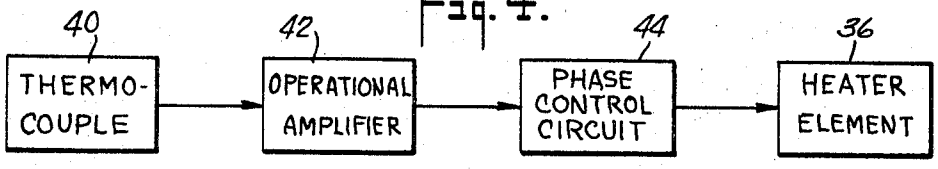
April 20, 1971 C. S. McARTHUR ET AL 3,575,766

BAND SEALER FOR CIGARETTE OR FILTER MAKER

Filed Oct. 29, 1968

Fig. 4.



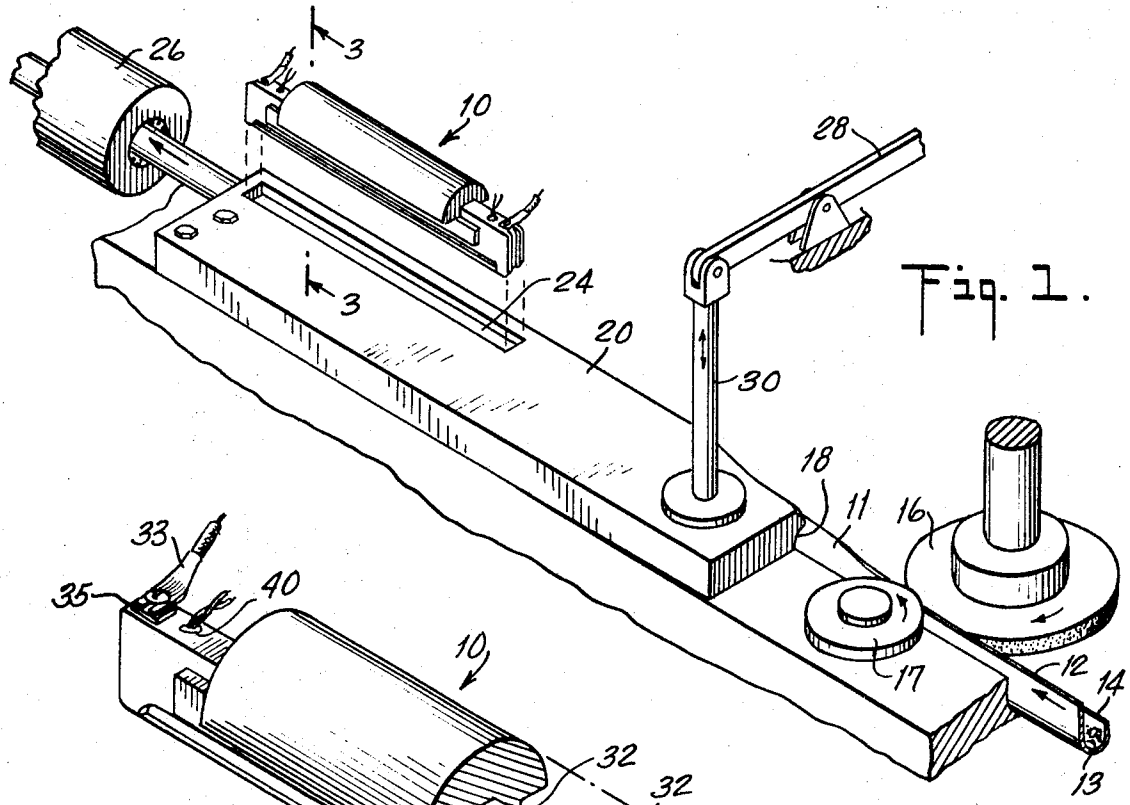


Fig. 1.

