United States Patent [19]

Morris, Sr.

[11] **3,709,382**

[45] **Jan. 9, 1973**

[54] SORTING APPARATUS

[76] Inventor: **William W. Morris, Sr.**, 5320 F Great Oak Way, Columbus, Ohio 43213

[22] Filed: **June 4, 1971**

[21] Appl. No.: **149,900**

[52] **U.S. Cl.** .....**214/11 R,** 193/31 A

[51] **Int. Cl.**.....**B65g 43/00**

[58] **Field of Search**.....214/11 R; 209/111.5

[56] **References Cited**

UNITED STATES PATENTS

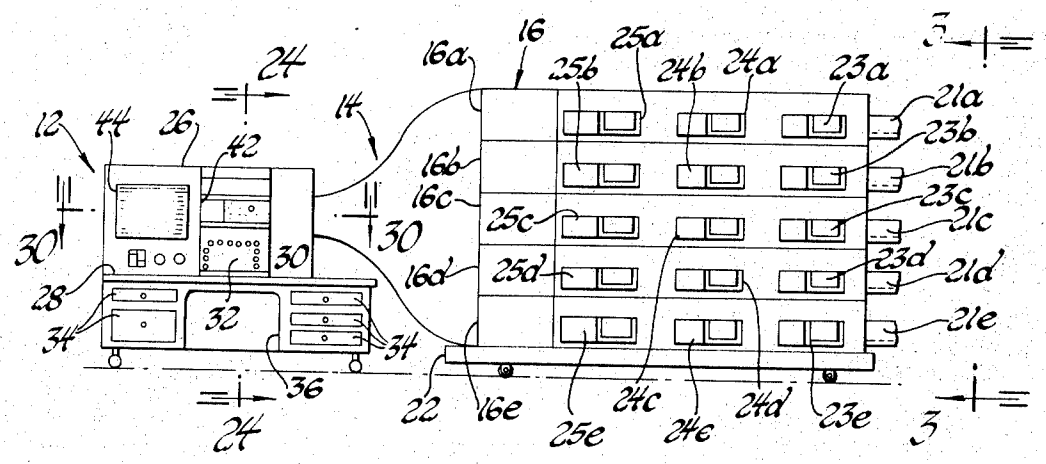
2,613,825	10/1952	Setzer et al.	214/11 R
2,670,087	2/1954	Stehlik	214/11 R
3,158,271	11/1964	Cook	214/11 R
3,217,903	11/1965	McLagan	214/11 R
3,343,672	9/1967	DeVries	209/74

Primary Examiner—Gerald M. Forlenza
Assistant Examiner—R. B. Johnson
Attorney—Lon H. Romanski

[57] **ABSTRACT**

A mail sorting apparatus having an operator's console equipped with key-operated switches has a selector section positioned intermediate a mail or parcel propelling device and a diverter section which includes sorted mail receiving trays. Operation of any of the key switches selects a particular related channel or chute in the selector section and a particular related diverter door to be opened in the diverter section so as to present one path which that iemt of mail or parcel post must follow to the desired receiving tray. Operation of an other of the key switches causes the establishment of another particular related path for the article to follow to another receiving tray.

23 Claims, 47 Drawing Figures



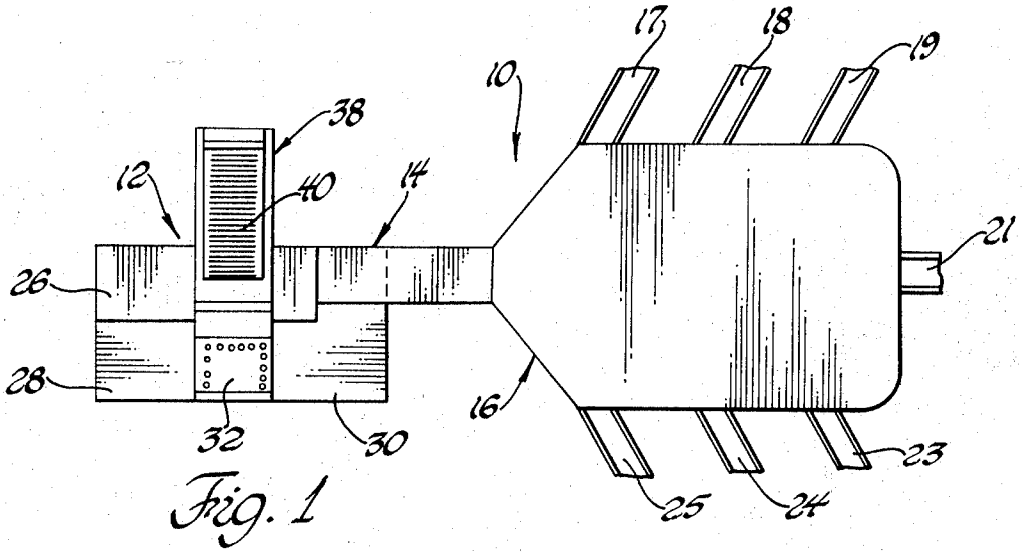


Fig. 1

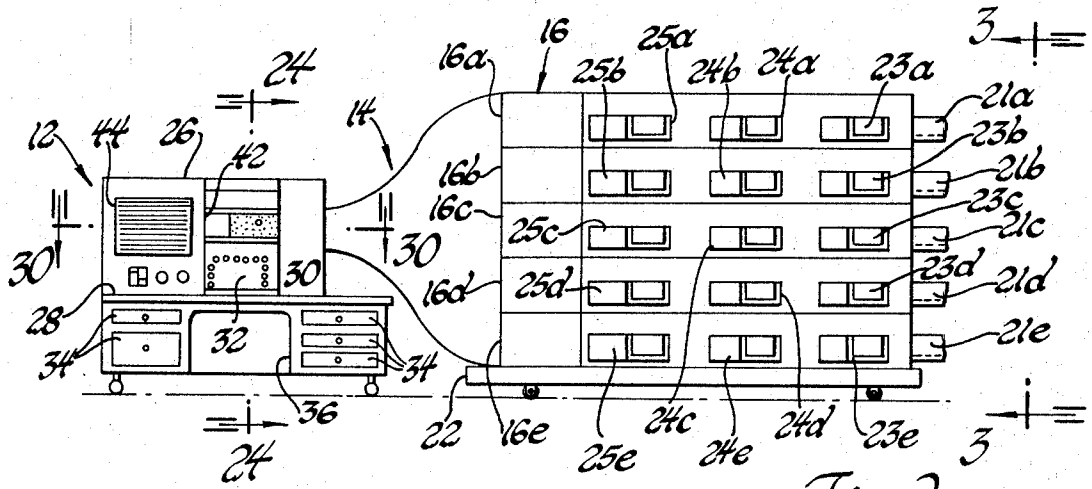


Fig. 2

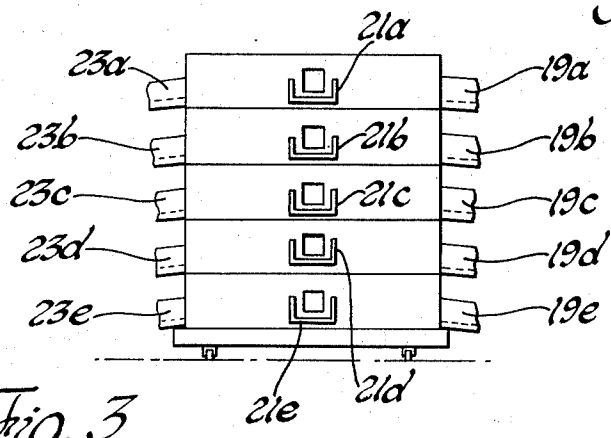


Fig. 3

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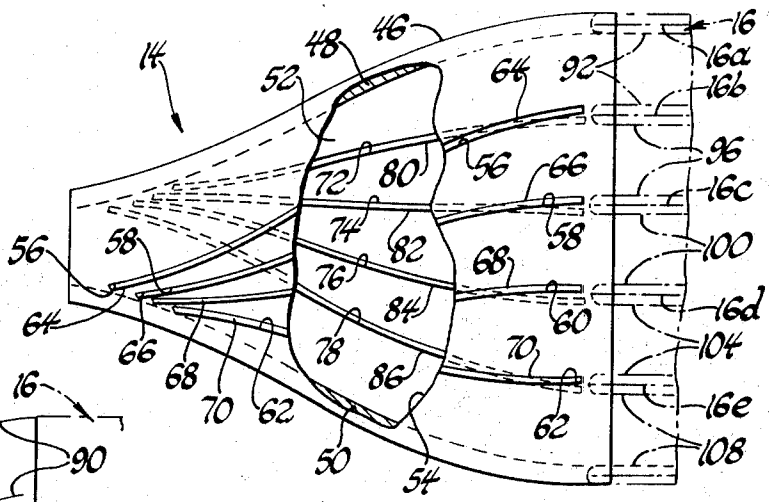


Fig. 4

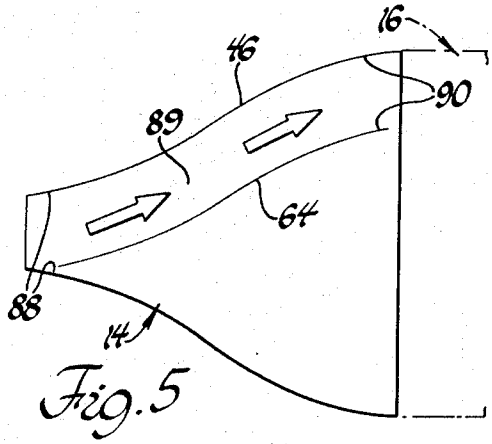


Fig. 5

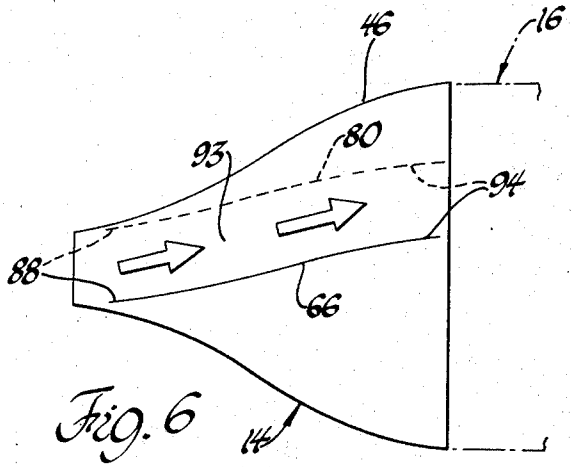


Fig. 6

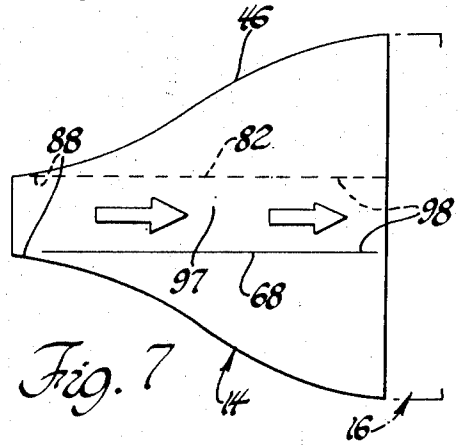


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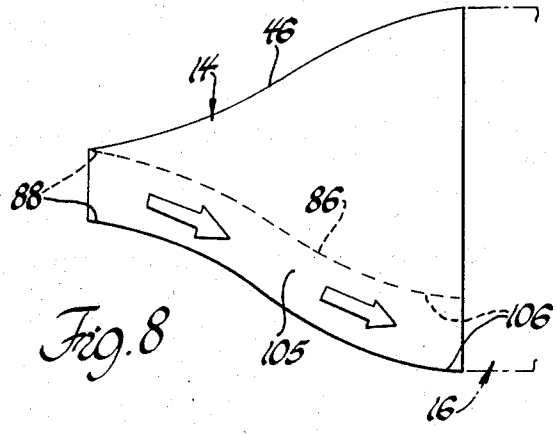


Fig. 8

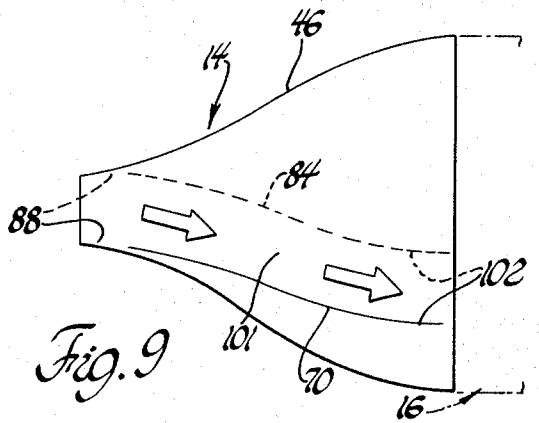


Fig. 9

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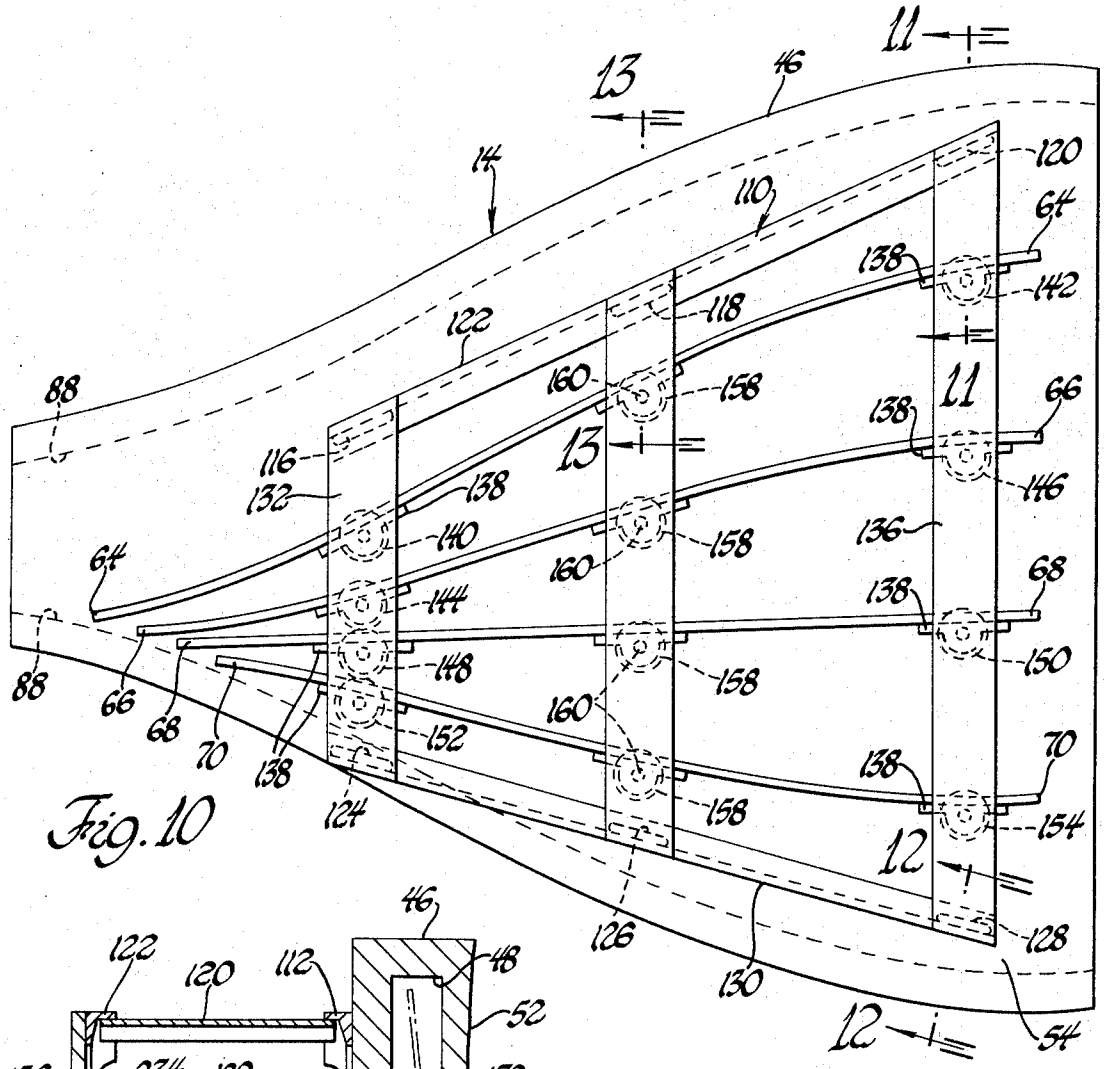


