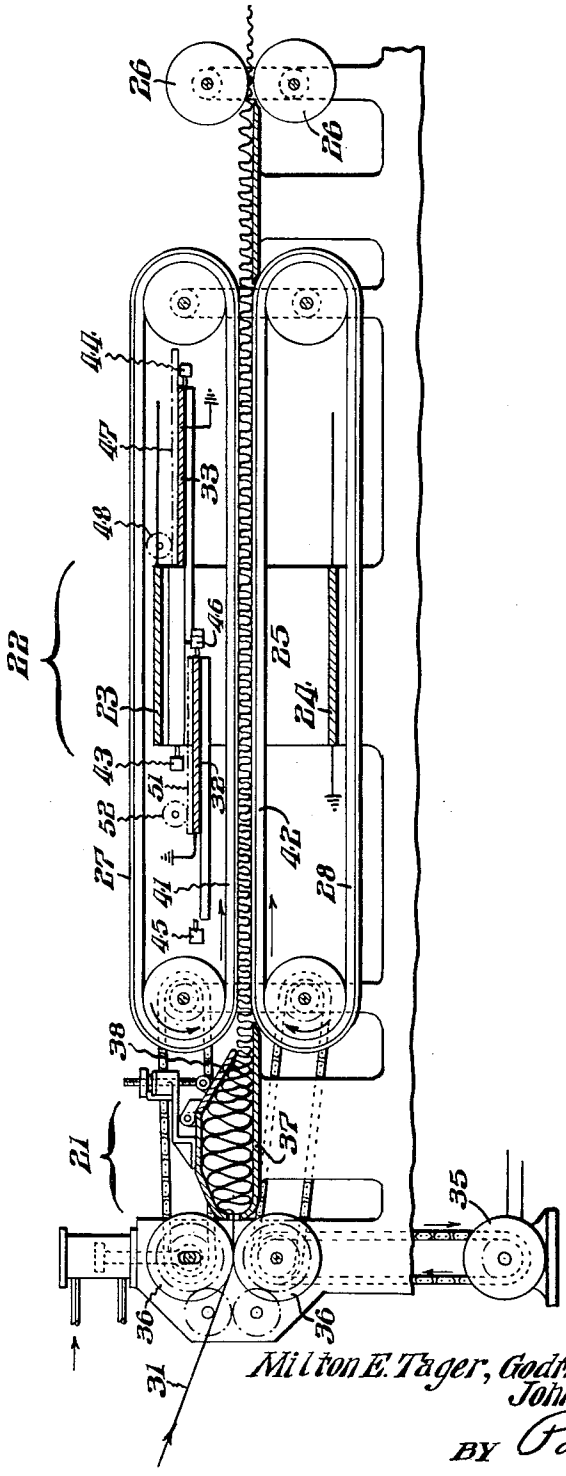
July 17, 1962 M. E. TAGER ET AL 3,044,145

