United States Patent

[11] 3,590,548

[72] Inventors **Edwin F. Pierce**
Cherry Hill, N.J.;
Robert J. Russell, Philadelphia, Pa.

[21] Appl. No. **817,619**
[22] Filed **Apr. 16, 1969**
[45] Patented **July 6, 1971**

[73] Assignee **Kenco Corporation**
Cherry Hill, N.J.

[54] ENVELOPE OPENING MECHANISM

6 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **53/3,** 34/105, 53/381, 83/912, 214/1, 225/2, 225/96, 225/100, 225/106

[51] **Int. Cl.** **B26f 3/02,** B65h 35/10

[50] **Field of Search** 53/381, 3; 83/912, 170; 225/2, 93.5, 96, 100, 106

[56] **References Cited**

UNITED STATES PATENTS

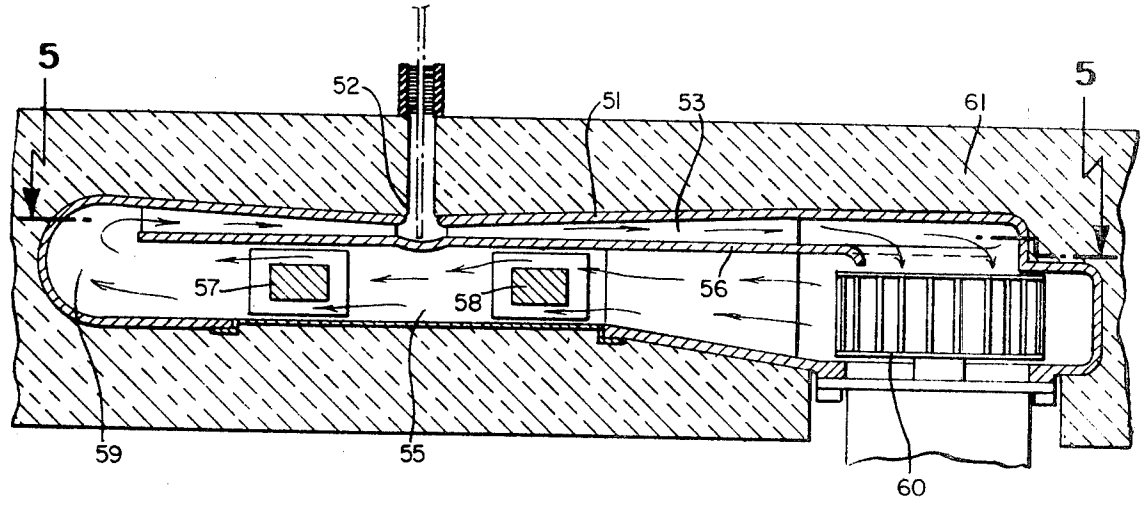
2,365,998	12/1944	Bentley	83/170 X
3,116,718	1/1964	Krupotich	83/912 X
3,132,629	5/1964	Krupotich	83/912 X

FOREIGN PATENTS

556,374	10/1943	Great Britain	83/170

Primary Examiner—Theron E. Condon
Assistant Examiner—Neil Abrams
Attorney—Charles F. Duffield

ABSTRACT: Apparatus for opening envelopes by weakening three edges thereof by the passage of heated air or gas sequentially across each of the three edges to carbonize and weaken the edges. A parallelogram vacuum pickup is employed which operates in conjunction with a vacuum distribution valve for controlling the pickup and delivery of the envelope. Opposed belts convey the envelope sequentially through three burner sections interposed between which are flipover mechanism which rotate the envelope 90° to present the next adjacent edge for carbonizing. At the end of the burner sections, a third flipover rotates the envelope into position in a flip-down mechanism which delivers the envelope to a differential roller with its unopened edge in a trailing position. A differential roller conveyor assembly is provided which includes a conveyor belt and a roller with a brake which is selectively actuated in response to the appearance of the envelope in the opening mechanism to exert a shearing force on the envelope and lay back an edge thereof exposing the contents.