Fig. 10

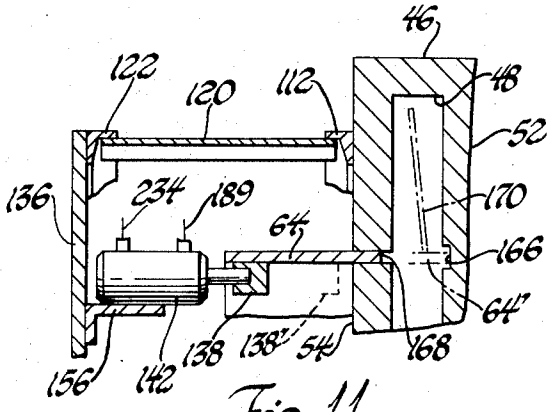


Fig. 11

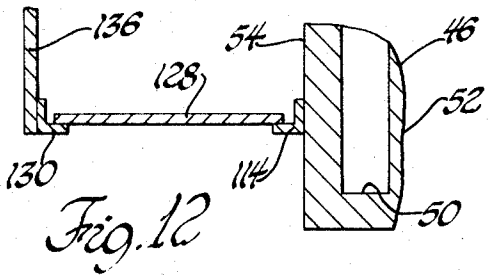


Fig. 12

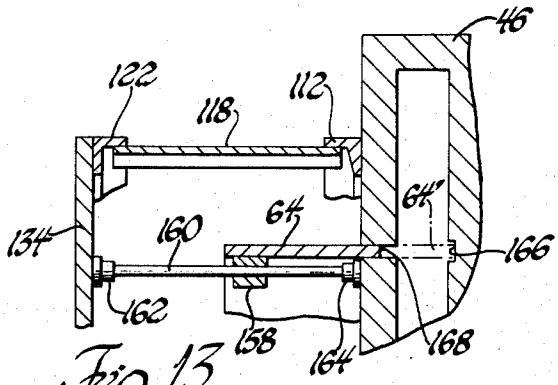


Fig. 13

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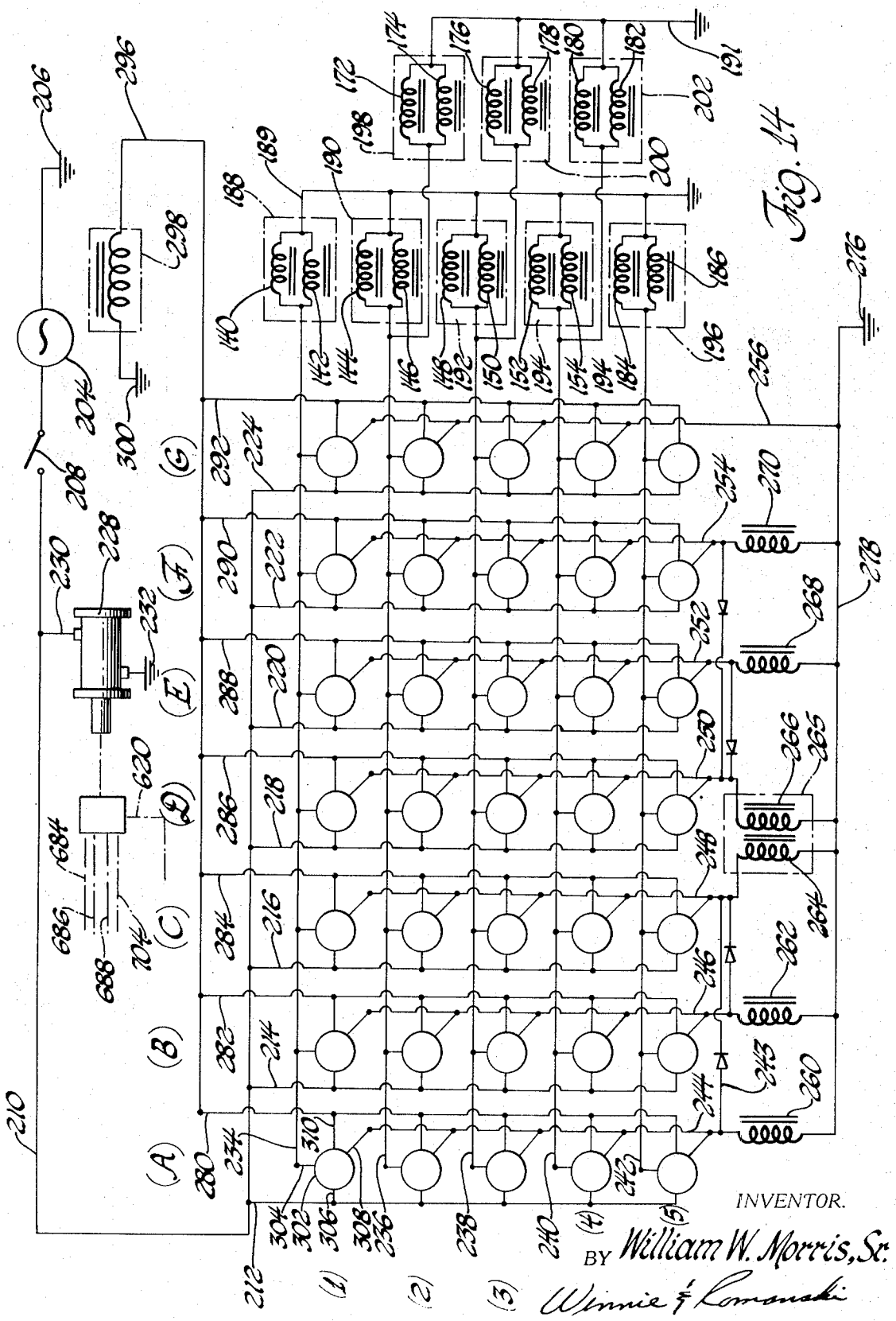


Fig. 14

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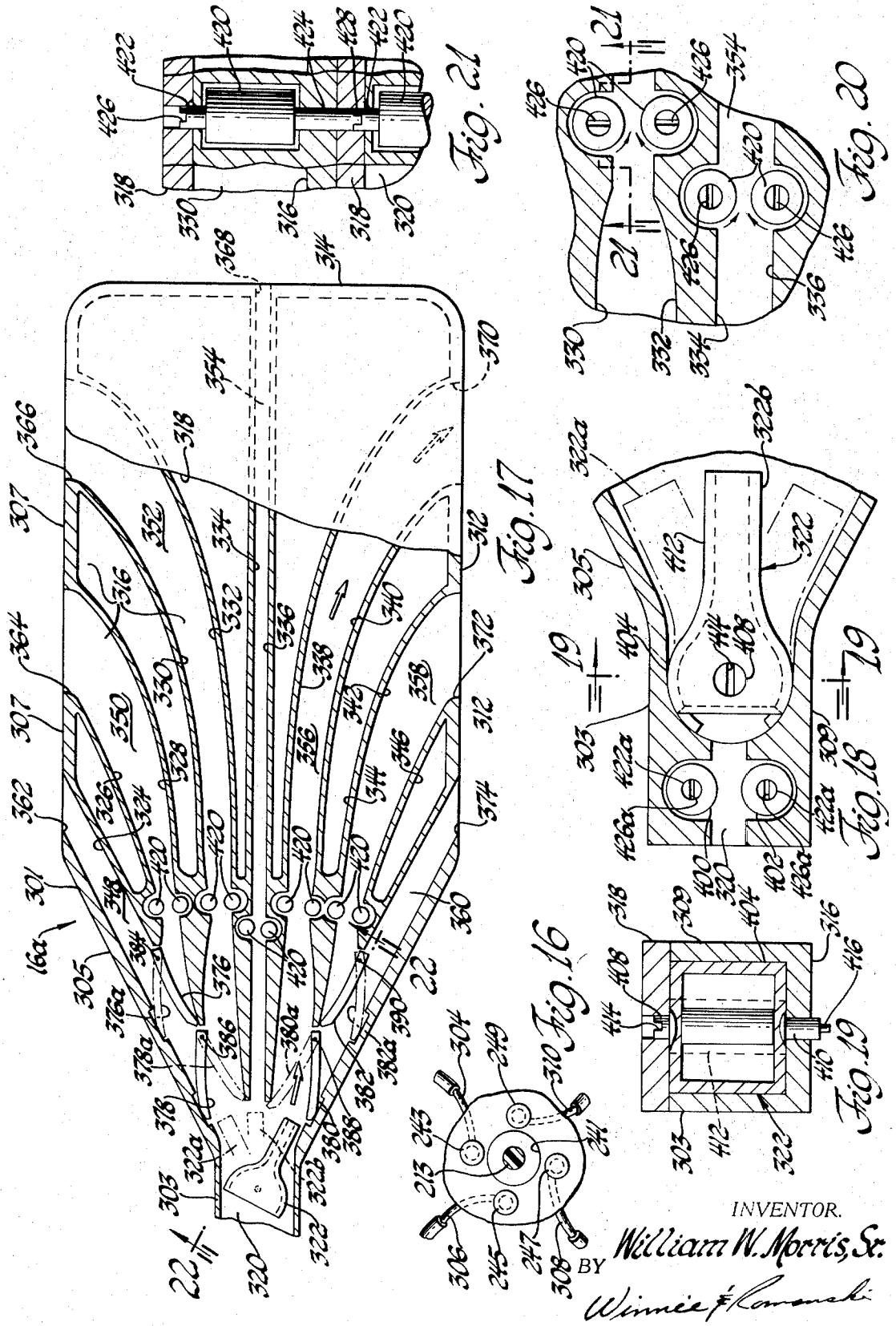


Fig. 21

Fig. 20

Fig. 17

Fig. 18

Fig. 19

Fig. 16

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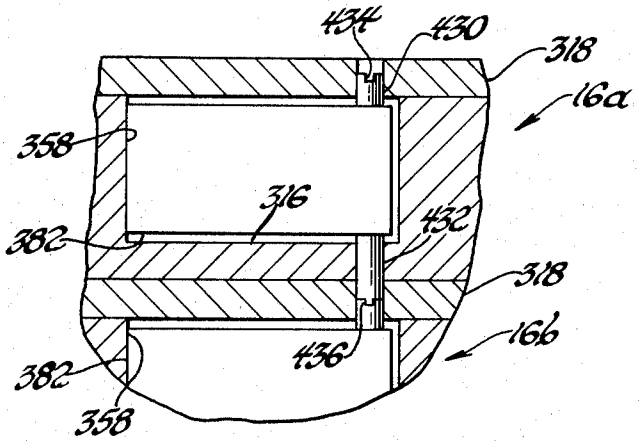


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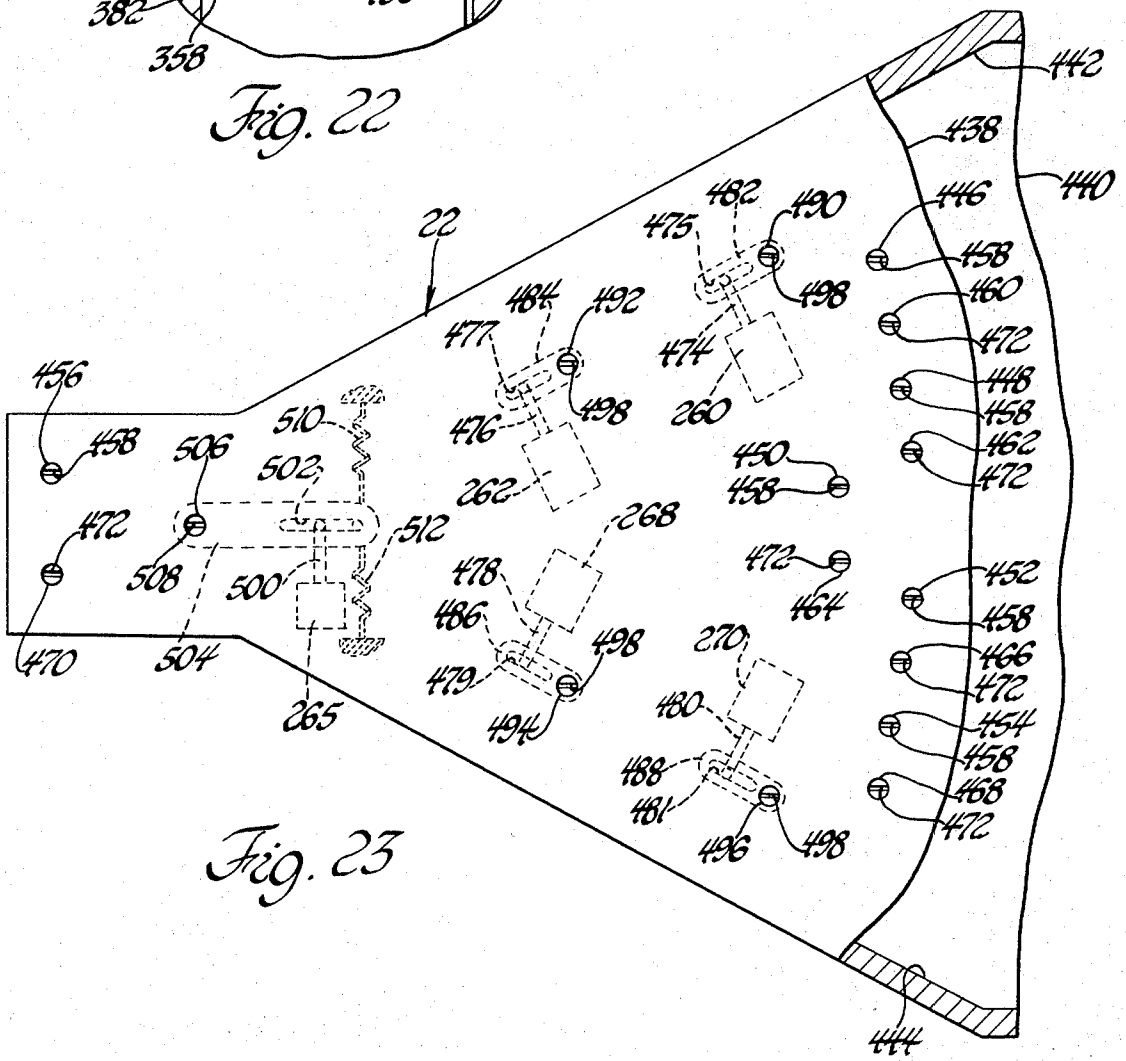