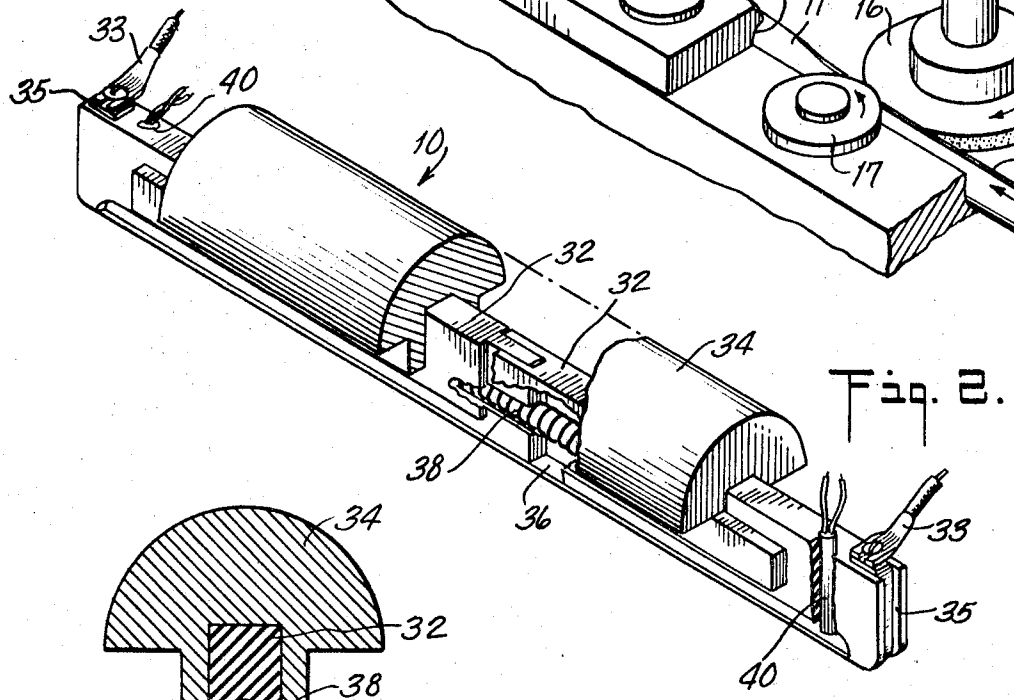


Fig. 2.

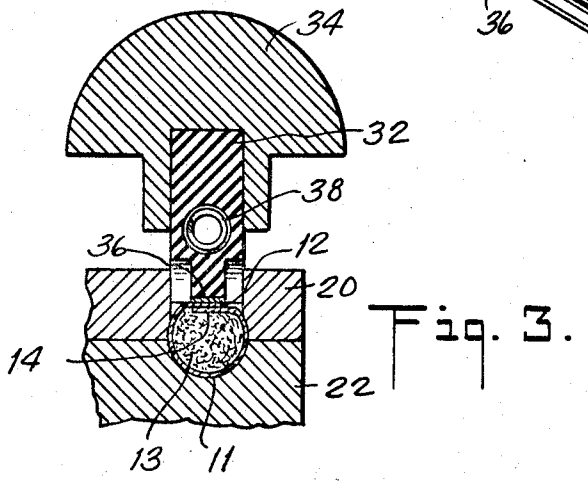


Fig. 3.

INVENTOR.
COLIN S. McARTHUR
BY MAX N. BAKER
Lester W. Clark
ATTORNEY

United States Patent Office 3,575,766 Patented Apr. 20, 1971

3,575,766

BAND SEALER FOR CIGARETTE OR FILTER MAKER

Colin Shaw McArthur, Winston-Salem, and Max Norris Baker, Rural Hall, N.C., assignors to R. J. Reynolds Tobacco Company, Winston-Salem, N.C.

Filed Oct. 29, 1968, Ser. No. 771,399
Int. Cl. B32b 31/20
U.S. Cl. 156—359 4 Claims

ABSTRACT OF THE DISCLOSURE

A band sealer for sealing the margins of cigarette wrapper paper or cigarette filters using a thin strip heater element. The sealer comprises a plurality of non-conducting coaxially-interconnected sealer blades with a weighted housing for holding the blades against the wrappers to be sealed, a small and narrow metal heating element connected to and extending across the base of the blades engaging the wrappers and responsive to rapid changes in temperature, a spring urging the blades apart for holding the heating element taut so that it will apply even heat to the wrappers, and a control circuit including thermocouple sensors and an operational amplifier which increases the strength of the signals sent by the thermocouple sensors for maintaining the heating element at a predetermined temperature.

