

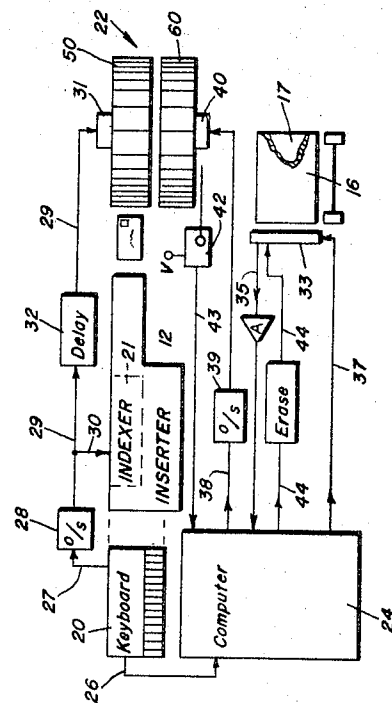
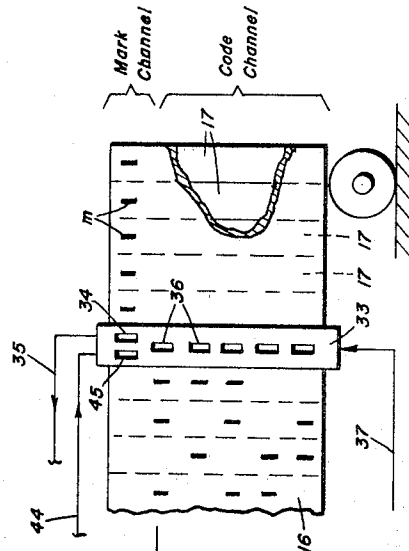
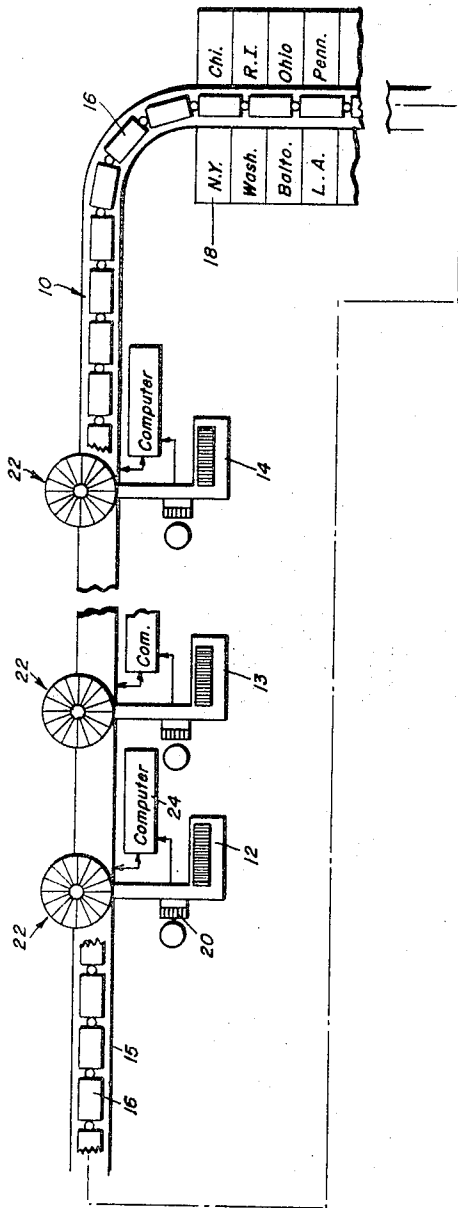
July 7, 1970