Fig. 23

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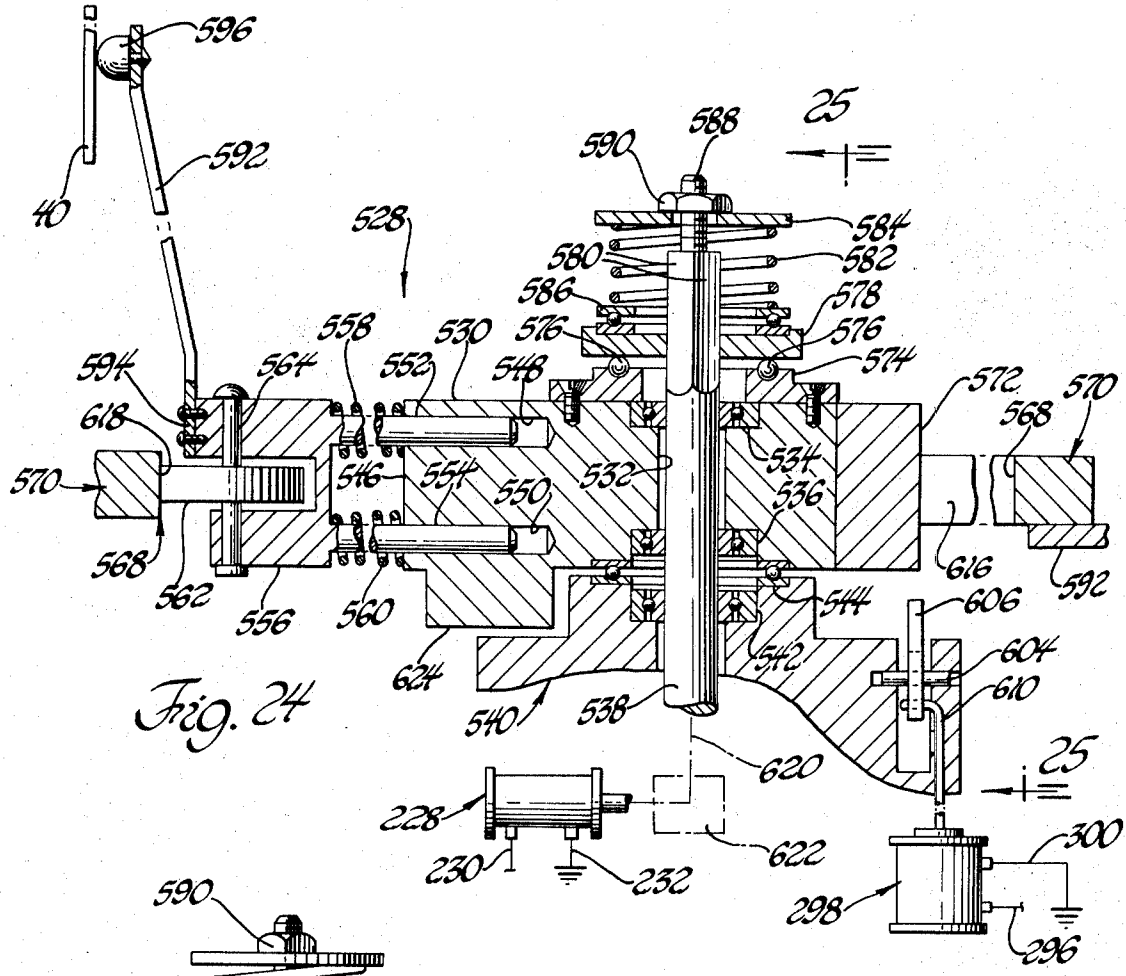


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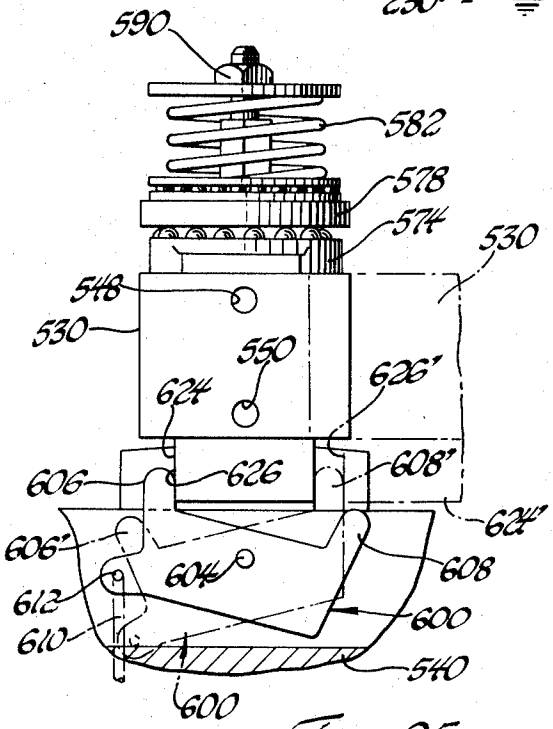


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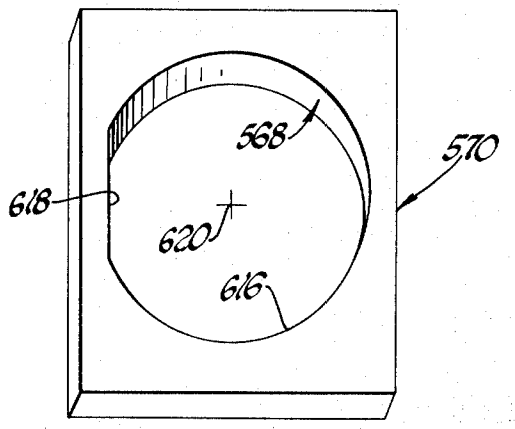


Fig. 26

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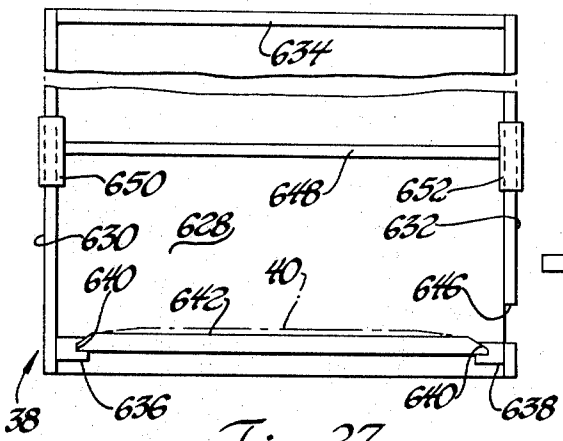


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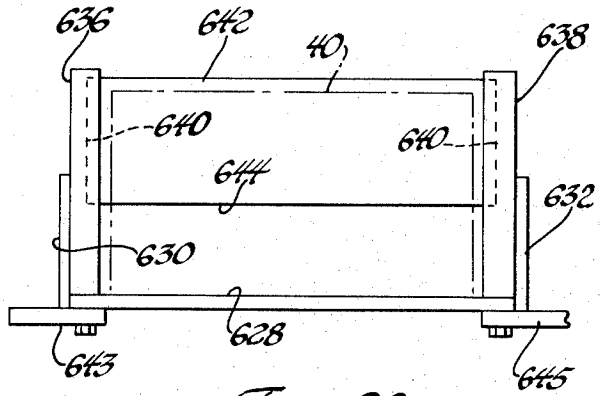


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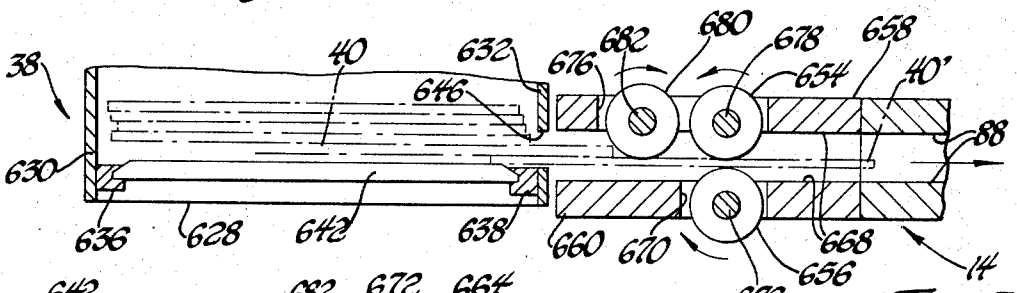


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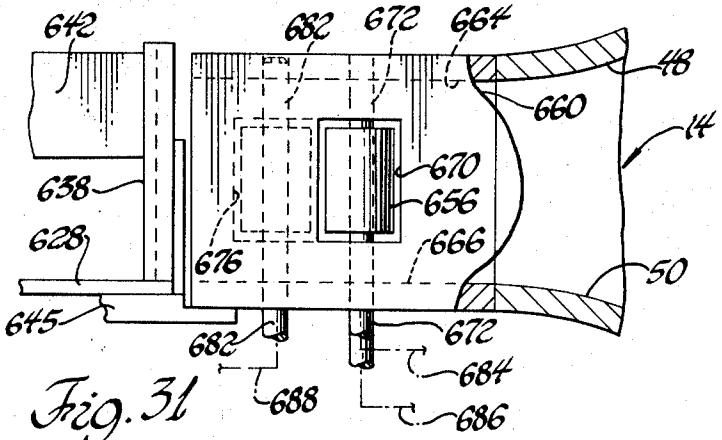


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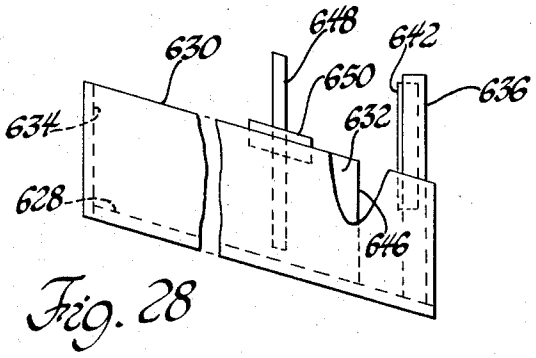


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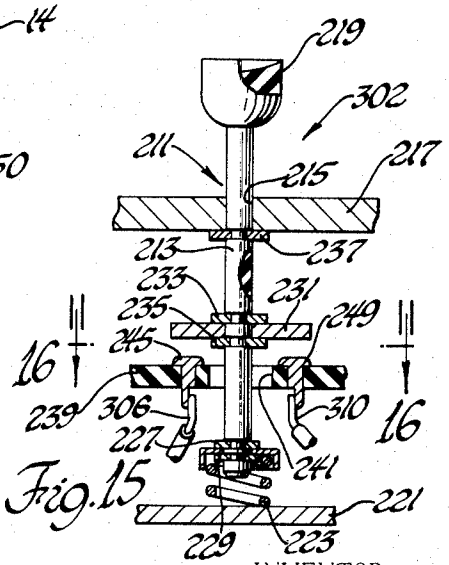


Fig. 15

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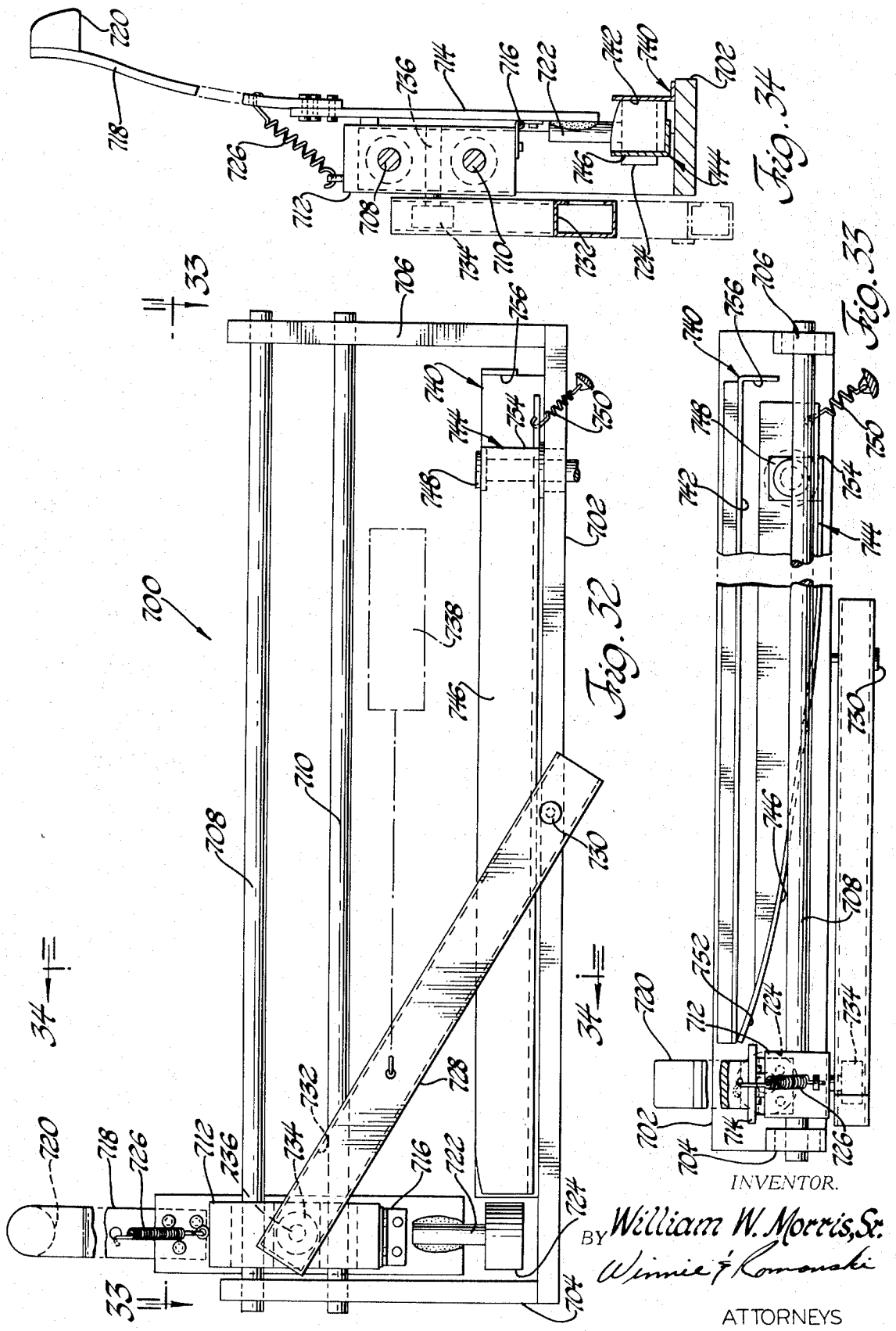


Fig. 34

Fig. 35

Fig. 33

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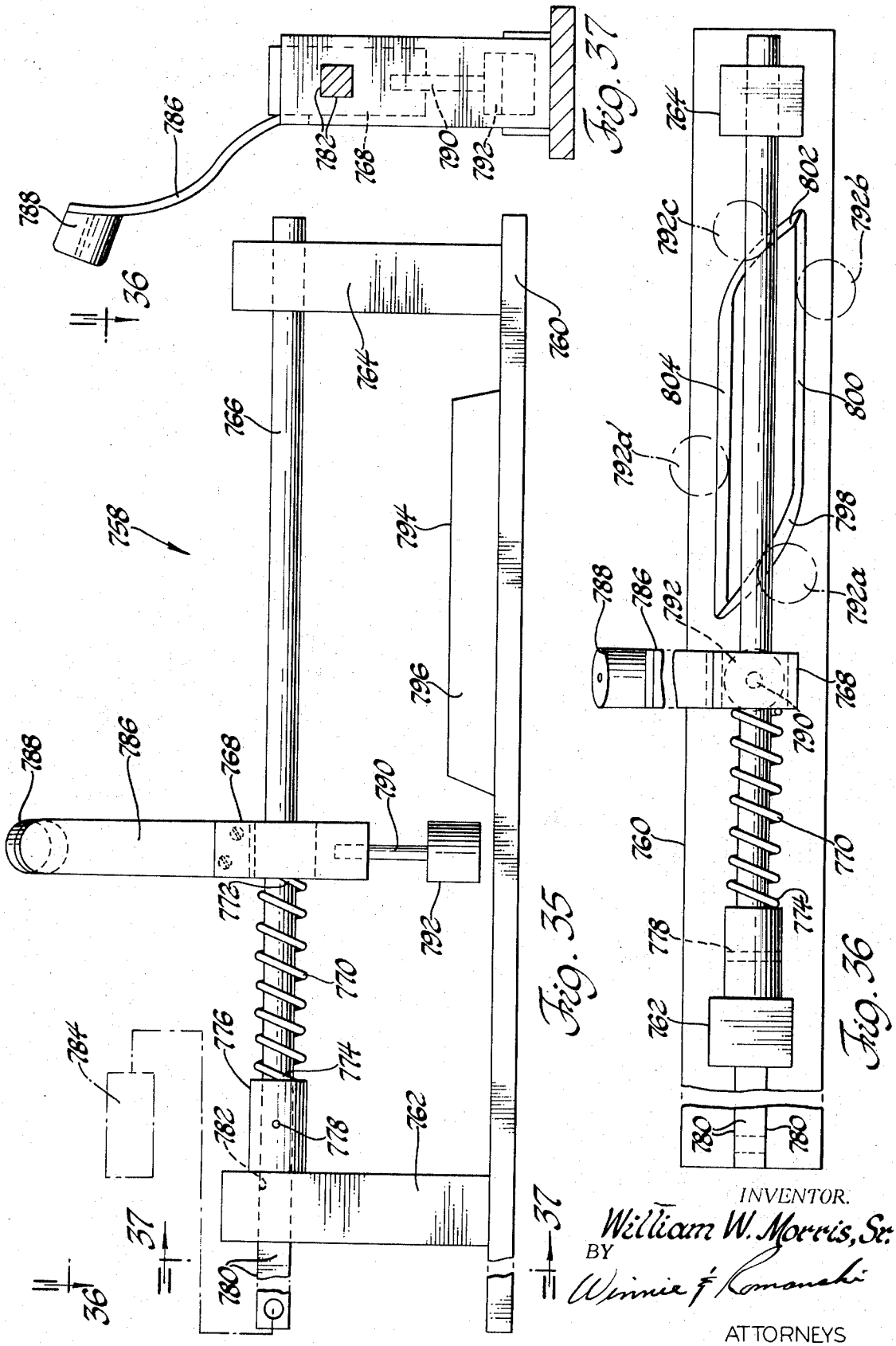