BACKGROUND OF THE INVENTION

The present invention relates to the cigarette making art and more particularly to an improved band sealer for sealing the margins of cigarette wrapper or cigarette filters.

One of the most critical components in an apparatus for manufacturing cigarettes is the band sealer, which heat seals the margins of the cigarette paper together to form a neat and trim rod after the paper has been filled with tobacco and paste has been applied to one margin of the paper. Such devices have been in use, of course, for many years and have more recently been employed in preparing filters for use with cigarettes.

The existing band sealers have generally utilized quite massive heating sections and sealer blades to apply heat to the previously pasted and folded margins of the cigarette paper. The use of large sealer blades as the heating element results in rather slow response to changes in temperature when the controls are applied, such as upon commencing or terminating the manufacturing operation. Moreover, because of the large mass of the heating element, several times the input power that is actually needed for sealing is required. This latter characteristic produces the consequence of considerable overshoot in temperature when the machine is being controlled or when it is temporarily inactive. Thus, a large quantity of cigarettes or filters may be wasted when the heating element overheats, burning the wrapper paper, or conversely fails to provide enough heat to properly seal the paper. A further disadvantage of the present method of sealing cigarette paper wrappers is that in time the tolerance between the heat source and sink gradually increases causing poor heat transfer to the heating element and a short heating element life.

The present invention is directed toward improvements in controlling the heat transfer to the heater element and the cigarette wrapper in a band sealer.

SUMMARY OF THE INVENTION

The improved heat transfer control of the present invention is accomplished by employing a plurality of smaller interconnected sealer blades and using a small and narrow thin strip heating element attached to the

sealer blades and held taut against their lower surfaces by a spring within the sealer blades urging them apart. The power supply utilizes thermocouple sensors in combination with an operational amplifier to provide more rapid response in the heating element to changes in temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the band sealer of the present invention showing its relation to the surrounding apparatus in a cigarette-making machine;

FIG. 2 is an enlarged perspective view of the band sealer of the present invention with parts broken away to show inner structural details;

FIG. 3 is a sectional view taken on line 3—3 in FIG. 1 but showing the band sealer in its operational position in the surrounding apparatus; and

FIG. 4 is a block diagram of the heater element controls of the present invention.

DETAILED DESCRIPTION

The band sealer of the instant invention is shown in FIG. 1, designated generally by the numeral **10**. The heated sealer **10** is operationally positioned in a recess **24** in a folder block **20** to engage the surface of a cigarette wrapper **11** after folding by the block **20**. In accordance with manufacturing practices known in the art, the cigarette paper wrapper **11** is filled with tobacco **13** with one margin **12** of the wrapper held higher than the other margin **14**. The filled paper **11** is passed rapidly between an idler **17** and a paster wheel **16** which applies a sealing paste to the inner edge of the higher margin **12**. The paper **11** is then formed into a long, narrow cylinder as it moves through a shaped channel **18** on the folder block **20**, which is attached to the bed of the machine **22**. The band sealer **10**, contained in the recess **24** in the folder block **20** at the end of the shaped channel **18**, applies heat to the pasted margin so that the filled cigarette wrapper **11** will be nearly instantaneously heat-sealed as it passes out of the shaped channel **18**. A sensing head **26** at the downstream end of the folder block **20** determines whether the completed cigarette rods are of the proper diameter and causes any necessary adjustments to be made such as through fluid amplifier controls (not shown), which work a lever **28** and a control rod **30** to raise or lower the folder block **20** repositioning the shaped channel **18**.

The particular construction of the band sealer **10**, is most clearly illustrated in FIG. 2. Instead of using one sealer blade to transfer heat to the cigarette wrapper seam as in the prior art, two or more smaller blades **32** with cooperating mortised ends shaped to fit coaxially, are employed. These blades **32** are fashioned of a heat-resistant, nonconducting material and are much smaller in size than the massive blades used in existing devices of the kind already mentioned. To compensate for their lack of weight, the blades **32** support a saddle weight **34** which may be constructed of any suitable material that will provide the necessary weight to hold the blades **32** against the passing cigarette wrapper **11**.