J. G. MACDONALD
SORTING APPARATUS

3,519,145

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3 Sheets-Sheet 1



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Fig. 4

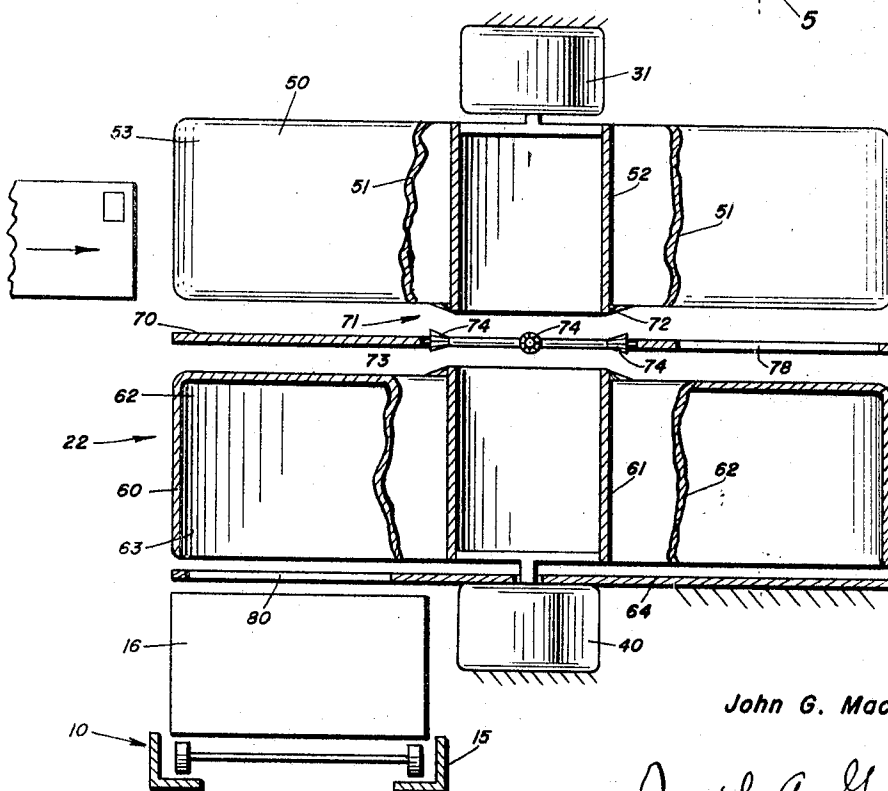
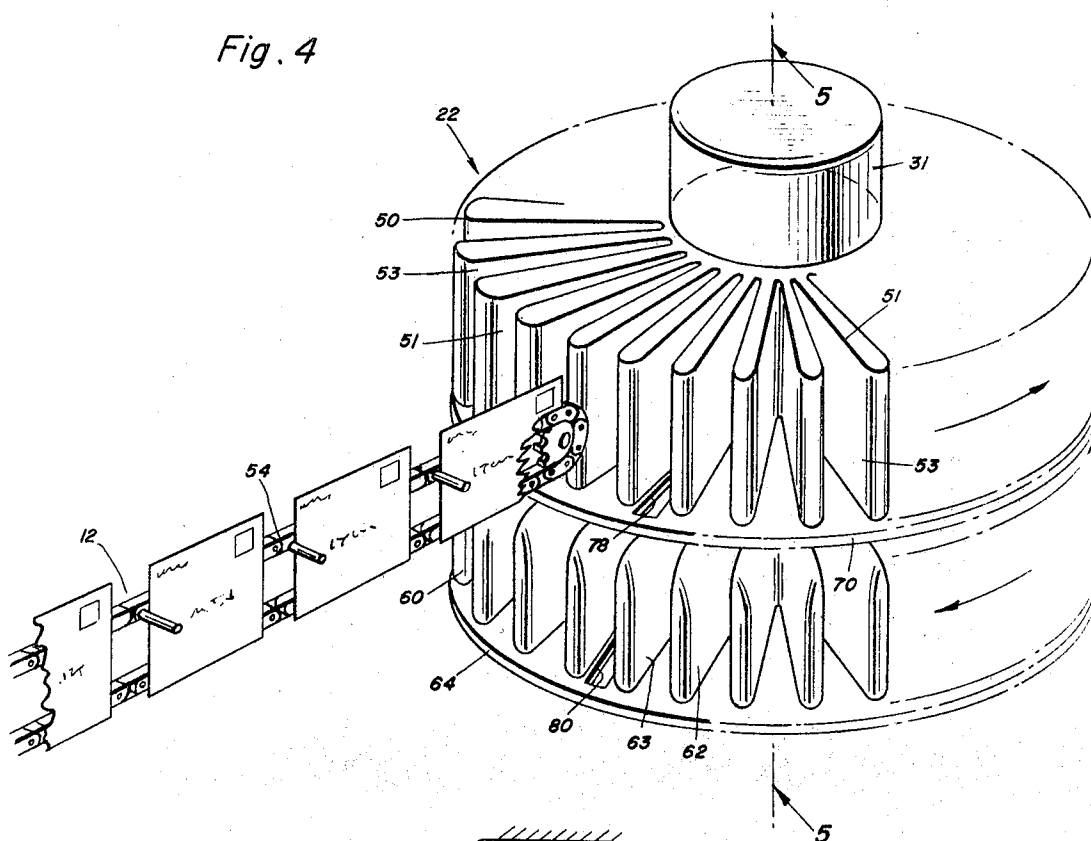