Fig. 35

Fig. 36

Fig. 37

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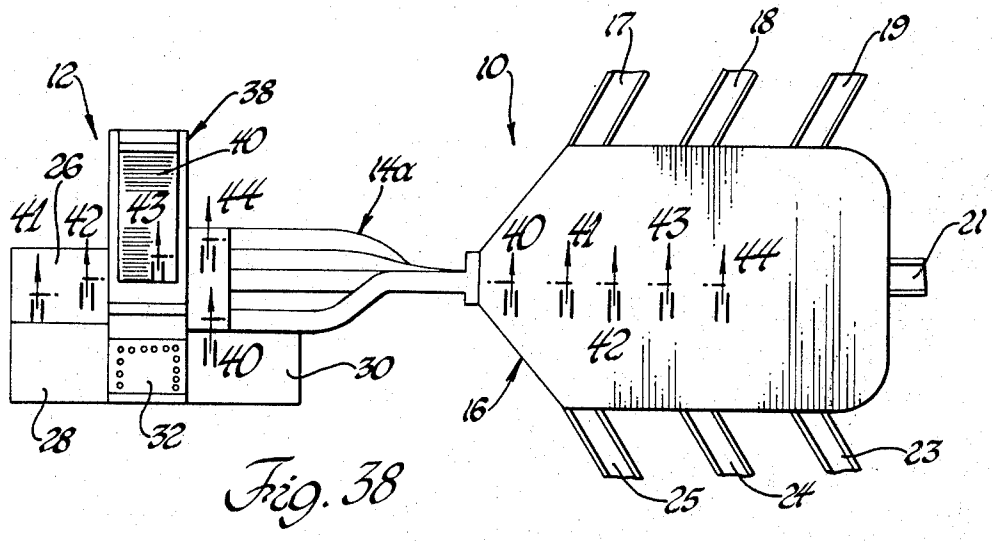


Fig. 38

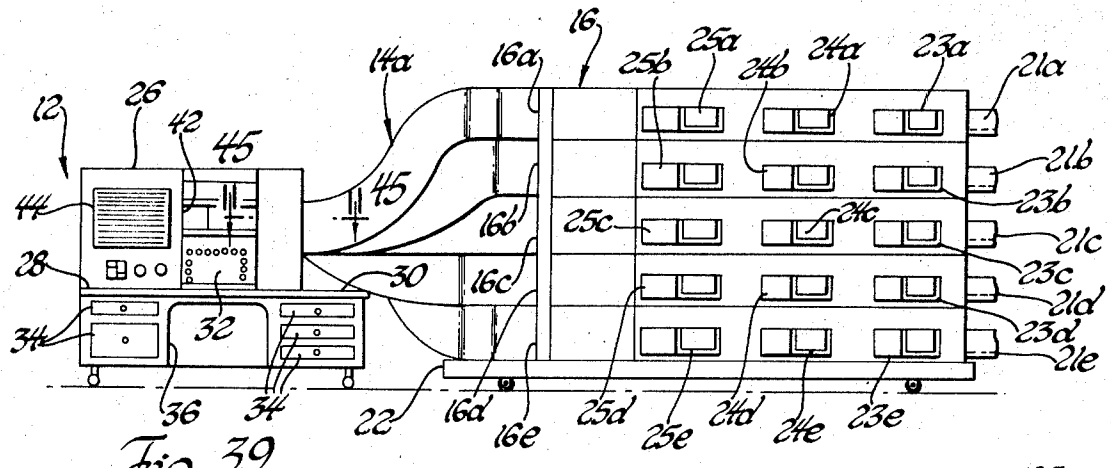


Fig. 39

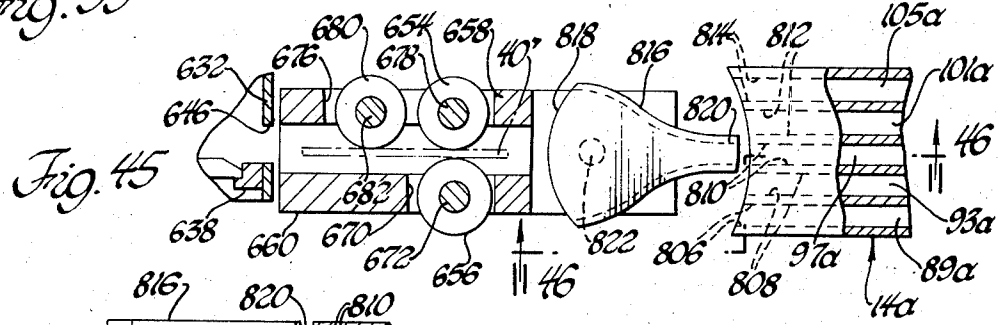


Fig. 45

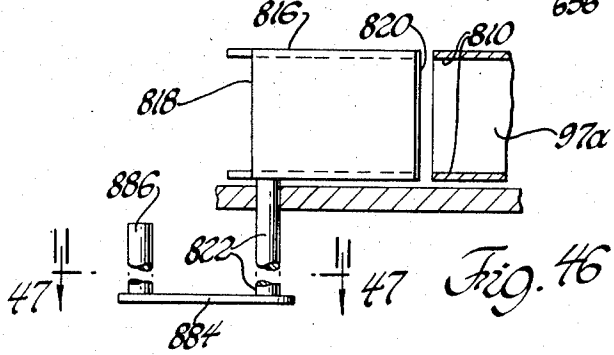


Fig. 46

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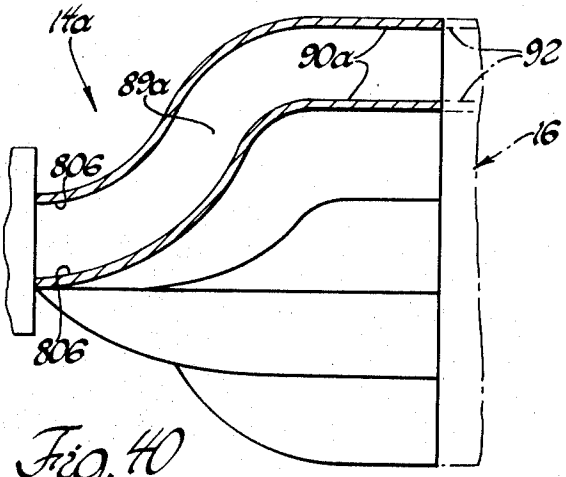


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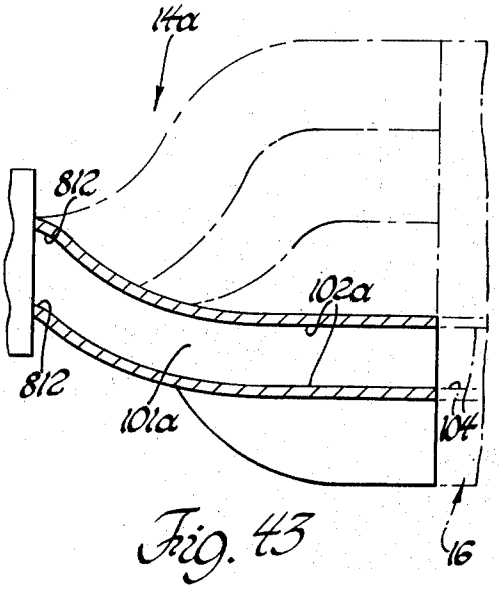


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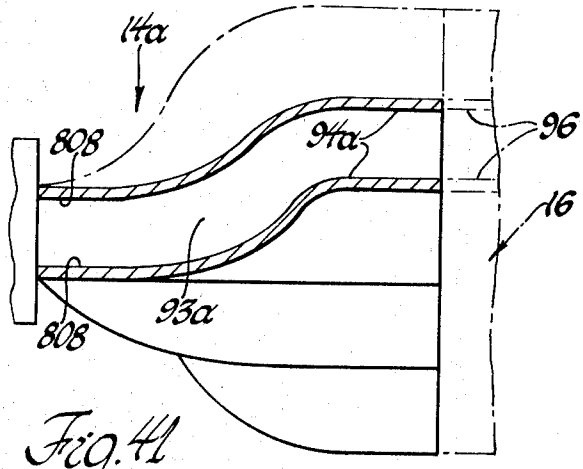


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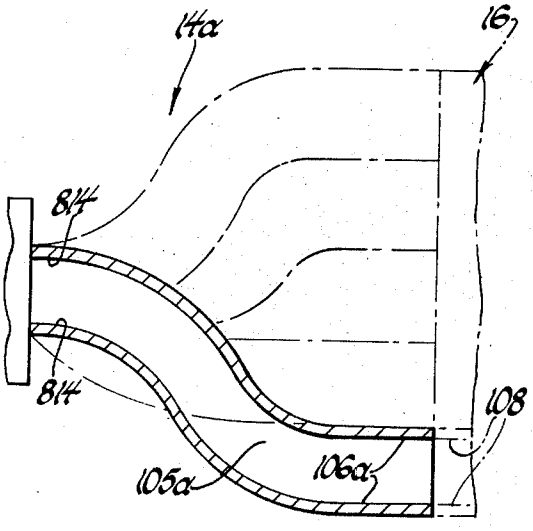


Fig. 44

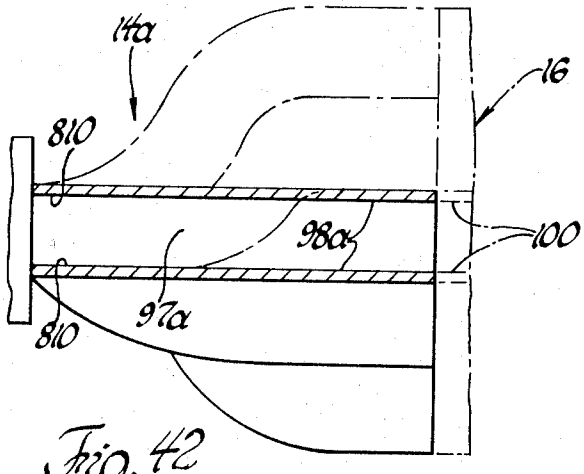


Fig. 42

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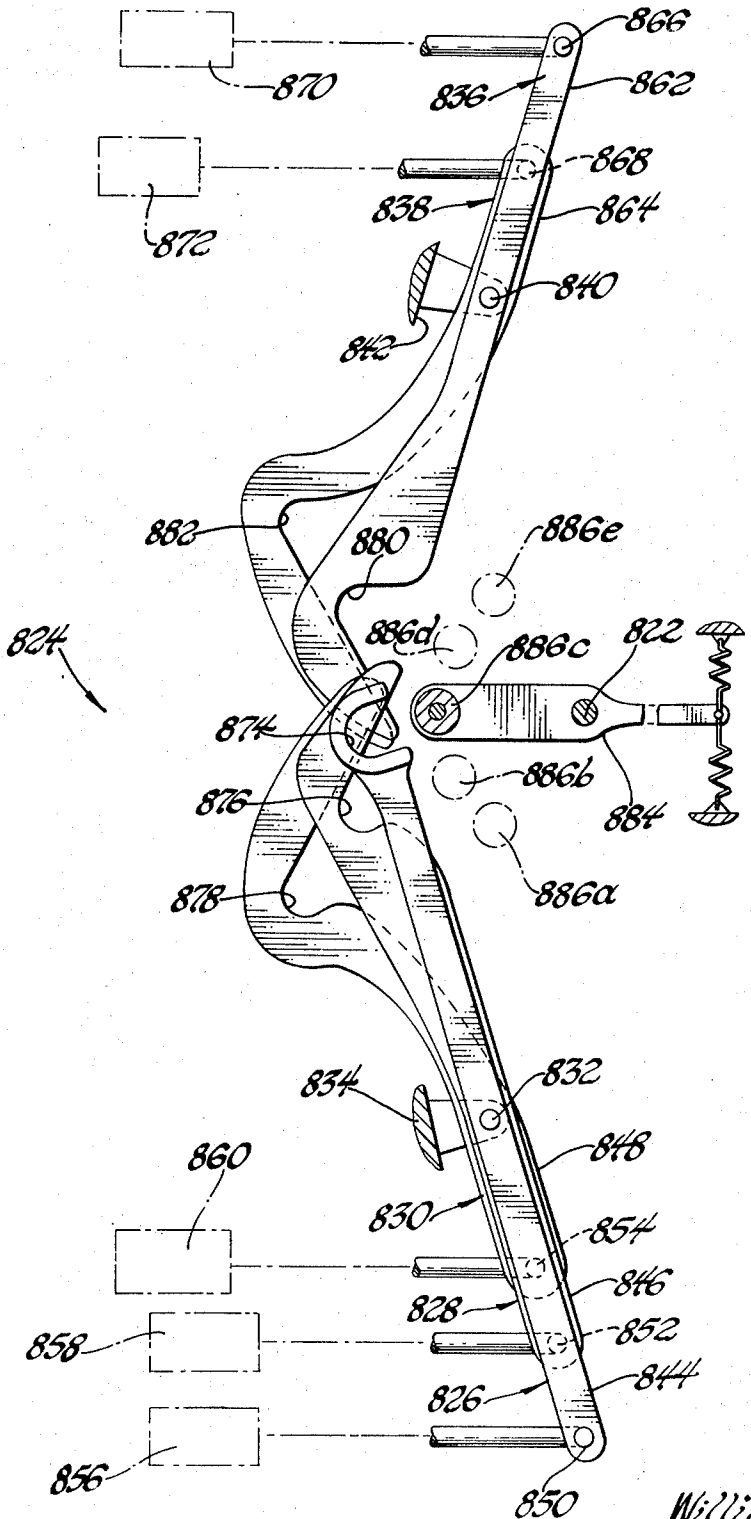


Fig. 47

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SORTING APPARATUS

RELATED APPLICATION

This application is copending with my previously filed application Ser. No. 802,061 filed Feb. 25, 1969, now U.S. Pat. No. 3,596,782, titled "Sorting Apparatus."

Heretofore, various sorting machines have been proposed for the sorting of articles such as items of mail; however, such machines or devices often required complex and costly conveyor systems for both transporting and separating the items of mail; others relied on a combination of gravity for separation and conveyor systems for transportation. This, in turn, required structures of considerable elevation in order to provide sufficient gravitational forces. Other arrangements were constructed in a circular pattern thereby, along with other limitations previously mentioned, automatically eliminating any possibility of expanding the capabilities of the sorting machine as well as practically precluding its use in a modular manner.

According to the invention the article sorting apparatus comprises a selector section capable of selecting a desired channel for the passage therethrough of the article being sorted and a diverter-receiver section having a plurality of passageways one of which communicates with the desired channel for providing a path for the article being sorted whereby the said article is directed through a door opening communicating with the passageway and into related receiving means.

Accordingly, a general object of this invention is to provide, in an article sorting arrangement, means whereby a first sorting stage is accomplished by structure intermediate the supply of articles to be sorted and the ultimate receivers of articles sorted, and additional means whereby a second sorting stage is accomplished by structure following the first sorting stage.

Another object of this invention is to provide sorting apparatus of a configuration and mode of operation which may be employed in a modular manner.

Another object of this invention is to provide a sorting apparatus which is not intrincically dependent upon gravity or moving conveyor systems for the performance of its sorting function.

Other more specific objects and advantages of the invention will become apparent when reference is made to the following detailed description considered in conjunction with the accompanying drawings wherein certain details may be omitted from one or more views for purposes of clarity.

