Nov. 28, 1967 D. C. PRINCE 3,355,016

SORTING DEVICE FOR CODE BEARING ARTICLES

Filed Jan. 4, 1965 3 Sheets-Sheet 1

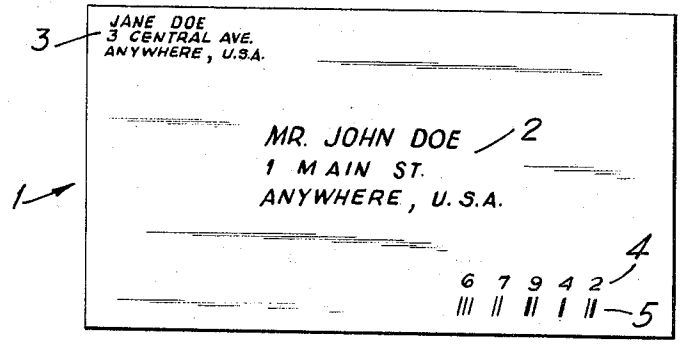

FIG. 1

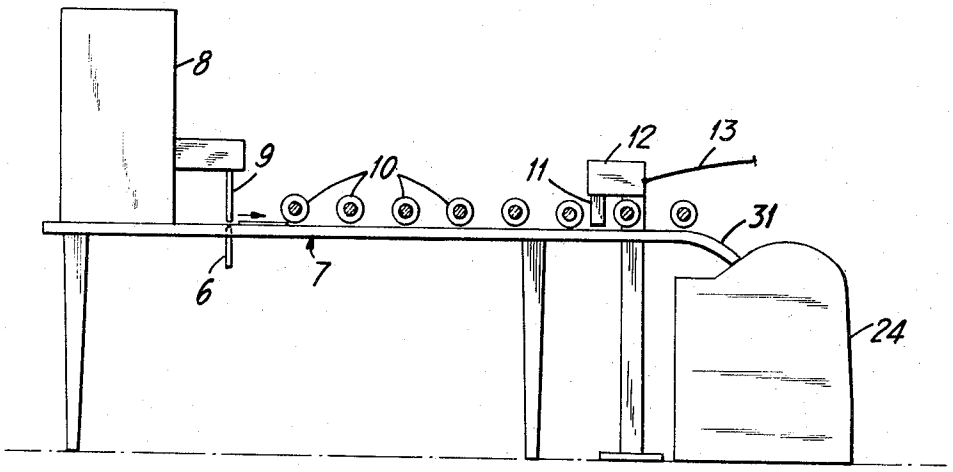

FIG. 2

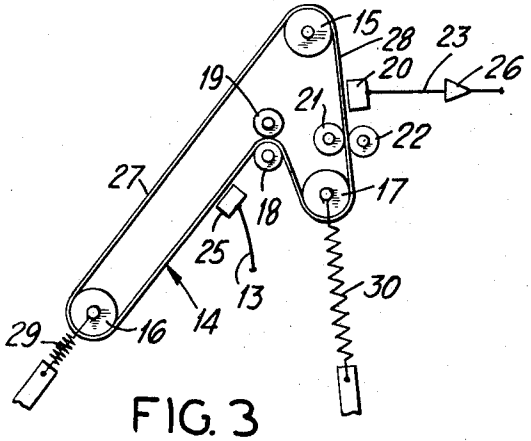

FIG. 3

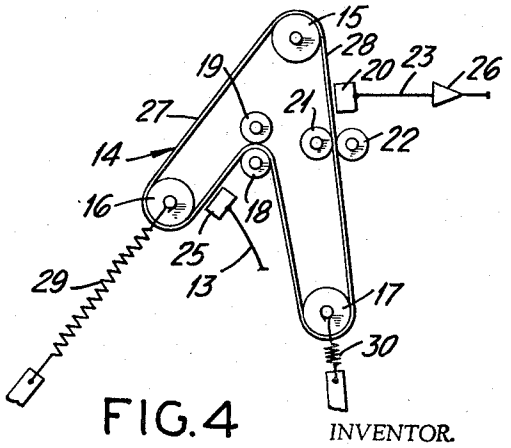

FIG. 4

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SORTING DEVICE FOR CODE BEARING ARTICLES