Fig. 5

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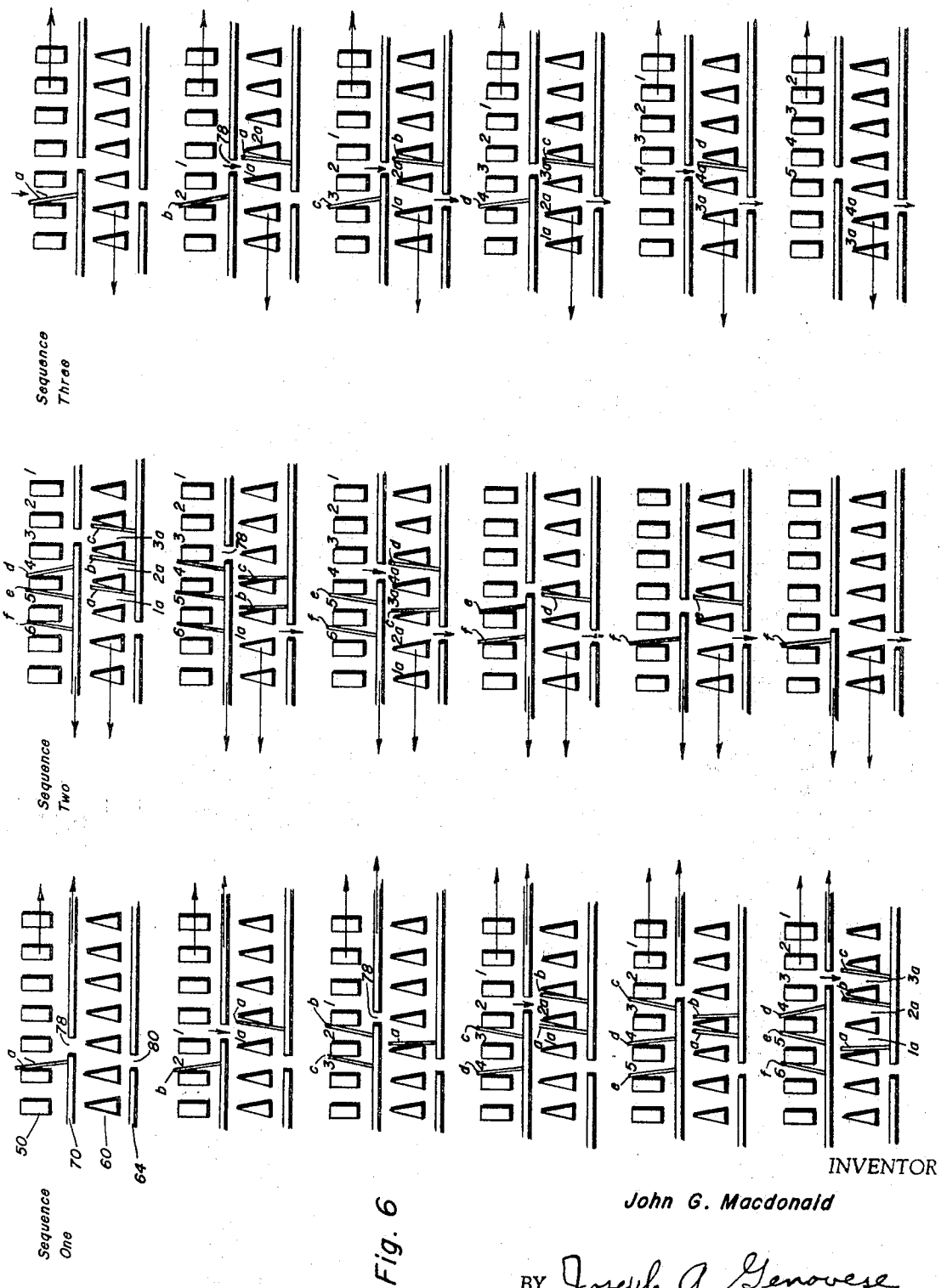
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3,519,145

SORTING APPARATUS

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9 Claims

ABSTRACT OF THE DISCLOSURE

An accumulator for temporary storage of articles fed by an asynchronous feeder to a fixed-speed sorting machine. The articles, for instance postal letters, are accumulated at the speed of the feeder and are discharged for acceptance by the sorting machine at a rate synchronized with the sorting machine. The accumulator accomplishes this with a first rotary compartmented member which is stepped at the rate of the feeder to accept articles, a second rotary compartmented member which is actuated upon article-requisition of the sorting machine and at the rate of the sorting machine, together with an article transfer mechanism between the members which preserves the receipt order of articles in the first member in transferring them to the second member. Preserving the receipt order enables the earliest articles entering the first member to be the earliest to be discharged by the second member of the accumulator.

The necessity for sorting articles, e.g. packages, punch cards, checks, letters, sheets of paper and others, has led to the development and use of numerous sorting machines. In many instances it is difficult to match the input of articles with the optimum speed of the sorting machine. One of the sorting tasks which best exemplifies this difficulty is postal letter sorting where a typical sorting machine used by the U.S. Post Office operates at a given speed, and a number of human operators working at their own rates actuate keyboard inserters for the same sorting machine.

Typically, an inserter presents successive letters to the view of an operator who reads the address of each and operates the keyboard as required to encode the address. The depression of the keys provides a numerical code which correspondingly encodes a pocket of the sorting machine, and the inserter directs the latter into the coded pocket of the machine. Operators can read and translate addresses at the rate of from two letters a second to one letter every two seconds. Accordingly, the operators of several inserters are always out of phase with each other and their inserters direct letters asynchronously relative to the sorting machine whose input must be at a fixed maximum design rate for efficient use of the machine. For a better understanding of such sorting machines attention is directed to Pats. Nos. 2,901,089 and 2,670,087 and 2,936,556. U.S. Pat. No. 3,071,261 discloses several inserters connected to a single speed sorting machine. U.S. Pat. No. 3,103,285 describes the very problems with which this invention is concerned, and such description is incorporated herein by reference.