In the drawings, wherein for purposes of clarity, certain elements and details may be omitted from one or more views;

FIG. 1 is a top plan view of a sorting apparatus constructed in accordance with the teachings of this invention;

FIG. 2 is a front side elevational view of the apparatus of FIG. 1;

FIG. 3 is an end elevational view taken generally on the plane of line 3—3 of FIG. 2 and looking in the direction of the arrows;

FIG. 4 is an enlarged side elevational view of a portion of the apparatus as shown in FIG. 2, having portions broken away and in cross-section;

FIGS. 5, 6, 7, 8 and 9 are simplified views, of reduced size, of the portion shown in FIG. 4 under variously determined operating conditions;

FIG. 10 is a view, similar to FIG. 4 illustrating in elevation additional structure associated therewith;

FIGS. 11, 12 and 13 are typical fragmentary cross-sectional views taken respectively on the planes of lines 11—11, 12—12 and 13—13 of FIG. 10 and looking in the direction of the arrows;

FIG. 14 is a schematic wiring diagram of control circuitry employable within the apparatus of FIG. 1;

FIG. 15 is a cross-sectional view of a typical key-operated switch assembly employed within the circuitry of FIG. 14;

FIG. 16 is a fragmentary cross-sectional view taken generally on the plane of line 16—16 of FIG. 15 and looking in the direction of the arrows;

FIG. 17 is a slightly enlarged plan view of one of the deflector units shown in FIGS. 1 and 2 with portions thereof broken away and in cross-section;

FIG. 18 is an enlarged fragmentary view of a portion of the structure shown in FIG. 17;

FIG. 19 is a cross-sectional view taken generally on the plane of line 19—19 of FIG. 18 and looking in the direction of the arrows;

FIG. 20 is an enlarged fragmentary view of a portion of the structure shown in FIG. 17;

FIG. 21 is a cross-sectional view taken generally on the plane of line 21—21 of FIG. 20 and looking in the direction of the arrows;

FIG. 22 is an enlarged cross-sectional view taken generally on the plane of line 22—22 of FIG. 17 and looking in the direction on the arrows;

FIG. 23 is an enlarged fragmentary portion in plan view, of a portion of the structure shown in FIG. 2;

FIG. 24 is an enlarged cross-sectional view taken generally on the plane of line 24—24 of FIG. 2 and looking in the direction of the arrows;

FIG. 25 is an end elevational view of the structure of FIG. 24, during a particular stage of operation, taken generally on the plane of line 25—25 of FIG. 24 and looking in the direction of the arrows;

FIG. 26 is a top plan view, of reduced size and slightly in perspective, of an element shown in FIG. 24;

FIGS. 27, 28 and 29 are respectively top plan, side and front elevational views of a supply chute assembly shown, in reduced size, in FIG. 2;

FIG. 30 is an enlarged fragmentary cross-sectional view taken generally on the plane of line 30—30 of FIG. 2 and looking in the direction of the arrows;

FIG. 31 is a fragmentary front elevational view of the structure as shown in FIG. 30;

FIG. 32 is a front elevational view of a second form of letter feeder mechanism employable in the invention;

FIG. 33 is a top plan view taken generally on the plane of line 33—33 of FIG. 32 and looking generally in the direction of the arrows;

FIG. 34 is a cross-sectional view taken generally on the plane of line 34—34 of FIG. 32 and looking in the direction of the arrows;

FIG. 35 is a front elevational view of a third form of letter feeder mechanism employable in the invention;

FIG. 36 is a top plan view taken generally on the plane of line 36—36 of FIG. 35 and looking in the direction of the arrows;

FIG. 37 is an end view of the feeder mechanism taken generally on the plane of line 37—37 of FIG. 35 and looking in the direction of the arrows;

FIG. 38 is a view similar to FIG. 1 illustrating a second embodiment of the invention;

FIG. 39 is a side elevational view of the structure of FIG. 38;

FIG. 40, 41, 42, 43 and 44 are enlarged fragmentary cross-sectional views respectively taken on the planes of lines 40—40, 41—41, 42—42, 43—43, and 44—44 of FIG. 38 and looking in the direction of the arrows;

FIG. 45 is an enlarged fragmentary cross-sectional view taken generally on the plane of line 45—45 of FIG. 39 and looking in the direction of the arrows;

FIG. 46 is a view taken geneally on the plane of line 46—46 of FIG. 45 and looking in the direction of the arrows; and

FIG. 47 is an enlarged view of actuating mechanism taken generally on the plane of line 47—47 of FIG. 46 and looking in the direction of the arrows.

Referring now in greater detail to the drawings, FIGS. 1, 2 and 3 illustrate the sorting machine 10 as comprising an operator's console station 12 operatively connected to a selector section 14 which, in turn, is operatively connected to a diverter section 16 which may have, in association therewith, a plurality of receiving trays situated on, for example, tray carriers or assemblies 17, 18, 19, 20, 21, 22, 23, 24 and 25.

As illustrated generally by FIGS. 1 and 2, the operator's station may be comprised of a general console housing 26, including desk-top-like side portions 28 and 30 between which a selecting or controlling keyboard assembly 32 is situated so as to place the keys within comfortable reach of the operator when the operator is seated. Suitable drawers 34 may be placed on either side of an opening 36 provided for the comfort of the operator.

The housing 26 preferably also contains the various electrical control circuitry and other actuating and motivating mechanisms to be subsequently described in detail. Further, as shown in FIG. 1, a suitable supply chute assembly 38 is situated at the rear of the console 12 so as to deliver, in this case, articles of mail 40 to the window-like opening 42 where the operator may read the mailing address thereon and actuate selected keys in accordance therewith. If desired, a code chart 44 may be secured to the front of console housing 26 so as to be of ready aid to the operator in selecting the proper actuating keys, comprising the keyboard assembly 32, according to the "ZIP" codes or other information appearing on the article of mail to be sorted.

As shown in FIG. 4, the selector section 14 is basically comprised of an outer housing 46 having top and bottom walls 48 and 50 joining rear and forward side walls 52 and 54. The left end of the housing 46 provides an inlet for the articles to be sorted while the right end provides, as will become apparent, a plurality of outlets. (A portion of the front wall 54 is broken away in order to more clearly show the plates and slots, to be described, in the rear wall.) The front wall 54 has formed therein a plurality of curvilinear slots 56, 58, 60 and 62 respectively slidably receiving therein plates 64, 66, 68 and 70 each of a complementary curvilinear profile. Suitable supporting and actuating means, to be described, are provided enabling the selective actuation of the plates whereby they are made to, one at a time, slide through the respective slots and extend laterally a distance sufficient to be in at least close proximity to the inner surface of the rear wall 52. Similarly, the rear wall 52 has formed therethrough a plurality of curvilinear slots 72, 74, 76 and 78 respectively slidably receiving therein plates 80, 82, 84 and 86 each of a complementary curvilinear profile. Further, suitable supporting and actuating means are provided for enabling selective actuation of the plates 80, 82, 84 and 86 whereby they are moved, one at a time, to slide in the respective slots and extend laterally a distance sufficient to be in at least close proximity to the inner surface of the front wall 54.

Without regard to the specific apparatus for accomplishing the control and actuation of the selector plates, FIGS. 5, 6, 7, 8 and 9 illustrate, in a somewhat simplified schematic manner, the formation of selector channels by the actuation of one or more of the selector plates. In FIG. 5, a first channel 89 is formed by actuation of selector plate 64 in its corresponding slot 56. As the selector plate 64 is moved inwardly of the housing 46 (with all of the remaining plates remaining in their slots but not extending into the space between the inner surfaces of front and rear walls 54 and 52) a direct channel is formed from the inlet 88 to a first top-most exit 90 thereby enabling the articles of mail to travel a path, designated generally by the arrows, exiting from exit 90 into the top-most passage 92 of the diverter section 16 (FIG. 4).

FIG. 6 illustrates a second condition whereby front selector plate 66 and rear selector plate 80 (the actuated rear plates being shown in hidden lines) are both actuated to form a second direct channel 93 communicating between the inlet 88 and a second upper exit 94 thereby enabling the articles of mail to travel a path, designated generally by the arrows, exiting from exit 94 into the next upper passageway 96 of the diverter section 16.

FIG. 7 illustrates a third condition whereby front selector plate 68 and rear selector plate 82 are both actuated to form a third direct channel 97 communicating between the inlet 88 and a generally medially disposed outlet or exit 98 thereby enabling the articles of mail to travel a path, again designated generally by the arrows, exiting from outlet 98 into the generally medically located passageway 100 of the diverter section 16.

FIG. 8 illustrates a fourth condition whereby front selector plate 70 and rear selector plate 84 are both actuated to form a fourth direct channel 101 communicating between the inlet 88 and a lower outlet or exit 102 thereby enabling the articles of mail to travel a path, again designated generally by the arrows, exiting from outlet 102 into the lower passageway 104 of diverter section 16.

In view of the preceding, it should be apparent channel 89 is defined by the lower surface of upper wall 48, the inner surfaces of side walls 52, 54, and the upper surface of selector plate 64; channel 93 is defined, at its top, by the lower surface of selector plate 80, at its sides by the inner surfaces of side walls 52 and 54 and at its bottom by the upper surface of lower selector plate 66. Channels 97 and 101 are defined similarly to channel 93 while channel 105 is defined similarly to channel 89 of FIG. 5.

Accordingly, depending on which particular channel is formed by the selective actuation of the selector

plates, mail will enter the inlet 88 and be directed out of the corresponding exit or outlet and into the particular diverter passageway in communication therewith. it should be apparent that the selector section disclosed provides for five degrees of separation of classification from a single source.

Each bank of selector plates (those located at the front side as well as those located at the rear side) may be provided with a supporting structure as typically shown in FIGS. 10, 11, 12 and 13.

Referring now in greater detail to FIGS. 10 – 13, support structure 110 may, typically, be comprised somewhat longitudinally extending upper and lower anchor members 112, 114 suitably secured to side wall 54 of selector housing 46. Upper laterally extending support members 116, 118 and 120 are suitably secured, as by welding or any other adaptable securing means, at their respective one ends to anchor member 112 and at their respective other ends to a first generally longitudinally extending upper frame member 122, spaced from wall 54. Similarly, lower laterally extending support members 124, 126 and 128 are suitably secured at their respective one ends to the lower anchor member 114 and at their respective other ends to a second generally longitudinally extending lower frame member 130 also spaced from wall 54. The upper and lower frame members 122 and 130, in turn, have connected thereto vertically directed support members 132, 134 and 136 which serve to support the guide and actuating means associated with the respective selector plates.

Each of the selector plates may be provided with brackets 138 secured as at the underside thereof at generally opposite ends. Such brackets may then be respectively secured to spring biased solenoid armatures of solenoid assemblies are preferably mounted to the vertically directed support members as by a bracket 156 also typically shown in FIG. 11.

Further, each of the selector plates is provided with a guide bushing 158 suitably secured to the underside thereof generally between brackets 138. Each of the bushings 158 is adapted to slidably receive therethrough a guide bar 160 which may, in turn, be secured at its opposite ends, as by anchor members 162 and 164 to the vertical support member 134 and wall 54, as typically illustrated in FIG. 13.

Under normal conditions the various selector plates would remain in a position as generally illustrated by FIGS. 11 and 13 which could be achieved by resilient means within the solenoid assemblies (or if desired, additional externally situated spring means). When the suitable solenoid assemblies are energized, as for example solenoids 140 and 142, the corresponding selector plate, in this case plate 64, would be moved inwardly of the housing 46 to a position as illustrated by the phantom line 138′ of bracket 138 and the phantom line 64′ of plate 64. Preferably, grooves, such as at 166, are formed in the inner surfaces of side walls 52 and 54 so as to partly receive therein the leadin adge 168 of the selector plate. It is anticipated that the articles of mail will travel through the channels in and edge-wise position, much like that depicted at 170; accordingly, the provision of grooves as 166 to receive the ends of the actuated plates will eliminate the possibility of an opening being formed between the edge 168 of the actuated plate and the inner surface of the side wall in which the edge of an article of mail could become caught.

As has been stated, the supporting structure 110 is typical and would be constructed in a mirror image for use on the rear wall 52 of the selector housing 46. It, of course, follows that bushings, guide bars and solenoid assemblies corresponding to those associated with structure 110 would also be provided. For ease of further discussion, let it be established that: rear selector plate 80 (FIGS. 4 and 6) is actuated by solenoid assemblies 172 and 174; real selector plate 82 is actuated by assemblies 176 and 178; rear selector plate 84 is actuated by solenoid assemblies 180 and 182 and rear selector plates 86 is actuated by solenoid assemblies 184 and 186.

Solenoid aseemblies 172, 174, 176, 178 180 182, 184 and 186 as well as solenoid assemblies 140, 142, 144, 146, 148, 150, 152 and 154 are schematically illustrated in the wiring diagram of FIG. 14. For simplicity, since cooperating pairs of solenoid assemblies are arranged in parrallel, such pairs are enclosed within respective phantom-lime boxes each identified with ints own reference number.

FIG. 14 schematically illustrates one form of wiring diagram including therein simplified diagrammatic representatiaons of key-operated switch assemblies. One acceptable construction of such a key-operated switch assembly is typically illustrated in FIG. 15. In FIG. 14, a suitable source of electrical energy 204, grounded as at 206 and in series with a line switch 208, supplies electrical current through a main supply conductor 210 to a plurality of branch supply conductors 212, 214, 216, 218, 220, 222 and 224 as well as an electric drive motor 228 by means of a branch conductor 230 and ground 232.

A first plurality of output conductors 234, 236, 238, 240 and 242 are respectively connected at one end to selector plate solenoid actuating means 188, 190, 192, 194 and 196. A second plurality of output conductors 244, 246, 248, 250, 252 and 256 are respectively connected at one end to solenoids 260, 262, 265, (having reversed windings 264 and 266), 268, and 270 which in turn may be grounded as at 276 by a common conductor 278. As illustrated, conductor 256 is connected directly to ground conductor 278. A third plurality of output conductors 280, 282, 284, 286, 288, 290 and 292 are respectively connected at one end to a common conductor 296 which is, in turn, connected to feeder solenoid assembly 298 grounded as at 300.

For ease of description and purposes of clarity, the various key-operated switches, as diagrammatically illustrated at 302, will be referred to by the reference numbering grid of alphabetical letters A, B, C, D, E, F, and G for the seven columns and numbers (1), (2), (3), (4), and (5) for the five rows. Further, let it be established that each of the switches, as switch 302 at (1)–A, is provided with four separate electrical contacts respectively connected to one end of branch conductors 304, 306, 308 and 310. In the switches of (1)–A through (1)–G each of the respective branch conductors 304 would be connected to output conductor 234; in the switches (2)–A through (2)–G each of the respective branch conductors 304 would be connected to output conductors 236; in the switches of (3)–A through (3)–G each of the respective branch

conductors 304 would be connected to output conductor 238; in the switches of (4)–A through (4)–G each of the branch conductors 304 would be connected to output conductor 240 and in the switches of (5)–A through (5)–G each of the branch conductors 304 would be connected to output conductor 242.

Similarly, in the A column of switches: each of the respective branch conductors 306 would be connected to the branch supply conductor 212; each of the respective branch conductors 308 is connected to branch output conductor 244; and each of the respective branch conductors 310 is connected to the branch output conductor 280.

In the B column of switches: each of the respective conductors 306 is connected to branch supply conductor 214; each of the respective conductors 308 is connected to branch output conductor 246; and each of the respective conductors 310 is connected to the branch output conductor 282.

In the C column of switches: each of the respective conductors 306 is connected to branch supply conductor 216; each of the respective conductors 308 is connected to branch output conductor 248; and each of the respective conductors 310 is connected to branch output conductor 284.

In the D column of switches: each of the respective conductors 306 is connected to branch supply conductor 218; each of the respective conductors 308 is connected to branch output conductor 250; and each of the respective conductors 310 is connected to branch output conductor 286.

In the E column of switches: each of the respective conductors 306 is connected to branch supply conductor 220; each of the respective conductors 308 is connected to branch output conductor 252; and each of the respective conductors 310 is connected to branch output conductor 288.

In the F column of switches: each of the respective conductors 306 is connected to branch supply conductor 222; each of the respective conductors 308 is connected to branch output conductor 254; and each of the respective conductors 310 is connected to branch output conductor 290.

In the G column of switches: each of the respective conductors 306 is connected to branch supply conductor 224; each of the respective conductors 308 is connected to branch output conductor 256; and each of the respective conductors 310 is connected to branch output conductor 292.

All of the switches in rows (1) through (5) are normally open so that at such time no current flow is experienced from any of the branch supply conductors 306 to the respective branch output conductors 304, 308 and 310. However, whenever anyone of the key-actuated switches 302, as shown at (1)–A, is depressed and thereby closed the circuits between conductors 306 to 304, conductors 306 to 308, and conductors 306 to 310 are completed.