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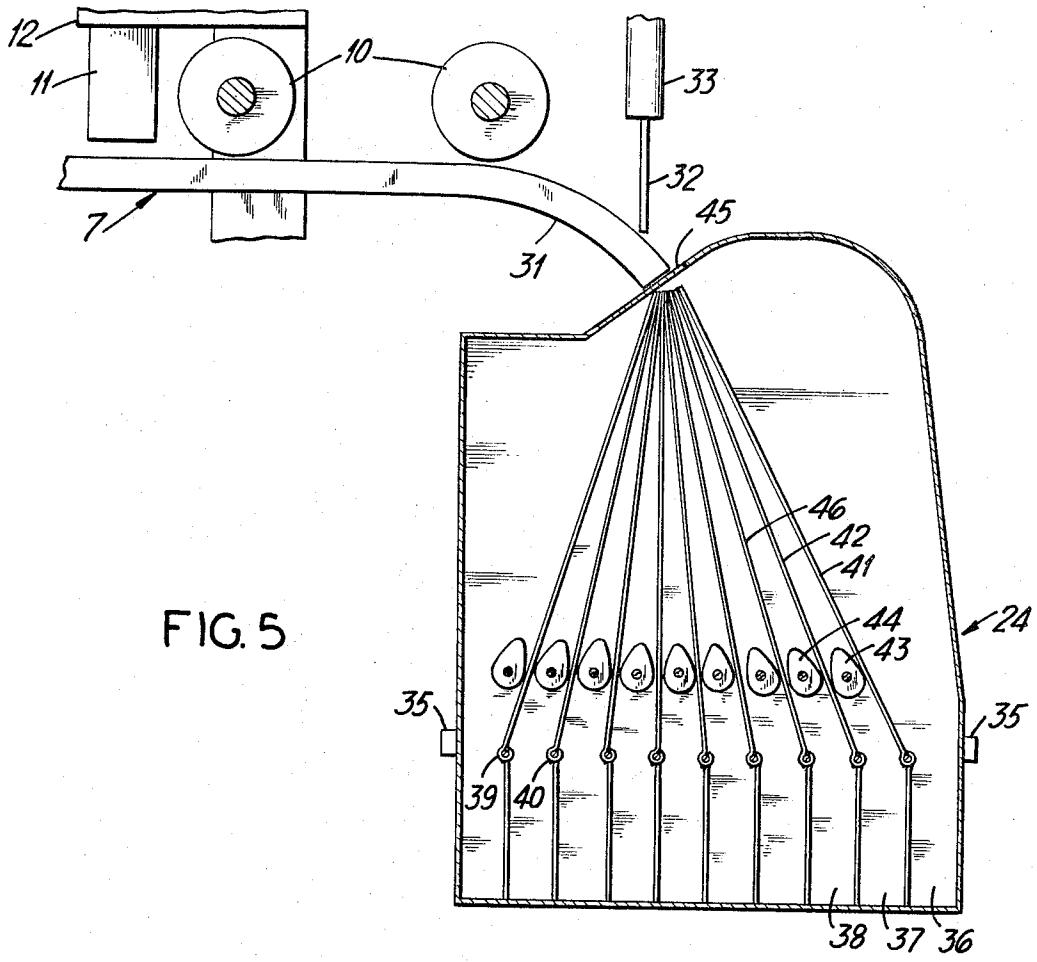

FIG. 5

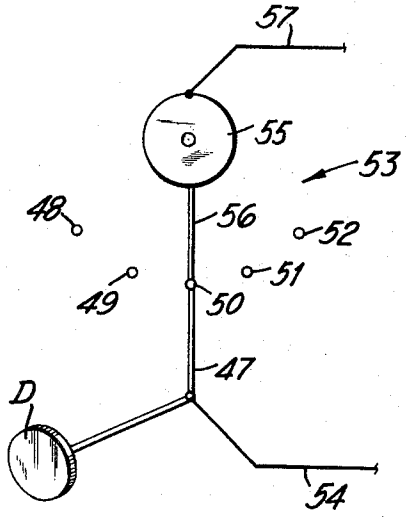

FIG. 6

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SORTING DEVICE FOR CODE BEARING ARTICLES