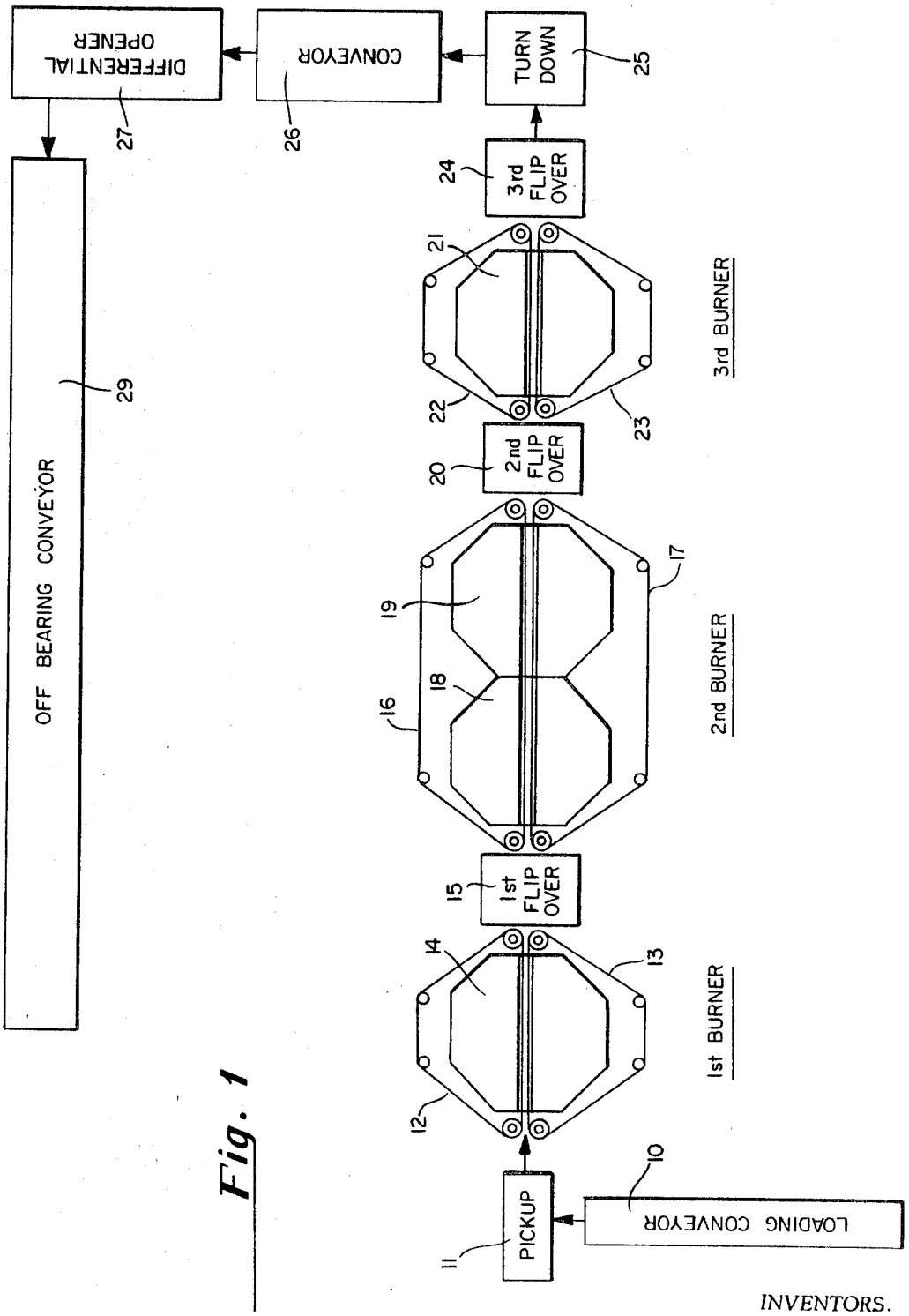


Fig. 1

INVENTORS.
EDWIN F. PIERCE
ROBERT J. RUSSELL
BY
Charles F. Duffield
ATTORNEY.

