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Varner

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[54] **CONTROL SYSTEM FOR A CIGARETTE MAKING MACHINE OR THE LIKE**

[75] Inventor: **Donald E. Varner,** Columbus, Ohio

[73] Assignee: **Industrial Nucleonics Corporation,** Columbus, Ohio

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[52] **U.S. Cl.**..... **131/21 B,** 131/84 B, 131/84 C

[51] **Int. Cl.**..... **A24b 05/34**

[58] **Field of Search**..... 131/84, 21 D, 21 B, 84 B, 131/84 C; 73/194 M

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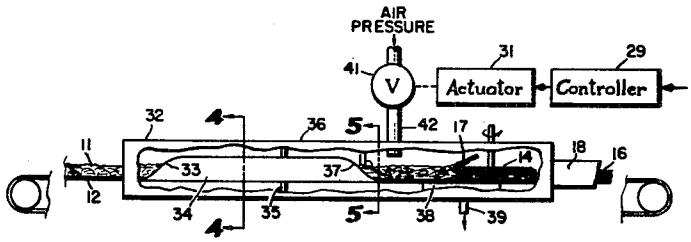
Primary Examiner—Joseph S. Reich

Attorney, Agent, or Firm—Anthony D. Gennamo; Robert K. Schumacher; C. Henry Peterson

[57] **ABSTRACT**

A control system for a cigarette making machine or the like having a device for feeding shredded tobacco in excess of that required on to a relatively narrow belt to form a filler stream thereon. The belt conveys the filler stream to and through a compression chamber having a valve controlled compressed-air inlet and an air exhaust port, the air compressing the stream within the chamber. A pair of rotary trimming knives removes the excess tobacco from the stream in the chamber and the rod stream formed thereby is advanced to rod former and to other apparatus adapted to form finished cigarettes. A detector is placed adjacent to the rod and provides a signal which is used to control the valve in the compressed-air inlet thereby controlling the degree of pressure in the chamber so that the rod stream produced thereby has a uniform density.

