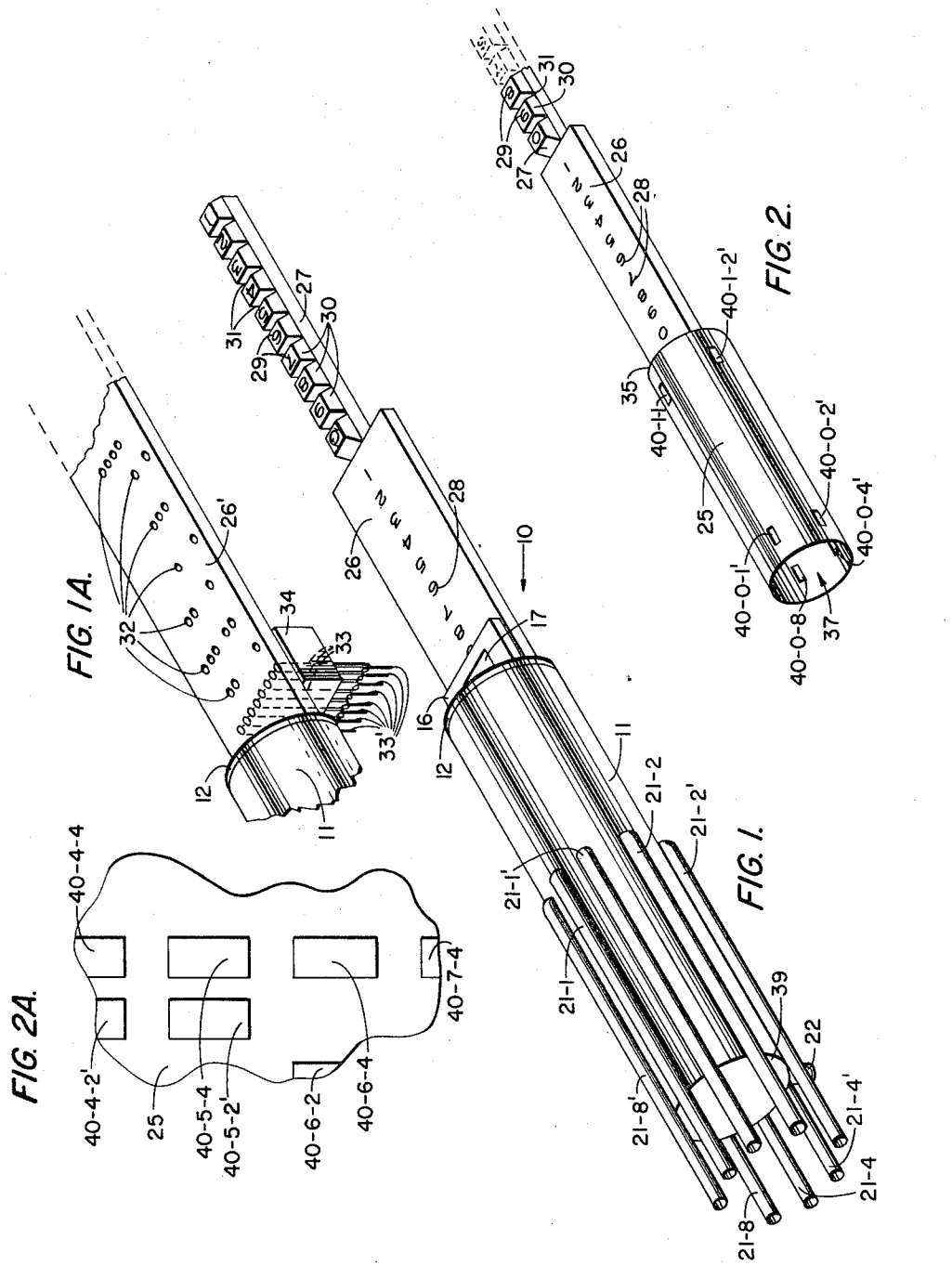
Aug. 13, 1968 G. B. GREENE 3,397,403

FLUID ACTUATED PRINTER

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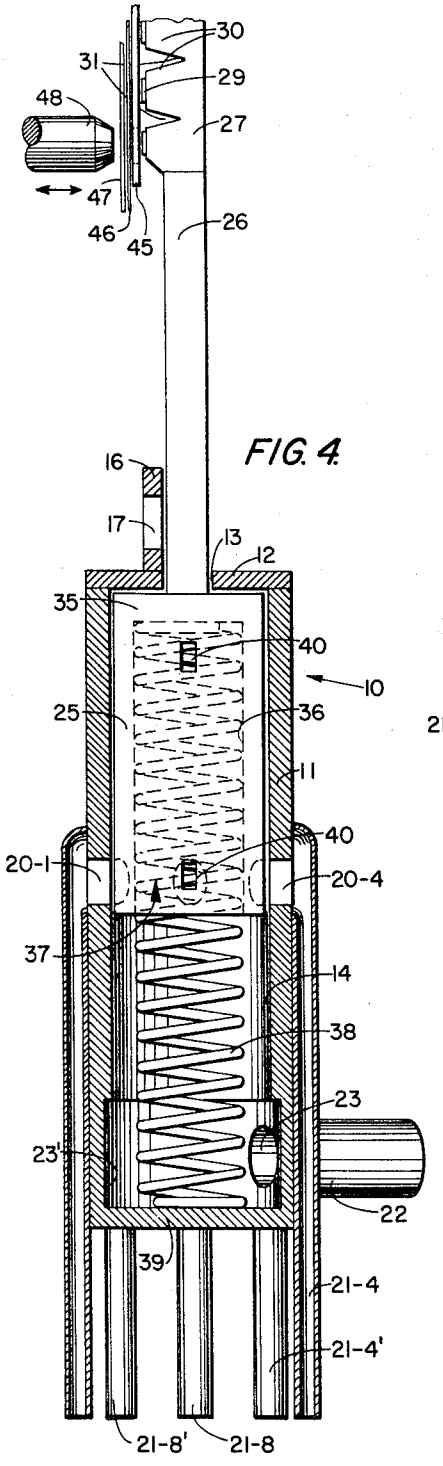


FIG. 4.

FIG. 3.

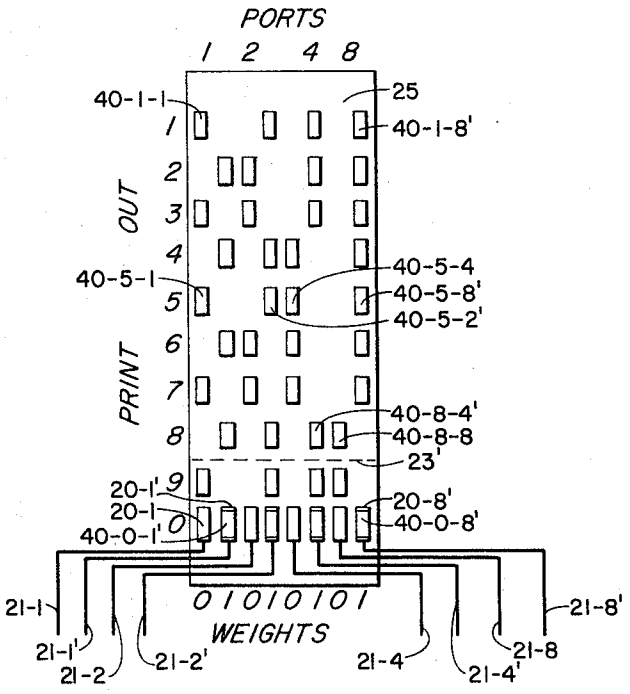
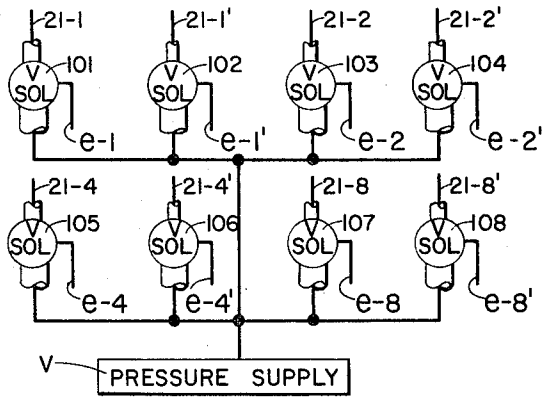


FIG. 6.