Filed Jan. 4, 1965 3 Sheets-Sheet 3

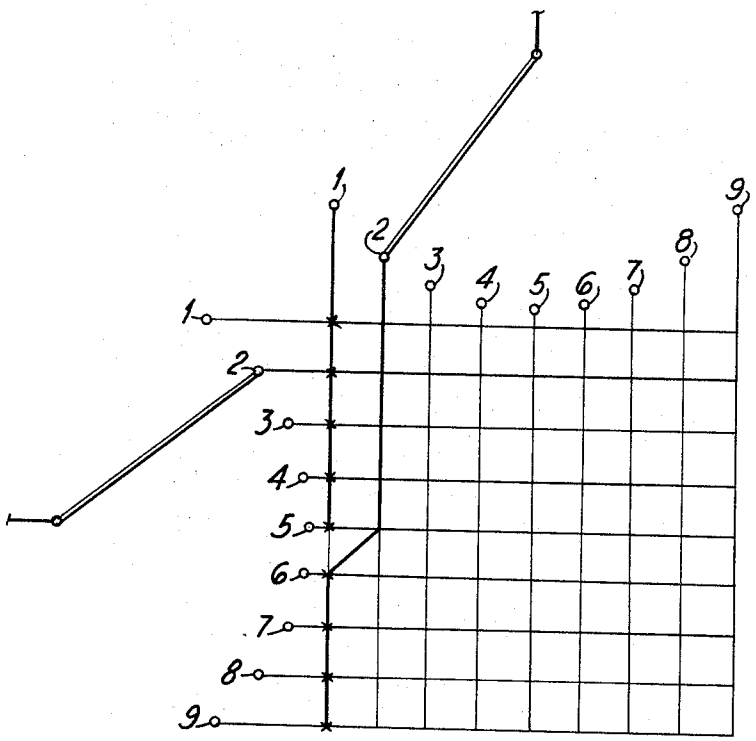

FIG. 7

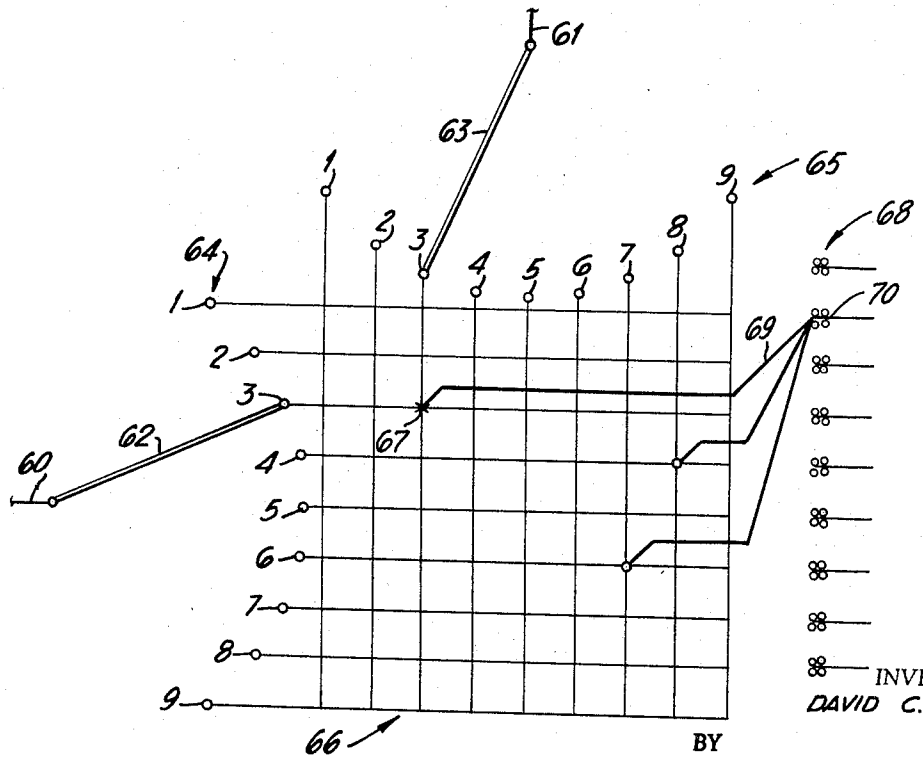

FIG. 8

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United States Patent Office 3,355,016 Patented Nov. 28, 1967