In order to cope with the difficulty posed by one or more article inserters which are asynchronous with respect to a sorting machine whose design and/or reasonable efficiency demands synchronous, uninterrupted input, this invention provides an article accumulator interposed between an inserter and the sorting machine. The accumulator serves as a buffer whose article acceptance rate is slaved to (identical to) the rate of the inserter and whose discharge rate is synchronous with the sorting machine.

As mentioned before, the normal operation of an inserter entails the generation of a numerical code corresponding to the keys depressed by the operator, and that code is impressed upon the sorting machine for the pocket in which the inserted letter is deposited. With the interposition of an accumulator buffer, it becomes necessary (or at least desirable in the interest of simplicity) to enter the destination codes of the letters into a temporary storage, and to make certain that the order of the letters entering the accumulator is preserved. For example, the first letter entering the accumulator must be the first one discharged so that the destination code for that letter can be easily withdrawn from storage. Under these conditions the simplest of computers can be used to store the codes and to exercise various sorting system control functions described later.

An object of this invention is to provide an article accumulator having a first rotary compartmented member operable at a variable rate to accept articles in successive compartments, a second article compartmented member operable at a speed independent of the first member to discharge articles, and an article transfer mechanism between the two members which operates to transfer articles from the first to the second member in a manner such that the order of article acceptance by the first member is preserved. In other words the first article entering the first member is always the first to be discharged by the second members; the second article entering the first member is the second discharged from the second member; the third to enter is the third to be discharged; the fourth . . . etc.

Another object of the invention is to provide an uncomplicated means to synchronously interface the articles issuing from a variable speed article input device with a single speed sorting apparatus and to do so in a manner that enables the input device to operate at any speed but which discharges articles for the sorting apparatus at the design speed for article acceptance by the sorting apparatus whether or not that is slower or faster or the same as the speed of the input device.

A further object of the invention is to provide article accumulators interposed between an article sorting machine and the article input devices of the sorting machine, the accumulators accepting articles at the input devices rates and discharging them for the sorting machine upon demand of the machine.

Other objects and features will become apparent in following the description of the drawings.

FIG. 1 is a top schematic view showing a sorting machine system incorporating the invention.

FIG. 2 is a schematic view showing the electrical connections between the sorting machine and one of its article coding stations.

FIG. 3 is an enlarged schematic side view showing typical sorting conveyor cart magnetic coding.

FIG. 4 is a perspective view of the article accumulator of the invention.

FIG. 5 is an exploded sectional view taken on the line 5—5 of FIG. 4.

FIG. 6 is a diagrammatic view showing three sequences of operations of the article accumulator.

Background

FIG. 1 shows a sorting system having a sorting conveyor 10 with a plurality of inserters (feeders) 12, 13 . . . 14. For the purpose of explaining the invention, the sorting conveyor and the inserters are considered to be conventional. Accordingly, sorting conveyor 10 can, as in Pat. No. 2,901,089 be composed of track 15 supporting a series of connected carts 16. Each cart has a group of pockets 17 (FIG. 2) open at the top and closed by doors (not shown) at the bottom which are

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operable, as in the above patent, to discharge letters at the proper destination bins, sacks, etc. as at 18 in FIG. 1. The commands for opening the pocket doors at the proper times originate from the matching of magnetic, mechanical or other codes as is common in the letter sorting art. Inserters 12, 13, etc. are equally well known. A typical inserter (FIG. 2) presents letters to the view of an operator who encodes the address by depressing keys of keyboard 20. The address code is committed to memory from which it is impressed as a destination code on (or for) one of the pockets 17 of the sorting machine. Thereafter, the inserter discharges the letter, e.g. by an indexer 21, into the encoded pocket of the sorting machine. When that pocket reaches the coded destination, e.g. the New York bin 18, the code for that pocket matches the code for the New York bin, and through conventional means (not shown) this causes the door of the pocket to open allowing the letter to be deposited in the bin.

While the codes for the pockets 17 and destination bins 18 can be established mechanically as in Pat. No. 2,901,089, explanation is somewhat simplified by using magnetic coding for the conveyor system. Thus, the side of cart 16 (FIG. 3) is covered with magnetic material or a wide magnetic tape on which code and control signals can be recorded and read. In a conventional sorting system using magnetic codes, the destination code for each letter can be recorded on the magnetic material alongside of the pocket 17 which receives the letter for which the keyboard 20 was actuated to encode the cart and insert the letter into the sorting machine.

As explained before, it is impractical and/or inefficient to change the speed of sorting conveyor 10 to match the variable rates of inserters regardless of how they are operated, i.e. by human beings or by the output signals of magnetic or optical reading machines. It is evident that for maximum efficiency of the sorting system, sorting conveyor 10 must operate at a fixed, maximum design speed, and all of the pockets 17 must be used during the sorting operation.

