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[54] **AIRLINE BAGGAGE TRANSFER SYSTEM AND METHOD**

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[52] **U.S. Cl.** ........................................**209/74 M,** 209/111.7
[51] **Int. Cl.** ........................................................**B07c 5/34**
[58] **Field of Search** ..................209/111.7, 111.5, 111.6, 75, 209/DIG. 1, 74 R, 74 M

[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,511,372 | 5/1970 | Kantarian et al. | 209/111.5 |
| 3,414,731 | 12/1968 | Sperry | 209/111.7 X |
| 3,446,351 | 5/1969 | Born | 209/111.7 |
| 3,438,489 | 4/1969 | Cambornac et al. | 209/111.5 |
| 3,520,406 | 7/1970 | Turner | 209/111.5 |
| 3,557,949 | 1/1971 | Washington | 209/111.7 |

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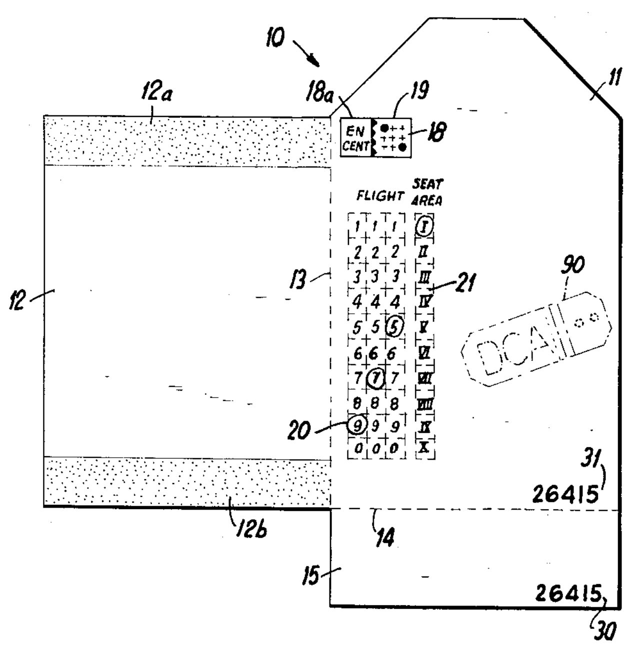
[57] **ABSTRACT**

A system is provided for the handling of baggage onto and from airplanes. The system relies upon a baggage tag and a baggage label, both of which are particularly arranged to present the same information in the form of code and are attached to the same piece of baggage. A series of optical readers read the tag and label and communicate the information to a data processing controller which compares the information and controls the baggage gates.