APPARATUS AND METHOD FOR SETTING YARN AND FOR CRIMPING AND SETTING YARN

Filed Oct. 31, 1958 4 Sheets-Sheet 1

FIG. 1



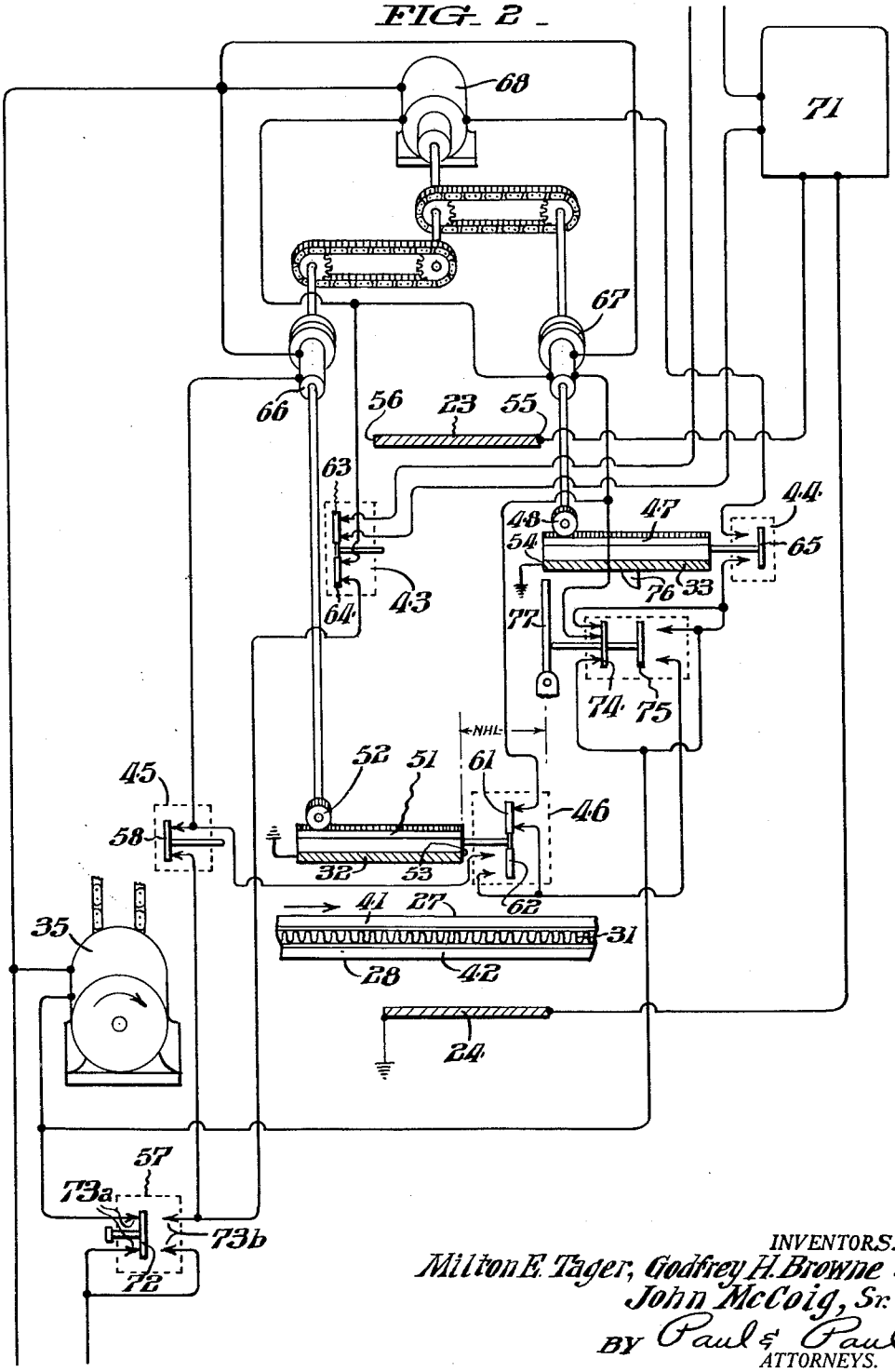
INVENTORS.
Milton E. Tager, Godfrey H. Browne & John McCoig, Sr.
BY Paul & Paul
ATTORNEYS.

July 17, 1962 M. E. TAGER ET AL 3,044,145

APPARATUS AND METHOD FOR SETTING YARN
AND FOR CRIMPING AND SETTING YARN

Filed Oct. 31, 1958 4 Sheets-Sheet 2

FIG. 2



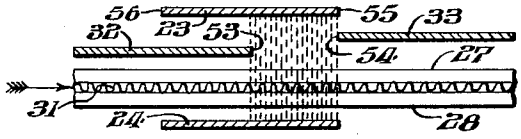
INVENTORS.
Milton E. Tager, Godfrey H. Browne &
John McCoig, Sr.
BY Paul & Paul
ATTORNEYS.

July 17, 1962 M. E. TAGER ET AL 3,044,145

APPARATUS AND METHOD FOR SETTING YARN AND FOR CRIMPING AND SETTING YARN

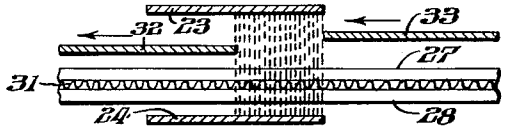
Filed Oct. 31, 1958 4 Sheets-Sheet 3

FIG. 3



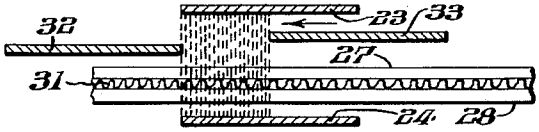
NORMAL RUNNING

FIG. 4



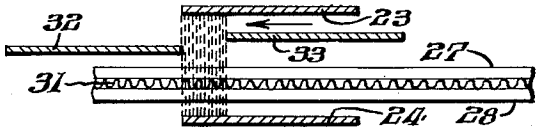
STOPPAGE CRIMPER STOPS ERASE PLATES MOVE TO LEFT AT SAME SPEED YARN WAS TRAVELLING