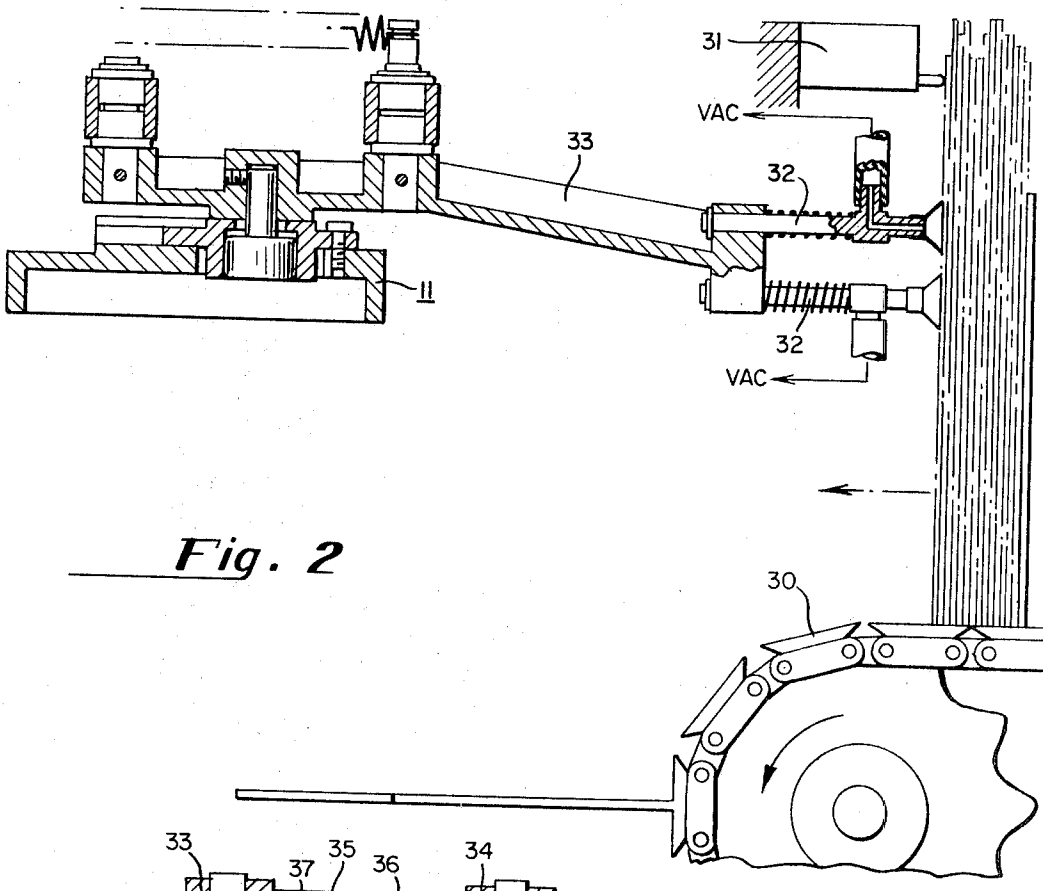


Fig. 2

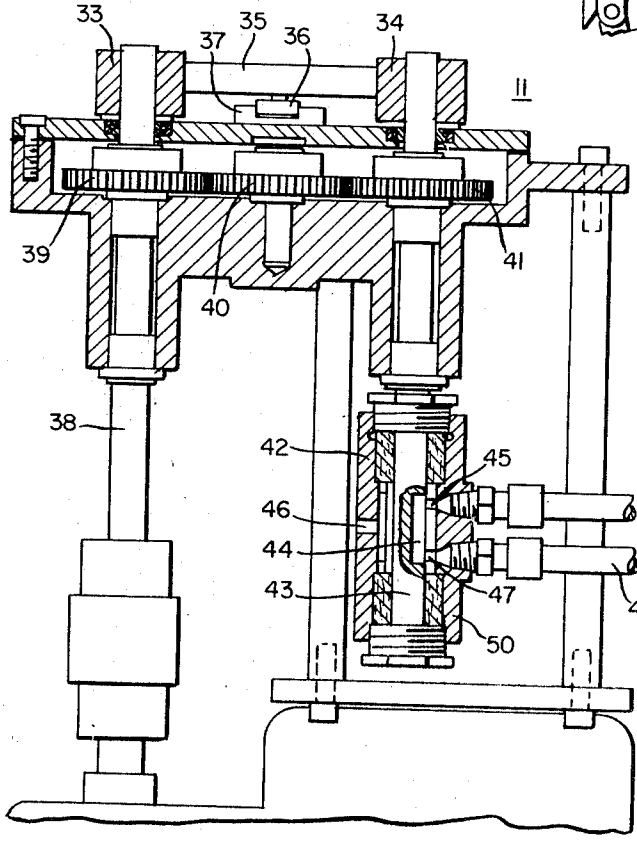


Fig. 3

INVENTORS.
EDWIN F. PIERCE