3,355,016

SORTING DEVICE FOR CODE BEARING ARTICLES

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Filed Jan. 4, 1965, Ser. No. 423,231
3 Claims. (Cl. 209—74)

The present invention relates to apparatus for sorting articles and more particularly to apparatus for sorting mail according to addresses in a post office.

Various machines have been proposed in the past for sorting letters or the like, particularly for use in post offices. Current interest in post office sorting devices is due to the rising volume of mail and the shortage and expense of skilled personnel. However, the machines which have been proposed, and those which have been put into use in the United States and abroad, are either automatic and expensive or require manual control.

It is the objective of the present invention to provide a sorting device, particularly for branch post offices, which is relatively inexpensive and which is wholly automatic.

In accordance with the present invention, a special visible code is used on the envelope. The code is typed, printed or stamped on the envelope by the sender, for example in the bottom right-hand corner. It is preferably a code representation of the so-called "zip code." In the post office, the letters are first sorted by envelope size. Then all of the envelopes within a certain range of sizes are placed on the automatic reading machine of the present invention. This machine reads the coded "zip code" either by magnetic or optical means and converts the code into a series of electrical signals.

Each digit of the zip code enables the letters to be sorted into nine categories. By proper adjustment of the machine, any one or more characters of the zip code may be ignored, so that the machine will sort into as many different categories as are desired. The machine is highly flexible in that the number of different pockets into which letters are sorted may be selected at will. The finer degrees of sorting are obtained by operating more pockets or bins.

Other objectives of the present invention will be apparent from the following detailed description of a preferred embodiment taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a top plan view of an envelope having the zip code in the code of the present invention;

FIG. 2 is a schematic view of one portion of the machine of the present invention;

FIGS. 3 and 4 are side schematic views of tape machines which may be used with the machine of FIG. 2;

FIG. 5 is a side view of a portion of the machine of FIG. 2;

FIG. 6 is a schematic view of a switching mechanism which may be used with the present invention; and

FIGS. 7 and 8 are top schematic views of switching boards which may be used with the present invention.

The letters which are prepared to be sorted with the machine of the present invention are shown in FIG. 1. They consist of a conventional mailing envelope **1** having the name and address of the adressee **2** and the usual return name and address **3**. In addition, in the lower right-hand corner the zip code **4** has associated with each of its characters a magnetic code **5** in the form of elongated slashes. Preferably the code lines **5** are at an angle relative to the letters **4** of the zip code, as is explained in the applicant's copending application entitled "Alphabetical and Numerical Code," Ser. No. 410,189, filed Nov. 10, 1964.

The zip code, along with its associated code markings,

may be placed on the envelope by a typewriter. Preferably, however, the markings are about the same size as typewriter letters and are placed on the envelope using a stamp. A stamp similar to the type often used for dates, which has a rotary portion and a plurality of rubber belts, is well adapted for this purpose. For use with a magnetic pick-up, the stamp uses magnetic ink obtained from a special stamp pad. Gummed labels may also be used, which can be printed with an address and a zip code in code markings in magnetic ink.

Each envelope has on it the zip code in characters and in its associated visible code consisting of elongated lines. A relatively simple code may be used since it is only necessary to distinguish nine numerals in each position. The 5-bit Baudot code is more than sufficient for this purpose and a 4-bit or even a 3-bit code may be used. Each character in these codes may have a starting bit which would be longer than the other bit places, followed by the presence or absence of darkened elongated lines.