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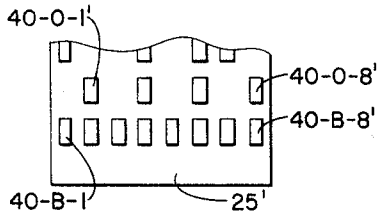


FIG. 5A.

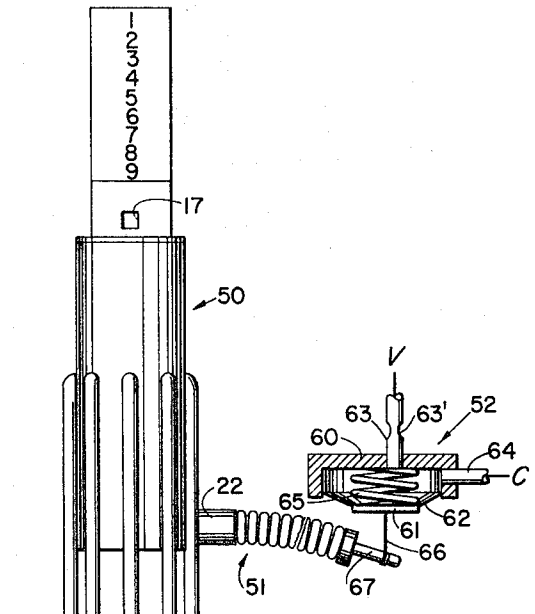
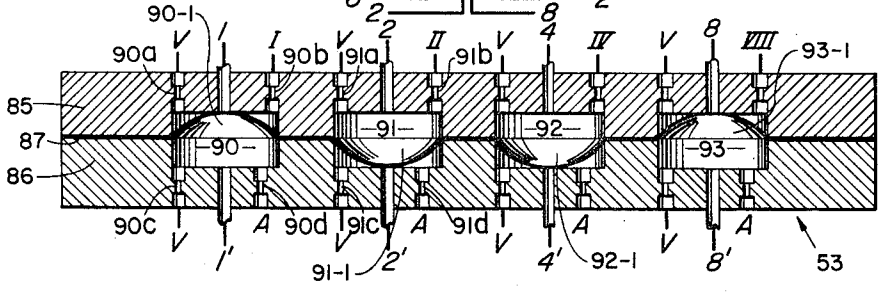
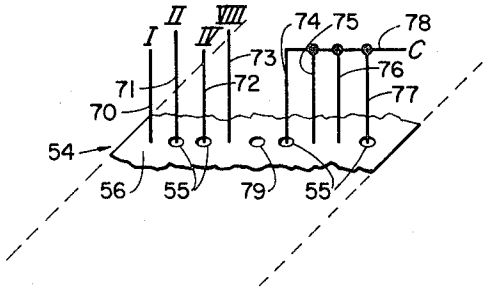


FIG. 5.





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3,397,403

FLUID ACTUATED PRINTER

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Filed Nov. 21, 1966, Ser. No. 595,975
16 Claims. (Cl. 346—72)

This invention relates to novel and inexpensive apparatus for translating data signals from a first code into a second code manifesting said signals in said second code. More particularly, this invention relates to a fluid-operated device having a plurality of input means adapted, as a set, to receive signals in the form of permutations of fluid pressures (vacuum or superambient), and having as its output means a carrier bearing a plurality of symbols (e.g., representations of characters corresponding to said signals, types adapted to imprint such representations, or coded arrangements of perforations or electrical contacts corresponding to said signals), said carrier means being moved by said permutations of pressures to bring symbols corresponding to said signals into coacting relationship with manifesting means (e.g., an aperture exposing only one of said representations at a time, ribbon and hammer means for causing imprints of the types corresponding to input signals to be impressed upon a record medium, stationary pipes for reading said coded perforations or stationary contacts for reading said electrical contacts).

In those arts now known by the generic term "fluidics," and more particularly in the fluidic control, computation, and information handling arts, a need has long existed for compact, simple, inexpensive means for translating signals in a first code represented by permutations of the pressures (including vacua) in a plurality of fluid conduits into signals in a second code represented by permutations of pressures in a second plurality of fluid conduits, by displacements of one or more mechanical elements, etc. Further, the need has long existed in these same arts for compact, simple, inexpensive means for manifesting such signals in the form of displayed representations of characters corresponding thereto, imprinted representations of characters corresponding thereto, and the like. In addition, a need exists in these arts for compact, simple, inexpensive apparatus capable of efficiently carrying out both of these functions, e.g., translating Binary-Coded Decimal, bit parallel, digit serial fluidic signals into printed decimal numbers. Such a translating and manifesting device will be referred to herein as a "transfestor."

It is therefore an object of the invention to provide compact, simple, and inexpensive apparatus capable of displaying or printing a sequence of characters corresponding to a sequence of multi-channel fluidic signals applied to its input.

Another object of the invention is to provide compact, simple, inexpensive apparatus capable of translating multi-channel fluidic signals in a first code into multi-channel fluidic signals in a second code.

Another object of the invention is to provide compact, simple, inexpensive apparatus capable of accepting multi-channel fluidic signals and manifesting these signals as symbols in the form of printed characters, successively displayed representations, etc.

Another object of the present invention is to provide simple, compact, inexpensive means for manifesting in a plurality of forms the characters corresponding to multi-channel fluidic signals successively applied thereto, e.g., displayed representations of said characters and printed representations thereof.

Another object of the present invention is to provide compact, simple, and inexpensive means capable of accepting electrical signals provided within an electronic or

electromechanical calculating or computing device in the internal code of said device and either displaying sequences of characters corresponding to sequences of said signals, printing sequences of characters corresponding to sequences of said signals, or both.

Another object of the invention is to make possible an inexpensive mobile teleprinter for use in police digital radio communications systems, and the like.

Another object of the invention is to provide inexpensive storage capacity for signals in a fluidic coded data transmission and handling system (e.g., calculator, computer, data processing device, or the like).

Other objects of the invention will in part be obvious, and will in part appear hereinafter.

The invention, accordingly, comprises the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description, taken in connection with the accompanying drawing, in which:

FIGURE 1 is a perspective view of a signal translating, print-out, and display device embodying the invention;

FIGURE 1*a* is a partial perspective view of a tape code translating device according to the invention;

FIGURE 2 is a perspective view of a code piston and symbol carrier assembly adapted to be employed in an embodiment of the present invention;

FIGURE 2*a* illustrates a small area of the outer wall of the code piston of FIGURE 2;

FIGURE 3 shows the outer wall of the code piston of FIGURE 2 as developed on a plane, and the associated input pipes and ports;

FIGURE 4 is a central sectional view of a signal translating and manifesting device ("transfestor") embodying the present invention;

FIGURE 5 represents a fluidic system according to the present invention for displaying seriatim the numerical characters perforated into a tape;

FIGURE 5*a* illustrates a modification of the device of FIGURE 1 which is incorporated in the signal translating and manifesting apparatus of FIGURE 5 to adapt it to the application shown therein;

FIGURE 6 illustrates the use of the present invention in, manifesting (i.e., displaying or printing) electrical signals, as in an electronic desk top calculator.