Sorting system

To accomplish the above, the invention provides the sorting system with article accumulators 22 (FIG. 1) in the input path of letters between the inserters 12, 13, etc. and the sorting conveyor 10. The accumulators accept letters at the inserter rate which is variable, temporarily store them, and discharge the letters into conveyor 10 at the speed of the conveyor. In other words, the input rate of each accumulator is synchronized with its inserter regardless of its variable rate, but the output rate of the accumulator is synchronized with the sorting conveyor operating at a fixed speed. If not essential, in the interest of simplicity of the entire system the receipt order of letters by the accumulator is preserved in the sense that the first letter received is the first to be discharged, the second letter received by the accumulator is the second to be discharged, the third received is the third out, etc.

The sorting system (FIGS. 1-3) using accumulators 22 is constructed and operates as follows. Each inserter, e.g. inserter 12, operates in conjunction with a very simple digital computer 24 to store and transmit keyboard generated codes and to provide a few control signals. In practice a simple computer can service a number of inserters. Alternatively, the functions performed by computer 24 are so rudimentary that a special purpose controller can be used in its place.

When the inserter present a letter to the view of the operator, the operator translates the address to a code by depressing the keys of keyboard 20. The keyboard logic provides a numerical code which is conducted over line (or cable) 26 to the computer memory. The code may, for example, represent New York city. At the same time (or thereafter) the keyboard logic provides

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a "finish" signal on line 27 which fires one shot multi-vibrator 28 whose output is conducted over lines 29 and 30 to step or trigger indexer 21. The indexer ejects the New York letter into accumulator 22 (described in detail later), and the inserter is prepared to present the next letter to the view of the operator. As described later, the accumulator is stepped after receipt of the New York letter by the signal on line 29 being impressed on stepping motor 31 after a delay as at 32. Assume for the present that a quantity of letters is stored in accumulator 22 and that sorting conveyor 10 begins to request letters therefrom as follows.

Each cart 16 (FIG. 3) has an "empty pocket" magnetic mark channel with a magnetic code, e.g. bit *m*, recorded next to each empty pocket 17. As an empty pocket passes stationary magnetic head assembly 33 alongside of the moving carts, head 34 reads a bit *m* and provides a signal on line 35 which is amplified and conducted to computer 24 as a command to release a letter from accumulator 22. The command is issued from computer 24 as a signal on line 38 which fires one shot multi-vibrator 39 whose output is impressed on stepping motor 40 of accumulator 22. Motor 40, as described later, causes a letter to be discharged into the empty pocket 17 of conveyor 10. In keeping with the New York city example, assume that it is the previously mentioned New York city letter which is discharged from the accumulator 22.

As the letter passes from accumulator 22 to enter pocket 17, it operates switch 42 connected with a voltage source *v*, to provide a signal on line 43 to computer 24. A photocell and light source (not shown) can be used in place of switch 42. In either case the signal enables the computer to trigger erasure of bit *m* (because pocket 17 is accepting a letter, i.e. the accumulator had a letter available to discharge), and to record the destination code (New York city) in the code channels (FIG. 3) alongside of the pocket 17 receiving the New York letter. The erase signal for bit *m* is conducted from the computer over line 44 in which a broad band DC Erase circuit or the line is interposed. The erase signal on line 44 is impressed on head 45 of head assembly 33. The New York city code is conducted from the internal or external memory of the computer 22 over code-record cable 37 whose wires are connected to heads 36 or head assembly 33.

Upon detection of the next empty pocket 17 the above letter discharging, bit *m* erasing, and code recording cycle is repeated. It is understood that each destination bin 18 will have an associated magnetic read head for the cart code channels, and when the code on the cart, e.g. New York, matches a fixed (stored) code (New York in the example) the door for the New York coded pocket 17 is caused to open thereby releasing the letter for the New York bin 18. At a location ahead of the inserters 12, 13, etc., a magnetic record head re-records the "empty pocket" bits *m* in the mark channel (FIG. 3). Code storing, matching and recording are so well known that further detail is unnecessary.

Accumulator

Attention is directed to FIGS. 4 and 5 showing the construction of accumulator 22 and its relationships to inserter 12 (FIG. 4) and to sorting conveyor 10 (FIG. 5). Accumulator 22 is composed of a first rotary member 50 provided with radial dividers 51 extending from hub 52. The radial dividers define peripherally-opening radial compartments 53. Inserter 12 (FIG. 4) is represented by a pin conveyor 54 which is indexed (by indexer 21, FIG. 2) on command, a distance sufficient to propel letters into the individual compartments 53. The shaft of stepping motor 31 is attached to hub 52. As explained before, stepping motor 31 is actuated after receipt of each letter to step member 50 and align the next empty compartment with the inserter. Obviously

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index or stepping motor 31 can be replaced with a mechanism, e.g. a Geneva, or an electro-mechanical indexer of another type.