FIG. 5



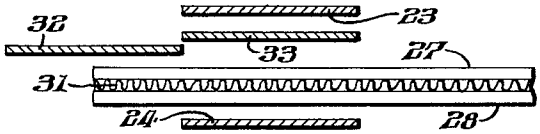
STOPPAGE STILL ON RUN ERASE PLATE REACHES MAXIMUM TRAVEL STOP ERASE PLATE CONTINUES TO MOVE

FIG. 6



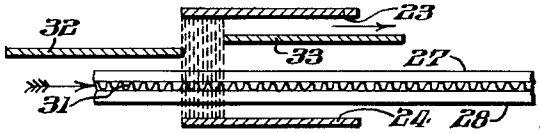
STOPPAGE STILL ON STOP ERASE PLATE CONTINUES TO MOVE

FIG. 7



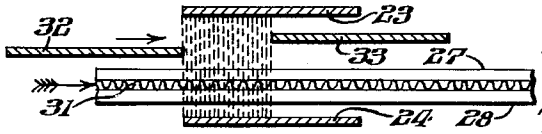
STOPPAGE STILL ON STOP ERASE PLATE SHUTS OFF GENERATOR HEAT COMPLETELY OFF

FIG. 8



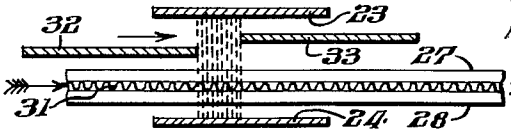
RESTARTING CRIMPER RUNS STOP ERASE PLATE MOVES TO RIGHT AT SAME SPEED AS YARN IS TRAVELLING AND OPENS GAP

FIG. 9



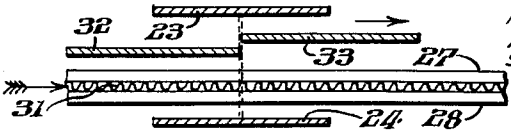
STOP ERASE PLATE STOPS HALFWAY IN ITS TRAVEL TO THE RIGHT AND RUN ERASE PLATE STARTS TO MOVE TO THE RIGHT

FIG. 10



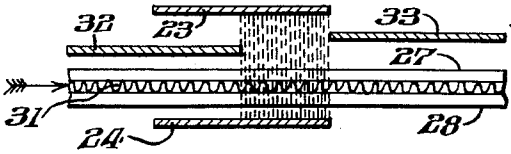
RUN ERASE PLATE MOVES TO THE RIGHT AT SAME SPEED THAT YARN IS TRAVELLING

FIG. 11



RUN ERASE PLATE STOPS AT MIDPOINT AND THE STOP ERASE PLATE STARTS AND OPENS THE GAP

FIG. 12



STOP ERASE PLATE REACHES LIMIT OF TRAVEL AND STOPS. MACHINE IS BACK TO NORMAL RUNNING

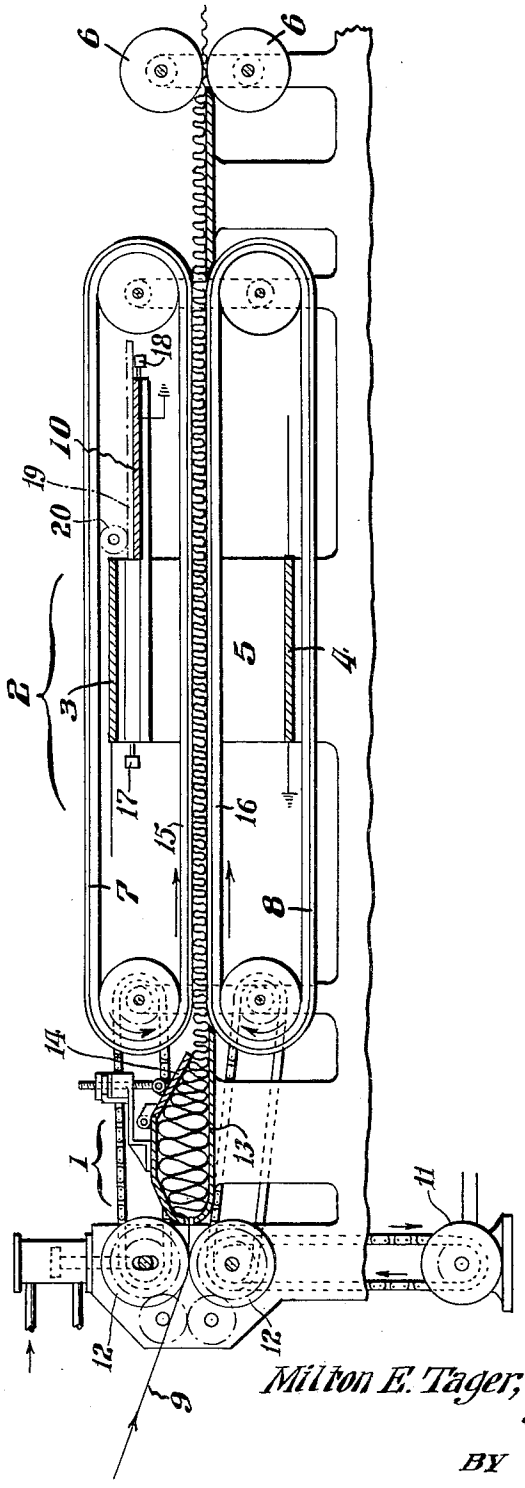
INVENTORS.
Milton E. Tager, Godfrey H. Browne & John McCoig, Sr.
BY Paul & Paul
ATTORNEYS.