The envelopes which have been sorted according to size, for example with the type of mechanism shown in U.S. Patent 3,137,390 of June 16, 1964, are placed in a receiving box **8** (see FIG. 2). The box **8** is mounted on table **7**. A plurality of motor-driven rollers **10** is arranged along the top of the table to progress the letters along its surface. A roller underneath the sorting box **8** (not shown) tries to force the bottom envelope in the box onto the table. The envelope is held back, however, by means of a gate **9**. Gate **9** is operated by a solenoid. The solenoid and its gate constitute a timing mechanism which feeds the envelopes periodicaly onto the table with predetermined spacing between each envelope. If desired, a further bottom gate **6** can also be used in coincidence with the top gate **9** to correctly space the envelopes moving onto the table. The envelopes are carried in sequential order, with a space between each of them, between rollers **10** until they arrive at the reading head **11**, which is supported on stand **12**. Alternatively, reading head **11** may be mounted in the table and the envelopes, with their faces down, progressed over the head.

The reading head **11** picks up the code markings **5** on the envelopes either by optical means or by magnetic means, if the code markings are magnetically printed. A suitable magnetic reading means is described in the inventor's prior U.S. Patent No. 2,897,267. The envelope is then progressed to the plurality of bins **24**. A detailed description of the bin mechanism is given below in connection with FIG. 4.

The reading head may directly control the opening of the bins. However, the pick-up device may operate in terms of less than one millisecond, since it is purely electronic. In comparison, the electromechanical controls for the bins are relatively slow. In order to avoid feeding data too fast to the bin control mechanism, the intermediate data transfer mechanism of FIGS. 3 and 4 are used. Alternatively, one may simply progress the letters on the table underneath head **11** sufficiently slowly so that it may directly feed data to the bin control.

The wire **13** from reading head **11** leads to magnetic writing head **25** which is positioned over an endless belt **14** of magnetic material, see FIGS. 3 and 4. Belt **14** rides on freely rotating rollers **15**, **16** and **17**. The belt **14** is driven by rollers **18** and **19** so that its surface is progressed at the same speed as the envelopes are progressed along the table **7**. Writing head **25** places the same magnetic code on the belt **14** as is found on the envelope being read by reading head **11**.

If rollers **18** and **19** are operated continuously, there would be spaces between each of the blocks of code information because of the equivalent spaces between each of the envelopes and because of the uncoded portion of each envelope. The rollers **18** and **19** are therefore

made responsive to the initiation of the pulse train from head **11**. Rollers **18** and **19** progress the belt **14** only when the head **11** is reading the code, and they progress it comparatively rapidly. The belt **14** is taken up from its loose loop **27** (see FIG. 3), by rollers **18** and **19** and formed into a second loose loop **28** (see FIG. 4). The loops **27** and **28** are kept free of slack by freely rotatable rollers **16** and **17**, whose shafts are suspended on the ends of springs **29** and **30**, respectively.

The loose loop **28** of FIG. 4 is taken up by motor driven rollers **21** and **22**. Rollers **21** and **22** are initiated to operate by a photoelectric switch (not shown) which detects the presence of an envelope at the bin opening. The timing of the mechanism is arranged in such a manner that the envelope at the bin opening is the same whose code has been magnetically printed on the bottom of the belt in loose loop **28**. Preferably, the timing allows for only the information from one envelope to be on the belt at one time.

The purpose of this device is to enable the code to be printed on the belt at a fast speed and to be read at a slow speed. For this purpose, two free loops of belt are used which are taken up by the rollers at different speeds. Some of the safety devices which are preferred with this device are (1) having two limit switches (not shown) which sense that the loops **27** or **28** are too small and stop the machine; (2) having the driven rollers **18**, **19**, **21** and **22** with an over-drive clutch mechanism (free wheeling) so that they will revolve freely if the tape is pulled through them while they are stopped or rotating slower than the tape movement; and (3) having a feedback circuit to stop the feeding of envelopes to head **11** if the belt mechanism or bin mechanism is operating too slowly.

The code, which is in magnetic form on belt **14**, is read by reading head **20**, which is connected by means of wire **23** and amplifier **26** to the bin operating mechanism. An erase head is mounted along with reading head **20** and following it.