ROBERT J. RUSSELL
BY
Charles J. Daffield
ATTORNEY.

Fig. 4

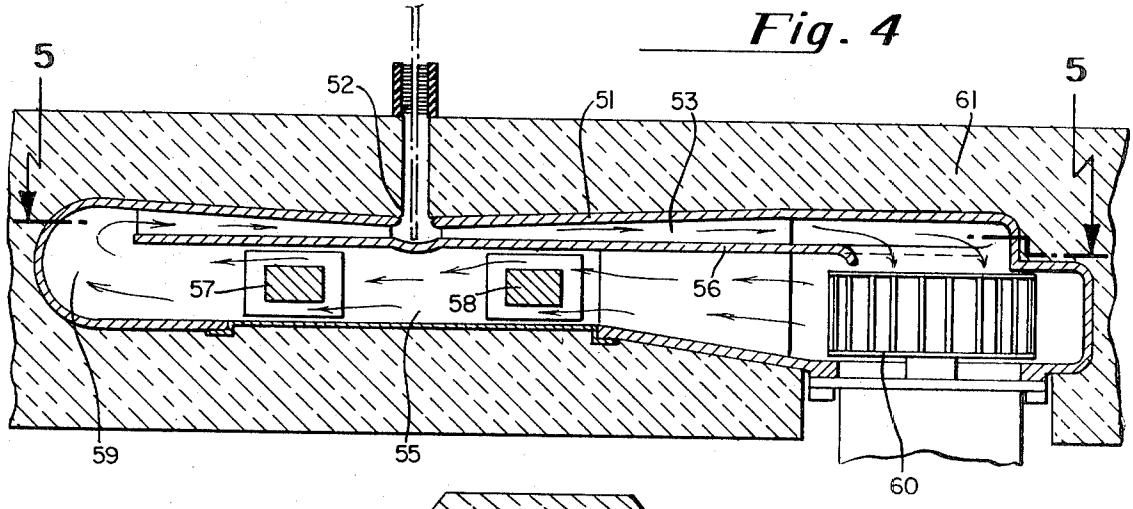
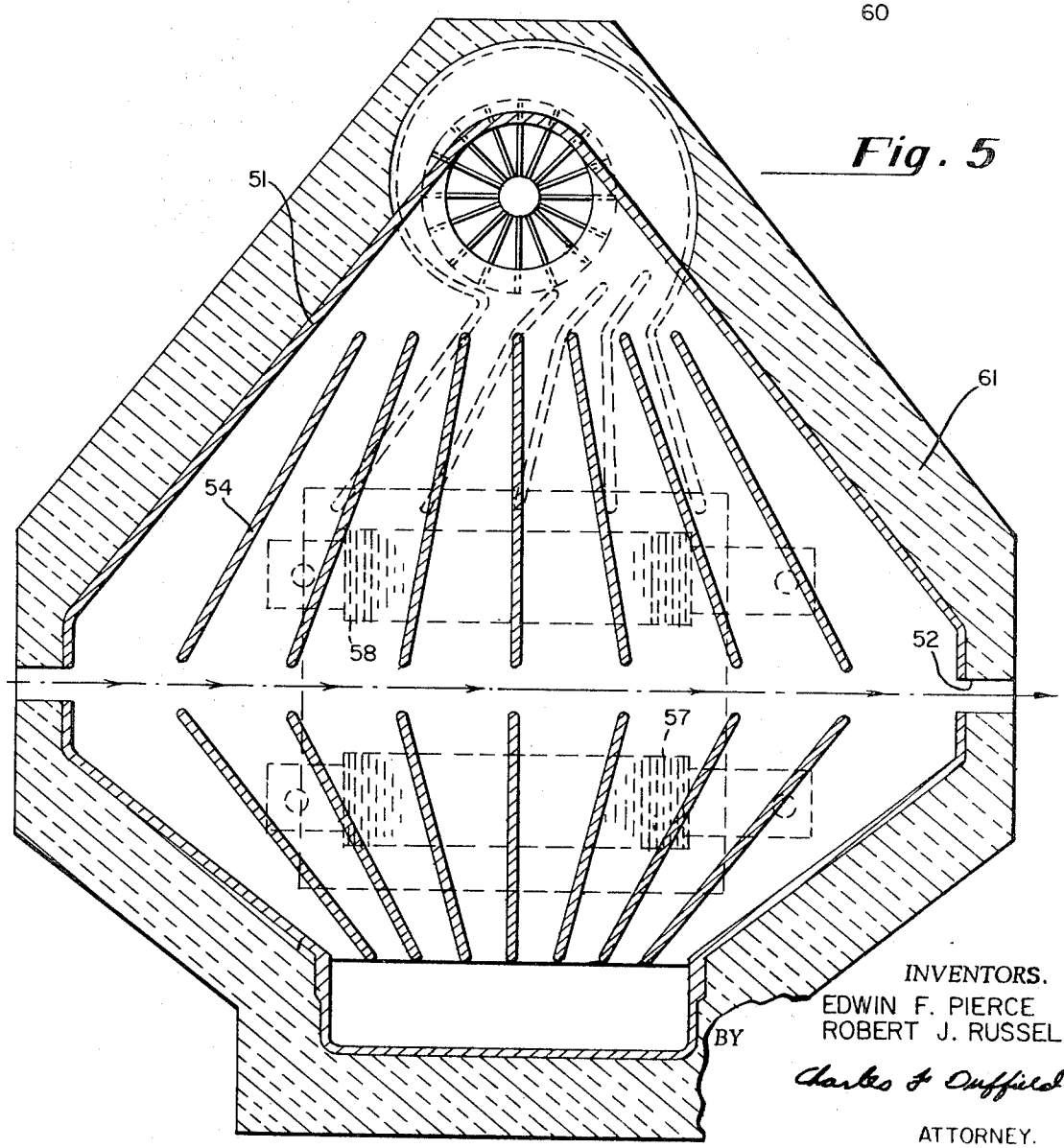