Accumulator 22 has a second rotary member 60 having a central hub 61 from which radial dividers 62 extend to define radial compartments 63 having open tops and open bottoms. Stepping motor 40 or the equivalent, is fixed to a stationary plate 64 which forms the bottom closure for compartments 63, and the shaft of motor 40 is attached to hub 61. Thus, when motor 40 is actuated, member 60 is stepped while plate 64 remains fixed.

A letter transfer mechanism is interposed between members 50 and 60 when they are assembled coaxially, e.g. with a pilot bearing (not shown) within hubs 52 and 61. The transfer mechanism consists of a circular plate 70 which forms the bottom closure for compartments 53. Although shown flat, plate 70 may have annular ribs on which the lower edges of letters in compartments 53 more easily slide.

Plate 70 is coupled with both compartmented members 50 and 60 by a planetary gear train 71 to cause plate 70 to move in a specific manner in response to rotary movements of either and/or both of the compartmented members. The specific movements of the letter transfer mechanism are described in connection with FIG. 6. The illustrated planetary gearing 71 consists of ring gears 72 and 73 attached to hubs 52 and 61, together with pinions 74 mounted on spindles which are secured to the central apertured portion of plate 70. When assembled (the accumulator 22 is shown as an exploded view in FIG. 5), pinions 74 are meshed with ring gears 72 and 73.

The arrows (FIG. 4) show that member 50 is stepped counterclockwise and member 60 is stepped clockwise by their respective stepping motors. Thus, if member 50 is stepped counterclockwise while member 60 is stationary, planetary gearing 71 will cause the article transfer plate 70 to step counterclockwise through one-half the angle of member 50. This is shown as Sequence One in FIG. 6. The transfer plate 70 will step through one-half the angle and in the direction of member 60 when member 50 is held stationary (Sequence Two) and member 60 stepped. When both members are stepped in opposite directions through equal angles (Sequence Three), gearing 71 will require transfer plate 70 to remain stationary. The magnitude of the angles through which members 50 and 60 are stepped will depend upon the number of compartments in each member.

The transfer plate 70 has an opening 78 dimensioned in relation to the width of compartments 51 and 62 as shown in FIGS. 5 and 6. Opening 78, as fully described later, communicates compartments 51 with compartments 62 to allow letters to be transferred from member 50 to member 60. Plate 64 has an opening 80 located above pockets 17 of carts 16 as they move beneath accumulator 22. Thus opening 80 is a discharge opening for the passage of letters from compartments 62 into pockets 17 when member 60 is stepped by motor 40. As indicated before, motor 40 is stepped upon command (FIG. 2) originating from a detected empty pocket bit *m* via computer 24.

Attention is now directed to FIG. 6 Sequence One, which depicts the operation of accumulator 22 when inserter 12 directs letters into the accumulator, and there is no requirement (no empty pockets 17 passing beneath opening 80 of FIG. 5) for discharging letters into sorting conveyor 10. Examining Sequence One from the top, there are six separate figures depicted. In the first figure letter *a* has been inserted into compartment 1 (one of compartments 51) of member 50 by inserter 12, and the number 50 and transfer mechanism plate 70 (note opening 78) are about to step in the direction of the arrows. Since member 60 does not move, stepping motor 31 steps member 50 (say 10 degrees ccw.) and the differential gearing 71 causes member 50 to step transfer plate 5

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degrees ccw. This positions opening 78 directly above compartment 1*a* (one of the compartments 63) of member 60 and allows letter *a* to drop into it as shown in the second figure of Sequence One. Letter *b* can be and is inserted by inserter 12 into compartment 2 of member 50.

Again, member 50 is stepped (10 degrees ccw.) and this movement rotates transfer plate 5 degrees ccw. to the positions shown in FIG. 3 of Sequence One. No letter is transferred between members because opening 78 has not yet moved far enough. The next letter *c* enters compartment 3 of member 50, and again member 50 is indexed 10 degrees ccw. and transfer plate 5 degrees ccw. to reach the relative positions in FIG. 4 of Sequence One. In so doing letter *b* enters compartment 2*a* of member 60 (through opening 78) and letter *d* is inserted into compartment 4 of member 50 by inserter 12.

The above procedure continues as is now evident and further shown in FIGS. 5 and 6 of Sequence One. Note, however, that the order of receipt of letters *a*, *b*, *c*, *d*, *e*, and *f* is preserved in the compartments 1*a*, 2*a*, 3*a*, etc. of member 60 referenced from the right of discharge opening 80. This is correct because member 60 indexes clockwise to discharge letters from the accumulator.

Attention is now directed to the six successive figures of Sequence Two. The operation depicted is the unloading of accumulator 22 while the inserter 12 is idle. For example, assume that six empty pockets 17 of a cart pass under accumulator 22 (letters are demanded) during a period that the operator of inserter 12 is idle (or an automatic letter-address reading machine is rejecting letters as unreadable by the reader which is not shown herein). For simplicity and continuity the top figure of Sequence Two is the same as the lowest figure of Sequence One but the operational requirement is different.

