Jan. 19, 1965 R. T. VAUGHAN ETAL 3,166,182

HANDLING APPARATUS

Filed Dec. 21, 1962

4 Sheets-Sheet 1

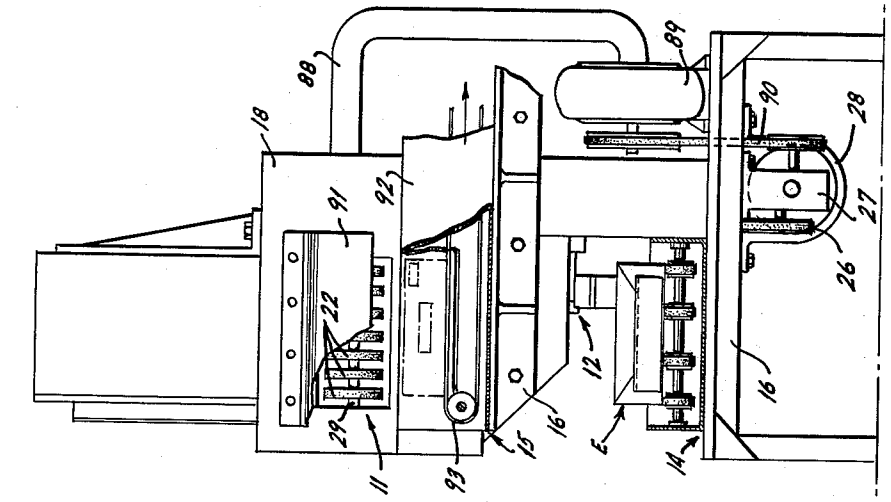

FIG. 2.

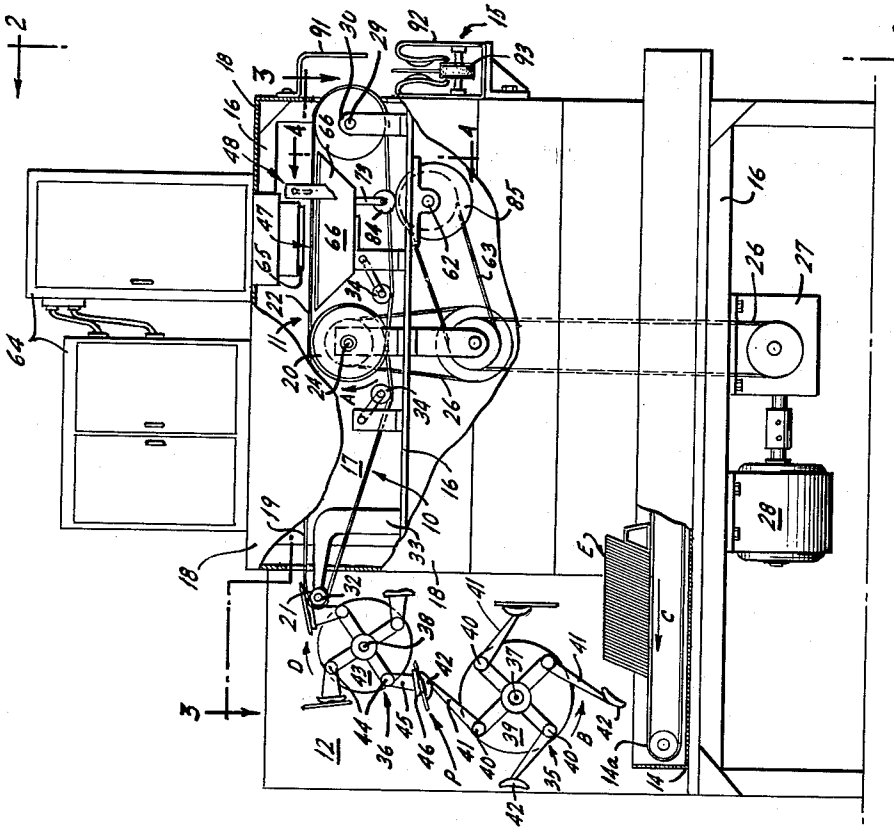

FIG. 1.