**9 Claims, 6 Drawing Figures**



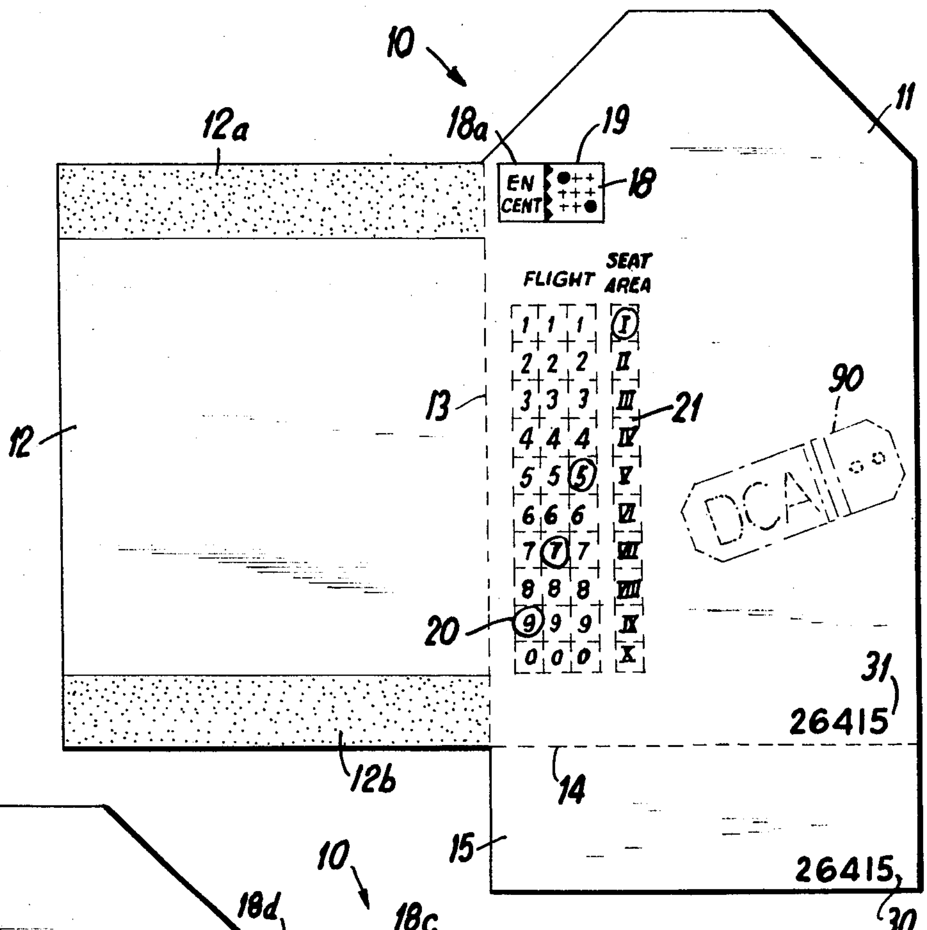



FIG.1

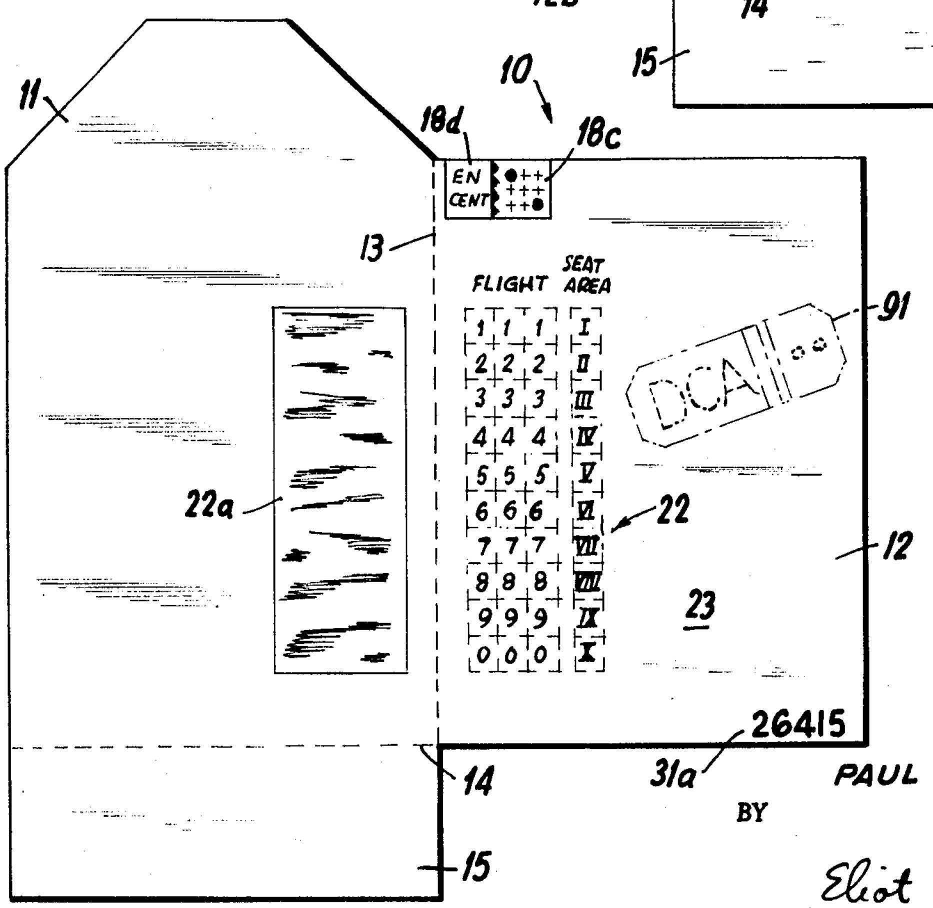



FIG.2

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