July 17, 1962 M. E. TAGER ET AL 3,044,145

APPARATUS AND METHOD FOR SETTING YARN AND FOR CRIMPING AND SETTING YARN

Filed Oct. 31, 1958 4 Sheets-Sheet 4

FIG. 13



INVENTORS.
Milton E. Tager, Godfrey H. Browne & John McCoig, Sr.
BY Paul & Paul
ATTORNEYS.

United States Patent Office

3,044,145

Patented July 17, 1962

3,044,145

APPARATUS AND METHOD FOR SETTING YARN AND FOR CRIMPING AND SETTING YARN

Milton E. Tager, Godfrey H. Browne, and John A. McCoig, Sr., Gastonia, N.C., assignors to Cocker Machine & Foundry Company, Gastonia, N.C., a corporation of North Carolina

Filed Oct. 31, 1958, Ser. No. 771,005

6 Claims. (Cl. 28—1)

This invention relates to textiles, and more particularly concerns apparatus and method for setting yarn, and for crimping and setting yarn.

In the heat setting of yarn made, for example, of continuous filament nylon, the yarn is passed through a heating zone in which the yarn is brought to a predetermined maximum temperature. It is desirable to extrude the yarn from a crimper and to set it in a continuous manner, and to set a multiplicity of yarn ends at the same time. However, machinery such as crimpers are subject to failure, and such failure causes a stoppage of the yarn travelling through the heating zone. This stoppage of the yarn subjects the yarn to variations in temperature since some portions of the yarn remain in the heating zone longer than other portions, which causes variations in the dye index of the yarn and results in variations in shading of the color of the yarn when dyed. This variation in shading is objectionable.

Accordingly, it is an object of this invention to crimp and to heat-set yarn at a uniform temperature.

It is another object of this invention to give the yarn a uniform dye index so that when dyed the yarn is a uniform shade.

It is another object of this invention to heat-set yarn by uniformly exposing the yarn to an electronic field, and to heat-set a multiplicity of ends of yarn made of continuous filament nylon or the like.

It is another object of this invention to continuously crimp and set filament yarn. It is another object to avoid over-heating the yarn in case a stoppage occurs in the advancement of the yarn through the setting mechanism.

Other objects and advantages of this invention, including its simplicity and economy, as well as the ease with which it may be used with existing equipment, will further become apparent hereinafter and in the drawings, in which:

FIG. 1 is an overall view in side elevation of another embodiment of this invention;

FIG. 2 is a diagrammatic view of controls for erase plates which constitute an element of the embodiment of FIG. 1;

FIGS. 3–12 represent partial views illustrating the operation of the erase plates of the embodiment of FIG. 1; and

FIG. 13 is an overall view in side elevation of one specific embodiment of apparatus constructed in accordance with this invention.

In describing the preferred embodiments of the invention illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, it is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Turning now to the specific embodiment of the invention selected for illustration in FIG. 13, there is shown a crimper mechanism **1**, a setting mechanism **2** including electrodes **3** and **4** which form therebetween a heating zone **5**, and drag rolls **6** which operate together with conveyor belts **7**, **8** to advance yarn **9** from the crimper mechanism **1** through the setting mechanism **2**.