Referring first to FIGURES 1, 2, 2*a*, 3, and 4, the signal translating and manifesting apparatus of the embodiment shown therein, designated generally by the numeral **10**, comprises a cylinder **11** which is shown in FIGURES 1 through 4 as being circular in cross-section, though cylinders of other than circular cross-section may be used in carrying out the present invention, and will be preferred in certain applications of the present invention, e.g., where it is necessary to locate a plurality of the devices of the invention in close proximity in order to imprint a line of closely spaced characters thereby. One end of cylinder **11** is closed by a cap **12** which contains a guide slot **13** the function of which will be described hereinafter. Cap **12** functions, inter alia, to maintain a pressure differential between variable volume chamber **14** defined by cylinder **11** and its associated piston and the ambient atmosphere which, in most applications, exists outside cylinder **11**.

Mounted upon cap **12** is a plate **16** through which passes a generally rectangular aperture **17**. As described hereinafter, aperture **17** serves to designate the particular character corresponding to the input signals currently being supplied to the device.

A plurality of input ports **20–1 . . . 20–8'** are provided at locations substantially equidistant from the opposite ends of cylinder **11**. Each of these input ports passes through the wall of cylinder **11**, thereby providing communication between variable volume chamber **14** and a corresponding input pipe **21–1 . . . 21–8'**. For instance, as seen in FIGURE 4, port **20–1** provides communication between chamber **14** and input pipe **21–1**, when aligned with a code aperture as explained hereinafter.

While input pipes **21–1 . . . 21–8'** are arranged parallel to the axis of cylinder **11** in the embodiment of FIGURES 1 through 4, other arrangements of input pipes may be preferred in adapting the invention to certain applications. For instance, input pipes **21–1, 21–8'** may, in some applications, be short stub pipes extending radially outward from the surface of cylinder **11**. These short stub pipes, like the parallel input pipes shown in FIGURES 1 and 4, will be used to provide communication with chamber **14** via input ports **20–1 . . . 21–8'**. In a typical application of the device of the invention the input pipes will be interconnected with a source of multi-channel pressure signals by means of flexible tubing which may be affixed to the input pipes merely by frictional engagement, as when the fluid pipes are of slightly smaller diameter and forced thereover, or may be sealed to the input pipes by cementing.

The term "pressure" as used herein generally denotes absolute pressures, rather than gauge pressures. That is to say, the term "pressure" as used herein may refer to pressures less than ambient atmospheric pressure as well as pressures greater than ambient atmospheric pressure. As will be apparent from the following description, devices embodying the present invention may be constructed which are operated by superambient pressure signals as well as subambient pressure signals. Also, the reference pressure level to which said pressure signals are referred may be made other than ambient atmospheric pressure, as by enclosing cylinder **11** in a pressurized jacket.

Also communicating with chamber **14** is a vent pipe **22**, a port **23** in the wall of chamber **11** being provided for intercommunication between chamber **14** and the interior of vent pipe **22**. As may be seen in FIGURE 4, port **23** is considerably larger than ports **20–1 . . . 20–8'**, and vent pipe **22** is considerably larger than input pipes **21–1 . . . 21–8'**. As explained hereinafter, vent pipe **22** and vent port are made larger than the input pipes and ports in order that chamber **14** may be rapidly purged of any pressure differential between its interior and the ambient atmospheric pressure outside cylinder **11**, thereby returning device **10** to its "0" indication, or in some applications such as that illustrated in FIGURES 5 and 5*a*, to its blank indicating position in which no character is indicated as that corresponding to signals currently being received by the device via input pipes **21–1 . . . 21–8'**.

A hollow piston **25** is slidably disposed in close-fitting relation within cylinder **11**. A symbol carrier member **26**, of generally rectangular cross-section in the embodiment of FIGURES 1 through 4, is centrally affixed to the closed end of hollow piston **25** and projects through guide slot **13** in cap **12**. Guide slot **13** closely embraces symbol carrier **26**, both to reduce leakage between chamber **14** and the ambient atmosphere outside cylinder **11** and to hold piston **25** against rotation with respect to cylinder **11**. In certain applications of the instant invention it will be found desirable to affix to the end of symbol carrier **26** remote from cylinder **11** a semi-flexible extension **27** (FIGURES 1, 2, and 4). As seen in FIGURES 1 and 2, symbol carrier **26** carries a plurality of character symbols **28**. The set of character symbols borne by symbol carrier **26** in the embodiment of FIGURES 1 through 4 is "1, 2, 3, 4, 5, 6, 7, 8, 9, 0," though the present invention is not limited to display of the ten Arabic numerals, but may also be used to manifest alphabetic characters, either in addition to the Arabic numerals or without the Arabic numerals, in addition to any other desired arbitrary or conventional symbols. Also, it will be apparent that the device of the present invention may be arranged to manifest sets of characters comprising more or less characters than the ten characters of the device of FIGURES 1 through 4.

Extension **27**, when used, carries a plurality of types **29** in a linear array which corresponds closely with the linear array of character symbols **28** upon symbol carrier **26**. That is, as may be seen in FIGURE 1, types **29** are arranged in the same order as character symbols **28**, and are spaced from each other by the same distance as the corresponding ones of character symbols **28**. Each one of the types **29** is located upon the upper face of a projection **30** which extends upward from extension **27**. Alternatively, projections **30** may be thought of as being integral with extension **27**, or forming a part thereof, and being separated by cuts **31**. Considered from either point of view, it may be seen that the separation between projections **30** makes extension **27**, as a whole, far more flexible than would be the case if cuts **31** were not present. This flexibility of extension **27** makes it possible to deflect any one of the types **29** into printing contact with a record member, e.g., by means of a hammer in the case of impact printing, or a roller or the like when pressure printing is employed.

In lieu of, or addition to, symbol carrier **26** and extension **27**, or both of them, piston **25** may drive a code perforation carrier **26** (FIGURE 1*a*) pierced by code perforations **32** which are adapted to coact with passages **33** in tracker bar **34** to translate, say ASCIE code perforations to readings in the internal code of the Letteriter automatic typewriter.

As may now be seen by reference to FIGURES 1 and 4, translation of symbol carrier **26** will cause selected ones of the linear array of character symbols **28** to be displayed in aperture **17** of plate **16**. Since, as hereinafter explained, the application of particular permutations of pressure signals to input pipes **21–1 . . . 21–8'** causes hollow piston **25** and symbol carrier **26** to be translated by corresponding amounts, it follows that by selecting correct locations for the character symbols **28** on symbol carrier **26** it is possible to arrange that the character symbol corresponding to any permutation of pressures applied to the input pipe will appear in window **17**, and such is done in providing devices according to the present invention. As will be clear from FIGURE 1, types **29** are invariably translated by the same amount as character symbols **28** and thus, if types **29** are arranged in a linear array similar to the linear array of character symbols **28**, as described above, then types **29** will be moved to a fixed printing position at the same time that character symbols are moved into aperture **17** in plate **16**. The provision of a print hammer, a roller, or the like, an inked ribbon carrier, and means for feeding and supporting a record medium, for coacting with any type momentarily located at the fixed printing position, are all within the scope of one having ordinary skill in the art, and, for that reason, such means are not described or shown in detail herein.

As best shown in FIGURE 4, hollow piston **25** comprises an imperforate end wall **35** to which is centrally affixed symbol carrier **26** as described hereinabove. The interior of hollow piston **25** is a generally cylindrical cavity **36** having an open throat **37** at the end thereof opposite end wall **35**. Generally snugly fitting within cavity **36** is a coil spring **38** which extends from the inner face of end wall **35**, outwardly through throat **37**, and into contact with end wall **39** of cylinder **11**, all as shown in FIGURE 4. Thus, as may best be seen in FIGURE 4, coil spring **38** serves to maintain hollow piston **25** in such position within chamber **14** that its closed end **35** contacts the inner surface of cap **12**, except when piston **25** is drawn away from that position in the manner to be explained hereinafter. That positon into which piston **25** is normally biased by coil spring **38** will hereinafter be called the "home position" of piston **25**.