Fig. 5



INVENTORS.
EDWIN F. PIERCE
ROBERT J. RUSSELL
BY
Charles F. Duffield
ATTORNEY.

Fig. 6

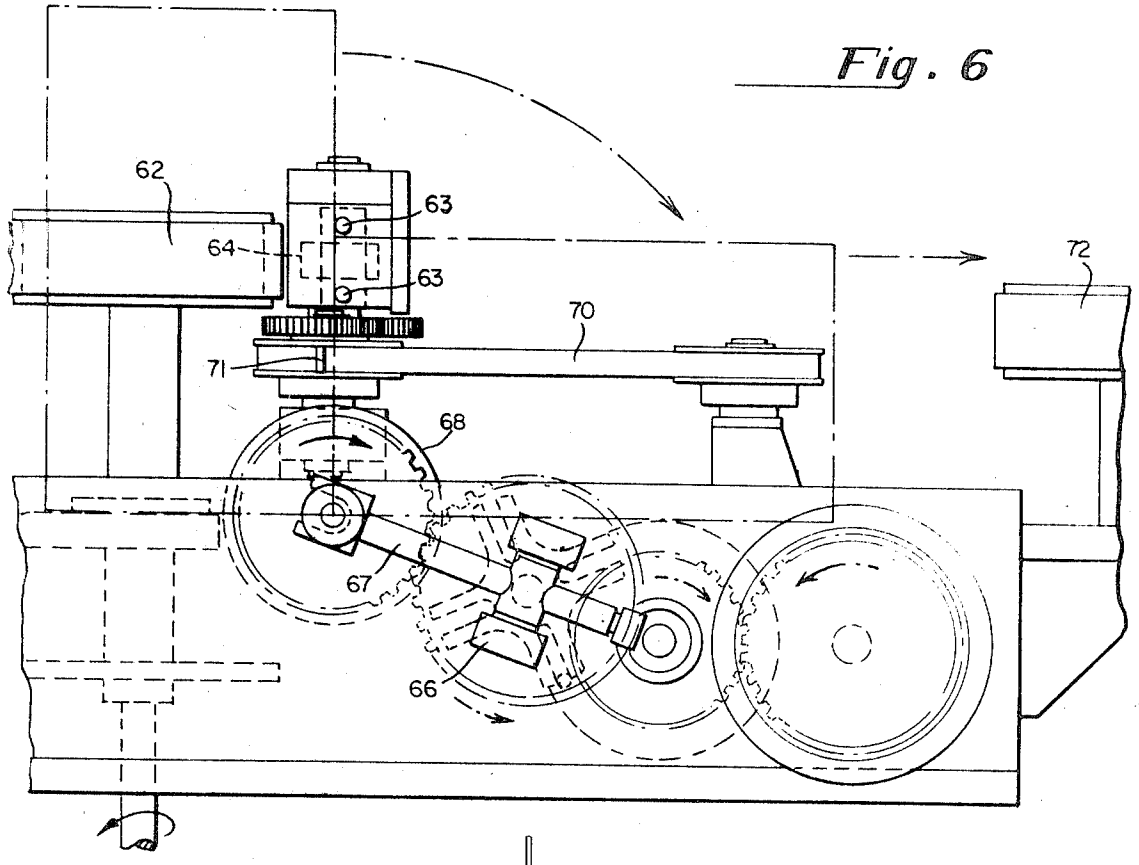
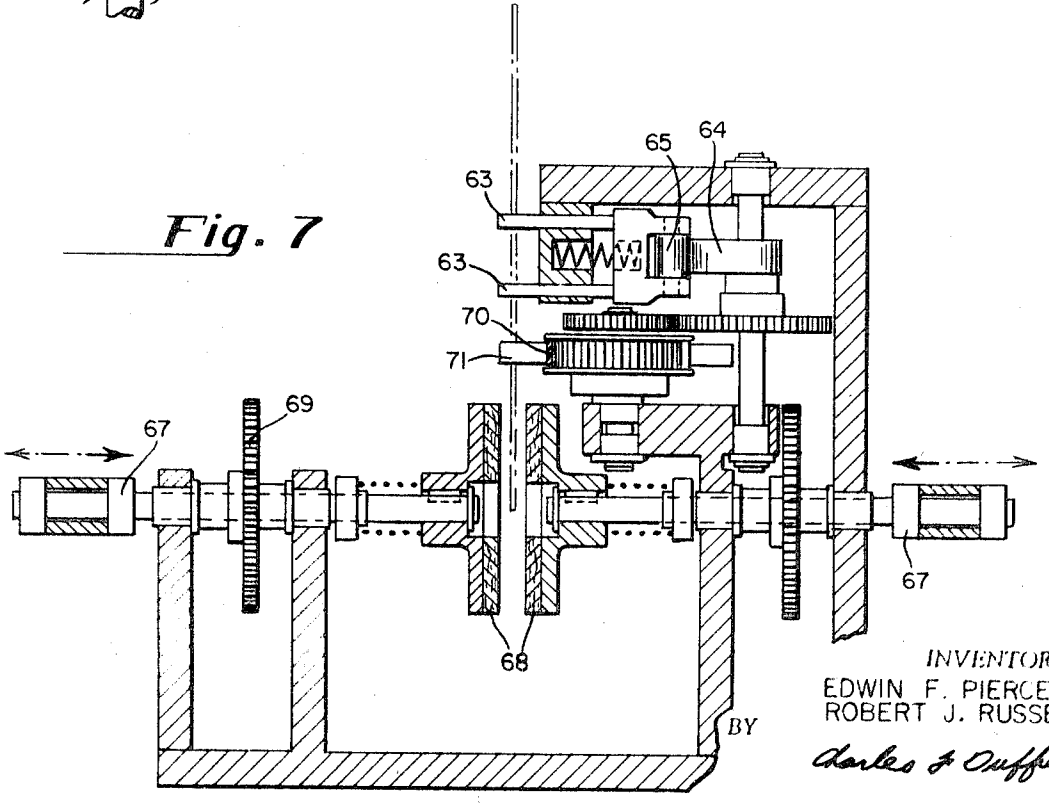