The actual heating element is a thin, narrow metal strip **36** which conducts the heating current. The metal strip **36** is fastened at its opposite ends to suitable leads **33** of an electrical power supply (not shown) and to the upper surfaces of the blades **32** at their outer ends. The intermediate portion of the strip **36** extends through grooves **35** in the blade ends and along the lower edges of the blades **32** engaging the outer surface of the pasted margin **12** of the passing wrapper **11**. The metal strip **36** serves to provide localized and concentrated heat for sealing the pasted wrappers **11**. This strip may be of a durable metal, such as Nichrome or stainless steel, and should be of small dimen-

sions and mass, e.g., about ⅛" wide by .030" thick. Of course, the dimensions and materials may be varied to suit the particular usage, but, it has been found that the smaller the mass of the heating element, the more sensitive it is to the controls and the less likely it is to burn the passing wrapper. On the other hand, too small a heating element may fail to seal the wrapper, as it moves through the sealer at a speed of several thousand feet per minute. The exact size of the strip used will depend on the dimensions of the blades and the processing speed of the entire operation.

As tautness of the heating element **36** is important to maintain uniform heat along the wrapper, a compression spring **38**, acting in mating central recesses in the blades **32**, is provided to urge the blades apart and keep the metal strip **36** in tension. The metal strip **36** is thereby prevented from scorching portions of the wrapper while failing to seal other portions.

Heat sensing elements, such as thermocouple sensors **40**, are positioned in recesses in the blades **32**, near both ends of the strip **36**, and are in contact with the upper surface of the metal strip **36**. These thermocouple sensors **40** are used to sense the temperature of the strip **36** and provide an indicative signal to a control circuit which determines the correct power input to maintain the pre-set temperature. As the strip **36** and the thermocouple sensors **40** are both small in mass, the changes in heat transfer required may take place rapidly, thus providing good control over the amount of heat eventually transferred to the cigarette wrappers **11**. The more rapid the operation of the controls, the fewer the cigarettes that will be wasted due to poor sealing. Thermocouple sensors are preferable to other heat sensing elements, such as thermistors, for the purpose of the present invention as they are more stable and rugged than thermistors.

The control circuit for operating and regulating the heating current to the strip **36** is shown generally in FIG. 4. Temperature indication signals from the thermocouple sensor **40** are sent to an operational amplifier **42**, which amplifies the output level of the signals to an acceptable operating value. The amplifier **42** may be an integrated circuit, which increases the strength of the small D.C. potential of the thermocouple signal. The amplifier **42** operates a phase control circuit **44** which turns on A.C. power to the heater element **36**. The phase control circuit **44** operates in such manner that power is supplied to the heater element **36** increasingly later in the half-cycle of the pulse wave as the temperature increases, thus resulting in less heat being transferred to the heater element **36**. The phase control circuit **44** conversely turns on the heating element **36** earlier in each half-cycle when the temperature decreases.

It will be seen that an improved band sealer is provided of simple, lightweight construction and which requires less operating power and has improved heat transfer capabilities over the apparatus of the prior art.

What is claimed is:

1. A band sealer comprising:

(a) means for transferring heat to the material to be sealed;

(b) means for holding said heat transfer means against the material to be sealed; and

(c) control means for maintaining the heat transferred to the material to be sealed at a predetermined level;

the improvement wherein said heat transfer means comprises:

(d) a thin strip of electrically conductive material attached to said holding means;

and said holding means comprises:

(e) a plurality of aligned non-conducting blades expansibly connected to each other with the end of the strip attached to different blades; and

(f) compression spring means urging said blades apart to maintain said strip in tension.

2. A band sealer as claimed in claim **1** wherein said holding means comprises a weighting means mounted on said blades.

3. A band sealer as claimed in claim **1** wherein said control means comprises:

(g) means for sensing the temperature of said strip and producing an indicative signal;

(h) an integrated circuit connected to said sensing means for amplifying said signal; and

(i) a phase control circuit connected between said integrated circuit and said strip for turning on A.C. power to said strip at different points in the half cycle of the pulse wave to accordingly vary a heating current to said strip inversely with respect to the magnitude of said signal.

4. A band sealer as claimed in claim **3** wherein said temperature sensing means comprises a thermocouple in contact with said strip.

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BENJAMIN A. BORCHELT, Primary Examiner

D. A. BENT, Assistant Examiner

U.S. Cl. X.R.

219—252; 156—583, 502, 378, 380