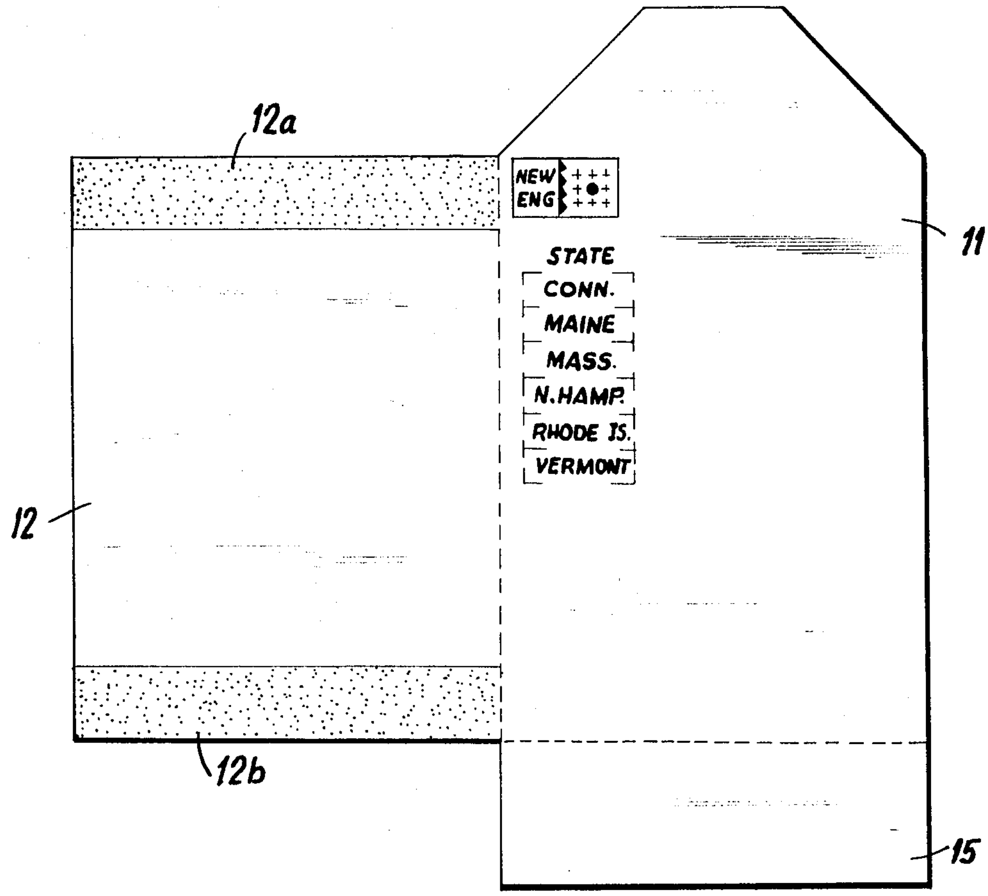


FIG.3

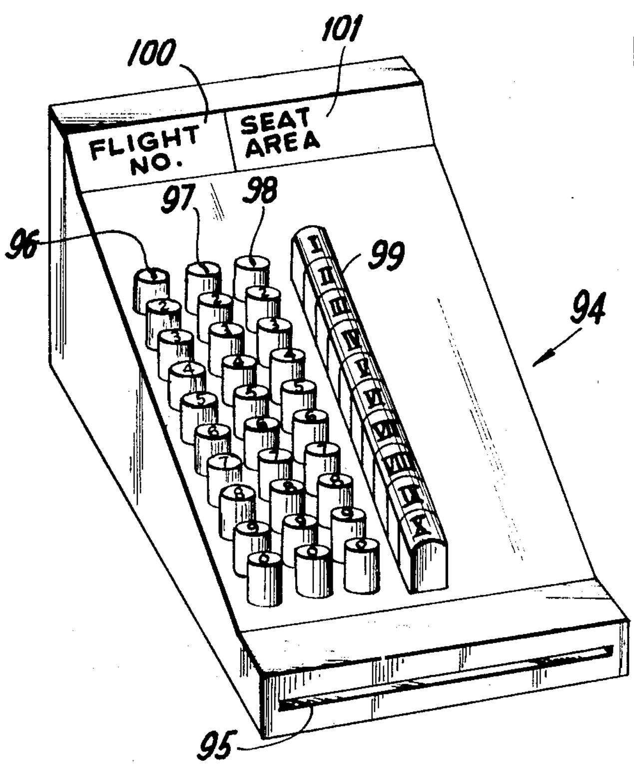


FIG.6

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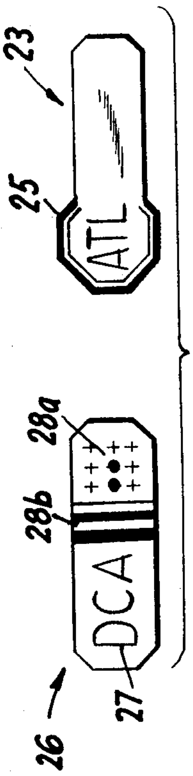