As only partially shown in FIGURES 2 and 4, the outer wall of piston **25** is pierced by a plurality of ports **40**. The convention is adopted herein with respect to ports **40**, i.e., the ports passing through the outer wall of piston **25**, that where reference is made to these ports in general, and not to a specific one of these ports, the reference numeral **40** should be taken to refer to any one of said ports, more than one thereof, or all of them. On the other hand, when it is desired to refer to a single particular port **40** an extended reference numeral is used having two hyphenated suffixes. Thus, in FIGURE 3, which shows the outer wall of piston **25** developed into a plane, it may be seen that **40–1–1** and **40–5–2′** are two different ports. Either of these ports, or both of them, may be referred to as **40** when it is not desired to distinguish between them. Similarly, any of the ports in the outer wall of cylinder **11** may be referred to as **20**, or a plurality of the same may be referred to as **20**, except when it is desired to refer to specific ones of these ports, in which case the extended reference numerals **20–1** through **20–8′** are used. Also, such a system of extended reference numerals is used with respect to the input pipes **21**, the extended reference numerals **21–1** through **21–8′** being used when it is desired to distinguish between input pipes **21**.

The configuration and relative placement of ports **40** is shown in FIGURE 2*a*. FIGURE 2*a* shows a portion of the outer surface of hollow piston **25** including all or part of ports **40–4–2′**, **40–4–4**, **40–5–2′**, **40–5–4**, **40–6–2**, **40–6–4**, and **40–7–4**. Comparing the height (larger dimension) of the ports **40** shown in FIGURE 2*a* with the vertical spacing therebetween, i.e., parallel to said larger dimension, and to the sliding axis of the piston, and keeping in mind that ports **20** are slightly taller than ports **40**, it may be seen that any input port **20**, when passing over two vertically adjacent ports **40** (e.g., **40–6–4** and **40–5–4**) as piston **25** moves in cylinder **11** will come into communicating relationship with one before going out of communicating relationship with the other. Thus, ports **20** and **40** are so configured and arranged that any port **20** passing two vertically adjacent ports **40** must for a finite period overlap both of the ports **40**. As will be clear from FIGURE 4, each port **20** is maintained in registration with one column of ports **40** by the close-fitting relationship between symbol carrier **26** and guide slot **13**.

From the above it may also be seen that the horizontal row, or set of ports **40** corresponding to any decimal number output (e.g., **40–5–1**, **40–5–2′**, **40–5–4**, **40–5–8′**, corresponding to decimal number output **5**, FIGURE 3) need not be arranged in linear array, so long as ports **40** and ports **20** are all arranged in the same array, while each vertical set, or column, of ports **40** (e.g., **40–1–8′** . . . **40–5–8′** . . . **40–0–8′**, FIGURE 3) must be arranged in a line parallel to the sliding axis of piston **25**. Further, as will become evident hereinafter, any pair of horizontal rows of ports may be interchanged as desired, provided only that the corresponding character symbols **28**, types **29**, and sets of code perforations **32** are correspondingly interchanged, without affecting the operation of the device of the invention.

As shown by the horizontal dashed line in the lower portion of FIGURE 3, recess **23′** in the lower portion of cylinder **11** extends far enough up from end **39** to assure that even when piston **25** is at the bottom of cylinder **11** vent port **23** communicates with cavity **36** via enough ports **40** to assure rapid venting when pipe **22** is opened.

While piston **25** is shown herein as hollow, it may also be made solid, allowing, of course, for spring **38**. The expression "solid" in the previous sentence is not to be understood to be limited to high density materials, since cellular materials such as Styrofoam may be advantageously used to reduce the mass of a solid piston while at the same time limiting the volume which must be evacuated in order to displace the piston over a given distance. For example, the volume to be evacuated may be reduced by disposing a cellular material cylinder within spring **38**, said cylinder clearing spring **38** sufficiently to provide fluid passage from ports **40** to chamber **23′**. A thin-walled, sealed hollow cylinder may alternatively be used. It will be appreciated by those having ordinary skill in the art that optimum response may be secured by selecting the optimum balance of piston mass and volume evacuated to suit a given application.

In FIGURE 3, the arrangement of the entire set of ports **40** passing through the outer wall of hollow piston **25** may be seen. As noted above, only a few of the ports **40** are shown in FIGURES 2 and 4, though it is to be understood that the entire set of ports **40** indicated in FIGURE 3 will be found in the outer wall of the hollow piston actually employed in an operative embodiment of the invention.

The particular arrangement of ports **40** shown in FIGURE 3 is dictated by the function served by the device of the embodiment of FIGURES 1, 2, 2*a*, 3, and 4, viz, the translation of four-place binary signals consisting of permutations of pressures and obturations into displayed or printed decimal digits, or other binary codes. When, however, a device according to the present invention is designed to fulfill some other function, e.g., the translation of, say, ASCIE code into the code unique to the Letteriter automatic typewriter described in United States Patent 3,219,165, then the arrangement of ports in the hollow piston will be considerably different. In that case, for example, there will be sixteen columns of ports parallel to the axis of symmetry of the piston, rather than eight columns as shown in FIGURE 3. The use of sixteen columns of ports results from the use of eight channels of perforations in the perforated tape code to be translated. Also, in this exemplary case, there will be fifty-four "horizontal" rows of ports, i.e., sets of ports all lying in the same planes perpendicular to the axis of the piston, rather than the ten horizontal rows of ports shown in FIGURE 3. The fifty-four horizontal rows of ports in the exemplary case will, of course, correspond to the fifty-four codes, both printing and functional, employed in the abovesaid Letteriter automatic typewriter. It will also be apparent that, in the exemplary ASCIE-to-Letteriter code transistor, the number of input ports **20** will necessarily be increased to 16, as will the number of input pipes **21**. A translation device of this type is shown in part in FIGURE 1*a*.

The output code involved in translation by the exemplary device may be changed at will if the symbol carrier is made demountable and replaceable with a differently coded symbol carrier, or both input and output codes may be changed at will if the piston and symbol carrier are made demountable and replaceable.

Returning to FIGURE 3, it may be seen that each of the ports **40** is represented by a small rectangle. Ports **20** passing through the outer wall of cylinder **11** are also represented in FIGURE 3, wherein they are indicated by taller rectangles of the same width as the rectangles representing ports **40**. Thus, in the lower left-hand corner of FIGURE 3 there is one tall, rectangular symbol representing port **20–1**. Immediately to the right of this rectangle representing port **20–1** may be seen a similar rectangle upon which is disposed one of the smaller rectangles representing a port **40**. Thus, the rectangular symbol second from left in the bottom row of rectangular symbols in FIGURE 3, having cross strokes located near its upper and lower ends, represents both port **20–1′** and port **40–0–1′**. In the bottom row of FIGURE 3, then, may be seen representations of all eight ports **20–1** through **20–8′**; and there may also be seen ports **40–0–1′**, **40–0–2′**, **40–0–4′**, and **40–0–8′**, aligned with ports **20–1′**, **20–2′**, **20–4′**, and **20–8′**, respectively. This particular alignment of ports **20** and **40** prevails, of course, only when hollow piston **25** is in its home position. As explained hereinafter, other ones of the horizontal rows of ports on piston **25** will be brought into alignment with ports **20** by

the application of various permutations of pressure signals to input pipes **21**.

As may also be seen in FIGURE 3, each of the input pipes **21** is represented therein by a heavy, solid line extending outward from its corresponding port **20** and downward to the lower edge of the figure.

The arrangement of ports in the piston of a device according to the present invention may be determined as follows.

In the most common applications of the present invention there will be given a set of symbols to be represented on the symbol carrier, and a corresponding set of n-bit binary numbers, called herein the "binary equivalents" of the respective symbols. For instance, the set of symbols in connection with which the device of FIGURES 1 through 4 was designed is the set of one-digit decimal numbers 0 through 9, while the binary equivalents thereof are the well known equivalent four-bit binary numbers 0000 through 1001.