Fig. 7



INVENTORS.
EDWIN F. PIERCE
ROBERT J. RUSSELL
BY
Parker & Duffield
ATTORNEY.

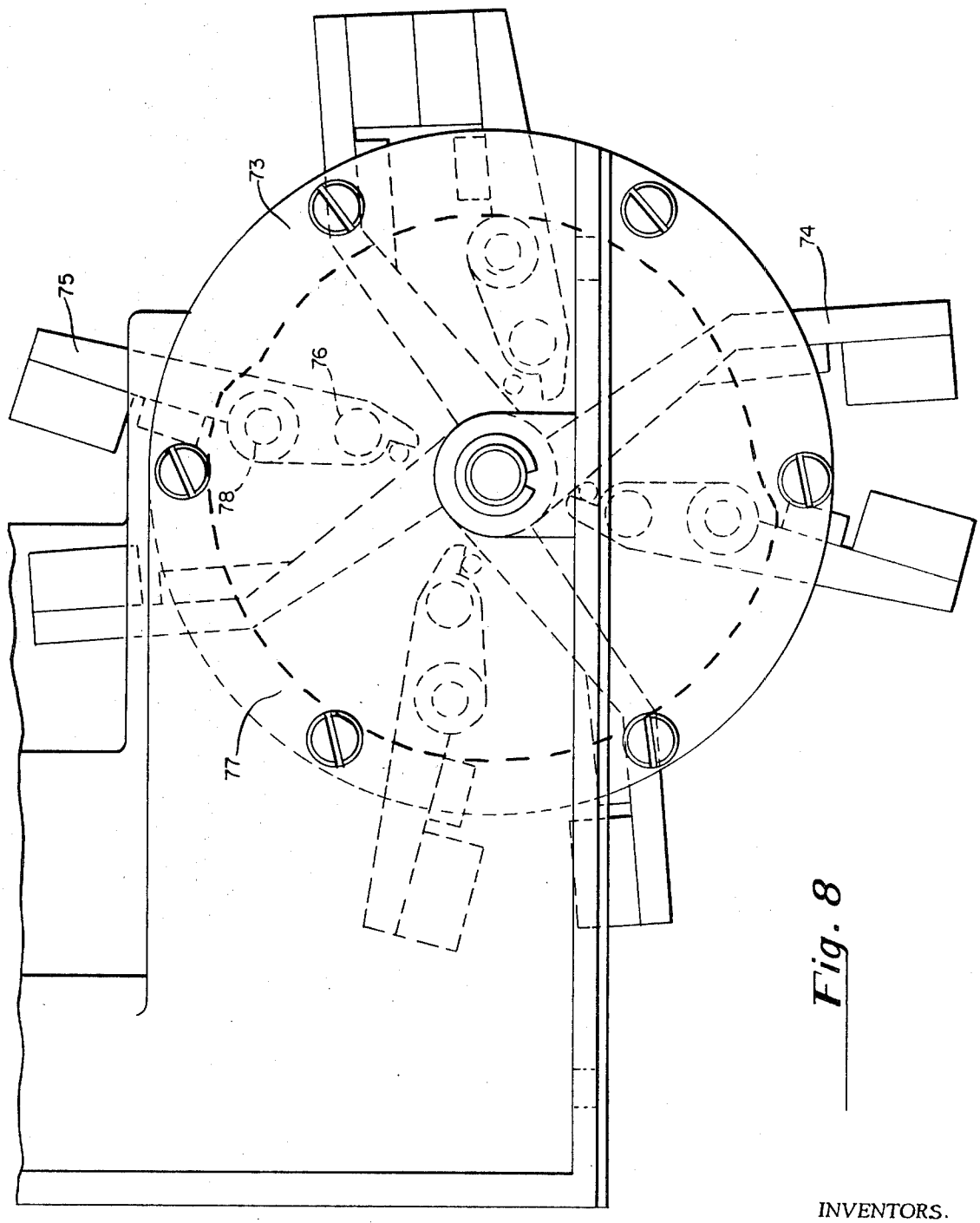


Fig. 8

INVENTORS.
EDWIN F. PIERCE
ROBERT J. RUSSELL

BY

Charles L. Duffield

ATTORNEY.

ENVELOPE OPENING MECHANISM

BACKGROUND OF INVENTION

Many businesses today, for example, the large credit card companies, experience extremely large volumes of mail every week which needs to be opened. The apparently simple task of opening the envelopes becomes a rather major task and extremely expensive when large volumes of mail are involved. In some businesses, literally millions of pieces of mail are received weekly and must be physically opened by personnel.

A number of machines have been proposed to open the mail and operate on a variety of different principles. For example, there are a number of machines which operate on the principle of cutters which slice one or more edges of the envelopes. One of the drawbacks of these machines is that, quite frequently, the contents of the envelopes are sliced as well.

Another type of apparatus is the abrading type which, rather than slicing the envelope, abrades the edge thus weakening it. The problems inherent in this type of device is that the edges of the envelope must be straight or certain sections thereof will not be sufficiently weakened for opening. Also, apparatus of this type are slow in their operation.

In yet another type of apparatus, an electric spark is employed to weaken the edge. This type of apparatus has found some success, however, the greatest problem encountered in this type of opening apparatus is the registry of the edge of the envelope with the spark.

A more recent method of opening envelopes which has been developed is that of applying heat to the edges of the envelope by means of a heated guide rail. The heat will carbonize and weaken the edges of the envelope. This method and apparatus for carrying out the method are disclosed in Krupotich U.S. Pat. No. 3,132,629.

SUMMARY AND OBJECTS OF INVENTION

The apparatus and methods of the present invention are concerned with improvements to the general concept of opening envelopes by the application of heat to the edges thereof and it is the principle object of the present invention to apply the heat to the edges of the envelope by means of passage of heated air against the envelope without requiring their direct contact with heated elements.

It is also an object of the present invention to provide a faster, more efficient, and more positive method or sequence of conveying the envelopes sequentially through the opening means to weaken three edges thereof.

It is yet another object of the present invention to provide an improved differential opening assembly.

The foregoing objects are carried out by the present invention by utilizing three sets of burner assemblies through which each of the three edges of the envelopes to be weakened are sequentially conveyed. Opposed conveyor belts carry the envelopes through the burner assemblies. At the end of each of the assemblies, a flipover mechanism rotates the envelope 90° preparatory to passage of the next assembly thus positioning the next adjacent edge of the envelope for passage through the burner assembly. The burner assembly directs heated air perpendicular to the edges of the envelopes.

At the end of the sequence when all three edges have been weakened, a third flipover rotates the envelope into contact with a turndown mechanism which places the envelopes on a conveyor with its unweakened edged in a trailing position.

The envelopes then pass through a differential opener between a conveyor belt and a roller. The roller has a brake assembly associated with the roller which is sequentially applied in response to a photocell mechanism which senses the appearance of an envelope in the assembly. The barking action on the roller serves to provide a shearing force on the weakened edges of the envelope thus rolling back one edge of the envelope to expose the contents.

A pickup assembly is also provided for removing the envelope from a loading conveyor and loading them into the first burner section. The pickup assembly employs a pair of pickup arms which are connected in a parallelogram and moved through a predetermined path by means of a guide track. One of the arms drives a vacuum indexing valve which sequentially applies vacuum and atmosphere to the vacuum cups on the pickup arms.

Other objects and advantages of the present invention will become apparent from the detailed description thereof taken in conjunction with the drawings.

DESCRIPTION OF DRAWINGS

FIG. 1 is diagrammatic view of the envelope opening apparatus and method of the present invention;

FIG. 2 is a side view partially in section of the pickup mechanism of the present invention;

FIG. 3 is an elevational view in section showing the vacuum indexing valve associated with the pickup mechanism;

FIG. 4 is a sectional view of the burner assembly of the present invention;

FIG. 5 is a plan view partially in section of the burner assembly of the present invention;

FIG. 6 is a side view of the flipover mechanism of the present invention;

FIG. 7 is an end view partially in section of the flipover mechanism of the present invention and;

FIG. 8 is a side view of the turnover mechanism of the present invention.

DETAILED DESCRIPTION OF INVENTION

The overall concept of the apparatus and method of the present invention may be seen from the diagrammatic illustration thereof shown in FIG. 1. The envelopes to be opened are loaded on the loading conveyor 10. A pickup mechanism 11 removes the envelopes from the loading conveyor and then passes them between opposed belts 12 and 13. The opposed belts 12 and 13 convey the envelopes through a burner assembly 14. The loading conveyor and pickup mechanism 10 and 11 are so arranged that the envelopes are fed into the opposed belts standing on one of their two shorter edges. As the belts move the envelopes through the burner 14, heated air is passed perpendicular to or transversely across the edge of the envelope and carbonizes and weakens the edge.