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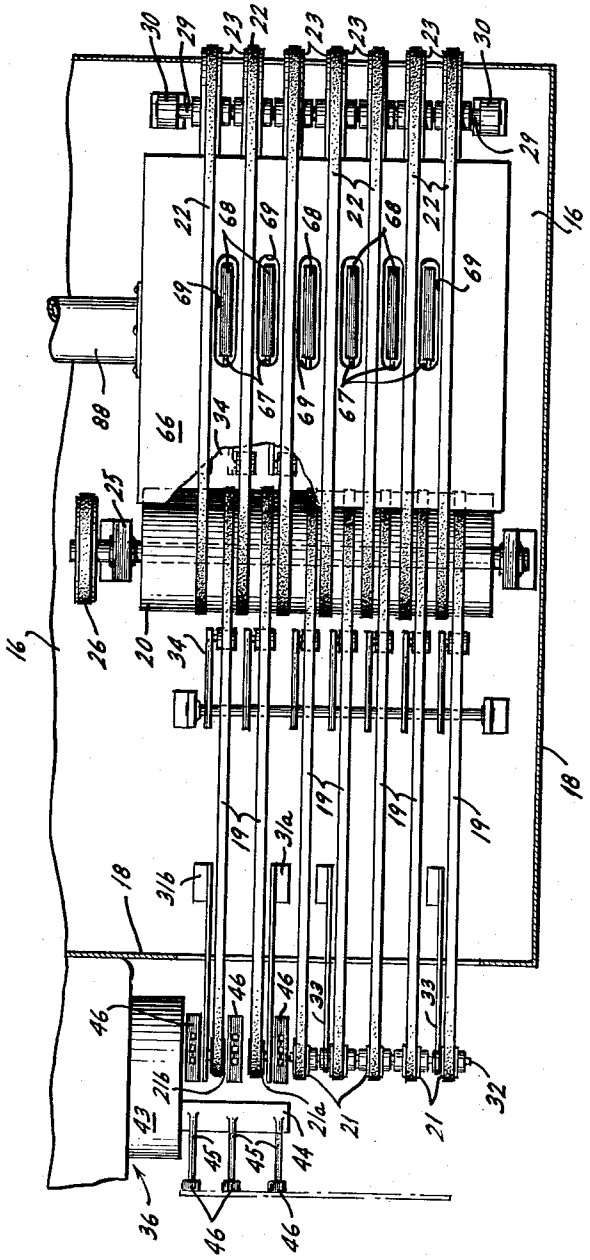
4 Sheets-Sheet 2

FIG. 3.



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HANDLING APPARATUS

Filed Dec. 21, 1962 4 Sheets-Sheet 3

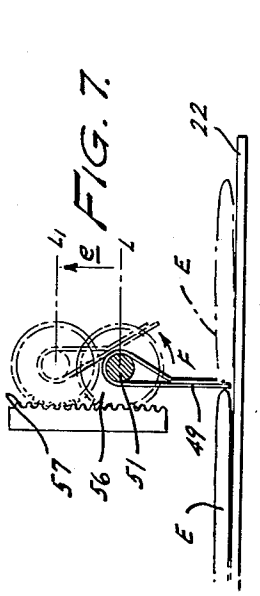

FIG. 7.

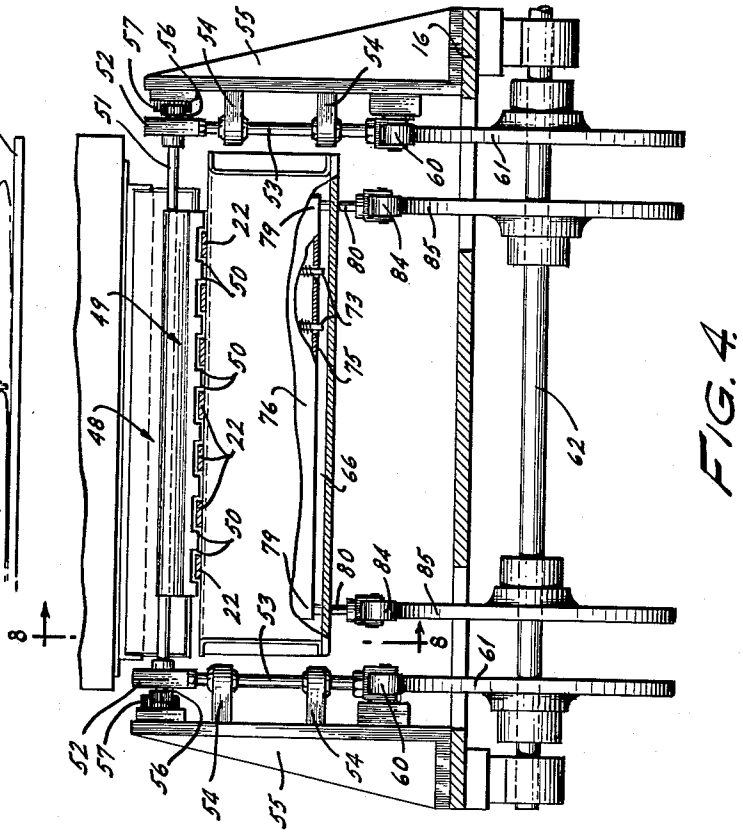

FIG. 4.