As is well known, every binary place of a binary number may be conceived of as having a multiplying factor called a "weight" associated with it, such that the sum of the products of each bit and its associated weight equals the equivalent decimal number. The respective binary places of said binary equivalents are identified herein by their weights, called "index numbers." E.g., the index number corresponding to the third binary place to the left of the binary point (implied) in the binary equivalents of the symbols found on the symbol carrier of the device of FIGURES 1 through 4 herein is 4.

For each of the *n* binary places of the binary equivalents in a given embodiment of the invention there are two columns of ports on the piston. E.g., the binary equivalent of the symbols carried on the symbol carrier in the device of FIGURES 1 through 4 have four binary places, and thus there are eight columns of ports on the developed piston **25** shown in FIGURE 3. The index number of the corresponding binary place is used to designate the pairs of columns. E.g., the pairs of columns of ports in FIGURE 3 are each designated by an index number set above the columns of the pair. Thus, the rightmost pair of columns of ports in FIGURE 3 corresponds to the binary place of the binary equivalents having the weight 8.

In each pair of columns of ports, the column nearest the columns having the next higher index number is arbitrarily said to be of binary weight 7, while the column adjacent those having the next lower index number is said to be of binary weight 0. Thus, in FIGURE 3, the input pipes and ports having unprimed reference designations coact with the columns of binary weight 0, while those having primed reference designations coact with the columns having binary weight 7.

Each row of ports corresponds to one symbol on the symbol carrier, and thus to one binary equivalent number. (In FIGURE 3, the number set to the left of each row.)

Given the above described conventions, the arrangement of ports in any row may be determined by (1) finding the binary complement of the binary equivalent of the symbol represented by that row, and (2) in every pair of columns having a common index number, locate a port in the column of weight 0 if the binary place of the complement having the same index number contains the bit 0, or in the weight 7 column if binary place of the complement having the same index number contains the bit 7.

The onput signal permutation of obturations and vacua corresponding to any symbol on the symbol carrier may be applied by

(1) For every 7 bit in the binary equivalent, evacuate the corresponding primed input lines and block every corresponding unprimed input line.

(2) For every 0 bit in the binary equivalent, evacuate the corresponding unprimed input lines and block every corresponding primed input line.

Before considering the operation of the device of the invention, attention is directed to a typical print-out mechanism which may be associated with extension **27** of symbol carrier **26** in order to imprint the identity of successively read codes upon a record member. This typical imprinting mechanism is shown in the upper portion of FIGURE 4. Going to FIGURE 4, it may be seen that the first component of this imprinting mechanism is a shield **45** having an aperture through which one, and only one, of the types **29** may be brought into contact with a record medium **46**, such as a ticker tape. The particular type **29** positioned in the aperture in shield **45** will, as described hereinafter, be determined by the permutation of pressure signals applied to input pipes **21**. Transport means for record medium **46** may be supplied by those having ordinary skill in the art, and so are neither described nor shown herein. On the opposite side of record medium **46** from shield **45** is provided an inked ribbon of the kind commonly employed in typewriters, and the like. Since transport means for successively advancing such an inked ribbon may be supplied without invention by one having ordinary skill in the art, such a ribbon transport mechanism is not shown or described herein. Finally, the imprinting mechanism includes a hammer, or pressure pad, **48**, adapted to rapidly strike, or firmly press, ribbon **47** and record medium **46** against one of the types **29** through the aperture in shield **45**. Since driving and synchronizing means for such a hammer, or pressure pad, may easily be supplied by one having ordinary skill in the art they are not shown or described herein. It will also be apparent to one having ordinary skill in the art that, due to the flexibility of extension **27**, alternative means may be employed to printingly drive the types **29** through the aperture in shield **45**, and that ribbon **47** may be located on either side of record member **46**.

Operation

The operation of the present invention may best be understood by reference to FIGURE 3 taken in conjunction with FIGURE 4.

As explained hereinabove, hollow piston **25** of FIGURE 4 is shown developed on a plane in FIGURE 3. In FIGURE 3 a complete set of piston ports **40** is shown, the location of a complete set of input ports **20** with respect to ports **40** when piston **25** is in its home position is shown, and the input pipes **21** are indicated.

As may be seen in FIGURE 4, piston **25** is normally biased into its full upward, or "home," position by coil spring **38**. Thus, when vent pipe **22** is open to ambient atmosphere, piston **25** will be located at its upper position wherein its closed end **35** is butted against the inside of cap **12**. This condition of operation is shown in FIGURE 3 by the location of the rectangles indicating input ports **20**.

By way of example, the operation of the device of FIGURES 3 and 4 to display and print the numeral "7" will now be described. As pointed out hereinabove, the operation of the device of the invention to display and print a character requires the supplying of a corresponding permutation of pressures and obturations to the full set of input pipes **21** and the blocking of vent pipe **22**. The expression "pressures," as pointed out hereinabove, embraces both vacua and superambient pressures, though the embodiments shown and described herein are adapted to be operated by permutations of vacua and obturations. Thus, in the device of FIGURES 1 through 4, the term "permutation of pressures," as used directly above, may be more narrowly stated as "permutation of vacua." On the other hand, devices according to the invention may be supplied by those having ordinary skill in the art which, narrowly stated, operate on "permutations of superambient pressures." In these devices spring operation and home position will be reversed.

It is an operating requirement of the device of the invention that those input pipes **21** to which vacuum is *not*

supplied must be blocked, or obturated. As will be apparent to those having ordinary skill in the art, such permutations of pressures, and blocking of the non-pressurized pipes, can be provided by several types of expedients well known in the fluidics arts, e.g., check valves, fluidic flip-flops of the type shown in FIGURE 5, perforated tape coacting with a plurality of reading pipes, as also shown in FIGURE 5, etc.

By way of example, the application of the predetermined permutations of pressures and obturations corresponding to the decimal number "7" to the input pipes **21** of the device of FIGURES 1 through 4, and the resulting appearance of the numeral "7" in window **17**, will now be considered.

For reasons which will become apparent when the operation of the embodiment of FIGURES 1 through 4 has been fully considered, the code of pressures and obturations corresponding to any output character may be derived by considering the corresponding set, or horizontal line, of ports **40** in piston **25**, as developed in FIGURE 3. The input pipes to be obturated are those corresponding to ports in this set, while the input pipes **21** to be evacuated are those *not* corresponding to ports in this set. Thus, to operate the device of FIGURES 1 through 4 to display the numeral "7" requires that input pipes **21–1**, **21–2**, **21–4**, and **21–8'** be obturated, while input pipes **21–1'**, **21–2'**, **21–4'**, and **21–8** are evacuated.

