In their forward movement the rear portions 56′ of the grippers contact with cam surface 68 mounted on a suitable standard 69, the action of this cam surface being to cause the gripper mechanism to open. The gripper mechanism, due to the action of the cam surface 68, remains open until its jaws surround the coated material. At this instant the rear edge 56′ of the gripper moves off the front edge of the cam surface 68 and causes the gripper mechanism to embrace the coated material. Immediately thereafter the rear portions 56′ of the gripper mechanism momentarily contact with spring switch members 70 which are fastened to the support 69. The switch members 70 are connected by wires 71 and a wire 72 which leads to the mid-point of the battery 35. It is evident therefore that during the instant that the gripper mechanism is in contact with the switch members 70 and at the same time is gripping the coated material, the potential of at least one-half the battery 35 is applied to the small portion of the coated material between a gripper mechanism on the conveyer baking frame and a similar gripping mechanism on the main conveyer belt 2. The application of this comparatively large potential to such a small length of material causes it to be fused off and thereby cause the severance of the forward portion of the coated material from the remainder. The conveyer frame continues slowly to rotate and a point is reached shortly after the material is gripped by the grippers 52 when the rear spring contact 55 on the bracket 53 makes contact with a metallic plate 56 on the standard 38. This plate 56 is connected to the wire 63. By this connection the switch 58 is short-circuited and the control of the application of the potential of battery 35 to the motor 64 is taken from the switch 58 and borne by the contact between the plate 56 and the rear end 56′ of the gripper. The circuit whereby this is brought about is as follows:

From battery 35, through wire 61, the conductor bar 48, through the side portions 54 of a gripper member 52 through the contact spring 55 of said gripper member, through the plate 56, through wire 73, through wire 63, to one side of the armature of motor 64, thence to wire 65, and back to the other side of the battery. The upper end of the plate 56 provides a definite sharp edge and is definitely positioned along the edge of the upright standard 38 so that the energization of the motor 64 is cut off exactly at the desired instant so that the movement of conveyer belts 46 and 47 may be terminated exactly in the position desired. When the movement of the belts is thus terminated, another gripper mechanism has been brought around into position ready to engage the coated material. After a length of coated material has been carried around by the conveyer belts 46 and 47, the time comes when the rear portion 56′ of each gripper contacts with cam surface 74 (see Fig. 2) at the end of their paths of movement and this engagement causes the gripper members 52 to be open to release the coated material which then drops into some suitable receptacle.

As a portion of the coated material is being moved upward by the baking conveyer mechanism, the conveyer belt 1 and its associated mechanisms are still moving to advance the filamentary material over the coating mechanism and beyond it adjacent the baking conveyer to be later severed and carried up by the same. The speed of movement of the baking conveyer belts and the coating conveyer belts is such that a new section of coated material is brought adjacent the baking conveyer belt each time a set of gripper devices on the baking conveyer belt is brought into gripping position. It has been calculated that the speed of movement of the baking conveyer belts 46 and 47 for one complete revolution should consume about two hours time which is thought to be

sufficient to suitably dry the coated material.

The baking of the material carried by the belts 46 and 47 is brought about by passing a current therethrough while they are being thus carried. The application of this current to the material while on the baking frame is brought out by reason of the fact that the grippers which grip the material thereon also contact through side members 54 with the conducting bars 48 to 51, inclusive. These bars are electrically connected respectively to wires 61 and 65 which wires are connected to opposite sides of the battery 35 whereby the potential of the battery 35 is applied to the ends of the coated material.

It is evident that this invention is not limited to the particular type of filamentary material employed neither is it limited to any particular kind of coating therefor. The apparatus as described, however, is particularly adapted for applying to nickel wire, a coating of a gelatinous glue-like substance composed of barium carbonate and strontium carbonate in a solution of water. This kind of coating as is well known in the vacuum tube art, possesses high thermionic activity when heated in a vacuum. As previously stated, the solution of the carbonates in container 28 should be heated sufficiently to give the desired consistency. The coating material preferably should be a thick paste so that the grooves of the rollers 27 are practically filled with the material. This insures that the wire 23 in passing over the rollers 27 is practically immersed in the coating material thereby insuring a substantial uniform coating. The coating material above described while at ordinary temperatures acting as an insulating material, acts as a fairly good conductor when it is heated. This insures that the grippers 8 and 52 make satisfactory electrical connections with the metallic wire.

What is claimed is:

1. In combination, means for feeding a continuous piece of filamentary material, means for coating said piece of material, and electrical means for severing portions of the coated piece of material therefrom by fusion.

2. In combination, means for feeding a continuous piece of filamentary material, means for coating said piece of material, and means for electrically heating a small length of said material whereby said material is severed by fusion.

3. In combination, means for gripping and feeding filamentary material, a second means for gripping said material at regular intervals, and means for impressing a difference of electrical potential between said gripping means to fuse the material therebetween.