FIG. 4

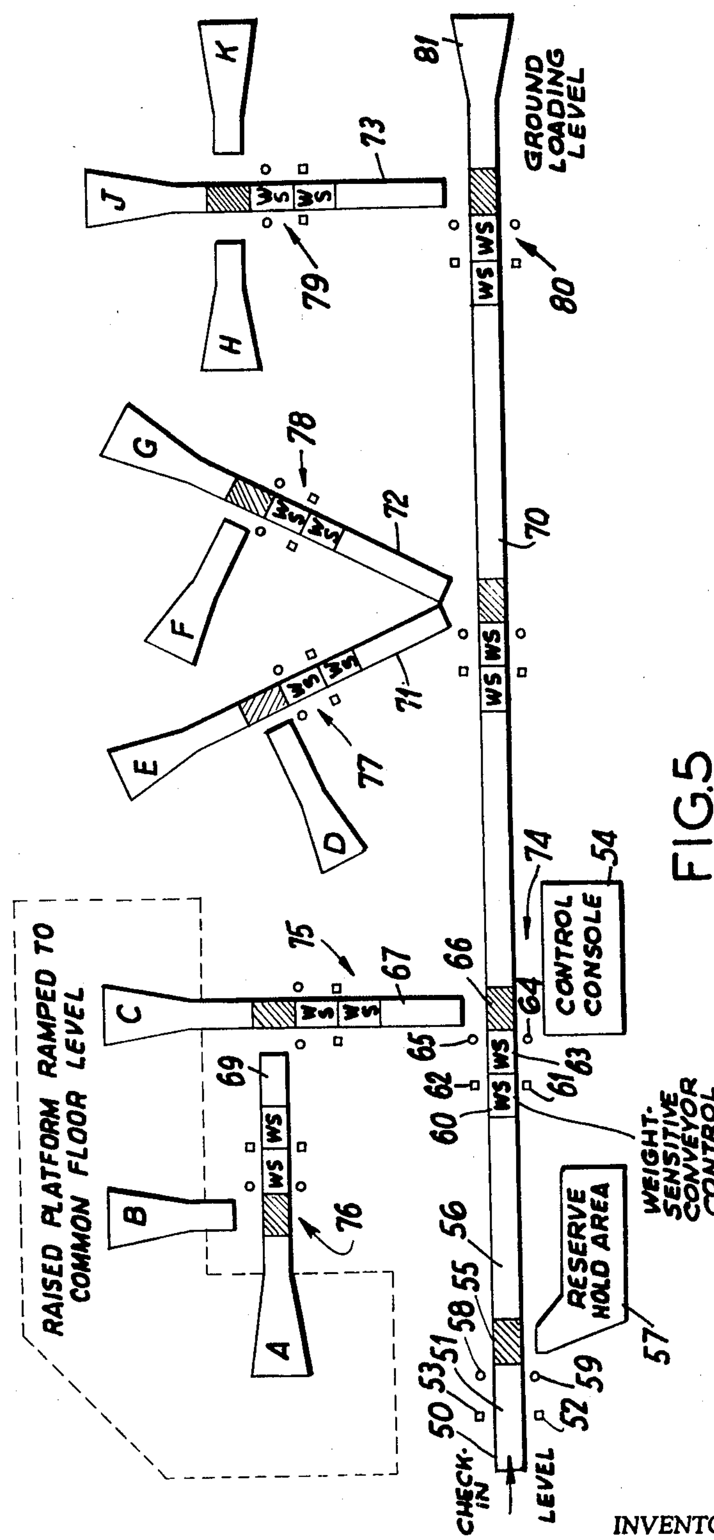


FIG. 5

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AIRLINE BAGGAGE TRANSFER SYSTEM AND METHOD

DISCLOSURE

The present invention relates to material handling systems and more particularly to an airline baggage handling system and baggage identification tags.

At the present time one of the major problems of the airlines is the handling of baggage. Few things are more likely to exasperate a passenger than to arrive at his destination without his baggage. With many airlines flying duplicate or alternative competitive routes, a lost piece of baggage, for the guilty airline, may mean a lost customer.

This problem has been recognized and many domestic airlines subscribe to a system which seeks to match misplaced baggage with its owners. When a passenger reports lost baggage, or when stray or unclaimed baggage shows up at a terminal, its description is teletyped to a control location at which a computer attempts to match descriptions. However, even if the baggage is located, it must be delivered personally to the passenger, not to the terminal. That entire procedure is costly and often means that the baggage is delivered only when the passenger returns home. If the baggage is lost, its value must be paid for and the passengers may claim that it's always the lost suitcases which contain the more expensive clothes.

The errors which occur in the present system seem to arise from many sources. Ticket clerks, counter clerks, curb-side baggage handlers, and other airline personnel who originally ticket the baggage (choose or mark the tags attached to the baggage) are frequently rushed, particularly neat to flight time. They ticket the baggage incorrectly (incorrect tagging) so that it goes to an incorrect destination or is placed on an incorrect flight. Other errors arise from mistakes made by personnel in the baggage loading area, and at interconnecting points. For example, at an interconnection point a valise may be misdirected to the wrong city. Sometimes the problem arises from tags which become lost, either because they are incorrectly secured or are pulled off in the handling of the baggage.

The recent and promised introduction of larger jet airplanes, such as the Boeing 747, Lockheed 1011, McDonnel-Douglas DC–10, and the European Air Bus, will add to the existing problem. To quickly load or unload the baggage for hundreds of passengers, and to insure that passengers and baggage are correctly matched, will become an increasing burden for the airlines.

It is an objective of the present invention to provide an airline baggage handling system which reduces to a minimum the problem of lost or misdirected baggage, by delivering a passenger's baggage to the same terminal, and at the same time, as the arrival of the passenger.

It is a further objective of the invention to minimize the possibility of human error, either at the baggage arrival location (curb-side or check-in counter) or in the loading area, or at the arrival terminal.

It is also an objective of the present invention to provide such a system in which present personnel may quickly and thoroughly be retrained in its use.