2 Claims, 7 Drawing Figures



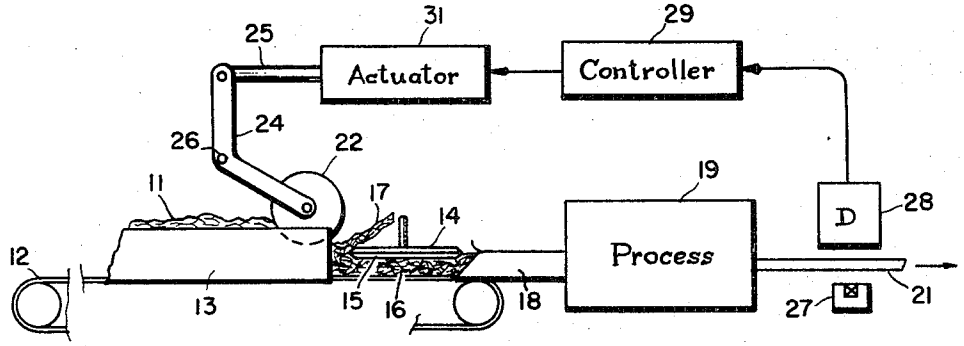


Fig. 1

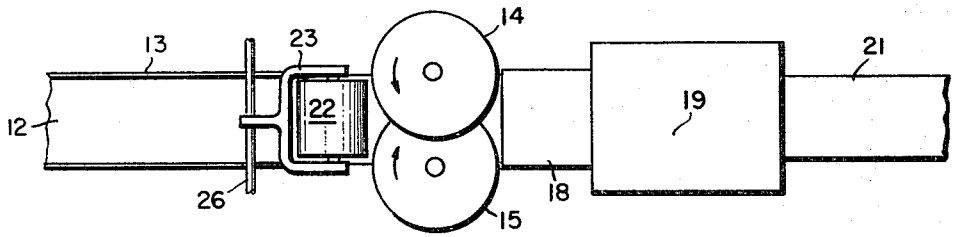


Fig. 2

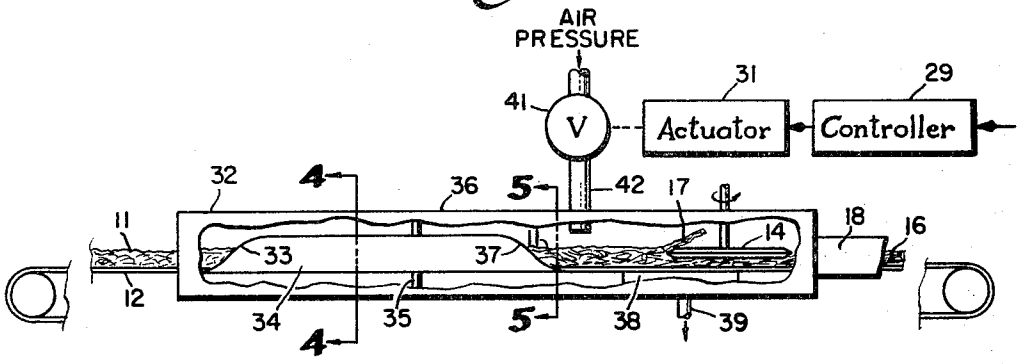


Fig. 3

INVENTOR
Donald E. Varner
By Anthony D. Cennamo

Fig. 4

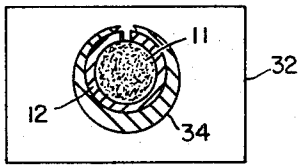
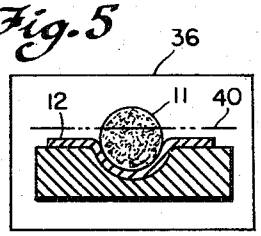


Fig. 5



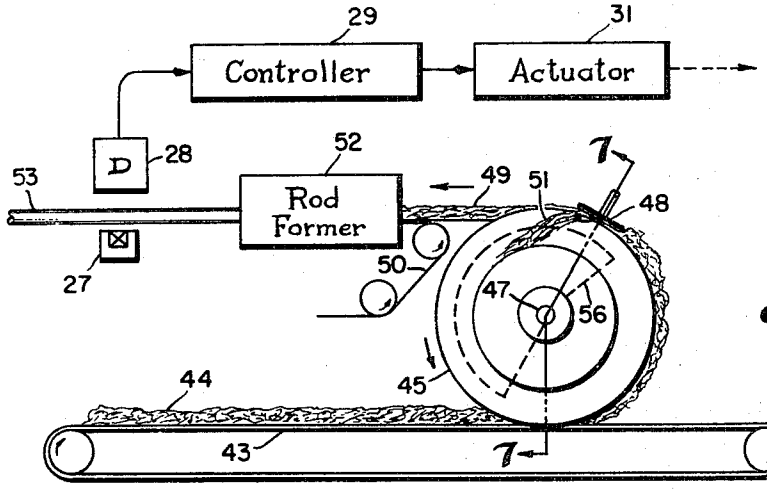


Fig. 6

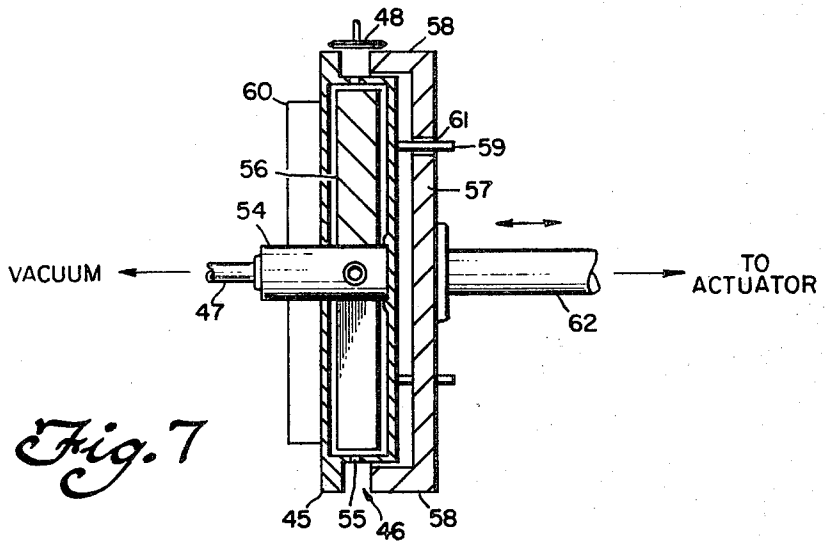


Fig. 7

INVENTOR
Donald E. Varner
By Anthony D Cennamo

CONTROL SYSTEM FOR A CIGARETTE MAKING MACHINE OR THE LIKE

This invention relates generally to industrial process control systems, and more particularly to arrangements for controlling the basis weight of a finished product by automatically adjusting the density of the material utilized in the process to make the product.