The table **7**, after head **11**, is terminated in an inclined portion **31**. The top motor driven rollers **10** progress the envelope until the gate **32** is reached. Gate **32**, controlled by solenoid **33**, is timed so that it holds the envelope until the bin operating mechanism is ready for it. The bin **24**, positioned below inclined portion **31**, includes a detachable tray of bins **36–38**, preferably ten. This tray may be readily removed and another tray of bins substituted by detachment of its locks **35**.

The tops of each bin separation fit into a hinge mechanism **39–40**. Each hinge mechanism **39–40** has a metal plate (leaf) **41–42** attached to it, with the leaves rotatable about the hinge. When there are ten bins, there will be nine hinge mechanisms and nine metal leaves. Cams **43–44** are positioned between each of the leaves and are operated by a teletypewriter type of mechanism, see, for example, Principles of Electricity, Etc. (A T & T 1938 ed.), p. 110, for a description of a suitable mechanism.

When the zip code for the digit to be sorted is read, it operates one of the cams. For example, if the third digit position is to be sorted, then the first and last two digits are filtered out and only the third digit fed to the teletypewriter mechanism.

If third third digit is number 3, then cam **44** operates pushing leaves **41** and **42** above the entry mouth **45**. The envelope falls between leaves **42** and **46** and into bin **38**.

A simple switch mechanism can provide the selection of the digit to be sorted. In FIG. 6 a dial D is set so that its contact **47** is on the third switch position **50** of a switch mechanism **53**. The output line **54** is connected to contact **47**. A stepping switch **55** is positioned so that its contact arm **56** is in contact with each of the contacts **48** through **52** in turn. Each step of switch **55** is initiated by a start of digit pulse, preferably a long pulse fed to switch **55** over input line **57**. The shorter pulses constituting the digit numbers are screened out by an R–C network. The input line **57** is in contact, through switch **55**, with contact **56**. In operation, the first digit positions arm **56** on contact **48**. But contact arm **47** has been manually dialed to contact **50** so that there is no output. Similarly, there is no output from contacts **49**, **51** and **52** corresponding to the second, fourth and fifth digits, respectively. When the arms **56** and **47** are both on contact **50**, the pulses forming the number of the third digit are sent from input line **57** over output line **54**. The last (fifth) digit automatically resets switch **55** to contact **48**, which can be accomplished by a limit switch.

More than one digit may be used for sorting with the switching system shown in FIG. 7. For example, if ten bins are to be filled (ten categories), it may be desired to use a different breakdown system than using the ten numbers of one digit. A hypothetical example of one such system would be as follows:

Digit Position	Numbers	Bin
1	1–5	1
1	5–9	2
2	1–5	3
2	5–9	4
3	1 and 2	5
3	3 and 4	6
3	4 and 5	7
3	6 and 7	8
3	8 and 9	9
No code on letter		10

Ignore 4th and 5th digits.

Any number of other sortings may be programmed, for example, the number of groups, with 10 bins, can be from 2-10 and the number of combinations into those bins with 5 digits, can be 99,999. In one suitable mechanism for this system, the first digit is connected to the bin operating mechanism by the timing stepping switch of FIG. 6. The bins are wired on a plug board as shown in FIG. 7 for the first digit of the example. A separate board would be used for the second digit and a third board for the third digit.

A separate bin is used to separate letters not having the coded zip code. These letters are subsequently hand sorted.

In the switching board of FIG. 8, each of the rotary switches **60** and **61** are responsive to one digit of the coded number. For example, if the zip code is a 5-digit number, the switch **60** may be responsive to the first digit and the switch **61** responsive to the second digit. It is seen that each of the switches have a rotary arm **62** and **63**, respectively, which contact one out of its nine switch contacts **64** and **65**, respectively. These contacts are connected in a grid **66** so that each of the 99 numbers making up the two digits have a single cross-point. For example, the cross-point **33** is marked with an X and is designated by number **67**,

Each of the cross-points consists of the female member of the connection jack. The male member on the end of the wire is plugged into the female jack and the wire is run to its connecting contact **68**, shown with nine contacts. In the illustrated example a jack is connected to cross-point **67** by wire **69** and is lead to the second contact **70** of contact bank **68**. Each contact of the contact bank **68** is connected to operate one of the cams **43**. The contact **70** operates cam **43** to open up pocket **37**. As many cross-points may be connected to each of the contacts **68** as is desired. For example, as shown, three wires each lead to contact **70**.