Accordingly, with master switch 208 closed, it can be seen that the closure of switch 302 as at, for example, (1)–B will cause current flow from conductor 210, through conductor 214, branch conductor 306, to each of branch conductors 304, 308 and 310. Branch conductor 304 in turn supplies current flow through output conductor 234 to actuating solenoid means 188; branch conductor 308 supplies current flow through output conductor 246 to solenoid assembly 262; branch conductor 310 supplies current flow through output conductor 282 and common conductor 296 to the feeder solenoid assembly 298.

In view of the preceding it should be apparent that the switch assemblies 302 are so arranged as to result, whenever closed, in the energization of one particular combination of remotely situated devices. For example, the closure of any of the switches 302 always results in the energization of feeder solenoid assembly 298. Further, closure of any of the switches in any one column always results in the enrgization of the same solenoid assembly related to that column; for example, in column A, the corresponding solenoid assembly would be 260. Additionally, the closure of any of the switches in any one row always results in the energization of the same selector plate solenoid actuating means; for example, in row (5) the closure of any switch always causes energization of solenoid means 196.

FIG. 15 illustrates a typical switch assembly 302 as being comprised of a depressible plunger-like key member 211 having a stem 213 guided within an aperture 215 of a stationary key guide plate 217 and provided with a key head portion 219. A lower stationary abutment plate 221 serves to contain one end of a compression spring 223 which, by means of a spring cup 225 secured to stem 213 by opposed snap rings 227 and 229, biases the key member 211 upwardly to the position shown. A switch member 231, which may be of a washer-like configuration is carried by and secured to stem 213 as by spaced opposed snap rings 233 and 235. An additional snap ring 237 may be provided at the upper portion of stem 213 in order to serve as an abutment against plate 217 when urged thereagainst by the spring 223.

An intermediate support member 239, having formed therein an aperture 241 for the reception therethrough of stem 213, carries a plurality of electrical contacts 243, 245, 247 and 249 which are respectively connected to one end of conductors 304, 306, 308 and 310 (also see FIG. 14). Accordingly, any time key member 211 is sufficiently depressed, the switch member 231 bridges contacts 243, 245, 247 and 249 thereby completing the circuits between the branch supply conductor 306 and branch output conductors 304, 308 and 310.

Referring again to FIGS. 1, 2, and 3 as well as FIGS. 17, it can bee seen that the deflector assembly 16 is comprised of a plurality of deflectors sections 16*a*, 16*b*, 16*c*, 16*d*, and 16*e* arranged in a generally stacked relationship. As typically illustrated in FIG. 17 by deflector unit 16*a*, each of the deflector units may be comprised of a main body 301 with side wall portions 303, 305, 307, 309, 311 and 312, and end wall 314 a lower or bottom wall 316 and a top wall 138 (a portion of which is broken away).

The top, bottom and side wall portions 318, 316, 303 and 309 combine to form in inlet passageway 320 in which a deflector-like gate or chute 322 is pivotally situated for purposes to be described. Also, as shown, located between the top and bottom walls 318 and 316 are a plurality of inner walls 423, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344 and 346 which combine

with said top and bottom walls **318** **316** to define respective passageways **348**, **350**, **352**, **354**, **356**, **358** and **360** having respective outlet openings **362**, **364**, **366**, **368**, **370**, **372**, and **374** which, as in the case of deflector assembly **16***a*, would in turn communicate with suitable receiving means such as trays **17***a*, **18***a*, **19***a*, **23***a*, **24***a* and **25***a*.

In addition to the above, a plurality of selectively positionable doors are contained within the deflector unit. For example, as shown, doors **376**, **378**, **380** and **382** are pivotally supported as at **384**, **386**, **388** and **390**. It can be seen that when the cute **322** is in the position shown with deflector door **380** also in the position shown, a path for the flow of mail is thereby defined as comprising passageway **356**. If the door **380** were rotated to a position as shown at **380***a* with deflector door **382** being in the position shown, the mail coming out of chute **322** would flow through channel of passageway **360** and out of opening **374**. Further, if deflector door **380** is rotated to its position at **380***a* while deflector door **382** is rotated to **382***a* then the mail coming out of chute **322** would pass partly through passageway **360**, strike and deflect off of door **382** and continue through passageway **358** finally passing out of outlet opening **372**. Similarly, if the chute **322** is rotated to its position shown at **322***a*, the deflector doors **378** and **376** may be selectively positioned (as shown or to their respective phantom-lime positions **378***a* and **376***a*) in order to thereby define paths for the flow of mail as through either of passageways **348**, **350** or **352** as the case may be. If, on the other hand, the chute **322** is positioned as at **322***b*, then the mail passing through chute **322** would pass directly into and through passageway **354** and out of outlet **368**.

FIG. **18**, in enlarged fragmentary view, illustrates the typical inlet end of the deflector sections or units **16**, as well as the chute **322**. In the preferred embodiment the typical inlet passageway **320** generally contains rotating wheels **400** and **402** which serve to propel the mail passing therebetween into and through the chute **322**. Preferably, the chute **322** is comprised of a main body **404** of generally cylindrical configuration closely received in a complimentary surface **406** and pivotally located therein as by opposed pivotal shaft portions **408** and **410**. An extension **412** of the body **404** defines a confining chute portion swingable to positions as incidated in phantom line. As generally depicted in FIG. **19**, the upper shaft **408** secured to chute body **404**, may be somewhat recessed within cover **318** and provided with a cross-slot **414**. The lower shaft **410** extends beyond the lower wall **316** and is provided with a cross tang **416**. With this arrangement, it is possible to stack one deflector assembly or unit **16** atop another and have the tang **416** of one chute shaft **410** received in the cross slot **414** of the chute shaft in the deflector unit immediately below.

AS shown in FIGS. **2** and **3**, the deflector units such as **16***a*, **16***b*, **16***c*, **16***d* and **16***e* are in stacked relationship and preferrably situated atop a lower base **22** which may be provided with suitable wheels or casters for mobility. The base **22** may, in turn, carry the various actuating motor means for controlling the positions of the chutes **322** in each of the deflector sections **16***a*, **16***b*, **16***c*, **16***d* and **16***e*, providing the driving force for the propulsion wheels carried by deflector units as well as positioning the various deflector doors in each of such deflector units.

As typically illustrated in FIGS. **17**, **20** and **21**, each of the deflector units **16***a*, **16***b*, **16***c*, **16***d* and **16***e* are preferrably provided with a plurality of auxiliary-like propulsion wheels **420** which are arranged in pairs to be respectively counter-rotating in order to operatively engage the article of mail passing through the passageway and propel it toward the corresponding opening or outlet.

As shown in FIG. **21**, each of the auxiliary drive wheels **420** is provided with upper and lower shaft portions **422** and **424** operatively connected thereto for rotation therewith. The upper shaft portion **422** may be somewhat recessed within the cover or top wall **318** while the lower shaft portion **424** extends downwardly beyond the wall **316**. The upper shaft **422** as a cross-slot (or some suitable drive surface) **426** formed therein while the lower shaft **422** carries a tang **428**. When the various deflector sections are stacked atop each other, the tang **428** is received within the cross-slot **426** of the shaft **422** in the next lower deflector section as depicted in FIG. **21**.

Drive wheels **400** and **402** carried at the inlet of each of the deflector sections, as shown in FIG. **18**, may also be provided with upper shaft portions **422***a*, corresponding to shaft portions **422** of FIG. **21**, and lower shaft portions **424***a* corresponding to shaft portions **424** of FIG. **21**. Accordingly, such shaft portions **422***a* and **424***a* would coact in the same manner as shaft portions **422** and **424** when the deflector units **16***a*, **16***b*, **16***c*, **16***d* and **16***e* were stacked atop each other.

FIG. **22**, in enlarged fragmentary cross-section, typically illustrates a deflector door arrangement. That is, as typically depicted deflector door **382**, as well as other deflector doors, may include upper and lower shaft portions **430** and **432** with the upper shaft portions **430** being somewhat recessed within the cover or upper wall **318** while the lower shaft **432** extends below the bottom surface of the lower wall **316**. Each of the upper shafts **430** may be provided with a cross-slot **434** while the lower shaft **432** is provided with a tang **436**. As shown, when the various deflector units are stacked, the tang **436** of the lower shaft **432** is operatively received within the cross slot **434** of the upper shaft **430** immediately therebelow.

FIG. **23**, in enlarged fragmentary plan view, illustrates a portion of the base **22** as being comprised of, for example, upper and lower walls **442**, and **444**. A first plurality of stub-like drive shafts **446**, **448**, **450**, **452**, **454** and **456** are carried by the base **22** in a manner as to be preferrably recessed within the upper wall **438** and journalled for rotation therein. Each of the first plurality of stub shafts, formed with a cross-slot **458**, is geared for counter-clockwise rotation through suitable motion transmitting means as is well known in the art. A second plurality of stub-like drive shafts **460**, **462**, **464**, **466**, **468** and **470** are similarly carried by the base **22** in a manner as to be recessed within the upper wall **438** and journalled for rotation therein. Each of the second plurality of stub-shafts, formed with a cross-slot **472**, is adapted for clockwise rotation through suitable motion transmitting means.

In addition to the above, FIG. 23 also illustrates the fact that the solenoids 260, 262, 268 and 270, previously referred to with regard to FIG. 14, may be carried by the base 22 and respectively connected through their armatures 474, 476, 478 and 480 to elongated slots 475, 477, 479, and 481 of swingable actuating arms 482, 484, 486 and 488 which, in turn, are fixedly connected to stub-like actuating shafts 490, 492, 494 and 496 recessed and journalled for rotation within upper wall 438. Each of the shafts 490, 492, 494 and 496 is provided with a cross slot 498 formed in the upper end thereof. Solenoids 260, 262, 268 and 270 are illustrated in their normal position; that is, when energized, solenoids 260 and 262 cause clockwise rotation of levers 482, 484 and shafts 490, 492 while, when actuated, solenoids 268 and 270 cause counter-clockwise rotation of levers 486, 488 and shafts 494, 496.

A fifth solenoid 265, which may be comprised of counter-wound field windings 264, 266 (FIG. 14) is similarly connected through its armature 500 to an elongated slot 502 of a lever 504 which is fixedly secured to a stub shaft 505 journalled for rotation within upper wall 438. As with the other stub shafts, a cross slot 508 may be formed in the upper end of shaft 506. Suitable biasing springs 510 and 512 may be suitably secured to the lever 504 in order to assure lever 504 attaining or remaining in its illustrated null position when the solenoid 265 is not energized.

In view of the above, it can be seen that when the respective deflector assemblies or units are atacked on the base 22, that: (a) the lower projecting shaft portions 424*a* of wheels 400 and 402 are drivingly engaged by driving shafts 456 and 470; (b) the lower shaft portion 410 of the lowermost chute 322 is operatively engaged with stub shaft 506; (c) the lower shaft portions 432 of each of the deflector doors 376, 378, 380 and 382 are respectively operatively engaged with stub shafts 490, 492, 494 and 496; and (d) the lower shaft portions 424 of the auxiliary drive wheels 420 are respectively operatively engaged with stub drive shats 446, 460, 448, 462, 450, 464, 452, 466, 454 and 468. In the normal or unenergized conditions: (a) deflector door 376 would be in its solid line position illustrated in FIG. 17; (b) door 378 would be in its phantom line position 378*a*; (c) chute 322 would be in its phantom line position 322*b*; (d) door 380 would be in its phantom line position 380*a*; and (e) deflector door 382 would be in its solid line position.

Generally, during operation whenever, for example, solenoid 260 is energized, all of the doors 376 on the pivot means 384 (which comprises all of the corresponding shaft positions of the stacked deflector units) are respectively simultaneously moved to their positions illustrated in phantom line 376*a* in FIG. 17. The same would be true as regards all other elements which are serially stacked on the various stub shafts carried by the base 22.

In view of the preceding and referring to FIGS. 4, 5, 10, 14, and 15, 17 and 23, it can be seen that if switch assembly 302 at location A–(1) of FIG. 14 were closed, solenoid 260 would be energized, through conductor 244, rotating stub shaft 490 thereby moving all of the stacked deflector doors 376 to their respective positions indicated by 376*a* of FIG. 17; simultaneously, solenoid means 188, comprised of solenoids 140 and 142, would be energized, through conductor 234 thereby moving selector plate 64 inwardly (as shown in FIGS. 10 and 11) so as to define the contoured channel or chute 89 as shown in FIG. 5.

Accordingly, an article of mail caused to travel through chute 89 would exit from outlet 90 and enter the corresponding inlet 92 of the upper-most situated diverter of deflector section 16*a* and progress through passageway 320 into the chute 322. However, at this time, current has also flowed through conductor means 243 to the winding 264 thereby causing chutes 322 to assume positions corresponding to 322*a* of FIG. 17. Therefore, such article of mail will exit from chute 322 of deflector unit 16a and progress generally along passageway 348 until it strikes the deflector door 376 at which point the article of mail would deflect into passageway 350 pass between counter-rotating wheels 420 and be propelled through exit 364.

The same general action would take place if the switches at locations A–(2), A–(3), A–(4) or A–(5) were depressed except that the selector section 14 would be actuated so as to respectively form channels 93, 97, 101 and 105 thereby delivering the article of mail to the respective inlets 96, 100, 104 and 108 of the deflector units 16*b*, 16*c*, 16*d* and 16*e* so as to cause respective exiting of the mail from corresponding outlets 364 of such stacked deflector sections units.

In comparison, if any of the switches in column G are depressed, chute solenoid 265 is not actuated thereby enabling the article of mail to pass through passageway 354 of the selected deflector unit and exit from the outlet 368 into suitable receiving means.

In view of the preceding, it should be apparent that in the particular embodiment of the invention disclosed, it is possible to select and direct an article of mail to any of 35 different receivers.

Thus far, the selector section 14, deflector section 16 and related control circuitry, as well as their related and interrelated operations, have been disclosed and described. The portions now to be described are those relating primarily to the selection and propulsion of the article of mail.

Referring now to FIG. 24, a fragmentary cross-sectional view taken generally on the plane of line 24—24 of FIG. 2, looking in the direction of the arrows, a letter feeder mechanism 528 is illustrated as comprising a body 530 having a passageway 532 formed therethrough with radial bearing assemblies 534 and 536 located at opposite ends thereof so as to have the respective inner and outer bearing races engaged with a rotatable shaft 538 and the body 530. A base 540 situated below body 530 provides a journal support for shaft 538 as by another radial bearing assembly 542. Situated generally between and engaging body 530 and base 540 is a thrust bearing assembly 544. Shaft 538 is precluded from axial motion while being free to experience rotative motion by any suitable means well known in the art.

One end 546 of body 530 is provided with guideways 548 and 550 which respectively slidably receive therein guide pins or members 552 and 554 carried by bight-like clevis portion 556. Compression springs 558 and 560 continually urge clevis or yoke portion 556 radially outwardly, with respect to the centerline of shaft 538,

so as to maintain engagement between a wheel **562**, pivotally secured to yoke **556** by an axle pin **564**, and surface **568** of a generally horizontally disposed track member **570**. The other end of body **530** may have suitably secured thereto a counter weight **572** in order to offset the unbalanced weight of the yoke **556** and related structure supporting it as well as supported thereby.

The upper side of body **530** has secured thereto a clutch plate **574** which, in turn, contains a plurality of generally circumferentially spaced friction members **576** (which may be cork pellets). A drive shaft plate **578**, having an aperture formed therethrough of a configuration drivingly engageable with the flatted portions **580** of the drive shaft **538**, is situated above the clutch plate **574** and urged into frictional engagement with friction members **576** by a compression spring **582**. The spring may be axially contained between an axially adjustable washer-like member **584** and a thurst bearing assembly **586** carried by the drive plate **578**. The upper end of drive shaft **538** may have formed a threaded portion **588** for engagement by an adjustable lock nut **590**.

A resilient finger **592** secured at one end **594** to yoke **556** has at its other end a pad **596** which is adapted to contact forward-most article of mail **40** and start such piece of mail into its journey through the selector assembly **14** and, subsequently, the diverter or deflector section **16**.