Applying this code signal to input pipes **21** as shown in FIGURE 3, and considering piston **25** to be in the home position as indicated in FIGURE 3, it will be seen that the variable volume compartment **14** (FIGURE 4) defined by cavity **36** within piston **25** and the walls of cylinder **11** (FIGURE 4) will be initially evacuated by way of piston ports **40–0–1'**, **40–0–2'**, and **40–0–4'**, each of which is in registration with an input pipe **21** being evacuated. Evacuation of this variable volume compartment, however, may be seen to cause piston **25** to move downward in FIGURE 4 against the action of coil spring **38** by reason of the force of ambient atmospheric pressure on end **35** thereof, the fit between the outer surface of piston **25** and the inner surface of cylinder **11** being sufficiently good to prevent immediate leakage of ambient atmosphere into said variable volume compartment. (Said fit must also be sufficiently good, of course, to prevent immediate leakage between adjacent ports **40**.) As evacuation of said variable volume compartment **14** proceeds through the ports **40–0–1'**, **40–0–2'**, and **40–0–4'**, an amount of deflection of piston **25** is reached whereat ports **20** commence to overlap the ports of the "9" set. At this time the evacuation of said variable volume compartment through ports **40–9–2'**, **40–9–4'**, and **40–9–8** begins to take place. Thus, piston **25** will continue to move downward as seen in FIGURE 4, even after input ports **20** are no longer in registration with the piston ports **40** of the "0" set. However, evacuation through piston ports **40–9–2'**, **40–9–4'**, and **40–9–8** will continue to take place until some of ports **20** commence to overlap ports of the "8" set, and will continue thereafter. When ports **20** begin to overlap the piston ports **40** of the "8" set, evacuation of said variable volume compartment will begin to take place through ports **40–8–1'**, **40–8–2'**, **40–8–4'**, and **40–8–8**, and will continue even after piston **25** has retreated so far into cylinder **11** that ports **20** no longer in registration with any of the piston ports of the "9" set. Shortly thereafter, due to continued evacuation of said variable volume compartment by way of piston ports **40–8–1'**, **40–8–2'**, **40–8–4'**, and **40–8–8**, piston **25** will be retracted sufficiently into cylinder **11** so that input ports **20** will commence to overlap the piston ports **40** of the "7" set. Said variable volume compartment **14** cannot be evacuated by way of any of piston ports **40** of the "7" set, since all of the piston ports **40** in that set are in registration with obturated input pipes **21**, and all of the evacuated input pipes **21** are in registration with locations whereat ports do not exist. Thus, compartment **14** will continue to be evacuated via ports **40–8–1'**, **40–8–2'**, **40–8–4'**, and **40–8–8** until piston **25** has retreated so far into cylinder **11** that input ports **20** are no longer in registration with any of the **40–8** ports. At this time further evacuation of compartment **14** cannot take place, and the position of piston **25** along the length of cylinder **11** will stabilize at such a location that the numeral 7 on symbol carrier **26** will be seen through window **17**, and the type **29** corresponding to numeral 7 will be positioned at the aperture in shield **45** (FIGURE 4). At this location piston **25** can be moved no further into cylinder **11** because exacuation cannot take place through any of the ports of set **40–7** for the reason explained above, while piston **25** cannot be impelled further out of cylinder **11** by the force of spring **38** because any increment of such motion will result in bringing a part of each of the piston ports **40–8–1'**, **40–8–2'**, **40–8–4'**, and **40–8–8** into registration with evacuated ones of input ports **20**, resulting in evacuation of compartment **14** and the retraction of piston **25** into cylinder **11** until evacuation via ports of the **40–8** set discontinues.

Thus, it may be seen that, for each such set of piston ports **40–*x*–*x*** corresponding to a given character *n*, a particular, easily determined, permutation of obturations and vacua may be applied to the full set of input pipes **21** which will result in displaying the character *n* in window **17**, and bringing the type **29** corresponding to the character *n* into print position in the aperture of shield **45** (FIGURE 4). The combinations of obturations and vacua necessary to display characters other than 7 may be derived from FIGURE 3 as explained hereinabove.

For the reasons given above, this deflection of piston **25** to the corresponding *n* position will continue as long as the *n* permutation of obturations and vacua is applied to input pipes **21**, and vent pipe **22** is blocked. The return of piston **25** to its home, or zero-indicating position may be accomplished by opening all of the input pipes **21** to ambient atmosphere, though in the usual application of the invention it will be found more desirable to open vent pipe **22** to ambient atmosphere.

Synchronizing means for operation of print hammer **48** and blocking of vent pipe **22** are not described herein because the provision of such is well within the scope of one having ordinary skill in the art.

The selective positioning of piston **25** corresponding to any one of a number of permutations of vacua and obturations may be utilized to serve several desirable ends. First, the displacement of piston **25** and its attached symbol carrier **26** may be used to display selected characters in window **17**. Second, displacement of piston **25** and its immediately attached print extension **27** may be utilized to print images of types displaced into the aperture in shield **45** (FIGURE 4). Thus, as shown in FIGURE 1*a*, displacement of piston **25** and its attached symbol perforation carrier **26'** may be utilized to successively bring selected sets **32** of permutations into registration with reading passages **33** in tracker bar **34**, thereby, for instance, translating the code perforations in a perforated tape, which code perforations are in a first code and are utilized to determine the vacua and obturations applied to input pipes **21**, into a second code which is read, character-by-character, from the code perforations in carrier **26'** via reading passages **33**.

Other means of utilizing the selected deflection of piston **25** will appear to those having ordinary skill in the art, when taught by the present disclosure; e.g., provision of metallic elements in place of the perforations of symbols **32** in FIGURE 1*a*, and the use of cooperating pairs of feelers in place of each one of the reading passages **33**, whereby output electrical code indications will be derived from the shoring together of certain of said pairs of feelers.

Finally, it will be within the scope of those having ordinary skill in the art, as taught hereby, to provide multi-character storage means according to the present invention

by providing a simple detent capable of holding, say, code perforation carrier **26'** in place between its successive deflections by successive tape code permutations, i.e., holding carrier **26'** in place even though vent **22** is open, or no code permutations are applied to input pipes **21**, or both. Such a simple detenting action may be provided by equipping code perforation carrier **26'** with a complete column of centrally located perforations corresponding generally to the sprocket holes provided in the usual form of perforated tape, and arranging for a spring-loaded pin to be engaged with one perforation of said column except when said pin is withdrawn by a vacuum device during application of a new input signal to input pipes **21**. Such a vacuum solenoid may be operated, of course, by the same mechanism used to control the blocking and unblocking of vent pipe **22**. Vacuum supplies for carrying out the successive operations of piston **25**, etc., may, of course, be supplied by one of ordinary skill in the art, and thus are not shown or described in detail herein.

Application of the invention

Referring now to FIGURE 5, there is illustrated therein one of many possible applications of the present invention.

The data reading, translating, and manifesting system of FIGURE 5 generally comprises: a transfestor **50** embodying the present invention and generally similar to the transfestor of FIGURES 1 through 4; a spring valve **51** of the type shown and described in my co-pending United States patent application Ser. No. 397,988 arranged to valve the vent pipe **22** of transfestor **50**; a device **52** of the type sometimes known in the prior art as a vacuum solenoid, arranged to actuate spring valve **51** as hereinafter described; a device **53** of the type known in the prior art as logic block, comprising four bi-stable fluidic devices and adapted to convert multi-channel signals into pressure and obturation signals of the type needed to operate transfestor **50**; and a cooperating plurality **54** of reading pipes, four of which are designated I, II, IV, and VIII, respectively, and four of which communicate with a common pipe C. As will be evident to those having ordinary skill in the art on consulting FIGURE 5, the open ends of said reading pipes are adapted to coact with perforations **55** in perforated tape **56** by reason of the location of said open ends closely spaced above and in alignment with the channels of the perforated tape, when tape **56** is advanced past pipes **54** by means which may be supplied by one having ordinary skill in the art without the exercise of invention.

Transfestor **50** differs from the transfestor **10** of FIGURES 1 through 4 only in that it is adapted to display a blank through window **17**, in addition the numerals 0–9 which can be displayed by transfestor **10**. This addition of a blank indication to the device of FIGURES 1 through 4 is made possible by lengthening piston **25** by an amount sufficient to accommodate an additional character to be displayed and, as shown in FIGURE *5a*, piercing piston **25** (then designated **25'**) with an additional set of ports **40–B–1 . . . 40–B–8'**, this additional set of ports being equal in number to and capable of being registered with input ports **20**, and being located at the end of piston **25** adjacent the **40–0** set of piston ports. In addition to lengthening piston **25** by a one character increment, as described above, an equal increment is added to the side wall of cylinder **11** immediately beneath cap **12**, and an equal increment is added to symbol carrier **26** at its junction with end wall **35** of piston **25**. Thus, it is arranged that the full set of piston ports **40–B** is in registration with input ports **20** when piston **25** is maintained in its home position by coil spring **38**, and that a blank appears in window **17** when piston **25** is in its home position.

Since, as explained hereinabove, piston **25** will be in its home position when vent pipe **22** is open, and since the vent pipe **22** of transfestor **50** shown in FIGURE 5 is valved to ambient atmosphere by means of spring valve **51**, it follows that transfestor **50** will display a blank in window **17** whenever spring valve **51** is open.