Various arrangements have been employed in the past for controlling the quantity of material which is continuously introduced into a process device in order that the finished product produced by the process device may have a uniform weight per unit length. Many of these arrangements have provided for adjusting the cross-sectional size or shape of the moving strand of material at a trimming station where a portion of the strand of material may be trimmed off and discarded or recirculated in the process thereby providing control of the ultimate basis weight of the finished product. While these prior arrangements have proved satisfactory in particular applications, certain disadvantages exist due to the difficulty involved in mechanically altering the cross-sectional size of the moving material flow. This change in size of the material flow presented to the process device must obviously be compensated for in the process in order that the finished product may be uniform and not reflect the change in size or cross-sectional shape of the stream of material flowing into the process.

The present invention is applicable to a wide class of continuous industrial processes in which a flow of material is involved that is capable of having its density altered. More specifically, the control of the weight per unit length of a finished product manufactured from such material is accomplished by feeding to the process a substantially constant cross-sectional area of the material. With this arrangement the weight of material in the finished product is determined by the multiplication of the rate of flow times the cross-sectional area of the material times the density of the material. Therefore, by maintaining the linear rate of flow and the cross-sectional area of the flow constant, the weight can be controlled directly by controlling the density of the material.

It is the primary object of the present invention to provide arrangements for the automatic control of industrial processes which utilize materials which are capable of having their densities controlled.

A further object is to provide arrangements for compressing a stream of moving material thereby adjusting the density of material supplied to a process for the purpose of controlling the finished product produced.

A still further object of the invention is to provide a combination of density and cross-sectional area control for the material in a process in order to control the final weight of the product produced.

These and other objects of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a schematic elevational view of a continuous process with mechanical means for altering the density of the material supplied to the process;

FIG. 2 is a plan view of the apparatus of FIG. 1 with the actuator and controller omitted for clarity;

FIG. 3 is an elevational view of a process showing the density control of a material by means of air pressure;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken along the line 5—5 of FIG. 3;

FIG. 6 is a schematic elevational view of a portion of a cigarette making machine adapted to be controlled in accordance with the invention; and

FIG. 7 is a sectional view taken along the line 7—7 of FIG. 6.

Referring now to FIG. 1, the supply of material 11 to an industrial process is obtained by means of a conveyor belt 12 which transports the material 11 through a channel 13. This channel confines the horizontal transverse dimension of the material flow 11. At the delivery end of the channel 13 a pair of horizontal rotary knife blades 14, 15 are provided to trim the material flow 11 into two portions. A constant cross-sectional dimension portion 16 is defined by the horizontal transverse interior dimensions of the channel 13 and the distance between the bottom of the channel 13 and the horizontal cutting plane of the cutting knives 14, 15. The remainder of the material 11 constitutes a discard portion 17 which may be recycled in the process, if desired. The constant crosssection portion 16 is delivered to an input chute 18 of a process apparatus 19 in which the material is formed into a finished product 21. The product 21 may be any of the various manufactured materials which are formed from raw materials capable of being compressed or expanded to alter the density thereof. The present invention is especially suited to a cigarette making process.

The density of the material 11 is altered by controlling the position of a roller 22 to adjustably compress the material 11 in the channel 13 just ahead of the trimming station formed by knives 14, 15. The basic feed rate for the material 11 is sufficient to maintain the quantity in channel 13 in excess of that needed for the process. In this way the vertical height of the material flow is higher than the cutting level of the knives 14, 15 and the vertical position of the roller 22 will determine the density of the material flow as it reaches the trimming station.

In order to adjustably position the roller 22, a suitable support, such as yoke 23, is provided to rotatably support the roller 22 and connect the same by means of bell crank 24 to an actuating arm 25. The bell crank 24 is pivoted on a horizontal pin 26 so that the horizontal position of the actuator arm 25 determines the vertical position of the roller 22. Various other mechanical arrangements for movably supporting a roller over a compressible stream of material are possible such as, for example, those shown in U.S. Pat. Nos. 548,686 and 554,635.