The weakened envelope is then moved, by the conveyor belts 12 and 13, into a first flipover mechanism 15. The flipover mechanism 15 is actuated by a photoelectric device upon the presence of the envelope and rotates the envelope through 90°. Upon the envelope being rotated through 90°, the next adjacent elongated edge of the envelope passes into a second pair of opposed conveyor belts 16 and 17.

The conveyor belts 16 and 17 carry the envelope through a double set of burner assemblies 18 and 19. The elongated edge is exposed to heated air in the same manner as the first edge in the burner assembly 14. The heated air, in a like manner, carbonize and weakens the elongated edge.

Two burners 18 and 19 are required for the elongated edge to maintain the same flow rate through these burners without interference with the following envelopes inasmuch as the elongated edges are approximately twice the length of the shorter edges thereof. The speed of the belts 16 and 17 are adjusted accordingly.

Upon the envelope completing its passage of the double burner assembly 18 and 19, it is then passed into a second flipover mechanism 20 which is identical to the first flipover mechanism 15. In the second flipover 20, the envelopes are again rotated and passed into a third burner assembly 21. At the completion of the second flipover, the next adjacent shorter edge of the envelope is presented to the third burner assembly. The envelope is carried through the third burner assembly by a third set of opposed belts 22 and 23 and delivered to a third flipover mechanism 24.

The third flipover mechanism 24 operates in an identical manner to that of the first and second flipover mechanisms 15

and 21 respectively. Upon the envelope passing the third flipover mechanism, its unburned edge is then turned down and the envelope fed into a turndown mechanism 25. The turndown mechanism grasps the envelope and lowers it onto a conveyor 26. The envelope, at this time, is in such a disposition that it unburned edge is trailing on the conveyor 26.

The envelopes, so arranged, are then passed into a differential opener 27. The differential opener 27 includes a belt upon which the envelopes are carried through the opener and, also, a roller running in engagement with the conveyor belts. A brake assembly on the conveyor belts works in conjunction with a photoelectric cell to sense the presence of the envelope. At a predetermined time in the sequence, the photoelectric cell applies the brake for a predetermined time and generates a shearing force on the three weakened edges of the envelope. The shearing forces result in the weakened edge being broken away and one side of the envelope scrubbed back or opened revealing the contents.

The opened envelopes are then passed onto an off bearing conveyor 29. The envelopes are permitted to move down the off bearing conveyor 29 past a number of stations at which operators are positioned to collect and sort the opened mail.

Shown in FIGS. 2 and 3 is the pickup mechanism 11 of the present invention. The envelopes are delivered to the pickup mechanism on a conveyor belt 30. An appropriate microswitch 31 operates in conjunction with the foremost envelope on the conveyor 30 to actuate the conveyor to progressively move the envelopes into the reach of the pickup mechanism as is necessary.

The pickup mechanism includes a pair of suction fingers 32 attached to a pair of parallel pickup arms 33 and 34, as best shown in FIG. 3. A coupling member 35 is interconnected between the outer ends of the two arms and maintains them in a parallelogram arrangement.

The coupling member 35 includes a cam roller 36 in the midportion thereof which operates in conjunction with a cam 37 to control the path of motion of the pickup arms during the sequence of picking up the envelopes and delivering them to the conveyors of the first burner.

The pickup arms are driven through a power shaft 38 and mating gears 39, 40 and 41 through the path of travel as defined by the cam 37.

The vacuum and release sequence as applied to the vacuum pickup fingers 32 is controlled by a vacuum distributor or sequence valve 42. The valve includes an inner shaft 43 which is driven by the gear 41 driving the pickup arm 34. The shaft 43 includes a relief 44 therein which is of sufficient number of degrees across the face of the shaft to sequentially register with a vacuum port 45 and an atmospheric port 46 to apply and release the vacuum to the vacuum fingers 32 by means of a third port 47 communicating with the vacuum fingers 32 through a vacuum line 48. The port 47 is angularly spaced in the housing 50 of the valve from the ports 45 and 46 in an appropriate number of degrees to provide a period of registration with the vacuum source, a period of dwell during which the vacuum is held and a period of release of the vacuum to the atmosphere all in sequence as required. The angular relationship of the various ports may be adjusted as desired to time the vacuum and release sequence as required.

The burner assembly of the present invention is shown in FIGS. 4 and 5. The burner assembly includes a die cast housing 51. Within the housing 51 is disposed an elongated channel 52 through which the envelope transverses during its passage of the burner. A first passage 53 including defuser veins 54 therein is disposed on either side of the channel 52 and directs the air in an even flow across the edge of the envelope to be opened.

A second passage 55 is disposed below the first passage 53 and shares a common wall 56 with the first passage 53.

Two heated elements 57 and 58 are disposed in the second passage 55 beneath the common wall 56.

The common wall arrangement provides for the maximum utilization of the output of the heaters and insures the minimum heat loss from the heaters.

The first and second passages 53 and 55 respectively are in communication at one ends by a common U-shaped conduit 59. The opposite ends of each of the passages are in communication with a blower wheel 60 which draws the heated air out of the passage 53 and returns the air into the passage 55 thus recirculating the heated air over the heaters.

The entire assembly is encased in an insulation casing 61. The opposed belts which carry the envelope through the burner assembly are designed to ride on the top of the insulation 61 thus ensuring an airtight seal between the burner assembly and the atmosphere.

The burner assembly has been found to operate efficiently in opening envelopes when the air is heated to within the range of 400° to 850°. One heater 58 may be kept on all the time and the other heater 57, may be cycled as necessary to maintain the required temperature.