The passage of yarn **9** through the mechanism shown and through other textile machines (not shown) is as follows. Yarn **9** enters crimper mechanism **1** as a sheet composed of a multiplicity of yarn ends. Yarn **9** is crimped in crimper mechanism **1** and extruded in the form of a bat and is carried by conveyor belts **7**, **8** through the electronic field which is created between electrodes **3**, **4** which are connected to a source of high frequency electrical energy. As yarn **9** enters the electronic field, the high frequency causes an internal heating to take place within the yarn so that the temperature within the yarn rises as it moves through the electronic field until it reaches approximately 400° F., at which temperature it passes out of the electronic field and is carried by belts **7**, **8** to the drag rolls **6**. Drag rolls **6** break the bat down into a continuous sheet which is taken up by a warper or similar device (not shown). The warper is running at approximately the same speed as crimping mechanism **1** and stretches yarn **9** to the extent that it may split by means of a comb (not shown) just prior to being wound on beams (not shown). From the beams, yarn **9** may be wound on individual cones or spools, or it may be plied and then wound on individual cones.

Since stoppages in the crimping process will inevitably occur due to broken or tangled ends of yarn, provision is made to insure that the yarn **9** is sufficiently heated to set the crimp, and also to insure that excessive heating does not occur. To accomplish this, an erase plate **10** is provided which is interposed between yarn **9** and electrode **3** when stoppages of yarn movement occurs. The crimp can be properly set only by closely controlling the temperature to which yarn **9** is subjected, and also by controlling the time during which yarn **9** is subjected to that temperature. The speed at which yarn **9** advances through setting mechanism **2** must be carefully controlled, and should stoppage occur, the heat applied to yarn **9** must be cut off at the same time as it would have been cut off had it continued its movement. This is accomplished by moving erase plate **10** between electrode **3** and yarn **9** when the yarn **9** has stopped, and moving erase plate **10** at the same speed as the yarn **9** had previously been moving.

Erase plate **10** thus travels in the direction opposite to yarn travel until it reaches its extreme left hand position at which point it completely cuts off electrode **3** from yarn **9**. After the fault has been corrected, the yarn resumes its travel and erase plate **10** travels with yarn **9** to resume its normal operating position as shown in FIG. 13.

It will be evident that crimper mechanism **1** includes drive motor **11** which drives crimper rolls **12**, and a crimper box **13** having an adjustable gate **14**.

The yarn **9** which is extruded from crimper mechanism **1** is picked up and advanced by conveyor belts **7**, **8** which are also driven by drive motor **11**. Belts **7**, **8** are provided with quilted layers **15**, **16** which afford sufficient insulation to prevent loss of heat from yarn **9**. Setting mechanism **2** also includes limit switches **17**, **18** for erase plate **10**. Erase plate **10** is provided with a rack **19** which is driven by pinion **20**.

Turning now to the specific embodiment of the invention selected for illustration in FIGS. 1–12, there is shown a crimper mechanism **21**, a setting mechanism **22** including electrodes **23** and **24** which form therebetween a heating zone **25**, and drag rolls **26** which operate together with conveyor belts **27**, **28** to advance yarn **31** from the crimper mechanism **21** through the setting mechanism **22**.

The passage of yarn **31** through the mechanism shown and through other textile machines (not shown) is as follows. Yarn **31** enters crimper mechanism **21** as a sheet composed of a multiplicity of yarn ends. Yarn **31**

is crimped in crimper mechanism 21 and extruded in the form of a bat and is carried by conveyor belts 27, 28 through the electronic field which is created between electrodes 23, 24 which are connected to a source of high frequency electrical energy. As yarn 31 enters the electronic field, the high frequency causes an internal heating to take place within the yarn so that the temperature within the yarn rises as it moves through the electronic field until it reaches approximately 400° F., at which temperature it passes out of the electronic field and is carried by belts 27, 28 to the drag rolls 26. Drag rolls 26 break the bat down into a continuous sheet which is taken up by a warper or similar device (not shown). The warper is running at approximately the same speed as crimping mechanism 21 and stretches yarn 31 to the extent that it may be split by means of a comb (not shown) just prior to being wound on beams (not shown). From the beams, yarn 31 may be wound on individual cones or spools, or it may be plied and then wound on individual cones.