It is a still further objective to provide that the control over the baggage be centralized, preferably using a data processing computer, to eliminate diffused authority and responsibility.

It is a still further objective to provide inherent safeguards against misdirected baggage.

It is a further objective of the present invention to reduce or eliminate the need to sort baggage by hand by its destination or flight.

Other objectives of the present invention will be apparent from the following detailed description giving the inventor's best mode of practicing the invention, the description being taken in conjunction with the accompanying drawing. In the drawing:

FIG. 1 is a top plan view of the front side of a combined tag and label;

FIG. 2 is a top plan of the back side of the tag and label of FIG. 1;

FIG. 3 is a top plan view of an alternative tag and label;

FIG. 4 is a top plan view of two small self-adhesive labels;

FIG. 5 is a schematic of the system according to the present invention; and

FIG. 6 is a perspective view of a marking device for use in the system of the present invention.

The overall system and method of the present invention utilizes a particular means to identify baggage and a specially designed system to use that identification means. The identification means, attached to each piece of baggage, consists of a precoded tag, a large precoded adhesive label, and small precoded labels adapted to be gummed onto the tag and label. The system includes a series of conveyor means (belts, rollers, etc.), a number of optical scanning devices, a control console which is a data processing system (a small computer having logic and memory functions), a weight-sensitive system, and controlled baggage transfer mechanisms.

FIG. 1 shows an example of a preferred combined baggage tag and label **10**. The baggage tag **11** is shown at the right side of FIG. 1 and the label **12** is shown at the left-hand side. The baggage tag and label **10** is printed as a single unit with perforations **13** to aid in their detachment. A second set of perforations **14** aids in detaching the stub **15** which is given to the passenger. The entire tag and label **10** is color coded. For example, the nine domestic regions of the country are each given a separate color. The same nine colors are used for the 10 international areas, except that the borders would have black cross-space borders. The 10th color with the black cross-space border would be unique to a single international area. The tag **11** may be designed either to show the geographic destination, that is, the state if the flight is domestic, as shown in FIG. 3, or the country if it is international, or alternatively to show the flight number designation, as shown in FIGS. 1 and 2. The tag, in the area **21**, has a series of numbered squares arranged in rows and columns. The first three columns provide a three-digit flight number in Arabic numerals. The fourth column provides a "seat area" designated by Roman numerals I–X, and may be used for the wide body jets, such as the Boeing 747 or the Air Bus. As shown in FIGS. 1 and 2 the flight is "975" and the seating area is "I."

A set of dots **18** and triangular-shaped areas, or other coding means, is positioned in the upper left-hand corner of the tag **11**. The code provides the same information as the color, that is, the domestic or international area of the destination, but in a form which is able to be read by an electronic optical reading device (optical scanner). The code **18** is next to the name **18*a*** of the area in letters. The particular code and particular code guides are such that the position of the box **19** within which the code appears, whether the tag is slanted or even upside down, would not have any effect on the correct reading of the code by the optical reading device.

The tag shown in FIG. 3 has the states listed for a particular domestic area. The domestic area is New England for the states shown in FIG. 3, namely, the states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

The ticket agent or other baggage handling personnel who first receive the passenger's baggage will mark the tag **11** by circling the numbers for flight, as shown in FIG. 1, or by circling the correct state, as shown in the example of FIG. 3. The marking, a typical marking shown at **20** of FIG. 1, alternatively made be made by a machine, described below, or alternatively by a No. 2 or softer pencil.

The label **12** is normally folded so that it is behind the tag **11**. A duplicating means **22*a*** is placed between the tag **11** and the label **12** so that marks made on flight numbers **21** will appear in the same position on the label. Such duplicating means may be a carbon-black strip on the rear of the tag **11**, as shown in FIG. 2 as area **22*a***, or carbonless reproducing material such as "NCR" of National Cash Register on the surface **23** of the label, that is, on the surface as shown in FIG. 2. The marking need not be exact, as the optical reading device does not read the actual printed information within the box (the flight number or the state) but rather only reads the relative position of the marking on the tag and label. The label 12 has a self-adhesive (self-gumming) material on one of its sides, namely, the side which faces upward in FIG. 1, shown by the adhesive strips 12*a* and 12*b*. That surface 23 may be temporarily covered by a paper or plastic sheet, if necessary, to separate one label from another during storage.

A set of separate small gummed labels are shown in FIG. 4. A first of these is label 12, which designates an interline destination point. Label 23, at its left, designates an airport in letters and in code lines 25 and at its right side has an open space in which the check-in personnel will write the interline carrier and flight number. The code 25 (shown as shaped darkened lines of different width) is identifiable as an interline destination point, and not for any other information. Preferably the interline destination point labels 23 are in a distinctive color, for example, red.