Upon command (a signal on line 38 of FIG. 2), member 60 is stepped (again say 10 degrees) clockwise which moves compartment 1*a* of member 60 over opening 80 in plate 64. Thus letter *a* drops into the empty compartment 17 beneath opening 80. In addition, transfer plate 70 is stepped 5 degrees clockwise by differential gearing 71 because member 50 remains stationary. Since plate 70 has moved only 5 degrees, opening 78 in plate 70 will move only half way between compartments 3 and 4 of member 50. See FIG. 2 of Sequence Two.

When the sorting conveyor 10 demands another letter (FIG. 3 of Sequence Two), member 60 is stepped 10 degrees clockwise, allowing letter *b* to drop from compartment 2*a* through opening 80. Also, gearing 71 causes transfer plate 70 to step 5 degrees clockwise thereby positioning opening 78 so that it registers compartment 4 of member 50 with compartment 4*a* of member 60. Thus, letter *d* drops into compartment 4*a* which is directly behind letter *c* in compartment 3*a* of member 60. From this explanation, continued operation to the end of Sequence Two is understandable.

The only other possible operations of accumulator 22 are shown in Sequence Three. Consider the worst case, i.e. with accumulator 22 empty and letters being inserted into member 50 while letters are being demanded from accumulator 22 by sorting conveyor 10. Under this condition, letter *a* is inserted by inserter 12 into compartment 1 of member 50 which is stepped 10 degrees ccw. by a signal on line 29 (FIG. 2). Member 60 is stepped 10 degrees clockwise by a signal on line 38. Transfer plate 70 remains stationary because the differential gearing algebraically adds the equal and opposite 10 degree components, meaning that transfer plate 70 does step.

Accordingly letter *a* is inserted into a compartment of member 50 (Sequence Three) and member 50 is stepped 10 degrees ccw. Member 60 is stepped 10 degrees clockwise but there is no letter in member 60 to be discharged into conveyor 10. Therefore, the empty pocket 17 which originated the letter demand will remain empty as it passes beneath the accumulator 22 associated with inserter 12 (see FIG. 1). An identical letter demand will be

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made at inserter 13 as the same empty pocket passes the next inserter 13, and if necessary a similar demand will be made at inserter 14, and the next inserter, etc. Accordingly, after member 50 and 60 have been stepped (top figure of Sequence Three) assume that another letter is inserted by inserter 12 and sorting conveyor 10 demands a letter from accumulator 22 via the circuits described before.

Letter *b* (FIG. 2 of Sequence Three) enters compartment 2 of member 50 and that member is stepped 10 degrees ccw. Member 60 is stepped 10 degrees clockwise. This aligns compartment 1 with opening 78 in plate 70 causing letter *a* to enter compartment 1*a* of member 60. Again there is no letter to be discharged from member 60 into conveyor 10. As described above, the empty pocket of conveyor 10 for which the letter demand was made will initiate an identical demand at the subsequent inserter stations along the conveyor. If an occasional pocket 17 remains empty throughout the conveyor cycle there are no dire results. However, if the empty pocket frequency is too high, this is an indication that either the operators are ineffectual at their inserter stations or an additional inserter-accumulator assembly should be added to the conveyor system.

Returning to Sequence Three, FIG. 3, letter *c* is inserted into compartment 3 of member 50. When member 50 is stepped 10 degrees ccw., letter *b* drops through opening 78 into compartment 2*a*. Owing to the stepping of member 60 clockwise, letter *a* in compartment 1*a* is discharged through opening 80 into a pocket of conveyor 10. Upon insertion of letter *d* into compartment 4 of member 50 and further demand of a letter by conveyor 10 (FIG. 4) member 50 steps ccw. to drop letter *c* into compartment 3*a* of member 60, and the stepping of member 60 10 degrees clockwise causing letter *b* to pass through opening 80 and enter conveyor 10.

The lowermost two illustrations of Sequence Three pertain to demands for letters by sorting conveyor 10 while the inserter has no letters to insert but the index signal for member 50 is given. In a practical case this can happen if the operator depresses the "finish" key on the keyboard 20 with no letter to be inserted (or the "finish" signal for indexer 21 or a similar signal from an automatic reader is given with no letter being inserted). What happens (FIG. 5) is that the stepping of member 50 causes letter *d* to drop from its compartment 4 into compartment 4*a* of member 60 through opening 78. The stepping of member 60 clockwise drops letter *c* into conveyor 10 through opening 80. Upon the next set of command signals, member 50 steps without transferring a letter into member 60 (there are none to transfer). The letter *d* is discharged through opening 80 from compartment 4*a* and enters an empty pocket 17 of conveyor 10. Further sets of command signals cannot be satisfied until additional letters are inserted into accumulator 22. As before, the demand for letters is renewed at subsequent inserter stations 13, 14, etc.