Since stoppages in the crimping process will inevitably occur due to broken or tangled ends of yarn, provision is made to insure that the yarn 31 is sufficiently heated to set the crimp, and also to insure that excessive heating does not occur. To accomplish this, run erase plate 32 and stop erase plate 33 are provided. The crimp can be properly set only by closely controlling the temperature to which yarn 31 is subjected, and also by controlling the time during which yarn 31 is subjected to that temperature. This means that the speed at which the yarn 31 advances through setting mechanism 22 must be carefully controlled, and should stoppage occur, the heat applied to yarn 31 must be cut off at the same time as it would have been cut off had it continued its movement. This is accomplished by interposing erase plates 32, 33 between the yarn and electrode 23.

Detailed Description

Crimper mechanism 21 includes drive motor 35 which drives crimper rolls 36, and a crimper box 37 having an adjustable gate 38.

The yarn 31 which is extruded from crimper mechanism 21 is picked up and advanced by conveyor belts 27, 28 which are also driven by drive motor 35. Belts 27, 28 are provided with quilted layers 41, 42 which afford sufficient insulation to prevent loss of heat from yarn 31. Setting mechanism 22 (referring to FIG. 1) also includes limit switches 43, 44 for stop erase plate 33, and limit switches 45, 46 for run erase plate 32. Stop erase plate 33 is provided with a rack 47 which is driven by pinion 48, and run erase plate 32 is provided with a rack 51 which is driven by pinion 52.

The distance between edge 53 of run erase plate 32 and edge 54 of stop erase plate 33 (with plates 32 and 33 positioned as shown in FIGS. 3 and 1), represents the normal heating length (NHL) through which the yarn 31 travels within heating zone 25 in order to be raised to the proper heating temperature. FIGS. 1, 3 not only illustrate the normal heating length, but also illustrate the normal heating position of plates 32, 33, with stop erase plate edge 54 positioned below exit edge 55 of electrode 23, and run erase plate edge 53 positioned half-way between entrance edge 56 and exit edge 55 of electrode 23.

Referring now to FIG. 2, there is shown a start-stop switch 57, drive motor 35, limit switch 45 with its contact 58, limit switch 46 with its contacts 61 and 62, limit switch 43 with its contacts 63 and 64, limit switch 44 with its contact 65, solenoid clutches 66, and 67, reversible motor 68, a high frequency generator 71, and electrical leads which are arranged to connect the various components in an electrical circuit. Start-stop switch 57 is provided with contact 72 and terminals 73*a* and 73*b*. Also provided are contacts 74, 75, trip arm 76 attached to the underside of stop erase plate 33, and actuating arm 77 which is operated by trip arm 76 to open contact 74 and close contact 75.

Operation of Erase Plates 32, 33

Since stoppages in the crimping process will inevitably occur due to broken or tangled ends of yarn, provision is made to insure that yarn 31 is sufficiently heated to set the crimp, and to insure that yarn 31 is not subjected to excessive heat. To accomplish this, the electronic field or heating zone 25 is equipped with erase plates 32, 33. Since the crimp can be set properly only by closely controlling the temperature to which yarn 31 is subjected and the time during which yarn 31 is subjected to that temperature, yarn 31 is advanced through heating zone 25 at a constant speed, and the speed is controlled very accurately. Should a stoppage occur, erase plates 32, 33 operate to cut off the heat and do so by moving through the heating zone in a direction opposite to the direction of yarn travel, and moving at the same speed as the yarn, had there been no stoppage.

In order to provide for erasing the heat of the electronic field under all conditions of operation, there are provided two erase plates, the stop erase plate 33 which enters heating zone 25 from its exit end, and run erase plate 32 which enters the heating zone 25 from its entrance end.

Under normal conditions, as is shown in FIG. 3, stop erase plate 33 is stationary and is positioned just outside the exit end of heating zone 25, and run erase plate 32 is positioned a normal heating length away from stop erase 33 so as to block off half of the electronic field between electrodes 23 and 24. Yarn 31 is advancing through the normal heating length at a predetermined constant speed and is heated to a predetermined maximum temperature, for example 400° F., to set the crimped yarn. If a stoppage of yarn 31 should occur, both plates 32, 33 immediately start moving in the direction opposite to the direction of yarn travel as is shown in FIGS. 4 and 5. Should the stoppage continue long enough, run erase plate 32 completes its travel and stops at the position shown in FIG. 5, with plate 33 continuing its advance as shown in FIG. 6. Notice that the distance between plates 32, 33 is now less than the normal heating length. With the stoppage continuing, plate 33 advances to the position shown in FIG. 7, which deenergizes electrodes 23, 24.