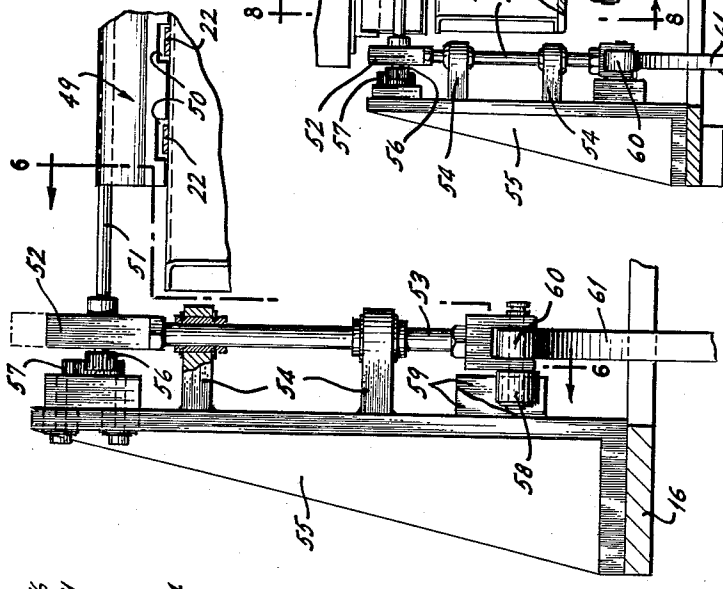

FIG. 5.

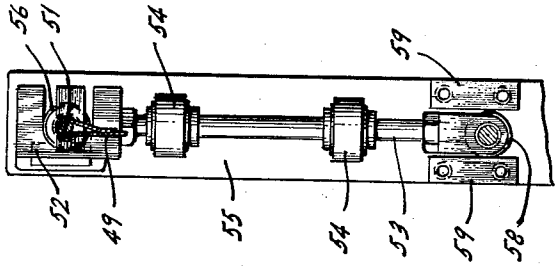

FIG. 6.

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HANDLING APPARATUS

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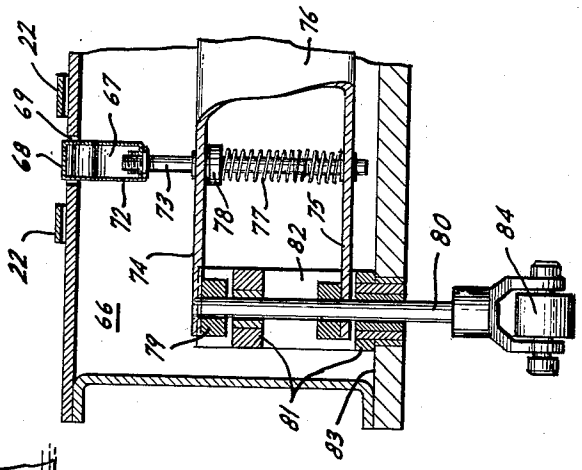

FIG. 9.