The feeder mechanism **528**, is, in FIG. **24**, illustrated in one of the positions it assumes during the mail feeding operation. That is, when the feeder mechanism **528** is in an unactuated or normal position, end **546** will be disposed generally to the right of the centerline of shaft **538** or, in other words, generally diammetrically opposed to the position illustrated with wheel **562** still in engagement with surface **568** of track member **570** which may be supported by any suitable structural portion **592** of the housing **26**.

FIG. **25**, a view taken generally on the plane of line **25—25** and looking in the direction of the arrows, illustrates the normal unactuated portion of body **530**, rotated 180° from the position shown in FIG. **24** and retained in such position by a latch or catch device **600**. (Guide pins **552**, **554**, as well as yoke **556** and related springs are not shown in FIG. **25** for purposes of clarity.)

Catch member **600** is illustrated as being comprised of a main body portion **602** pivotally secured to base **540** as by a pin **604** and having oppositely disposed upwardly directed abutment arms **606** and **608**. A linkage **610** pivotally secured to latch **600** as at **612**, is operatively connected at its other end to a solenoid assembly **298** which may include suitable means, for normally maintaining the catch **600** in the position illustrated. Whenever solenoid assembly **298** (also see FIG. **14**) is energized, linkage **610** is moved downwardly causing latch **600** to rotate counter-clockwise about pivot **604** thereby assuming a position as illustrated in phantom line at **600'**.

FIG. **26**, generally a plan view of track **570**, shown in slight perspective, illustrates the track **570** as being comprised of a body portion **614** having an inner track surface **568** formed therein in a manner defining a first generally arcuate section **616** and a second straight track section **618** blended at its ends with arcuate section **616**. The centerline **620** represents the axis of rotation of shaft **538** of FIG. **24**.

Whenever motor **228** is energized (FIG. **14**) it drives, through a suitable gear box **622**, shaft **538** so as to rotate clockwise, as viewed by the centerline **620** of FIG. **26**. HOwever, until such time as solenoid **298** is energized body **530** is locked in its "home" position by the upstanding abutment arm **606** of latch as shown in FIG. **25**. During such time that body **530** is latched as in FIG. **25**, shaft **538** continues to rotate and by means of flatted portions **580** drivingly rotate therewith drive shaft plate **578**. As a consequence of body **530** being latched, relative sliding motion is fricitonally experienced between the drive shaft plate **578** and friction members **576** of clutch assembly **574**. At this time, of course, wheel **562** is held against the arcuate track section **616** by the force of springs **558** and **560**.

When solenoid assembly **298** is energized, latch **600** is rotated to the position shown at **600'** thereby placing abutment arms **606** and **608** in the positions respectively shown by **606'** and **608'** (FIG. **25**). Such action enables the depending portion **624** of body **530** to pass over the top of abutment arm **606'** thereby permitting drive shaft **538** and drive shaft plate **578** to rotate body **530** clockwise about its centerline **620** (FIG. **26**). Such rotation of body **530** causes roller or wheel **562** to follow the curvature of track surface **568**. As wheel **562** approaches the straight section **618**, the resilient finger **592** engages the forward-most article of mail **40** and continued movement of wheel **562** along the straight section **618** results in the finger or arm **592** frictionaly engaging and moving the article of mail **40** so as to send it into the selector section **14**, in a manner to be described.

As body **530** completes its rotation and apporaches its "home" position, the actuated latch **600'** presents abutment arm **608'** in the path of movement of depending portion **624**. Accordingly, body **530** will continue its rotation until such time as leading surface **626** abuts against arm **608** as respectively illustrated in phantom line at **626'** and **608'** at which point rotation is arrested. As soon as solenoid assembly **298** is de-energized, linkage **610**, in association with suitable resilient means, rotates the latch **600** to the position shown in oslid line thereby lowering abutment arm **608** and enabling drive shaft **538** to rotate body **530** to a point where leading surface **626** of depending portion **624** abuts against the abutment arm **606**. The feeder assembly **528** is now in position for actuation into another cycle.

FIGS. **27**, **28** and **29** respectively illustrate the plan, side elevation and front elevation of an acceptable form of chute assembly **38**. As shown, the chute assembly **38** may be comprised of a lower base membe **628** having left and right side panels **630** and **632** suitably secured thereto and to a rear end apnel **634**. Front-mounted upwardly extending supports **636**, **638**, suitably secured to base **628** and side panels, are each provided with slotted portions **640** for the reception therein of a transparent member **642** which is held so as to define an opening vertically between the lower edge **644** of the window **642** and the top of the lower plate or base **628** and horizontally between supports **636** and **638**. As can be seen in both FIGS. **27** and **28**, side panel **632** is provided with a vertically directed opening **646**

in order to afford free passage therethrough of items of mail as such items are ejected from the chute assembly **38** and into the selector section **16**. A weighted movable slide plate **648**, having opposed L-shaped slide-guides **650** and **652** secured thereto, is employed for maintaining the items of mail in an upright position as well as to gravitationally move the stacked mail downwardly toward the window member **642**. The chute assembly **38** may be secured at its forward end within the housing **26** as by suitable structural members **643** and **645**.

FIG. **30**, a fragmentary cross-sectional view taken generally on the plane of line **30—30** of FIG. **2** and looking in the direction of the arrows, illustrates the relationship between the supply chute **38** and the primary propelling or drive wheels **654** and **656** situated respectively in opposite walls **658** and **660** of a housing section **662** carried within the covering or housing **26**. Housing section **662** is also provided with upper and lower walls **664** and **666** which combine, with the side walls **658** and **660**, to define a passageway **669** communicating generally between the side formed outlet **646** of chute assembly **38** and the inlet **88** of selector section **14**.

An opening **670** formed in wall **660** receives therein drive roller or wheel **656** which is secured to shaft **672** for rotation thereby; a second enlarged opening **676** formed in wall **658** accommodates the other drive roller or wheel **654**, secured to a shaft **678** for rotation thereby, and a second roller **680** which is secured to a shaft **682** for rotation thereby. Shafts **672**, **678** and **682** are, in turn, respectively connected as by suitably motion transmitting means **684**, **686** and **688** to a gear box **622** (FIG. **14**).

Drive rollers **654** and **656** are rotated, in directions indicated by the arrows, at a relatively fast speed. Such rotation is continuous whenever, for example, the switch **208** of FIG. **14** is closed. The same applies to retard roller **680**, however, roller **680** is preferably rotated at a speed relatively slow with respect to the speed of rotation of rollers **654** and **656** and in a direction opposite to that of roller **654**.

Whenever feeder finger **592**, **596** (FIG. **24**) is actuated and in its course of travel moves the forwardmost item of mail **40** to the right (as viewed in FIG. **30**) out through the opening **646**, the leading edge of the item of mail is cought between the fast rollers **654** and **656** (as generally illustrated in phantom line at **40'**) and driven at a high velocity into the inlet **88** of juxtaposed selector section **14** and through the selectively formed channel or chute therein into the corresponding passageway of diverter or deflector section **16**.

In certain rare instances the item of mail directly behind the forward-most item of mail may tend to be drawn to the right as the feeder finger moves the forwardly located article of mail into the rollers **654** and **656**. The retard roller **680** is provided in order to avoid the possibility of having two items of mail, one of which may consequently be misdirected, simultaneously pass between rollers **654** and **656**. As can be seen in FIG. **30**, as the second article of mail **40''** starts to move to the right simultaneously with the movement of the leading item of mail, it is caused to engage, as shown in phantom line, the slower rotating retard roller **680** which prevents its further movement. This, in turn, causes the trailing end of item **40'** to remain out of normal position and clearly visible to the operator who, upon noticing it, may then merely reach-up and reposition the item, if necessary, in order to read the complete address.

Feeder mechanisms other than that FIGS. **24**, **25** and **26** may, of course, be employed. One such alternative feeder structure is shown at **700** of FIGS. **32**, **33** and **34**. FIG. **32** illustrates the feeder mechanism **700** in a position as if it were located immediately in front of the mail supply chute of FIG. **29**.

The feeder mechanism **700** is shown as comprising a suitable base **702** having upstanding end portions **704** and **706** fixedly supporting, at opposite ends, parallel guide bars or rods **708** and **710** which, in turn, slideably support an movable block or body **712**.

A vertically directed member **714** is hingedly supported by the block **712** as by suitable hinge means **716** permitting the member **714** to be at times pivotally rotatable in the clockwise direction from the position shown in FIG. **34**. Member **714** has secured thereto an upper extension **718** with a resilient button like portion **720** at the end thereof, while the lower portion of member **714** carries a downwardly depending axle portion **722** which, in turn, rotatably supports a follower wheel **724**. A spring **726** resiliently urges member **714** into abutting engagement with block or body **712** as shown in FIG. **34**.

An actuating arm **728** pivotally secured to base **702** as at **730**, generally cinfiningly receives, within an inner track **732**, an actuating wheel **734** which is rotatably supported on an axle **736** carried by body **712**. Generally, as arm **728** is rotated clockwise, body **712** slides along bars **708** and **710** to the right as viewed in FIG. **32**. Such movement of the arm **728** may, of course, be achieved through suigable solenoid means **738** which may in fact directly replace the solenoid means **298** of FIG. **24**.

As best seen in FIGS. **33** and **34**, base **702** carries a first fixed guide track **740** which is preferably provided with a substantially flat upwardly directed planar surface **742** against and along which the guide wheel **724** may at times roll. A second guide track member **744** having a generally upwardly directed curved (when viewed in FIG. **33**) track or guide surface **746** is pivotally secured as at **748** to base **702**. Suitable spring means, such as that generally schematically illustrated at **750**, is secured as to a bottom poition of the movable guide member **744** as to continually urge the member **744** in a clockwise direction about pivot support **748**.

In operation, whenever solenoid means **738** is not energized the armature thereof causes the block **712** to return to the postion shown in FIG. **32** and **33**. However, when solenoid means **738** is rotated clockwise about pivot **730** thereby causing body **712** to slide to the right (as viewed in either FIG. **32** or **33**). As the body **712** thusly slides to the right, guide wheel **724** engages the left end **752** of contoured guide track **746** and proceeds to follow the contour thereof. As wheel **724** follows the track **746** the wheel **724** moves to the left, as viewed in FIG. **34**, thereby causing member **714** to rotate generally clockwise about the hinge pivot **716** which, in turn, causes the pad **720** to be moved toward and aginst the forwardly disposed article of mail **40** (FIG. **27**). Consequently, furhter sliding movement of

boyd 712 results pad 720 ejecting such article of mail into the wheels 654, 656 of FIG. 30.

When wheel 724 reaches and then exceeds the right end 754 of track member 744 the spring 726 rotates member 714 clockwise about pivot 716 thereby causing wheel 724 to move generally inwardly between end 754 of track member 744 and end 756 of track member 740. At the same time solenoid means 738 is de-energized, as through suitable switching circuitry, thereby causing the actuating arm 728 to be rotated counter-clockwise about pivot 728 and block or body 712 to slide to the left along rails 708, 710 on its return to its "home" position as shown.

It should be apparent that as wheel 724 changes from track 746 to track 742, pad 720 is moved away from any mail in the chute 38. As the body 712 returns to the left, wheel 724 follows guide track 742 and finally engages the inside of track 746 near end 752 thereof and in so doing causes end 752 to rotate generally counter-clockwise about its pivot support 748 against the resistance of spring 750. End 752 will so rotate a distance sufficient to permit wheel 724 to pass brom between the two tracks after which spring 750 again return guide track member 744 to the position shown to be ready for the next cycle of operation.

FIGS. 35, 36 and 37 illustrate another feeder mechanism 758; FIG. 35 illustrates the feeder mechanism in a position as if it were located immediately in front of the mail supply chute of FIG. 29.

The feeder mechanism 758 is shown as comprising a suitable base 760 having upstanding end portions 762 and 764 slideably supporting, at opposite ends, a guide or actuating rod or rail 776. A main carrier body 768 is pivotally situated on the rod 766 and positioned, in the normal position shown, by means of a coiled torsion spring 770 which has one end 772 secured to body 768 and an other end 774 secured to a block or body 776 fixedly secured to rod 766 as by means of a key-like pin 778. The left end of shaft or rod 766 may be formed to have flatted surfaces 780 which slideably coact with a like guideway 782 formed in end support 762 in order to thereby maintain a predetermined relationship of the rod 766 with respect to the base 760. As schematically illustrated, the left end of rod 766 may be operatively connected to suitable solenoid means 784 which may in fact directly replace the solenoid means 298 of FIG. 24.

Body or carrier 768 has a resilient upwardly extending finger-like member 786 which carries at the upper end thereof a suitable pad or button 788 for at times engaging a related article of mail. Body 768 also carries a downwardly depending shaft or axle 790 which, in turn, rotatably carries a wheel 792.

A cam body 794, having an outer inclined peripheral surface 796, is suitably fixedly secured to the base 760. As best seen in FIG.36, the outer inclined peripheral surface 796 is defined generally by surface portions 798, 800, 802 and 804 which are generally blended with each other to form a continuous surface.

In operation, solenoid means 784 is energized causing rod 766 to move to the right carrying with it the body or carrier 768. Such movement continues causing wheel 792 to strike cam surface portion 798 and start to roll along such surface as generally depicted at 792*a*. As wheel starts to follow cam surface portion 798, carrier of body 768 is rotated counter-clockwise (as viewed in FIG. 37) about the rod or shaft 766 causing the pad 788 to engage an article of mail 40. Such rotation of body 768 is against the resilient resistance of spring 770 which tends to maintain the body 768 in the position shown.

Further movement to the right causes the wheel 792 to roll along cam surface portion 800 as generally depicted at 792*b* thereby enabling the finger pad 788 to eject or feed an article of mail to the propelling wheels 654 – 656 of FIG. 30. When the follower wheel 792 reaches the end of surface portion 800 spring 770 will rotate carrier body 786 generally clockwise (as viewed in FIG. 37) thereby causing wheel 792 to start to engage cam surface portion 802. At this time the solenoid means 784 will become de-energized permitting its internal or related spring means to return the shaft 766 and carrier body 768 to the left to the "home" position illustrated. However, in so doing the wheel 792 rolls along surface 802, as generally shown at 792*c*, and continues along surface portion 804 as shown at 792*d*. It should be apparent that as the carrier is returning to the left, the body 768 and finger 786 are tilted away from the next awaiting article of mail thereby preventing accidental engagement between the pad 788 and article of mail 40. Once wheel 792 completes its passage over surface 804, spring 770 once more centers the body 768 and wheel 792 so as to be ready for the next cycle of operation.

FIGS. 38 and 39 illustrate another embodiment of the invention. All elements which are like or similar to those of FIG. 1 and 2 are identified with like reference numerals.

The basic difference between the embodiments of FIGS. 38 and 39 and FIGS. 1 and 2 is that the selector section 14 of FIGS. 1 and 2 is replaced by the selector section 14*a* of FIGS. 38 and 39. The functions of both selector sections are, however, the same. That is, each provides channel means by which an article of mail is moved to a preselected elevation for enterance to a correspondingly selected diverter or deflector unit within section 16. This can better be appreciated by a comparison of FIGS. 5, 6, 7, 9 and 8 to FIGS. 40, 41, 42, 43 and 44, respectively. There it will be seen that selectively formed channels 89, 93, 97, 101 and 105 functionally correspond to fixed channels 89*a*, 93*a*, 97*a*, 101*a* and 105*a*.

In the preferred form of the invention as shown in FIGS. 38–44, the selector section 14*a* is formed to have a plurality of fixed channels with respective outlet ends which are vertically aligned with each other as shown in plan view in FIG. 38 while having a plurality of inlets 806, 808, 810, 812, and 814 which are horizontally aligned as generally illustrated in FIGS. 39–44. This is in comparison to selector section 14 of FIGS. 1–9 which, even though having a like plurality of outlet ends, has a single inlet 88. Section 14*a*, if desired, may be constructed as a unitary structure or a group of individually formed channels secured in assembled relationship to each other.

FIG. 45, an enclarged fragmentary cross-sectional view taken on the plane of line 45—45 of FIG. 39 illustrates the preferred means employed for delivering an item of mail to the respective inlets 806, 808, 810, 812 and 814 of channels 89*a*, 93*a*, 97*a*, 101*a* and 105*a*. All elements in FIG. 45 which are like or similar to those of

FIG. 30 and 31 are identified with like reference numerals.

A chute-like guide channel member **816** has an enlarged inlet end **818** which gradually narrows to an outlet end **820**. The member **816** is carried by a pivot shaft **822** which selectively rotates the member **816** as to position outlet end **820** in juxtaposition to an inlet end of a selected fixed channel comprising the selector assembly **14***a*.