The position of the actuator arm 25 may be controlled by any suitable control system, the one shown in FIG. 1 being operated by a well-known beta ray gauging and control system. In such systems as disclosed and claimed in U.S. Pat. No. 2,955,206 to Spergel et al., the mass per unit length of the material 21 is determined by directing beta rays from a source 27 through the material 21. The unabsorbed radiation detected by a suitable radiation detector 28 is applied to a controller 29 for developing a product variable signal. This variable signal is then compared with a standard

value to produce a control signal in accordance with the mass per unit length of the material **21.** Thus the controller **29** provides an operating signal for an actuator **31** of any suitable type capable of moving the arm **25** in accordance with the signal detected by the detector **28.**

In operation of the system of FIG. **1** the signal detected by the detector **28** produces a control signal in controller **29** to energize the actuator **31** and adjust the position of the arm **25** in accordance with the deviation of the weight of the product **21** from the specification weight. This adjustment of the arm **25** has a sense such that if the weight of product **21** is less than the specification value, the arm **25** will move in the direction to depress the roller **22,** thereby compressing the material **11** into a more dense condition. In that instance the material in portion **16** will have a constant cross-sectional size of greater density and hence greater weight to supply to the process **19.** The adjustment to arm **25** is made in an amount sufficient to make up the deficiency in weight of the product **21.** If the product **21** is heavier than the specification value, the opposite control signal will raise the roller **22,** thereby permitting the material **11** to be less dense. In this instance the mass of the portion of the material **16** entering the process will thus have a lower weight per unit length of the flow.

Referring now to FIG. **3,** a modification of the invention is shown in which the density of the material supplied to the process is controlled by air pressure. The material **11** is delivered on belt **12** to a housing **32** wherein there is located a forming station **33.** The station **33** consists of suitably shaped die members which progressively form the belt **12** into a substantially cylindrical shape, with the material **11** contained therein, as indicated by the cross-sectional view shown in FIG. **4.** After the belt **12** is formed into a cylindrical shape, the die extension **34** passes through an airtight partition **35** separating the housing **32** from a pressurized housing **36.** Within the housing **36** the belt guide goes through a gradual transition by the forming member. This forming transition occurs at **37** until at section **5—5,** the belt **12** is laid open and the contents **11** are exposed above the surface of the belt, as shown in FIG. **5.** To the right of section **5—5** in FIG. **3,** the belt **12** passes over a chamber **38** having an open top in airtight contact with the undersurface of the belt **12.** In this modification, the belt **12** will be constructed of air-pervious material such that air can flow through the material **11** through the belt **12** and into the chamber **38.** Port **39** provides an exhaust for chamber **38** to the atmosphere. Located approximately midway of the longitudinal dimension of the chamber **38** are cutting knives **14, 15** separating the moving strand of material **11** into a constant cross-sectional portion **16** and a discard portion **17.** The cutting plane of the knives **14, 15** is indicated by the line **40** in FIG. **5.**

The housing **36** is substantially airtight except for the leakage path through the material **11** within the forming members **37** and **34,** the exit chute **18,** and the exhaust port **39.** The length of the path transversely through the material within the forming members **37** and **34** and the exit chute **18** is sufficient to maintain considerable air pressure within the housing **36.** High pressure air is supplied to a valve **41** which is controllable to vary the pressure within the housing **36** by controlling the amount of air supplied through conduit **42** leading from the valve **41** into the housing **36.** The pressure within the housing **36** is effective to compress the material **11** as soon as the material is positioned above the chamber **38.** The amount of compression, and hence the density, of the material **11** when it reaches the knife station for trimming by the knives **14, 15** will be determined by the setting of the valve **41.** In accordance with the invention, the valve **41** is controlled by a suitable detector of the weight of the finished product via a control loop similar to that shown in FIG. **1,** with the controller **29** and the actuator **31** operating to adjust the setting of the valve **41.**

Referring now to FIG. **6,** the modification of a known cigarette-making machine to incorporate the invention will be described. The general arrangement of said machine provides a tobacco feed belt **43** with the stream of tobacco **44** under a pickup wheel **45.** The bottom of the peripheral groove **46** is perforated and communicates with the interior of the wheel **45.** A slight vacuum is drawn by connecting a suitable pump to a pipe **47** communicating with the interior of the wheel **45.** The vacuum is effective to pick up the tobacco **44** in the groove **46** and carry it upward on the wheel **45** to a position adjacent a cutting wheel **48.** The tobacco stream is divided by the cutting wheel into a uniform cross-section portion **49** and a return excess portion **51.** The uniform cross-section stream **49** is fed to a rod former **52** encasing the tobacco in cigarette paper **50** to form a cigarette rod **53.** The position of the knife **48** is manually adjustable to control the cross-sectional size of the stream **49.**