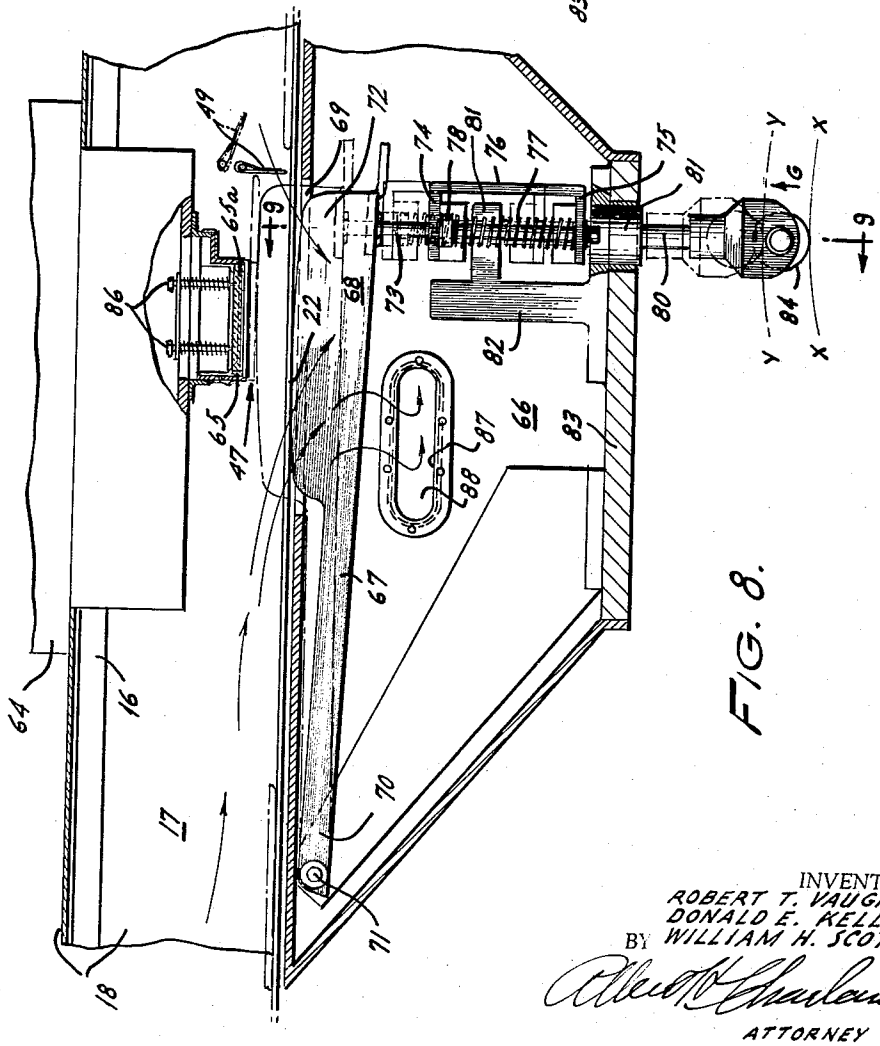

FIG. 8.

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HANDLING APPARATUS

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Filed Dec. 21, 1962, Ser. No. 246,447
14 Claims. (Cl. 198—103)

The present invention relates to handling apparatus and more particularly to conveyor systems for transporting data-carrying articles to and from a station where the data is interpreted to provide for subsequent sorting of the articles. While the invention is applicable to the handling of a variety of articles, it has particular application in the field of modern mechanization of postal operations to effect automatic processing of letter mail.

A customary procedure followed in mechanized mail handling is to arrange and stack letter envelopes in proper oriented relation for feeding in one-by-one processional order to a sorting machine which automatically sorts and directs the envelopes to receptacles arranged according to cities and States. In order to carry out automatic sorting and envelope-directing operations, it is necessary to provide the automatic handling equipment with means capable of identifying an envelope being progressively advanced towards the sorting machine.

For that purpose it has recently been proposed to utilize character recognition systems in which electronic means, located at a so-called "reading station" in the path of movement of the addressed envelopes, scans the City-State portion of the address to effect activation of controls which precondition the sorting machine the function of which is to direct the envelopes to the appropriate receptacles. Such systems are considered most advantageous because of the rapidity with which they perform their character-reading and control-setting functions, makes it possible to expedite the processing of letter mail at desirable rate, for example, 180 letters per minute. To accomplish this result, it is required: that the envelopes be moved at rapid rate; that a predetermined spacing be maintained between the trailing edge of a leading envelope and the leading edge of a trailing envelope; that an envelope be momentarily arrested and stabilized at the reading station; that an arrested and stabilized envelope be brought into a position where it can be read by the electronic scanning device; that an envelope be removed from reading position and released for departure from the reading station in timed relation with the arrival of the next succeeding envelope at that station.

It is with apparatus capable of fulfilling these requirements that the present invention is concerned, and accordingly it is a primary object of the invention to provide a novel arrangement and combination of elements which insure the attainment of such requirements. Towards that end, a preferred embodiment of the apparatus is featured by the use of a continuously moving conveying system, in novel combination with mechanism which stops the conveyed envelopes, or the like, during a scanning or reading interval.

Other and more specific objects and characteristic features of the invention have to do with the provision of apparatus which incorporates improved and simplified mechanisms for handling letter envelopes in the manner refered to above, which in operation requires minimum personnel attention, and which is readily adaptable for interposition between and cooperative association with other mechanisms, such as a letter envelope feeder and a letter envelope sorter.

To obtain these objectives and features, a preferred embodiment of the invention basically involves the use of conveyor means mounted to travel in a path passing the location of the recognition device to bring the data bearing articles to said location in succession, interceptor means for first arresting an article in said location to prevent movement of the article with the conveyor means for a predetermined time period and thereafter releasing the article for continued movement with the conveyor means, article-engaging means operable during the aforesaid time period for first removing the arrested article from the conveyor means and placing such article in position to be recognized by the device and for thereafter removing the article from said position and redepositing the article on the conveyor means for continued movement therewith, and means for receiving and transporting the recognized article away from the conveyor means.

In a preferred embodiment of the invention there is provided structure including a first section with which there is associated means for successively feeding letter envelopes, or the like, to that first section from a stack on a stacking table, and a second section which moves in a path passing beneath a character recognizing device of an electronic system adapted to store information, for example information as to city and State on an addressed envelope, and to transmit that information to a sorting machine. In this second section there is interposed means for momentarily preventing movement of an envelope upon reaching the location of the electronic scanning device, and means for raising and lowering such envelope between the mentioned second section and recognizing device so as to bring the envelope into position to be read by the device and then into position to be conveyed to the sorting machine which is set in response to signals transmitted in accordance with information recognized by the device.