4. The method which comprises feeding forward a continuous filamentary material, coating said filamentary material while being heated by an electric current, and severing a portion of the coated material by fusion as said material is fed foward.

5. The method which comprises feeding a continuous piece of material, coating said piece of material while being heated by an electric current, severing a portion of the coated piece of material by fusion and baking the coated portion by the application of current thereto.

6. The method which comprises gripping a definite portion of a continuous piece of material, coating said portion while being heated by an electric current, severing said coated portion therefrom by fusion, passing said severed portion to a baking frame, and subjecting the portion to current while on said frame.

7. The method which comprises feeding forward a continuous piece of material, alternately coating and glowing said piece of material and severing portions of said piece of material by fusion as said material is fed forward.

8. A machine for feeding forward material comprising means for feeding a continuous piece of material, and means operating after said material has been fed forward for applying potential to a portion of the material to sever a length of material from the main body thereof by fusion as said material is fed forward.

9. A machine for feeding material which comprises means for gripping a definite length of the material, means for feeding the material forward, means for coating said gripped length, means for applying a potential to said gripped length during coating, and means for applying a potential to a portion of said gripped length after coating to sever the length from the main body of material.

10. A machine for feeding material which comprises means for gripping a definite length of the material, means for feeding the material forward, means for coating the gripped length, means for applying a potential to the length during coating, means cooperating with said gripping means for causing a portion of said length after coating to be severed, means for gripping said severed length simultaneous with the severing thereof, and means for applying a baking potential to said severed length after fusing.

11. A machine for feeding material which comprises an endless conveyer, a plurality of spaced material grippers on said conveyer, means cooperating with said grippers to cause portions of said material to be severed and gripping means acting simultaneous with the severing means to convey the severed portions.

12. A machine for coating material com-

prising an endless conveyer, a plurality of spaced grippers on said conveyer, means to cause the grippers periodically to seize the material, coating means in the path of the grippers, and means to apply a potential between the grippers.

13. A machine for coating material comprising an endless conveyer, a plurality of spaced grippers on said conveyer, coating mechanism in the path of said grippers, a second system of grippers adapted to move in a different direction from the first set of grippers, means for causing said second set of grippers to seize a portion of the coated material, and means acting simultaneously with the seizing and cooperating with said conveyer grippers to cause said portion to be severed from the material.

14. A machine for coating material comprising an endless conveyer, a plurality of material grippers on said conveyer, a coating mechanism in the path of the grippers, a second set of grippers adapted to seize portions of the coated material, means acting simultaneously with the seizing and cooperating with said first set of grippers to cause the seized portion to be severed and means for applying a potential to the severed portions to bake the same.

15. A material conveying mechanism comprising an endless belt, the plurality of material gripping devices on said belt, cam mechanism located in the path of the movement of said grippers to open them for the seizure of a portion of the material, and electric circuit mechanism actuated by the grippers immediately after the seizure of a portion of the material whereby a potential is applied to the material adjacent to seized points to sever the same by fusing of the main body of the material.

16. A machine for conveying and drying material which comprises an endless conveyer, a plurality of material gripping means on said conveyer, a plurality of electrical conductors adjacent to said grippers, means on said grippers adapted continuously to contact with said conductors, and means for applying electrical potential to said conductors, for heating the material to be fed by said conveyor.

17. The method which comprises feeding a continuous conductive filamentary material, coating said filamentary material, passing electric current through said material during the coating operation, and periodically electrically heating a portion of said material to sever it by fusion.

18. The method which comprises gripping a definite portion of a continuous conductive material, coating said material, passing electric current therethrough during the coating operation, periodically severing the coated portion, passing said severed portion to a baking frame, and subjecting the coated portion to current while on said frame.

19. The method which comprises gripping a definite portion of a continuous filamentary material, coating said portion while said portion is being heated, severing said coated portion, passing said severed portion to a baking frame, and heating said portion while on said frame.

20. A machine for coating material comprising an endless conveyor, a plurality of spaced grippers on said conveyor, means to cause the grippers periodically to seize the material, coating means in the path of said grippers, and means for heating said material while being coated by said coating means.

21. A machine for feeding material which comprises an endless conveyor, a plurality of spaced material grippers attached to said conveyor, means cooperating with said grippers for causing the severing of said material into portions of equal length.

22. A machine for feeding material comprising an endless conveyor, a plurality of spaced material grippers on said conveyor, means cooperating with said grippers for causing the severing of portions of said material, and mechanism for gripping and for conveying said severed portions away from the region of said conveyor.

23. A machine for coating material comprising an endless conveyor, a plurality of spaced grippers on said conveyor, coating mechanism in the path of said grippers, a second set of grippers adapted to move in a different direction from said first set of grippers, means for causing said second set of grippers to seize a portion of the coated material, means to sever said portion from the remainder, and means to convey said second set of grippers away from the region of said conveyor.

In witness whereof, I hereunto subscribe my name this 15th day of October A. D. 1919.

PAUL SCHWERIN.