FIG. **47**, in enlarged generally plan view taken on the plane of line **47—47** of FIG. **46**, illustrates suitable mechanism **824** employable for selectively positioning the chute **816** of FIGS. **45** and **46**. The mechanism **824** is illustrated as comprising a first plurality of levers **826, 828** and **830** each pivotally secured as at **832** to a related support structure **834**. A second plurality of levers **836** and **838** is similarly pivotally secured as at **840** to related support structure **842**.

Arms **844, 846** and **848** of levers **826, 828** and **830** are respectively pivotally connected as at **850, 852** and **854** to solenoid assemblies **856, 858** and **860** while arms **862** and **864** of levers **836** and **838** are respectively pivotally connected as at **866** and **868** to solenoid assemblies **870** and **872**. The opposite arms of levers **826, 828, 830, 836** and **838** are respectively provided with recesses or notch-like portions **874, 876, 878, 880** and **882**.

Shaft **822**, secured to the chute **816**, is also fixedly secured to a lever arm **884**, which, in turn, carries a vertically upstanding roller assembly **886** adapted for engagement by the various notched recesses.

As should be apparent, when solenoid **860** is energized, lever **830** is rotated clockwise resulting in the notch recess **878** engaging roller **886** and through such action causing counter-clockwise rotation of lever **884** and shaft **822** until roller **886** attains a position as depicted generally at **886***a*. This, in turn, causes chute **816** to be rotated as to have its outlet end **820** juxtaposed to inlet **814** to channel **105***a*. Similarly, as solenoids **858, 870** and **872** are energized, the associated levers and notches cause roller **886** to be moved to positions **886***b*, **886***d* and **886***e* respectively, with end **820** of chute **816** being sequentially juxtaposed to inlets **812, 808** and **806** of selector channels **101***a*, **93***a* and **89***a*. When solenoid **856** is energized, recess **874** of lever **826** serves to engage roller **886** and assure its position as at **886**c so as to have end **820** of chute **816** juxtaposed to inlet **810** of channel **97***a*.

The circuitry, for the embodiment of the invention of FIGS. **38, 39** and **47** may be that as shown in FIG. **14**. In such a case, solenoid assemblies **860, 858, 856, 870** and **872** of FIG. **47** would be directly respectively substituted for solenoid assemblies **118, 190, 192, 194**, and **196** of FIG. **14**, and, further, solenoid assemblies **198, 200** and **202** of FIG. **14** would be eliminated from the circuitry.

In view of the preceding it should be apparent that the invention as herein desclosed provides sorting apparatus extremely simple to construct and capable of performing its sorting function in a relatively limited floor space. Further, the invention may be employed in a modular manner. For example, it is possible to have a second bank of deflector assemblies or units placed in series with outlets otherwise feeding receivers **21***a*, **21***b*, **21***c*, and **21***d* and **21***e* thereby expanding the range of sorting operations.

It should also be apparent that if desired, the various actuating solenoids may be substituted for by other appropriate means such as, for example, pneumatic piston-cylinder assemblies. In such instances, it would of course be possible to employ solenoid operated air valves leading to the piston-cylinder assemblies.

Still other modification are possible. For example, suitable sensing means whether such be limit switches, micro-switches, photo-electric devices or any other suitable means, may be employed at each of the deflector doors so as to sense the passage therethrough of an article of mail and, in turn, if desired, create a signal indicating to the operator the occurrence of such an event or even exhibit a related control function.

Although only a select number of preferred embodiments and modifications of the invention have been disclosed and described, it is apparent that other embodiments and modifications of the invention are possible within the scope of the appended claims.

I claim:

1. A sorting apparatus for sorting articles to be successively taken from a common source and distributed to various receiving means, comprising a plurality of vertically arranged first modular means including a plurality of vertically and laterally spaced passageways for the travel therethrough of successive ones of said articles, each of said first modular means comprising a plurality of door assemblies being selectively positionable so as to thereby cooperate with said laterally spaced passageways in defining paths leading to said receiving means, second means interposed between said common source and said plurality of vertically arranged first modular means and having an inlet and an outlet end, said second means including a plurality of translationally positionable selector means, said selector means being effective to define a plurality of channels, one at a time, communicating between said inlet and said outlet end in a manner whereby said plurality of channels communicate with said inlet but define a plurality of distinctly separate outlets within said outlet ends, said separate outlets when defined by said translationally positionable selector means being respectively generally juxtaposed to said spaced passageways in order to thereby define a substantially continuous path for the travel of a successive one of said articles from said common source through one of said channels into a juxtaposed passageway through an opened door assembly and onto one of said receiving means, and control means for selectively controlling said doors and translationally positionable selector means.

2. A sorting apparatus according to claim **1** wherein said second means comprises a housing having spaced first and second side walls and spaced upper and lower walls, said walls cooperating to define said inlet at one end of said housing and said outlet end at the other end of said housing, a first plurality of elongated slots formed in said first side wall, a second plurality of elongated slots formed in said second side wall, each of said first plurality of slots terminating at the respective one ends thereof near said inlet and in relatively closely spaced relationship to each other and terminating at the respective other ends thereof near said outlet and in spaced relationship substantially greater than said closely spaced relationship of said one ends, each of said second plurality of slots terminating at the respective other ends thereof near said outlet end in spaced

relationship substantially greater than said closely spaced relationship of said one ends of said second plurality of slots, wherein said selector means comprises a first plurality of elongated selector plates adapted to be respectively slidably received within said first plurality of elongated slots and a second plurality of elongated selector plates adapted to be respectively slidably received within said second plurality of elongated slots, said selector plates being moveable in directions transverse to said side walls so as to at times be placed in an actuated position spanning the space between said side walls, and actuating means operatively connected to said selector plates for at times causing selected ones of said selector plates to assume said actuated position and at other times to withdraw said selector plates from said space between said side walls.

3. A sorting apparatus according to claim 2 wherein said actuating means comprises solenoid means operatively connected to each of said selector plates.

4. A sorting apparatus according to claim 1, wherein said second means comprises a housing having spaced first and second side walls and spaced upper and lower walls, said walls cooperating to define said inlet at one end of said housing and said outlet end at the other end of said housing, a first plurality of elongated slots formed in said first side wall, a second plurality of elongated slots formed in said second side wall, each of said first plurality of slots terminating at the respective one ends thereof near said inlet and in relatively closely spaced relationship to each other and terminating at the respective other ends thereof near said outlet and in spaced relationship substantially greater than said closely spaced relationship of said one ends, each of said second plurality of slots terminating at the respective one ends thereof near said inlet and in relatively closely spaced relationship to each other and terminating at the respective other ends thereof near said outlet end in spaced relationship substantially greater than said closely spaced relationship of said one ends of said first plurality of slots, each of said respective one ends of said first plurality of slots being disposed on one side of an imaginary horizontal plane passing transversely and medially of said inlet and each of said respective one ends of said second plurality of slots being deposed on the side opposite to said one side of said imaginary plane, wherein said selector means comprises a first plurality of elongated selector plates adapted to be respectively slidably received within said first plurality of elongated slots and a second plurality of elongated selector plates adapted to be respectively slidably received within said second plurality of elongated slots, said selector plates being moveable in directions transverse to said side walls so as to at times be placed in an actuated position spanning the space between said side walls, and actuating means operatively connected to said selector plates for at times causing selected ones of said selector plates to assume said actuated position and at other times to withdraw said selector plates from said space between said side walls.

5. A sorting apparatus according to claim 1, wherein said second means comprises a housing having spaced first and second side walls and spaced upper and lower walls, said walls cooperating to define said inlet at one end of said housing and said outlet end at the other end of said housing, a plurality of first elongated slots formed in said first side wall, a plurality of second elongated slots formed in said second wall, said plurality of first slots having their respective one ends terminating near said inlet and in relatively closely spaced relationship to each other and terminating respectively at their other ends near said outlet and in spaced relationship substantially greater than said closely spaced relationship of said one ends, each of said plurality of second elongated slots having their respective one ends terminating near said inlet and in relatively closely spaced relationship to each other and terminating respectively at their other ends near said outlet end in spaced relationship substantially greater than said closely spaced relationship of said one ends of said plurality of second slots, wherein said selector means comprises a plurality of first elongated selector plates adapted to be respectively slidably received within said plurality of first elongated slots and a plurality of second elongated selector plates adapted to be respectively slidably received within said plurality of second elongated slots, supporting structure operatively connected to said housing, solenoid means carried by said supporting structure and respectively operatively connected to said selector plates, and control circuit means for at times energizing certain of said solenoid means, said certain energized solenoid means being effective for translationally moving said selector plates connected thereto through said slots so as to transversely span the space between said side walls.

6. A sorting apparatus according to claim 1 including feeder means for intermittently and successively causing said articles to be taken from said common source and introduced into said second means, said feeder means comprising a relatively resilient member frictionally engageable with successive ones of said articles at said source, a drive member for carrying said resilient member toward and away from said source, guide means for causing said resilient member to travel in a substantially linear path after said drive member has moved said resilient member toward said source a predetermined distance, said guide means being effective for enabling said resilient member to frictionally engage one of said articles and move said one article toward said second means as said resilient member travels in said linear path, and additional guide means effective after said resilient member has traveled a predetermined distance along said linear path for causing said resilient member to move in a direction away from said source.

7. A sorting apparatus according to claim 6 including disengageable abutment means effective for abuttably restraining further movement of said resilient member after said resilient member has moved a predetermined distance in said direction away from said source.

8. A sorting apparatus for sorting articles to be successively taken from a common source and distributed to various receiving means, comprising a plurality of vertically arranged first modular means for continuously defining a plurality of vertically and laterally spaced passageways for the travel therethrough of successive ones of said articles, each of said first modular means comprising a plurality of door assemblies being selectively positionable so as to thereby cooperate with said passageways in defining paths lead to said receiving means, second means interposed between said com-

mon source and said first means and having an inlet and an outlet end, said second means including a plurality of translationally positionable selector means, said selector means being effective to define a plurality of channels, one at a time, communicating between said inlet and said outlet end in a manner whereby said plurality of channels communicate with said inlet but define a plurality of distinctly separate outlets within said outlet end, said separate outlets when defined by said translationally positionable selector means being respectively generally juxtaposed to respective second inlets of said plurality of vertically arranged first modular means communicating with said laterally spaced passageways therein in order to thereby define a substantially continuous path for the travel of a successive one of said articles from said common source through one of said channels into a juxtaposed second inlet through a path defined by one of said door assemblies and passageways and onto one of said receiving means, including feeder means for intermittently and successively causing said articles to be taken from said common source and introduced into said second means, said feeder means comprising a guide track having formed therein a guide surface, a base, a drive shaft extending from said base, a body member pivotally situated on said base, friction clutch means operatively connecting said body member to said drive shaft, a wheeled follower assembly carried by said body member and resiliently urged against said guide surface, and an extending finger-like member adapted for frictional engagement with one of said articles, said drive shaft being effective to at times through said friction clutch means rotatingly drive said body member in a manner causing said wheeled follower assembly to follow said guide surface and in so doing frictionally engage and take from said common source said one of said articles and introduce said one of said articles into said second means.

9. A sorting apparatus according to claim 1 including means for providing a propelling force, greater than the force of gravity, to such of said articles as are introduced into said second means.

10. A sorting apparatus according to claim 9 wherein said means for providing a propelling force comprises first propelling means for propelling said articles through said respective channels and second propelling means for propelling said articles through said respective passageways.

11. A sorting apparatus according to claim 9 including additional means situated in close proximity to said propelling means for preventing the unintentional simultaneous introduction of more than one of said articles into said respective channels within said second means.

12. A sorting apparatus according to claim 1, wherein each of said first modular means comprises an inlet with pivotally positionable diverter chute means situated generally therein, said chute means being pivotally positionable to selected positions corresponding generally to the directions of at least certain of said laterally spaced passageways, and wherein said plurality of door assemblies are pivotally positionable to deflect and divert such articles of mail as pass through said chute means into a selected one of said laterally spaced passageways.

13. A sorting apparatus according to claim 12, including first solenoid means operatively connected to said diverter chute means for pivotally positioning said chute means, and second solenoid means operatively connected to said door assemblies for selectively pivotally positioning said doors.

14. A sorting apparatus according to claim 13 including electrically actuated feeder means effective when actuated for intermittently and successively causing said articles to be taken from said common source and introduced into said second means interposed between said common source and said first means, and including electrical circuit means containing a plurality of independent switch means, each of said independent switch means being effective upon closure to cause:

a. actuation of said feeder means;

b. positioning of certain of said selector means to define certain of said plurality of channels; and

c. energize certain of said solenoid means so as to selectively position said chute means and said door assemblies in order to thereby define said path for said article.

15. A sorting apparatus for sorting articles of mail to be successively taken from a common source and distributed to various receiving means, comprising first feeder means for successively moving an article of mail from said source to associated second means, said second means comprising elevation selector means having an inlet end extending over substantially one elevational level and an outlet end extending over a plurality of elevational levels; said selector means being effective to accept said article of mail from said feeder means at said inlet end and route said article of mail to a selected one of said plurality of elevational levels, and deflector means for receiving said article of mail from said selector means and routing said article of mail to one of said associated receiving means, said deflector means comprising a plurality of deflector assemblies, each of said deflector assemblies comprising a housing-like body with an inlet end and a plurality of outlets, a plurality of laterally spaced passageways formed in said deflector body in general communication with each other and with said plurality of outlets and said deflector inlet, a plurality of deflector doors carried generally within said passageways, said deflector doors being effective to be variably selectively positioned as to define a desired path of travel for said article of mail from said inlet of said deflector assembly through at least one of said passageways and out through one of said plurality of deflector outlets, said plurality of deflector assemblies being elevationally arranged in generally stacked relationship to each other as to thereby position the respective inlets of said deflector assemblies at a plurality of elevational levels corresponding to the plurality of deflector assemblies employed and so as to be generally juxtaposed to said outlet end of said selector means.

16. A sorting apparatus according to claim 15, including a pivotal deflector chute-like structure situated generally in each of said inlets of said deflector assemblies, each of said deflector chutes being pivotally positionable to accept said article of mail from said selector means and angularly deflect the path of travel of said article of mail to a selected one of said plurality of passageways.

17. A sorting apparatus according to claim 15, wherein said selector means comprises body means defining a plurality of channels, each of said channels having an inlet and an outlet, each of said channel inlets being lateraly spaced from each other but at substantially the same elevational level, and each of said channel outlets being vertically spaced from each other and at respectively different elevational levels, each of said elevational levels corresponding to the elevational level of the respective inlets of said deflector assemblies.

18. A sorting apparatus according to claim 15, wherein said feeder mechanism comprises a relatively resilient member frictionally engageable with successive ones of said articles of mail at said source, a drive member for carrying said resilient member toward and away from said source, and guide means for causing said resilient member to travel in a substantially linear path path after said drive member has moved said resilient member toward said source a predetermined distance, said guide means being effective for enabling said resilient member to frictionally engage one of said articles of mail and move said article of mail toward said second means as said resilient member travels in said linear path, said guide means being further effective after said resilient member has traveled a predetermined distance along said linear path for causing said resilient member to move in a direction away from said source.

19. A sorting apparatus according to claim 15, including means for providing a propelling force greater than the force of gravity to such of said articles of mail as are introduced into said second means.

20. A sorting apparatus according to claim 19, wherein said means for providing a propelling force comprises a first propelling means for propelling said articles of mail through said respective channels and second propelling means for propelling said articles of mail through said respective passageways.

21. A sorting apparatus according to claim 19, including additional means situated in close proximity to said means for providing a propelling force for preventing the unintentional simultaneous introduction of more than one of said articles of mail into said second means.

22. A sorting apparatus according to claim 17, including a pivotal deflector chute-like structure situated generally between said feeder means and said selector means, said deflector chute being pivotally positionable to accept said article of mail from said feeder means and angularly deflect the path of travel of said article of mail to a selected one of said inlets of said channels.

23. A sorting apparatus according to claim 15, including actuating means for actuating all of said door assemblies, said actuating means comprising a plurality of motor means with respective ones of said motor means being operatively connected for actuating as a group all of said door assemblies of the respective deflector assemblies as are generally vertically aligned with each other.

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