The invention, as well as its objects and advantages, will be more fully understood from the following description based on the accompanying drawings in which:

FIGURE 1 is an elevational side view of a mail handling machine incorporating the principles of the invention, portions of the housing structure being broken away to illustrate cooperative elements enclosed therein;

FIGURE 2 is an elevational end view looking in the general direction of arrows 2—2 of FIGURE 1, outer wall portions being broken away to illustrate normally hidden parts;

FIGURE 3 is an enlarged fragmentary view looking in the general direction of arrows 3—3 of FIGURE 1 and showing the main conveyor sections of the machine;

FIGURE 4 is an enlarged elevational sectional view looking in the general direction of arrows 4—4 of FIGURE 1;

FIGURE 5 is a fragmentary detailed view of a portion of the gate mechanism shown in FIGURE 4;

FIGURE 6 is an elevational sectional view looking in the direction of arrows 6—6 of FIGURE 5;

FIGURE 7 is an explanatory schematic view illustrating the operation of the gate mechanism;

FIGURE 8 is a vertical sectional view, on an enlarged scale, taken substantially on line 8—8 of FIGURE 4; and

FIGURE 9 is an elevational-sectional view looking in the general direction of arrow 9—9 of FIGURE 8.

With more particular reference to the drawings, the mail handling machine illustrated in FIGURES 1 and 2 is provided with a conveyor structure which basically comprises a first conveyor section designated generally at **10**, a second conveyor section designated generally at **11**, transfer mechanism generally designated at **12** for trans-

ferring data-carrying articles, in this instance addressed letter envelopes E, from a stack on a table **14** to the first conveyor section, and a transport mechanism designated generally at **15** for transporting letter envelopes from the second conveyor section to the mail sorting apparatus (not shown) of any suitable known type. These basic components of the illustrated machine are supported on framework **16**, the first and second conveyor sections **10** and **11** being housed by an enclosure **17** defined by paneling **18**.

As seen in FIGURE 3, the first conveyor section **10** includes a plurality of parallel endless belts **19** arranged in engagement with a driven drum **20** disposed at the central portion of the machine and with a series of coaxial pulleys **21** disposed at the forward or input end portion of the machine, and the second conveyor section **11** includes also a plurality of parallel endless belts **22**, the latter being arranged in engagement with the drum **20** and with a series of coaxially rotatable pulleys **23** disposed at the rearward or output end portion of the machine. The driven drum **20** is affixed to a shaft **24** rotatably supported in standards **25** mounted on the framework. As illustrated in FIGURE 1, the drum is driven at predetermined speed in the direction of arrow A through the shaft **24** which is connected by means of a belt drive **26** through a gear reduction unit **27** coupled to motor **28**.

As best seen in FIGURE 3, the series of pulleys **23** associated with belts **22** are supported for rotation on an axle **29** in bearing bracket arms **30** mounted on the framework **16**, whereas the series of pulleys **21** associated with belts **19** include two pulleys **21***a* and **21***b* which, as shown in FIGURE 3, are supported on bearing brackets **31***a* and **31***b*, respectively, the remaining pulleys **21** being rotatably supported on an axle **32** carried in brackets **33** also mounted on the framework **16**. The conveyor belts **19** and **22** are maintained under proper tension and guided in their travel by slack take-up roller means **34** in engagement with the belts.

Transfer mechanism **12** is of the pneumatically operative and mechanically actuated type, the general construction and basic functions of which are known in the art. As represented in FIGURE 1 such transfer mechanism includes a lower assembly **35** and an upper assembly **36**, these assemblies being rotatably driven about axes **37** and **38** respectively.

The lower assembly comprises a rotatable housing **39** provided with suction conduits **40** each having a suction arm **41** terminating with a suction head **42**. These suction heads are adapted, with rotation of the housing **39** in the direction of arrow B FIGURE 1), to come in contact with and to pick up the leading letter envelope in the stack on the stacking table **14** which is provided with conveyor means **14***a* for progressively advancing the stack in the direction of arrow C.