The fault having been fixed, yarn 31 resumes its travel as is shown in FIG. 8, and plate 33 travels with it to open the distance between plates 32, 33 to the normal heating length as is shown in FIG. 9. At this point plate 33 stops, and plate 32 starts to advance with yarn 31 and passes through the position shown in FIG. 10 to the position shown in FIG. 11. Plate 32 now has reached its normal position and stops there, and plate 33 resumes its travel with yarn 31 and stops at its normal position as shown in FIG. 12. Notice that FIG. 12 is the same as FIG. 3, the cycle has been completed.

Should the stoppage be corrected while plates 32, 33 are in any position between FIG. 4 and FIG. 5, plates 32, 33 stop and remain stationary, thus providing a normal heating length for the advancing yarn.

Should the stoppage be corrected after run erase plate 32 has completed its travel but before stop erase plate 33 has completed its travel (for example, the situation shown in FIG. 6), stop erase plate 33 immediately stops and run erase plate 32 advances toward stop erase plate 33 until edges 53 and 54 are aligned, whereupon run erase plate 32 stops and stop erase plate 33 moves along with the yarn until it is separated from run erase plate 32 by the normal heating length. Then stop erase plate 33 stops thereby providing a normal heating length for the advancing yarn. Notice that the normal heating length is provided even though stop erase plate 33 is not positioned in the normal heating position of FIG. 3, but is instead posi-

tioned somewhere between that position and the position of FIG. 5.

Relating FIGS. 3–12 With the Control Circuit of FIG. 2

With the erase plates **32**, **33**, positioned as shown in FIG. 3, in the control mechanism of FIG. 2, drive motor **35** is operating, reversible motor **68** is not energized, clutches **66** and **67** are disengaged, high frequency generator **71** is operating, and all contacts are closed except **73***b*, **62**, **75**, and **65**.

With conditions as shown in FIG. 4, the start of the yarn stoppage, motor **35** is cut off, motor **68** is running, clutches **66**, **67** are engaged, generator **71** is operating, and all contacts are closed except contacts **73***a*, **62**, **75**, and **65**.

With the stoppage continuing as shown in FIG. 5, drive motor **35** is de-energized, motor **68** is running, clutch **66** is disengaged, clutch **67** is engaged, generator **71** is operating, contacts **73***b*, **62**, **74**, **63**, **64**, and **65** are closed, and contacts **73***a*, **58**, **61**, and **75** are open.

With conditions as shown in FIG. 7, motor **35** is cut off, motor **68** is cut off, clutches **66**, **67** are disengaged, generator **71** is cut off, contacts **73***b*, **62**, **74** and **65** are closed, and contacts **73***a*, **58**, **63**, **64**, **61**, **75** are open.

With conditions as shown in FIG. 8, motor **35** is running, motor **68** is running, but is rotating in an opposite sense, generator **71** is operating, clutch **66** is disengaged, clutch **67** is engaged, contacts **73***a*, **62**, **63**, **64**, **74**, and **65** are closed, and contacts **73***b*, **61**, **75**, are open.

With conditions as shown in FIG. 9, motor **35** is running, motor **68** is running, clutch **66** is engaged, clutch **67** is disengaged, generator **71** is operating, contacts **73***a*, **58**, **63**, **64**, **62**, **75**, and **65** are closed, and contacts **73***b*, **61**, **74**, are open.

With conditions as shown in FIG. 10, motor **35** is running, motor **68** is running, clutch solenoid **66** is engaged, clutch solenoid **67** is disengaged, generator **71** is operating, contacts **73***a*, **58**, **63**, **64**, **62**, and **75** are closed, and contacts **73***b*, **61**, **65** and **74** are open.

With conditions as shown in FIG. 11, motor **35** is operating, motor **68** is operating, clutch **66** is disengaged, clutch **67** is engaged, generator **71** is operating, contacts **73***a*, **58**, **61**, **63**, **64**, and **75** are closed, and contacts **73***b*, **62**, **65** and **74** are open.

With conditions as shown in FIG. 12, the control elements of FIG. 2 are in the same condition as described in connection with FIG. 3.

Setting mechanism **22** with its erase plates **32** and **33** insures that yarn **31** is set at a uniform temperature, and gives the yarn a uniform dye index so that when dyed it is a uniform shade.

The apparatus of this invention provides for continuous and uniform heat-setting of a multiplicity of ends of yarn made of continuous filament nylon or the like, and does so by subjecting the yarn to uniform exposure in an electronic field. Over-heating of the yarn during a stoppage of its advancement through setting mechanism **22** is prevented by providing erase plates **32** and **33** and their controls.