The originating carrier destination is identified by a separate label 26 which is in a different color, for example, blue. The destination label 26, at its left side, has the final airport to which the baggage should be sent in alphabetical letters 27 and at its right side has the same designation in a code 28*a* in dots. The code 28*a* designates the particular destination, i.e., airport, or a particular baggage area in an airport. Code 28*b* (shown in vertical darkened lines of different widths) is a code guide which instructs the data processing controller to (1) always read to the right of this code guide for destination designation, and (2) identifies area designation. Both codes 28*a* and 28*b* are readable regardless of the position of the label by the optical reading device.

Both the labels 23 and 26 are self-gumming labels which may be positioned anywhere on the baggage tag and the baggage label, for example, positions 90 (on tag 11 in FIG. 1) and 91 (on label 12 in FIG. 2) shown by dot-dash lines. One of the small tags 23 or both small tags 23 and 26 are placed on the baggage tag 11 and a duplicate of the small tags 23 or duplicates of both small tags 23 and 26 are placed on the baggage label 12. The baggage tag is then slipped on or tied to the baggage handle or other appropriate place on the baggage. The pressure-sensitive adhesive label is adhered to the side of the baggage and the stub 15 is given to the passenger. The stub has a number 30 which corresponds to the same numbers 31 and 31*a* on the tag and on the label 12, see FIGS. 1 and 2.

A suitable marking device 94 for the marking of the tags and labels is shown in FIG. 6. The marking device 94 prints a circle around the selected numbers or state on the tag 11 with sufficient force so that the same circle appears on the label 12 by means of the duplicating means, such as the carbon area. The label and tag are folded along line 13 before inserting them in the slot 95. The marking device 94 has three columns of buttons marked with Arabic numbers 96, 97 and 98 and a column of buttons marked with Roman numbers 99. The columns 96, 97 and 98 give the flight number and the column 99 gives the seating area in a wide body jet. Each of the numbers becomes lit upon being depressed, providing for the self-checking of the correct entry of the flight number and seating area. The device 94 has space 100 for the flight number to be removably marked thereon and a space 101 for removably marking the seat area. Instead of circles, the marking device 94 may provide other code indications, for example, the blackening of small square, triangular, circular or other shaped areas, the punching of holes of various shapes or the printing of colored or reflective markings.

The baggage handling system is shown in FIG. 5. The entry 50 is at the check-in level and may be a collection area directly behind the check-in counter. The parallel lines (and throughout FIG. 5) indicate a conveyor means 51 for the movement of baggage. Such conveyor means may be an inclined series of free-running rollers in tandem, a driven series of rollers in tandem, a conveyor belt, or other suitable conveyor means.

Two optical scanning devices 52 and 53 are positioned next to the conveyor means 51, one on either side. The optical scanning device is a transducer which observes the code markings (the dots and triangles) on the tag and label and converts those markings into electrical signals.

A suitable optical reading device may be constructed similar to the "WABCO" railroad car reading device of Westinghouse Air Brake Company, Pittsburg, Penna. That device uses a coherent beam of light produced by a laser to scan the area, obtaining a 50-foot depth of field. The light is reflected by the code, a series of darkened bars alternating with white bars on a strip adhered to the railroad box cars. The reflected light is detected by a sensor (such as a phototransistor), the signal amplified and fed to suitable solid state circuits to eliminate noise and spurious signals. Although probably not necessary to increase reflectivity, the dots and triangles, or other code markings on the tag and label, may be printed with microscopic glass beads to aid in reflectivity. The optical scanners 52 and 53 are connected by wires (not shown) to a central control console 54, which includes a data processing system, preferably a "mini" digital computer. The computer controls the baggage transfer device 55, which may be a rotary (turntable) transport which takes baggage one piece at a time and conveys it in one of several selected directions. The rotary transport 55 directs the baggage either to a second conveyor means 56 or to a reserve hold area 57. To correctly time the rotary transport, a pair of photoresponsive devices 58, 59, consisting of a light source and a light responsive device, such as a phototransistor, is used. The device 58, 59 is triggered by the passage of a bag.