The upper assembly **36** also comprises a rotatable housing **43** provided with projecting suction conduits **44** which, in particular accordance with the present invention and as more clearly shown in FIGURE 3, are each provided with a set of three suction arms **45** each terminating with the suction head **46**. These arms **45** with their respective suction heads are spaced laterally with respect to each other so that with rotation of the housing **43** in a direction of arrow D (FIGURE 1) they will pass unobstructedly through the space on either side of the hereinbefore mentioned set of pulleys **21***a* and **21***b* (FIGURE 3). The lower and upper assemblies **35** and **36** are adapted to rotate in unison and to function synchronously through operation of associated conventional driving and suction-creating systems (not shown) customarily employed in transfer mechanism of the general type hereinabove referred to so that, as illustrated in FIGURE 1, the suction heads **42** of the lower assembly and the suction heads **46** of the upper assembly meet in the position shown at P. At this position, the letter

envelope picked up by and moving with a suction head **42** is picked off by the corresponding suction heads **46** of the upper assembly and carried thereby to the input end of the first conveyor section **10** where the envelope is deposited on belts **19**. These belts **19** convey the letter envelope to the input end of the second conveyor section **11** whereupon the belts **22** advance the envelope towards a data reading station indicated at **47** where the latter envelope is temporarily arrested and held in predetermined position.

For that purpose there is provided a gate mechanism **48** located in the path of movement of the letter envelope as it travels along with the conveyor belts **22**. As clearly shown in FIGURE 4 the gate mechanism includes an elongated gate element **49** suspended immediately above and extending transversely of the endless belts **22**, the gate element being formed with recesses **50** to accommodate said belts. The gate element is rigidly mounted on a horizontal shaft **51** rotatably supported in bearings **52** at the upper end of vertical rods **53** which are mounted for reciprocating motion in sleeves **54** on upstanding posts **55** arranged on the framework **16**. As more clearly appears in FIGURES 4, 5 and 6, each end of the shaft **51** is provided with a pinion **56**. These pinions mesh with racks **57** fixed on the posts **55** so as to cause the shaft **51** to rotate in bearings **52** as the latter move up or down with reciprocation of the rods **53** which, for that purpose, are provided with guide rollers **58** (FIGURES 5 and 6) running between guide blocks **59** on said posts and with cam followers **60** (FIGURES 4 and 5) disposed in riding engagement with eccentric cams **61** affixed on a rotatable cam shaft **62**. As shown in FIGURE 1, this shaft is driven by means of a belt-and-pulley drive **63** connected to the belt-and-pulley drive **26** which, as hereinabove described, is connected to the motor driven gear reduction unit **27**.

The operation of the gate element **49** to prevent a letter envelope at the reading station from moving with the belts **22** and to permit movement of an envelope with said belts after its recognition at the reading station, will be best understood upon reference to schematic FIGURE 7. As represented in this figure, the gate element **49** is normally resting in a lowered position (full line position) where the leading edge of a letter envelope E comes in abutting engagement with said gate element and is restrained thereby while the belts **22** continue to travel. When, through function of the associated cam and rod mechanism described above, the rigidly interconnected shaft **51** and gate element **49** are lifted as indicated by arrow *e* from lower location L to upper location L', the pinions **52** and corresponding racks **57** cooperate to impart rotational motion to said shaft and gate element as represented by arrow F. Thus the gate element is displaced from the aforesaid normal position to a raised position (broken line position) where the letter envelope E is released and carried by the belts **22** away from the reading station.

As hereinbefore mentioned the machine illustrated in FIGURE 1 is supplied with electronic equipment adapted to scan the "City-State" portion of the address appearing on the letter envelope arrested at the reading station by the gate mechanism **48**. The electronic equipment forms no part of the present invention and therefore need not be described. However, for electronic equipment suitable for use with the apparatus of this invention, reference may be had to copending application Serial No. 166,082 filed January 15, 1962 filed in the names of James S. Bryan and Charles F. Teacher and assigned to the assignee of the present application. The electronic equipment is housed in cabinetry **64** wherein there is incorporated a support structure **65** for a scanner glass panel **65***a* (FIGURE 8) located at the reading station **47** where there is also located an enclosure **66** containing article-engaging means for bringing a letter envelope into and out of contact with said glass panel.

As seen in FIGURE 3, the last mentioned means include a plurality of elongated lifting members **67**, one between each two adjacent belts **22**. These members have an envelope engaging portion **68** which registers with apertures or slots **69** in the top of the enclosure **66**, and, as shown in FIGURE 8, each member **67** is connected at one end **70** to a pivot **71** supported within the enclosure **66**. The other end **72** of each member **67** has secured thereto a depending rod **73**, best seen in FIGURE 9, which slidably passes through upper wall **74** and lower wall **75** of a transverse rail **76** mounted for vertical movement in the enclosure **66**. A coil spring **77** arranged about the depending rod bears against the lower wall **75** of the rail and against a collar **78** on the rod so as to impose thereon a thrust which serves to maintain the collar against the upper wall **74** of the rail and thus yieldably sustains member **67** in position where its envelope engaging portion **68** normally lies in predetermined spaced relation with respect to said upper wall of the rail. As illustrated in FIGURE 4, the opposite end portions **79** of the rail **76** are each provided with a vertically extending rod **80** which as more clearly shown in FIGURE 9 is received for axial sliding motion in vertically aligned bearings **81** carried on bracket **82**, the latter being supported on bottom wall **83** of the enclosure **66**. Also as illustrated in FIGURE 4, the rods **80** project through said bottom wall and carry rollers **84** which are disposed in riding engagement with eccentric cams **85** affixed on the cam shaft **62** to rotate therewith.