As pointed out hereinabove, spring valve **51** is actuated by vacuum solenoid **52**. Vacuum solenoid **52** comprises a body **60** in the form of a cylinder which is considerably shorter than its diameter, said cylinder being closed at one end by a rigid partition. At the open end of cylindrical body **60** is located a movable, disc-like member **61** the outer periphery of which is fluid-tightly sealed to the open end of cylindrical body **60** by means of a flexible diaphragm **62**. Thus, body **60**, moving member **61**, and diaphragm **62** coact to define a variable volume chamber. Two pipes, **63** and **64**, are provided for communication with said variable volume chamber. Pipe **63** (as shown in FIGURE 5) includes a constriction **63'** and communicates with a common source of vacuum which is designated V throughout FIGURE 5. Pipe **64** does *not* include a constriction, or includes a constriction of much larger minimum diameter than constriction **63'**, and communicates between said variable volume chamber and the common pipe with which four of the reading pipes **54** communicate, as shown in the lower portion of FIGURE 5. Within the variable volume chamber of vacuum solenoid **52** is located a coil spring **65** which serves to urge movable member **61** into its position most remote from body **60**, wherein diaphragm **62** is distended to its maximum. Movable member **61** is coupled to spring valve actuator **67** by means of linkage **66**. Therefore, as shown in FIGURE 5, spring valve **51** is held open when movable member **61** is at its maximum displacement from body **60** due to the presence of ambient atmosphere within said variable volume chamber; and is closed when a vacuum is drawn within said variable volume chamber, thereby compressing spring **65** and drawing movable member **61** toward body **60**, straightening, and thereby closing, spring valve **51**.

As shown at the bottom of FIGURE 5, the eight reading pipes, **70** through **77**, are divided into two groups, i.e., the group consisting of pipes **70** through **73**, hereinafter called the "number pipes," and the group consisting of pipes **74** through **77**, hereinafter called the "lockout pipes." None of the number pipes is in direct communication with any other one of the number pipes. Rather, each of the number pipes is connected by means of tubing to a corresponding port on the upper surface of logic block **53**, these tubing interconnections being indicated by Roman numerals, and not shown, to avoid confusion. Thus, number pipe **70** has an I set at its upper end and an I is located at the third port from the left-hand end of the top surface of logic block **53**, indicating that number pipe **70** is directly connected by tubing to said third port. Similarly, as indicated by II, number pipe **71** is directly connected by tubing to the sixth input port from the left in the top surface of logic block **53**. Similar direct tubing interconnections are indicated by IV and VIII.

Lockout pipes **74** through **77**, on the other hand, communicate in common with a single header pipe **78**. Header pipe **78** is directly connected by means of tubing to pipe **64** of vacuum solenoid **52**, as indicated by C adjacent the end of header pipe **78** and adjacent the outer end of pipe **64**.

As will be apparent to those skilled in the art, perforated tape **56** is of the eight-channel variety, each one of the reading pipes **70** through **77** coacting with one channel thereof. It is assumed for purposes of this example that the code in which the tape **56** is perforated is one in which the four channels located to one side of sprocket holes **79** express all of the numerical digits in Binary-Coded Decimal form, the channels located on the other side of the sprocket holes being blank, i.e., imperforate, when a character perforated into the tape is a numerical character. Thus, the character perforated into the tape shown at the bottom of FIGURE 5 is a non-numerical character, and, as explained hereinbelow, the fact that this is a non-numerical character causes transfestor **50** to manifest its blank indication as shown in the upper portion of FIGURE 5.

Going now to logic block **53** as shown in the central portion of FIGURE 5, it may be seen that logic block **53** is composed of two laminae, or plates, **85** and **86**, joined in fluid-tight fashion to the opposite sides of a diaphragm **87**. Within logic block **53**, formed by mating hollows in laminae **85** and **86**, are four valves of the type generally shown and described in my copending United States patent application Ser. No. 542,497. As more particularly described in said United States patent application, each one of these valves **90** through **93** comprises a chamber, part of which is located in lamina **85** and part of which is located in lamina **86**. A flexible sheet-like diaphragm member **87** is cemented between laminae **85** and **86** and so treated as to provide a domed, bi-stable "bubble diaphragm" in each valve **90** through **93**, these domed, bi-stable "bubble diaphragms" being designated **90–1** through **93–1**, respectively. Diaphragm **90–1** is shown in its upward, or "unprimed," position wherein it blocks passage **1**, or will do so when even a slight vacuum is drawn in the generally annular chamber formed by it and the cavity in lamina **85** which defines the upper half of valve chamber **90**. By contrast, diaphragm **91–1** is shown in its downward, or "primed," position, wherein it blocks, or is capable of blocking, pipe **2'**. In each of the valves **90** through **93** the space above the diaphragm will hereinafter be referred to as "the upper chamber," while the space below the diaphragm will be referred to as "the lower chamber." It will be realized, of course, that the volumes of these upper and lower chambers are capable of considerable variation depending upon the primed or unprimed position of the diaphragm.

Referring now to the upper chamber of valve **90**, it will be seen that three conduits provide interconnections with this upper chamber, viz, the **1** conduit, or passage, referred to hereinabove which is capable of being blocked by diaphragm **90–1** in its unprimed position; a left-hand conduit in direct communication with the same vacuum source V with which pipe **63** of vacuum solenoid **52** communicates; and a right-hand conduit, identified by I, which is in direct communication with number pipe **70** as explained hereinabove. Said left-hand and right-hand conduits both include a constriction, these constrictions being designated **90***a* and **90***b*, respectively. Conduit **1**, which does not include a constriction, is directly connected by means, for instance, of flexible tubing, to the input pipe of transfestor **50** indicated by a line next to which is set the numeral **1**.

Going to the lower chamber of valve **90**, it may now be recognized that the central conduit **1'** communicating therewith is, by similar convention, directly connected by tubing to the input pipe of transfestor **50** indicated by a line next to which is set the designation **1'**. The left-hand conduit communicating with the lower chamber of valve **90** is directly connected to the common vacuum supply V, and includes a constriction **90***c*. The right-hand conduit communicating with the lower chamber of valve **90** is open to atmosphere at its outer end, as indicated by the letter A set thereat, and includes a constriction **90***d*.

Valves **91** through **93** are all equipped with similar conduits, as may be seen in FIGURE 5, these conduits having structure and function corresponding to the same conduits communicating with valve **90**, rendering it unnecessary to describe them individually.

Operation of system of FIGURE 5

The operation of valves **90** through **93** is set out in detail in said United States patent application. For understanding of the system of FIGURE 5, however, it need merely be understood that constrictions **90***c* and **90***d* are of substantially equal flow impedance, while the flow impedance of constriction **90***a* is somewhat large than the equal flow impedances of **90***c* and **90***d*, and the flow impedance of constriction **90***b* is somewhat less than the equal flow impedances of constrictions **90***c* and **90***d*. Thus, when conduit I is closed off from ambient air by the web of tape **56** as shown in FIGURE 5, air is substantially prevented from entering the upper chamber of valve **90**, and this upper chamber will be pumped down by common, continuously applied vacuum V through constriction **90***a* until diaphragm **90–1** is brought into its unprimed position, as also shown in FIGURE 5. On the other hand, when conduit II associated with valve **91** is maintained open by the presence of a perforation **55** at the open end of number pipe **71**, as shown in FIGURE 5, air enters the upper chamber of valve **91** through constriction **91***b*. Since, as explained above, the flow impedance of constriction **91***a* is greater than the flow impedance of constriction **91***b*, the common, continuously operating vacuum source V will not be able to pump down the upper chamber of valve **91** as rapidly as air enters it, and, therefore, the pressure in the upper chamber of valve **91** will tend toward atmospheric. The lower chamber of valve **91**, on the other hand, is evacuated by common vacuum source V by way of constriction **91***c* which, as pointed out above, is of equal flow impedance to that of constriction **91***d*. Thus, according to well-known laws of fluid dynamics, the lower chamber of valve **91** will tend to stabilize at a pressure half-way between atmospheric and that of supply vacuum V, because its associated constrictions **91***c* and **91***d* are substantially equal, while the pressure in the upper chamber of valve **91** will tend to stabilize at a level nearer atmospheric than the supply vacuum V level because constriction **91***a* associated with the supply vacuum V line has greater flow impedance than the constriction **91***b* associated with line II leading to air via a perforation **55** in tape **56**. The result is that the pressure in the upper chamber of valve **91** will rapidly become greater than the pressure in the lower chamber of valve **91**, causing diaphragm **91–1** to "snap" to its primed position. The effect of the unblocking and blocking, respectively, of lines IV and VIII by a perforation **55**, or the absence thereof, in tape **56** will cause diaphragm **92–1** and **93–1** to assume the positions shown in FIGURE 5 for the same reasons given above in connection with valves **91** and **90**, respectively.