The flipover devices employed in the letter opener of the present invention are shown in FIGS. 6 and 7 of the drawings. The envelope is fed into the flipover mechanism by means of the conveyor belt 62. The edge of the envelope will come into contact and be stopped by a pair of stop fingers 63. Upon the envelope reaching the stop 63, a photoelectric light cell associated circuitry will initiate a one sequence movement of the flipover mechanism as controlled by a geneva wheel arrangement.

During the one sequence operation, a cam 64 and cam follower 65 arrangement will retract the fingers 63 permitting further passage of the envelope.

Simultaneously, a cam mechanism 66 operating through levers 67 on either side of the flipover mechanism operate to drive two resilient gripping pads 68 toward one another and in engagement with the envelope.

Immediately upon the gripping pads 68 gripping the envelope, a geneva wheel rotates the gripping pads through a 90° angle by means of gears 69. At this time, the cam mechanism 66 releases the grip on the envelope and a push out conveyor 70 having tabs 71 thereon rotates through a partial revolution and engages the rear of the envelope with the tabs 71 and pushes the envelope into the next set of conveyor belts 72.

The turndown mechanism of the present invention is shown in FIG. 8. This mechanism includes a large support wheel 73. Attached to the support wheel is a plurality of stationary gripping fingers 74. A like plurality of moveable gripping fingers 75 are pivotally connected to the support at their lower end 76 thereof.

A stationary cam wheel 77 (shown in broken lines) is disposed behind and adjacent the support wheel 73. The cam wheel has high and low cam surfaces on the inner circumference of the cam wheel which operate in conjunction with cam followers 78 on the movable fingers 75.

Upon the envelope moving between a pair of opposed fingers 74 and 75, the support wheel 73 will start rotating and the cam followers 78 will contact the raised portions of the cam wheel. This will result in the fingers closing and gripping the envelope upon the initial few degrees of rotation of the support wheel 73. The support wheel will then continue through an angle approximately 180° at which point the cam follower will move into the larger diameter or relieved part of the cam wheel thus opening or releasing the grip on the letter and permitting the letter to drop onto the conveyor carrying the envelopes to the differential opener.

The differential opener of the present invention (diagrammatically shown in FIG. 1) includes a conveyor belt onto which the envelopes are deposited and which carries the envelopes through the entire conveyor and deposits them onto the off bearing conveyor 29. Disposed above the conveyor belt in the differential opener is a large rubber roller which runs in engagement with the conveyor belt.

A photoelectric cell provided at the entrance of the differential opener senses the occurrence of an envelope in the opener. The photocell initiates a timing function which operates a brake on the roller for a predetermined period of time. The roller is completely stopped for a time sufficient to shear or brake loose the upper portion of the envelope and to

scrub back the portion thereof exposing the contents of the envelope. After this has occurred, the brake is released and the envelope continues to pass on the conveyor belt through a pair of ironing rollers to flatten the contents.

After the ironing operation, the envelope and its contents are deposited onto the off bearing conveyor **29**.

The foregoing invention has been described in respect to the particular embodiments thereto shown in the drawings. However, no limitation is thereby intended on the scope of the invention but, instead, the scope thereof is to be interpreted in view of the appended claims.

We claim:

1. The method of opening envelopes comprising the steps of:

convecting a gas over a heat source to heat the air to a temperature sufficient to carbonize paper;

confining the heated gas within a predetermined zone;

conveying the edge portion only of at least one side of the envelope through the zone of heated gas to surround the edge with the heated gas to carbonize and weaken the edge, and

separating the envelope at the weakened edge to expose the contents thereof.

2. The method of weakening the edges of envelopes to aid in opening thereof comprising the steps of:

conveying the edge portion only of at least one side of the envelope through a treating passageway;

passing a gas over a heat source to heat the gas;

delivering the heated gas to the passageway;

focusing the heated gas into a narrow band within the passageway; and

directing the narrow band of hot gas against the edge of the envelope to carbonize and weaken the edge thereof.

3. The method of weakening the edges of envelopes to aid to opening thereof comprising the steps of:

passing a gas over a heat source to heat the gas to a temperature sufficient to carbonize paper; and

delivering the heated gas to a passageway and directing a narrow band of the hot gas against the edge portion of the envelope to carbonize and weaken the same while maintaining the remainder of the envelope below carbonizing temperature.

4. Apparatus for destroying the edges of envelopes comprising:

an air conduit;

a heat source;

means interconnecting the conduit and the heat source;

means for delivering air across the heat source to heat the air sufficiently to carbonize paper and force convect the air through the conduit;

a passageway through said conduit; and

a conveyor disposed adjacent said passageway and adapted to convey at least one edge of the envelope through said passageway with the edge portion only thereof in contact with the heated air within said passageway whereby the edge of the envelope will be carbonized and destroyed preparatory to opening thereof.

5. Apparatus for preparing the edges of an envelope for opening of the envelope comprising:

a conveyor for gripping an envelope and moving the envelope through a predetermined fixed path, said conveyor leaving exposed at least one edge of said envelope for treatment;

a heat source;

a conduit in communication with said heat source;

fan means for force convecting air across said heat source and through said conduit, and

an air focusing nozzle connected to the opposite end of said conduit and disposed adjacent said conveyor and in alignment with the edge of the envelope to direct heated air against the edge thereof in its passage through said fixed path to carbonize and weaken the edge thereof.

6. Apparatus for preparing the edges of an envelope for opening comprising:

a passageway;

a heat source in communication with said passageway for heating the gas within the passageway to carbonizing temperatures, and

conveyor means for gripping the envelopes to be opened with at least one edge thereof exposed for treatment and moving said edge of said envelope through said passageway out of contact with any portion of the passageway and with said edge in contact with said gas while maintaining the remainder of the envelope below carbonizing temperatures whereby the edge of the envelope will be carbonized and destroyed in their passage of said passageway.