The reserve hold area 57 is used for baggage which is for flights which will depart at some later time. For example, if the baggage is delivered on a flight for departure the next day, it will be held at the reserve hold area until the time when baggage is being collected for that flight. The control console 54 will control the rotary transport 55 to pass the bag to the reserve hold area 57 if the flight number is listed (in the memory of the control console) as being later in the day or during the next day. The baggage forwarded by the rotary transport 55 to the conveyor section 56 is taken to a first weight-sensitive conveyor control 60. The baggage will then pass before another pair of optical reading devices 61 and 62 to a second weight-sensitive conveyor control 63 and before a second pair of photoresponsive devices 64 and 65. The weight-sensitive conveyor controls 60 and 63 insure that only one piece of baggage at a time enters the rotary transport 66. Each weight-sensitive conveyor section 60 and 63 continues to operate, that is, permit the baggage to roll forward until a piece of baggage occupies that section. Then that particular section ceases the forward motion of the baggage. The next weight-sensitive conveyor section meanwhile continues to operate until it also holds a piece of baggage. Then it, too, stops its forward motion. In this way the rotary transport 66 receives only one bag at a time from the conveyor system. The section 60 controls the conveyor belt 56. The weight-sensitive conveyor controls 60 and 63, in effect, provide a buffer system which enables the conveyor to operate almost continuously while the rotary transport is in motion, that is, while it is dispatching bags to one of its several directions. The rotary transport 66 conveys bags to either the conveyor section 67 or the conveyor section 68. These conveyor sections, along with similar sections 69, 70, 71, 72 and 73, are conveyor means such as conveyor belts or driven rollers. The control of the direction of the rotary transport 66 is by means of the control console 54 which receives the necessary control information from the optical reading devices 61 and 62. Based upon the program placed in the control console 54, and based upon the code communicated to the control console from the optical reading devices, the control console will direct the rotary transport 66 to convey the bag either to the conveyor means 67 or, alternatively, to the conveyor means 68. It will be understood that, although only one section 74 has been described in detail, the other sections 75, 76, 77, 78, 79 and

80 are similar. Each of them contains two weight-sensitive conveyor controls, a pair of optical reading devices which read the code on the tags and labels, a pair of photoresponsive devices which react to the absence or presence of a bag, and a rotary transport which is controlled so that it sends bags in one direction selected from a group of directions under control of the control console. Although a similar control console has been particularly described, it will be understood that an alternative is to use a separate control mechanism at each of the stations **74, 75, 76, 77, 78, 79** and **80**. If separate controls are used, the optical reading device will have an internal logic and memory system which will read the code on the back and/or the label and, directed by the code, will control the direction of the rotary transport. The control console **54** may be a relatively simple, i.e., a "mini," digital computer. The read instructions would be as follows: (1) to "read" the maximum code; (2) to search and read the most legible code, that is, as between the tag and the label; (3) to read by means of the code guides; and (4) to pass through to one of the specific locations, for example, the end location, designated **81**. Any piece of baggage having a nonreadable tag and label, or a missing tag and label, or a tag and label which do not agree with each other, are collected at the end location **81** and can be sorted by hand and, if necessary, new tags and labels affixed to them.

The redundancy between the small tags **26** and the label **12** and tag **11** to which they are attached provides an important self-checking method. The data processing console will react to any inconsistency on either the tag **11** or label **12** between: (1) the flight numbers **21** and the area designation **18** (each flight goes to a particular area); (2) the flight numbers **21** and the airport designation code **28a** (each flight goes to a particular airport); (3) the area designation **18** and the airport designation **28a** on the small tags **26**; and (4) that the flight number is a listed (acceptable) number in that it agrees with the departing flight numbers for the day or days. The tags and labels may be checked for the four above-listed required internal consistencies by an optical scanning device at the check-in counter. The check-in personnel, after marking the tag **11** and label **12**, and affixing the small tag **26**, will place the tag face down on an optical scanning device which is connected to the central console (data processing device). If the tag **11** or label **12** is incorrectly prepared, for example, with an unacceptable or inconsistent flight number, a bell or light will indicate that something is wrong. The scanning device also has means, such as lights or a readout device, to indicate the exact error.

The redundancy as between the label and the tag is an important element of the present invention. This redundancy serves the function of increasing the likelihood that at least one of each pair of the optical reading devices will have either a tag or a label within its field. For example, if a tag is torn off or is twisted so that it cannot be seen, it is still likely that the label which contains the same code information will be within the field of each one or the other of the pair of the optical reading devices. Similarly, if the label should become mutilated or fall off, it is still likely that the tag will be in a position to be read by either one or the other of the optical reading devices, one of which is placed on either side of the conveyor means. The redundancy of information as between the tag and the label also enables those bags which are incorrectly tagged, or incorrectly labeled, to be readily and automatically separated. Most of the time the optical reading devices will read both the tag and the label and the code information on them will be compared by the data processing device. If there is an inconsistency, the rotary transport will be controlled so as to separate out the bag having the inconsistent tag and label, enabling that particular bag to come to the attention of a baggage handler.