The manner in which the above described envelope lifting mechanism operates will best be understood by referring to FIGURES 8 and 9. As seen in these figures the mechanism normally rests in a lowered position (full line position in FIGURE 8) where the envelope engaging portions **68** of each member **67** is substantially flush with the top of enclosure **66** to clear belts **22** and envelope E thereon. Following the arrest of the envelope by the gate element **49**, the eccentric cam surfaces represented by curved lines X—X and Y—Y function to raise the mechanism to an elevated position (broken line position in FIGURE 8) where the aforesaid envelope-engaging portion **68** lifts the envelope and, by reason of the spring **77** in association with the rod **73** of each member **67**, holds the envelope snugly against the scanner glass panel **65***a*. To avoid damage to the glass panel **65***a*, the mounting structure **65** is suspended from spring biased pins **86** which normally locate the mounting structure and glass panel in proper position for envelopes of normal thickness but which will allow the panel and its mounting structure to give should articles of abnormal thickness be brought to the reading station.

It will be understood that the various portions of the machine, for example the gate mechanism and the envelope lifting mechanism, operate coordinately in timed relation to the predetermined speed of belt advance.

After the "City-State" portion of the address has been recognized for conditioning the sorting machine (not shown) to which the envelope is to be fed, the lifting mechanism returns to its normal lowered position thus redepositing the envelope on belts **22** to be removed thereby from the reading station, gate element **49** having in the meantime been lifted and swung to envelope-releasing position in the manner hereinbefore described.

In accordance with the invention, suction is utilized to effect positive retention of a letter envelope in proper position while being lifted from and redeposited on belts **22** by function of the envelope-engaging portion **68** of members **67**. For that purpose, the enclosure **66** for the lifting mechanism is provided with a port **87** (FIGURE 8) communicating with an air duct **88**. This duct, as seen in FIGURE 2, leads to the inlet side of a suction pump **89** which can be driven from the gear reduction unit **27** by means of suitable belt and pulley drive **90**. With this arrangement, it will be understood that as the pump operates there is created below an envelope at station **47** (FIGURE 8) a sub-atmospheric pressure condition whereby the envelope is prevented from shifting with respect to the portion **68** of members **67**. Moreover, it will be understood that because the pump will cause air within the enclosure **17** to flow as represented by the arrows in FIGURE 8, the envelopes resting upon and travelling with the conveyor belts are subjected to air pressure which effectively restrains the envelopes against uncontrolled shifting with respect to said belts.

An envelope released from the reading station and redeposited on the belts **22** is conveyed to the discharge end of the conveyor section **11** (FIGURES 1 and 2) whence the envelope is guided by a shield **91** in the transport mechanism **15**. This mechanism includes a channel structure **92** and a moving belt **93** arranged therein for carrying the envelope on its way to be sorted according to information gathered at the reading station.

From the foregoing description, it will be appreciated that the machine of the invention incorporates a novel combination of improved conveyor and article-control means which cooperate in a novel manner with data-recognizing means to facilitate the handling and disposition of articles supplied with identifying data. Particularly it will be recognized that a machine constructed in accordance with the invention facilitates the rapid disposal of letter mail in main post office centers where a large volume of letter mail is handled for distribution to local post office branches.

While a preferred embodiment has been shown and described, it will be understood that the invention is not limited to specific structures of that embodiment but embraces such changes and variations as come within the scope of the subjoined claims.

What we claim is:

1. Mechanism for conveying data bearing articles past a data recognizing device, comprising: conveyor means mounted to travel in a path passing the location of the recognizing device to bring the data bearing articles to said location in succession; intercepting means for first arresting an article at said location for a predetermined time period, and thereafter to release the article for continued movement; article-engaging means operable during the aforesaid time period for first removing the arrested article from the conveyor means and placing such article in a position to be recognized by the device and for then removing the article from said position for continued movement; and means for receiving the recognized article after its removal and release from said position.

2. Mechanism as set forth in claim 1, in which the intercepting means includes a gate element movable to a lowered position for arresting the article and movable to a raised position for releasing the article.

3. Mechanism as set forth in claim 1, in which the intercepting means includes an elongated gate element, a horizontal shaft rigid with the gate element and having end portions projecting longitudinally from said element, vertically slidable bearings rotatably receiving said shaft portions, pinions carried by said shaft portion adjacent the bearings, fixed racks disposed in engagement with the pinions, and cam means connected with the bearings to slide the same for raising and lowering the gate element and simultaneously imparting thereto opening and closing movements through the aforesaid pinions and racks.