In the operations depicted in Sequence Three plate 70 occupies the same position before and after the stepping of members 50 and 60. These members step in opposite directions, and the question of timing can be entertained in the sense that a letter must not strike the top of dividers 62 and be caught between members 50 and 60 as the letter enters the lower member 60. By slanting the sides of the dividers 62 from a line apex (shown in FIGS. 4 and 6) the likelihood of a letter becoming bound as it enters member 60, is negligible. While unnecessary, it is well within the art to slightly delay the stepping of either member 50 or 60 (e.g. delay 32 of FIG. 2 will suffice) to assure that the transfer of letters between members 50 and 60 will not be impaired by a letter striking the top of a compartment divider 62.

In a few instances reference was made herein to the use of a reading machine, e.g. an optical character reader such as disclosed in Rabinow et al. Pat. No. 3,104,069,

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to replace the human operator and the keyboard controlled inserter 12. Matching speeds of a reading machine with a sorting conveyor produces the same problems as matching inserter 12 (human operator) with the conveyor. While a reading machine can be slaved to a sorting conveyor, the irregularity in rejecting letters as non-machine readable, makes accumulator 22 a desirable adjunct in such a sorting system.

It is understood that numerous other modifications and changes may be made while remaining within the scope of the following claims.

What is claimed is:

1. In an article handling system including a sorting apparatus operable at a predetermined speed and having an asynchronous input device for the articles to be sorted, the improvement comprising an article accumulator operable as a buffer between the sorting apparatus and said input device, said accumulator including a first movable article storage member adapted to accept individual articles from said device at the speed of said input device, a second movable storage member vertically spaced below said first movable storage member, means for transferring articles from said first member to said second member in the order of receipt of article by said first member, said transferring means including a substantially horizontal movable article transfer element between said first and said second storage members, drive means for said transfer element, and said first and said second members providing mechanical inputs to move said transfer element, and means synchronous with said sorting apparatus for discharging articles from said second storage member into said sorting apparatus.

2. The subject matter of claim 1 wherein said first storage member is movable and compartmented, and means responsive to actuation of said input device for moving said compartmented member in coordination with said input device in a manner such that the articles are accepted by successive compartments of said member.

3. The subject matter of claim 2 wherein said second storage member is movable and compartmented, and said article transferring means are operable between said member in a manner to unload the earliest filled compartments of said first member into the earliest to empty compartments of said second member.

4. In an article handling system including a sorting apparatus operable at a predetermined speed, and an inserter which inserts articles for said apparatus at selected speeds with respect to the sorting apparatus, an accumulator operable between the inserter and sorting apparatus to accept articles at the rate of the inserter and to discharge said articles synchronously with respect to the speed of said sorting apparatus, said accumulator comprising a first movable member having a plurality of article compartments, means for moving said first member synchronously with said inserter in a manner to register successive compartments with the discharge of articles from said inserter upon actuation of the latter, a second movable member having compartments, means for moving said second member synchronously with and on demand of said sorting apparatus, a member forming the bottoms of the compartments of said second member and having a discharge opening through which the compartment which is aligned with the opening upon movement of the second member discharges its article therefrom, and substantially horizontally movable means actuated concurrently with the movements of said first and second members for transferring articles from the first member in the order of receipt thereof by said first member to said second member compartments in an order which the earliest article to enter the second member is the earliest to be discharged therefrom through said opening.

5. The subject matter of claim 4 including means mechanically coupling said element to both of said members in a manner such that said members provide mechanical inputs to said element tending to move said element.

6. The subject matter of claim 5 wherein said members are constrained to rotary motion in opposite directions, and said coupling means consist of a planetary drive whereby said transfer element remains stationary when both members move, and said element moves in response to rotary motion of either of said compartmented members.

7. A sorting system to distribute articles to predetermined destinations, comprising a sorting conveyor having a plurality of article pockets constrained to move in a predetermined path along which said destinations are located, a plurality of article inserters adapted to insert articles into said pockets as they move in said constrained path, coding means to associate a destination code for each inserted article with the pocket receiving the article, an article accumulator operable to buffer articles issuing from a said inserter for said pockets, said accumulator having first movable means to accept and store articles at a rate comparable with said inserter, and second movable means vertically spaced below said first movable to accept articles from said first means and to store said articles and to discharge said articles for said pockets at a rate compatible with the speed of said conveyor and which is independent of the rate of article acceptance by said first means, and a substantially horizontally movable article transfer mechanism with means responsive to movement of at least one of said first or second means for transferring articles from said first means to said second means in a manner such that the receipt order of articles by said first means is preserved and the earliest article entering said first means is the first to be discharged from said second means and subsequently to a pocket of said sorting conveyor.

8. The subject matter of claim 7 wherein said first means are movable in a first direction and said second means are movable in a second direction, and said article transfer mechanism includes a differential mechanical motion means coupled to said first and said second means whereby both the direction and magnitude of movement of said transfer mechanism corresponds to the direction and magnitude of movement of said first and said second means.

9. The subject matter of claim 7 wherein the codes provided by said coding means are temporarily stored when articles are inserted into said accumulator, means associated with said conveyor for signaling that a pocket thereof is empty, and means responsive to said signaling for causing an article to be discharged from said accumulator into said empty pocket and for withdrawing its associated code from storage to be related to the last-mentioned pocket.

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