In the present invention, the letters may be sorted using several digits of code at the same time, i.e., with one pass through the machine. In addition, the device may easily be wired so that any coded digit may be associated with any of the bins. This association may be altered by convenient wiring or switch changes.

I claim:

1. A sorting device including, in combination with a sorting table,

timing means to physically separate a plurality of articles to be sorted and place the articles on the table in an ordered and timed sequence,

progressing means to receive the articles and physically move them along the table,

code reading means to pick up a code printed on the articles, which code is in the form of a line of bits of visible markings which are representative of language characters but are not themselves language characters,

wherein the said markings are physically contiguous to the characters represented by those markings, the said characters are visible and printed on the articles, the said code reading means is responsive to the code markings but not to the characters, and the line of markings is aligned in the direction of movement of the articles,

the said reading means consisting of a single reading head adapted to read each of said lines,

operating means responsive to the said code reading means, and

a plurality of bins each having a gate plate controlling the opening into its bin,

wherein the operating means moves a plate in response to the code on the article,

and also including an intermediate tape mechanism comprising a first driven roller responsive to the code reading means so that it drives only during the reading of the code, a magnetic write head contiguous to the first driven roller, a second driven roller responsive to the ready condition of the bins, a magnetic read head contiguous to the second driven roller, and a continuous loop of magnetic tape having two variable loose loops, wherein the write head is connected to the code reading means and the read head is connected to the operating means.

2. A sorting device including, in combination with a sorting table,

timing means to physically separate a plurality of articles to be sorted and place the articles on the table in an ordered and timed sequence,

progressing means to receive the articles and physically move them along the table,

code reading means to pick up a code printed on the articles, which code is in the form of a line of bits of visible markings which are representative of language characters but are not themselves language characters,

wherein the said markings are physically contiguous to the characters represented by those markings, the said characters are visible and printed on the articles, the said code reading means is responsive to the code markings but not to the characters, and the line of markings is aligned in the direction of movement of the articles,

the said reading means consisting of a single reading head adapted to read each of said lines,

operating means responsive to the said code reading means, and

a plurality of bins each having a gate plate controlling the opening into its bin,

wherein the operating means moves a plate in response to the code on the article, and

wherein a selection board conects the code reading means and the operating means, said board comprising first and second selection switches each having a plurality of switch contacts and each connected to the said code reading means and operated by a different digit of the said code, a conductive matrix connecting the said switch contacts, connection means at each cross-point of the said matrix, a plurality of bin operating contacts of less number than the said cross-points and connected to the bin operating means, and a plurality of wires connecting the said connection means to the bin operating means.

3. A sorting device including, in combination with a sorting table,

timing means to physically separate a plurality of articles to be sorted and place the articles on the table in an ordered and timed sequence,

progressing means to receive the articles and physically move them along the table,

code reading means to pick up a code printed on the articles, which code is in the form of a line of bits of visible markings which are representative of language characters but are not themselves language characters,

wherein the said markings are physically contiguous to the characters represented by those markings, the said characters are visible and printed on the articles, the said code reading means is responsive to the code markings but not to the characters, and the line of markings is aligned in the direction of movement of the articles,

the said reading means consisting of a single reading head adapted to read each of said lines,

operating means responsive to the said code reading means, and

a plurality of bins each having a gate plate controlling the opening into its bin,

wherein the operating means moves a plate in response to the code on the article, and

wherein the bin operating means operates a series of cams each of which contacts one of the said plates and the said plates are arranged so that they normally contact each other near the end of the table, wherein an operating cam pushes the plates so that the sorted article falls from the table to between the selected plates and into the selected bin.

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