The unidentifiable baggage will be collected in the area **81**. This baggage includes those bags for which the codes are inconsistent or the codes do not agree with the list of flights or destinations stored in the data processing console. In addition, it includes those bags in which both the tag and the label cannot be read by the optical reading device. The loading personnel check the baggage area **81** for compatibility between region (area), flight number and carrier destination data. They read the standard nomenclature giving the airline designations for regions and destination and the circled flight number, as there is no need for them to read the geometric codes. If the region, flight number and carrier destination are compatible and agree with the list of acceptable flights, then the baggage will be carried to the appropriate aircraft because the probable cause of the nonreading by the optical reading devices is an obscure and hidden tag and label. If the carrier destination is not compatible to the region and flight number, the correct destination within the designated area can be written in because the probable cause would be the mislabeling of the destination sticker. If the flight number is not compatible with the region and carrier destination, then the correct flight number serving that destination will be written in and the baggage carted to the appropriate flight. The probable cause of that last type of error would be an error in marking the flight numbers, for example, by transposition of numbers. If the flight number and carrier destination are compatible but the region is not compatible, then the region would be written in and the baggage carted to the appropriate flight, because probably the wrong baggage label and tag were utilized. If the region, flight number and destination are all incompatible—a situation which is most unlikely to occur—an additional procedural step in the check-in process may be added to avoid this unlikely possibility. This additional step would be to distribute sequentially numbered tagging units (labels and tags) to each check-in location and to record on a form the tag numbers along with the region, flight number and carrier destination. The baggage handling personnel could then telephone the check-in location and correct the baggage label and tag in accordance with the recorded information. The aforementioned check and correction procedures may again appear redundant due to the optical scanning device at the check-in counter. In a sense, these procedures are added insurance against the loss or misplacement of baggage where the check-in personnel fail to use the optical scanning device or such equipment may not be available at some check-in locations, for example, at curb-side.

Although the present invention has been particularly concerned with the distribution of bags from the check-in counter to the various departing airplanes, the system is also usable to distribute bags from a central area outward to a number of baggage pickup bays. For example, all the baggage from a single plane, which may be a large jet passenger plane, may come to a central area corresponding to check-in level **50** of FIG. **5**. The baggage would then be placed on the system shown in FIG. **5** and automatically distributed to the different pickup bays A, B, C, D, E, F, G, H, J, K. The stubs of the passengers would indicate at which pickup bay they are to retrieve their baggage. However, in the system shown in FIG. **5** each of the bays A, B, D, E, F, G, H, J and K is associated with a particular jet aircraft which is scheduled for flight. However, alternatively, each of the bays, or some of the bays, may be associated with different sections of a single aircraft; for example, in a Boeing 747 the baggage may be collected at a check-in level **50** and distributed on the plane to specific baggage compartments corresponding to the bays A, B, C, D, E, F, G. In that way, upon landing, the baggage from each baggage compartment may be kept separate and taken to a baggage retrieval area, at which place the individual passengers will retrieve their baggage.

It will be understood that the term "baggage" or "bags," as used herein, refers to all luggages, boxes, bags, trunks, carriers, valises, suitcases, etc., which accompany a passenger. The present invention has been particularly described in connection with passenger baggage. However, it is also applicable to freight. For example, an air freight parcel which has attached to it the above-described tag and label and would be processed in the same manner as passengers' baggage.

I claim:

1. A method for the sorting and conveyance of baggage comprising the steps of: entering the destination of the baggage on a tag and a label by means of marking only on one and utilizing duplicating means to duplicate the marking on the other; adhering a first small tag to the label and adhering a second small tag to the tag, both of said two small adhered tags presenting the same destination information as each other in the form of an optical readable code; attaching the tag and the label to the same piece of baggage; entering and storing a list of flights and their destinations in a data processing control means; placing said baggage on a conveyor means and conveying it within the field of an optical reading device capable of reading and translating said designation markings into control signals; and controlling a baggage turntable by said signals; and comparing by means of said control means the consistency of the codes on the tag, label and two small tags with each other and with the entered flight and destination data.

2. A method as in claim 1 wherein said turntable passes the baggage to a second conveyor means, a second optical reading device and a second controlled turntable.

3. A system for the handling of baggage or freight including a tag having code markings thereon and adapted to be removably affixed to a bag; a first conveyor means, an optical reading device positioned adjacent said first conveyor means and adapted to read said code markings, a control means receiving information from said reading device; data processing and storage means associated with said control means and capable of receiving and storing a list of flights or destinations and comparing that list with the read code markings; a transfer mechanism positioned to receive bags from said first conveyor means; said transfer mechanism directing bags to one of a group of positions under the control of said control means; and second and third conveyor means positioned to receive bags from said transfer mechanism.

4. A system as in claim 3 and also including a label having the same code markings thereon and adapted to be removably adhered to the said bag.

5. A system as in claim 3 and also including a first and second small tags adapted to be adhered to said tag and label and having thereon code markings for the destination, said code markings also being compared by said data processing means with said list.

6. A system as in claim 3 wherein the optical reading device comprises two optical reading heads, one on either side of the conveyor means.

7. A system as in claim 3 wherein two weight-sensitive controlled conveyor mechanisms are in series between the first conveyor system and the transfer mechanism.

8. A system as in claim 3 wherein a second optical reading device is positioned adjacent said conveyor means, a second baggage transfer mechanism is positioned to receive bags from said second conveyor means under the control of said control means, and third and fourth conveyor means are positioned to receive bags from said second transfer mechanism.

9. A system as in claim 3 wherein said transfer mechanism is a rotary transport.

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