In accordance with the present invention, the abovedescribed cigarette making machine is modified as shown in FIGS. **6** and **7.** This adjustment of both the density of the tobacco in the stream **49** and the cross-sectional size of the stream **49** is accomplished without modifying the position of the knife **48.** Thus, in the present invention the knife **48** occupies a fixed position spaced from the periphery of the wheel **45.** As shown in FIG. **7,** the wheel **45** and the return wheel **60** rotate about a stationary hub **54.** This hub **54** supports the rotating parts and provides a communicating passageway from the pipe **47** to the interior of the wheel **45.** The communicating passageways between the interior of the wheel **45** and the bottom of the peripheral groove **46** are indicated at **55.** The hub **54** has a sector-shaped extension **56** to render the vacuum within the wheel **45** ineffective over that portion of the peripheral groove **46** adjacent the arcuate boundary of the sector **56.** Thus the tobacco **44** is not influenced by the vacuum when it arrives at the cutting station of knife **48.**

The density of the tobacco **44** at the knife **48** and the cross-sectional size of the stream **49** are determined by the horizontal position of a wheel **57.** There is provided on wheel **57** a continuous flange rim **58** with the end face thereof forming one side wall of the peripheral groove **46.** The flange wheel **57** is mounted for rotation with the wheel **45** by a plurality of pins **59** projecting from the surface of the wheel **45.** These pins **59** make a sliding fit with holes **61** in the wheel **57.** The wheel **57** is connected by a shaft **62** to an actuator capable of moving the assembly toward or away from the wheel **45,** as indicated by the double-headed arrow in FIG. **7.**

The control system shown in FIG. **6** is substantially identical with that described for FIG. **1** with the actuator **31** operating to control the horizontal position of

the shaft **62.** The quantity of tobacco in the groove **46** is thereby viewed to provide control of the weight of the tobacco in the stream **49.** The tobacco stream is then utilized to form the cigarette rod **53.** Variations in the position of the shaft **62** cause greater or lesser amounts of tobacco to be trimmed off and recirculated in the stream **51.** As hereuntofore described the system provides an effective control means for selecting that portion of the tobacco stream **44** which is utilized in making the cigarette rod **53.**

Many modifications of the invention will now be apparent to those skilled in the art, and such modifications together with the various equivalents of the disclosed embodiments are to be considered within the scope of the invention as defined in the appended claims. This application is directed to improvements on the invention disclosed in the co-pending application of Victor S. Levadi, Ser. No. 85,228 now abandoned.

What is claimed is:

1. In an industrial processing system using compressible material to form a product and including a conveyor for said material, and means for feeding an amount of said material to said conveyor in excess of that required to form the product, the material on said conveyor having a free surface, a control system for controlling the quantity of said material used in forming said product, said control system comprising separating means for separating said material into a first portion of predetermined cross section and a second portion containing the excess, adjustable means comprising an air jet of adjustable magnitude for pressing the free surface of said material with a pressure exceeding atmospheric pressure toward said conveyor ahead of said separating means thereby controlling the density of said material as conveyed to said separating means, means for feeding said separated first portion to form said product, detecting means for detecting the quantity of said material in said product, and means responsive to said detecting means for controlling said adjustable means in accordance with the quantity of said material detected to maintain said quantity constant.

2. In an industrial processing system using compressible material to form a product and including a conveyor for said material, a station for the material on said conveyor, and means for feeding an amount of said material to said conveyor in excess of that required for said product, a control system for controlling the rate at which said material is used in forming said product, said control system comprising adjustable air pressure means for varying the density of the material conveyed to said station, said adjustable air pressure means having a substantially air-tight housing adapted to contain said station and have said material enter said housing on said conveyor and exit to said process, a chamber within said housing and separated from said material by an air permeable wall, means for applying adjustable air pressure in said housing, and means for venting said chamber to a pressure lower than that in said housing; means at said station for separating said material into a first portion of predetermined cross-section and a second excess portion; means for feeding said separated first portion to form said product; means for detecting the quantity of said material in said first portion; and means for controlling said adjustable air pressure means in accordance with the quantity of said material detected to maintain said quantity constant.

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