4. Mechanism as set forth in claim 1, in which the article engaging means includes lifting members movable to a raised position for engaging the arrested article to remove it from the conveyor means and movable to a lowered position to remove the recognized article from said position.

5. Mechanism as set forth in claim 1, in which the article engaging means includes elongated lifting members each pivoted at one end and having an article engaging portion at the other end, rods depending from said portion of the lifting members, a rail extending

transversely of and slidably receiving the rods, spring means between the rail and rods and biasing the latter upwardly with respect to the rail, and cam means connected with the rail for raising and lowering the same to pivot the lifting members and thereby raise and lower their mentioned portions through the aforesaid rods.

6. Mechanism as set forth in claim 1, in which the article engaging means includes lifting members movable to a raised position for engaging the arrested article to remove it from the conveyor means and movable to a lowered position for lowering the recognized article from said position, an enclosure containing the lifting members and apertured for movement of the members into engagement with the arrested article, and a source of suction communicating with the interior of said enclosure.

7. Mechanism as set forth in claim 1, in which the intercepting means includes a gate element movable to a lowered position for arresting an article and movable to a raised position for releasing the article, in which the article engaging means includes lifting members movable to a raised position for engaging the arrested article to remove it from the conveyor means and movable to a lowered position for lowering the recognized article from said position, and in which means is provided for moving the gate element and lifting members in predetermined synchronism with respect to each other.

8. Mechanism as set forth in claim 1, in which the mentioned conveyor means includes a section having a series of coaxial pulleys disposed adjacent the transfer means and a plurality of parallel endless belts in engagement with said pulleys, brackets separably supporting certain of said pulleys to provide spaces therebetween, the transfer means including a rotatable housing and sets of suction arms provided thereon, the suction arms of each set being spaced laterally with respect to each other to register with and pass through the spaces between the aforesaid separably supported pulleys.

9. Mechanism for conveying data bearing articles past a data recognizing device, comprising: conveyor means mounted to travel in a path passing the location of the recognizing device to bring the data bearing articles to said location in succession; intercepting means for first arresting an article at said location to prevent movement of the article with the conveyor means for a predetermined time period, and thereafter to release the article for continued movement with the conveyor means; article-engaging means operable during the aforesaid time period for first removing the arrested article from the conveyor means and placing such article in a position to be recognized by the device and for then removing the article from said position and redepositing the article on the conveyor means for continued movement therewith; and means for receiving and transporting the recognized article away from the conveyor means.

10. Mechanism as set forth in claim 9, in which the article engaging means includes lifting members movable to a raised position for engaging the arrested article to remove it from the conveyor means and movable to a lowered position to remove the recognized article from said position, and to redeposit the article on the conveyor means.

11. Mechanism as set forth in claim 9, in which the article engaging means includes lifting members movable to a raised position for engaging the arrested article to remove it from the conveyor means and movable to a lowered position for lowering the recognized article from said position and redepositing the article on the conveyor means, an enclosure containing the lifting members and apertured for movement of the members into engagement with the arrested article, and a source of suction communicating with the interior of said enclosure.

12. Mechanism as set forth in claim 9, in which the intercepting means includes a gate element movable to a lowered position for arresting an article and movable to a raised position for releasing the article, in which the article engaging means includes lifting members movable to a raised position for engaging the arrested article to remove it from the conveyor means and movable to a lowered position for lowering the recognized article from said position and redepositing the article on the conveyor means, and in which means is provided for moving the gate element and lifting member in predetermined synchronism with respect to each other.

13. Mechanism for conveying data bearing articles past a data recognizing device, comprising: a first conveyor section; transfer means for moving a data bearing article from a stack to the first conveyor section; a second conveyor section mounted to travel in a path passing the location of the recognizing device and to receive an article from the first conveyor section and bring it to said location; intercepting means for first arresting an article at said location to prevent movement of the article with the second conveyor means for a predetermined time period and thereafter releasing the article for continued movement with the second conveyor section; means operable during said time period for first removing an intercepted article from the second conveyor section and placing said second article in position to be recognized by the device and for then removing the article from said position and redepositing the article on the second conveyor section for continued movement therewith; and means for receiving and transporting the recognized article away from the second conveyor section.

14. Mechanism as set forth in claim 13, in which the mentioned first conveyor section includes a series of coaxial pulleys disposed adjacent the transfer means and a plurality of parallel endless belts in engagement with said pulleys, brackets separably supporting certain of said pulleys to provide spaces therebetween, the transfer means including a rotatable housing and sets of suction arms provided thereon, the suction arms of each set being spaced laterally with respect to each other to register with and pass through the spaces between the aforesaid separably supported pulleys.

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