It is to be understood that the form of the invention herein shown and described is to be taken as a preferred embodiment. Various changes may be made in the shape, size and arrangement of parts. Equivalent elements may be substituted for those described herein, parts may be reversed, and certain features of the invention may be utilized independently of the use of other features, all without departing from the spirit of the invention or the scope of the subjoined claims. It is also to be understood that the term "yarn," as used in the subjoined claims, includes single ends of yarn, a tow of yarn, crimped and uncrimped yarn, yarn made of nylon, and, in general, any elongated object.

Having thus described our invention, we claim:

1. Apparatus for heat setting a yarn, comprising a pair of electrodes which generate heat and which are spaced apart to form a heating zone therebetween, means for transporting said yarn through said heating zone at a predetermined rate of speed to heat said yarn to various temperatures up to a predetermined maximum temperature, and shielding means for shielding said yarn from said heat after said yarn has reached said predetermined maximum temperature, said shielding means including a stop erase plate and control means for moving the plate at the speed of yarn travel in the direction opposite that of yarn travel after the yarn has stopped in order to cut off the yarn from heat as the yarn reaches said predetermined maximum temperature.

2. The apparatus for heat setting yarn defined in claim 1, wherein said shielding means is also provided with a run erase plate which is normally positioned a predetermined normal heating length away from said stop erase plate, means for stopping said run erase plate and for continuing the movement of said stop erase plate thereby to decrease the distance between said erase plates, and, upon the yarn resuming its travel with the distance between said erase plates less than said normal heating length, means for stopping said stop erase plate and for moving said run erase plate toward said stop erase plate.

3. Apparatus for heat setting yarn, comprising a pair of electrodes which generate heat and which are spaced apart to form a heating zone therebetween, means for transporting said yarn through said heating zone at a predetermined rate of speed to heat said yarn to various temperatures up to a predetermined maximum temperature, and shielding means for shielding said yarn from said heat in case of stoppage of yarn travel after said yarn has reached said predetermined temperature, wherein said shielding means includes a run erase plate and a stop erase plate normally positioned a normal heating length apart; and erase plate control means for moving said plates, upon the yarn stopping its travel, at yarn speed in the direction opposite yarn travel thereby cutting off the heat to the stopped yarn after it has reached said predetermined temperature; means for stopping said run erase plate upon reaching a limit and for continuing the movement of said stop erase plate for continuing to cut-off said heat from the yarn as the yarn reaches said predetermined maximum temperature, and means, upon the yarn resuming its travel, for again spacing said plates a normal heating length apart.

4. In an apparatus for crimping and heat-setting yarn, including crimper means for crimping the yarn and heat-setting means for subjecting the crimped yarn to heat of a predetermined temperature, the improvement which comprises, means for transporting the yarn at a substantially constant rate through said setting means, and shielding means connected to said setting means and disposed adjacent thereto for shielding said yarn from heat, said shielding means being arranged to respond to a stoppage of said yarn to move between said yarns and the source of said heat so that said yarn receives a uniform application of heat throughout the length thereof passing through said setting means.

5. Apparatus for heat-setting yarn, comprising a pair of electrodes which generate heat and are spaced apart to form a heating zone therebetween, means for transporting said yarn through said heating zone at a predetermined rate of speed to heat said yarn to various temperatures up to a predetermined maximum temperature, and shielding means for shielding said yarn from said heat after said yarn has reached said predetermined temperature and arranged to move between said electrodes and said yarn so that said yarn receives a uniform application of heat throughout the length thereof passing through said apparatus.

6. Apparatus for heat-setting a multiplicity of ends of yarn made of continuous filament nylon or the like, comprising a pair of electrodes which generate heat and which are spaced apart to form a heating zone therebetween, conveyor means for transporting said yarn through said

heating done at a predetermined, constant speed to heat said yarn to various temperatures up to a predetermined maximum temperature, and shielding means for shielding said yarn from said heat after said yarn has reached said predetermined temperature, said shielding means being arranged to move between said electrodes and said yarn whenever said yarn has stopped in its travel through said heating zone so that said yarn receives a uniform application of heat throughout the length thereof passing through said setting means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,448,008	Baker	Aug. 31, 1948
2,667,568	Ferier	Jan. 26, 1954
2,724,907	Walter	Nov. 29, 1955
2,733,122	Herele et al,	Jan. 31, 1956
2,758,357	Goodhue	Aug. 14, 1956
2,846,752	Lessig	Aug. 12, 1958
2,874,446	Sellers	Feb. 24, 1959