Thus, input pipes **1**, **2'**, **4'**, and **8** of transfestor **50** will be blocked, or obturated, and input pipes **1'**, **2**, **4**, and **8'** of transfestor **50** will be continuously evacuated, due to the positions of diaphragms **90–1** through **90–3** assumed under the control of the left-hand perforations **55** in tape **56**. As explained hereinabove in connection with FIGURES 1 through 4, the application of this permutation of vacua and obturations to the input pipes of transfestor **50** will cause the numeral "**6**" to be displayed in window **17**.

However, since perforations in tape **56** are associated with lockout pipes **74** and **77**, tubing line C is open to air. Since tubing line C is open to air the chamber of vacuum solenoid **52** is open to air via pipe **64**. Since pipe **64** is relatively unconstricted, while pipe **63** leading to common, continuously operating vacuum source V contains constriction **63'**, it follows that common vacuum source V cannot pump down the chamber of vacuum solenoid **52** as rapidly as air leaks into it via pipe **64**, and atmospheric pressure rapidly comes to exist within the chamber of vacuum solenoid **52**. Then, since the pressure on both sides of diaphragm **62** is equal, spring **65** is able to force movable member **61** downward, and thus, by means of linkage **66**, and actuator **67**, opens spring valve **51**. It follows that, as explained in detail hereinabove, ambient air admitted to the variable volume compartment of transfestor **50** via vent pipe **22** overcomes any tendency toward evacuation of the variable volume chamber via the input pipes of transfestor **50**, and the spring **38** (FIGURE 4) is enabled to maintain piston **25** (FIGURE 4) in its home position, thereby causing a blank indication to be displayed in window **17** as shown in FIGURE 5.

As may now be understood by reference to FIGURE 6, transfestor **10** of FIGURE 4 may be controlled, if desired, by means of suitable permutations of electrical signals applied to input electrical lines *e*–**1** through *e*–**8'** of

suitable solenoid valves **101** through **108**. Each of these solenoid valves may have an output pipe connected, as by flexible tubing, to one of the input pipes **21** of transfestor **10**, and all of the input pipes of these solenoid valves may be directly connected to the common pressure (i.e., vacuum) supply V, all as shown in FIGURE 6.

It will be appreciated that, by the above-described constructions, signal translating and manifesting apparatus may be provided which are capable of manifesting in one or more ways the identity of signals applied thereto in the form of permutations of pressures, including vacua, and obturations, said permutations of pressures and obturations being easily obtained from devices well-known and available in the art, are capable at the same time of translating between numerical or alpha-numerical codes, both those formed according to simple, rational laws, such as Binary-Coded Decimal codes, and those arbitrary codes which require what is sometimes called "lexicon translation," and are also capable of storing information by way of the identity of a previously selected one of a set of code characters. It will further be appreciated that the transfestor of the invention may be accommodated to accepting fluidic, electrical, or mechanical displacement inputs, may manifest its translated output by display, imprinting, or electrical or fluidic codes on a suitable plurality of output lines, and may be ganged in order to rapidly manifest or translate codes selected from a large set, e.g., the approximately 50 to 60 codes usually found in alpha-numeric print-out devices, such as automatic typewriters.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained, and, since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description, or shown in the accompanying drawings, shall be interpreted as illustrative only, and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A signal translating and manifesting device comprising:

a first member containing a chamber;

a second member closely fitting within said chamber, slidable therewithin parallel to an axis, and defining therewith a variable volume compartment in which may be maintained pressures different from that without said first member;

a set of ports passing through said first member, none of said ports lying on the same line parallel to said axis with any other of said ports;

a plurality of groups of ports passing through the closely fitting surface of said second member and communicating with said compartment, each of said groups having each of its ports in registration with one of the ports of said set when said second member is located at a predetermined position within said first member;

means for urging said second member toward a particular position within said first member;

means for successively applying signals consisting of permutations of pressures to the ports of said set, whereby said second member is successively moved to positions corresponding to said signals;

carrier means constrained to move with said second member and carrying symbol means corresponding to said signals;

and manifesting means associated with said carrier means for successively manifesting the symbols corresponding to the signals successively applied to said set of ports.

2. A device as claimed in claim **1** in which said manifesting means comprises a mask having an aperture in which the symbol means corresponding to a signal is exposed when said signal is applied to said set of ports.

3. A device as claimed in claim **1** in which said symbol means are types and said manifesting means comprises means for causing imprints of said types to be impressed upon a record medium.

4. A device as claimed in claim **1** in which said manifesting means comprises a plurality of valve means adapted to be operated by said symbol means.

5. A device as claimed in claim **4** in which said valve means comprise conduits adapted to be blocked by said carrier means and unblocked by perforations therein.

6. A device as claimed in claim **1** in which said carrier means carries pluralities of different symbol means corresponding to single ones of said signals.

7. A device as claimed in claim **6** in which each of said pluralities includes an indicium and a type.

8. A device as claimed in claim **1** in which said means for successively applying signals includes electrical means for producing permutations of pressures in accordance with corresponding permutations of electrical signals.

9. A signal translating and manifesting device comprising:

a cylinder;

a piston closely fitting within said cylinder, slidable therewithin parallel to an axis and at a fixed angular orientation with respect thereto, and defining therewith a variable volume compartment in which may be maintained pressures different from the pressure therewithout;

a set of input ports passing through the outer wall of said cylinder, none of said input ports lying on the same line parallel to said axis with any other of said input ports;

a plurality of groups of code ports passing through the outer surface of said piston and communicating with said compartment, each of said groups of code ports having each of its ports in registration with one of the input ports of said set when said piston is located at a corresponding predetermined position within said cylinder;

means for urging said piston toward a particular position within said cylinder;

means for successively applying signals consisting of permutations of non-ambient pressures and obturations to the input ports of said set, whereby said piston is successively moved to positions corresponding to said signals whereat none of said code ports is in registration with an input port to which a non-ambient pressure signal is supplied;

carrier means constrained to move with said piston and carrying symbol means corresponding to said signals;

and manifesting means associated with said carrier means for successively manifesting the symbols corresponding to the signals successively applied to said set of input ports.

10. A device as claimed in claim **9** in which said manifesting means comprises a mask having an aperture in which the symbol means corresponding to a signal is exposed when said signal is applied to said set of input ports.

11. A device as claimed in claim **9** in which said symbol means are types and said manifesting means comprises means for causing imprints of said types to be impressed upon a record medium.

12. A device as claimed in claim **9** in which said manifesting means comprises a plurality of valve means adapted to be operated by said symbol means.

13. A device as claimed in claim **12** in which said valve

means comprise conduits adapted to be blocked by said carrier means and unblocked by perforations therein.

14. A device as claimed in claim **9** in which said carrier means carries pluralities of different symbol means corresponding to single ones of said signals.

15. A device as claimed in claim **14** in which each of said pluralities includes an indicium and a type.

16. A device as claimed in claim **9** in which said means for successively applying signals includes electrical means for producing permutations of pressures in accordance with corresponding permutations of electrical signals.

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