

June 28, 1966

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3,258,118

FLUID APPARATUS

Filed June 25, 1964

2 Sheets-Sheet 1

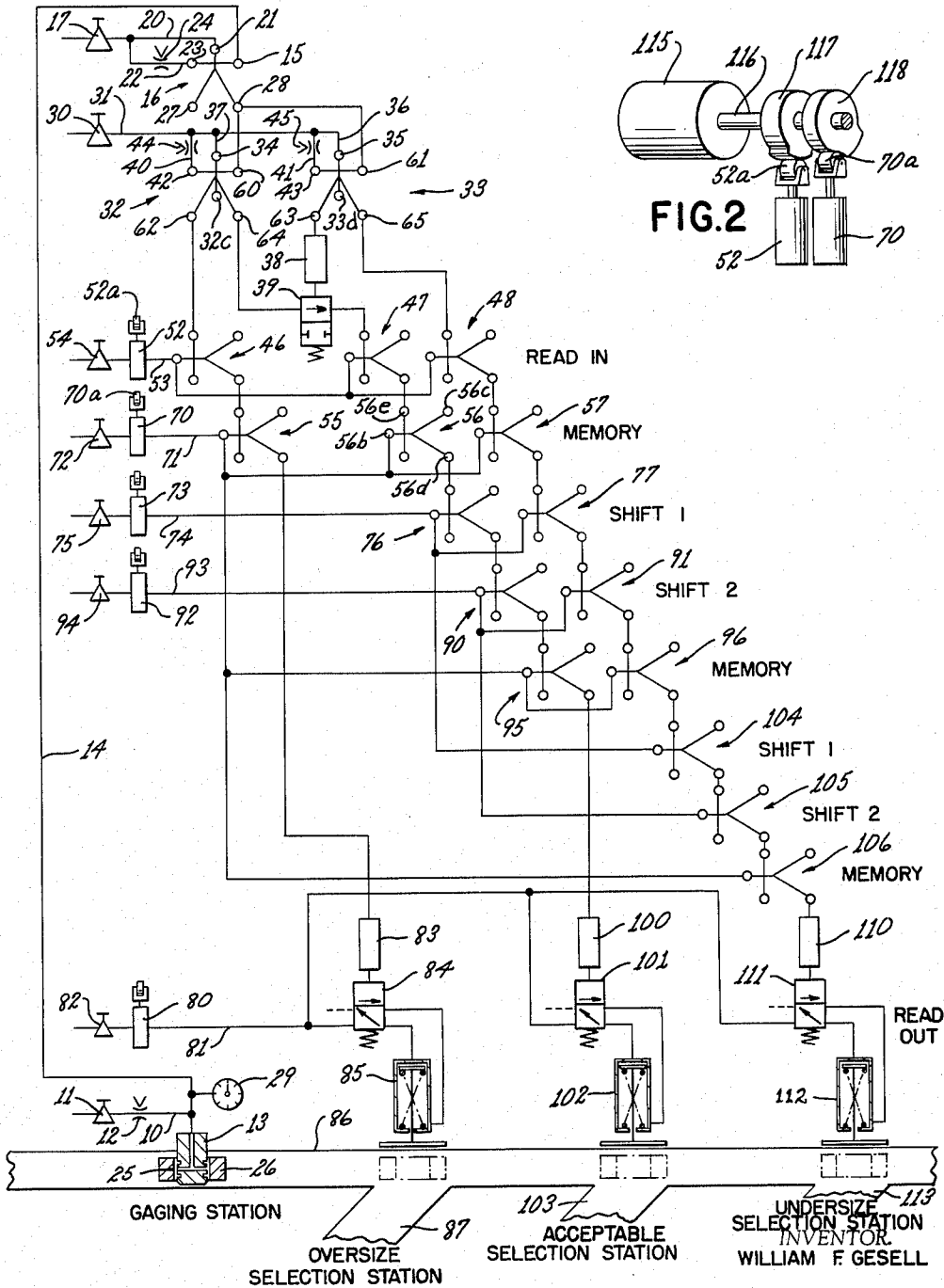


FIG. 1

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2 Sheets-Sheet 2

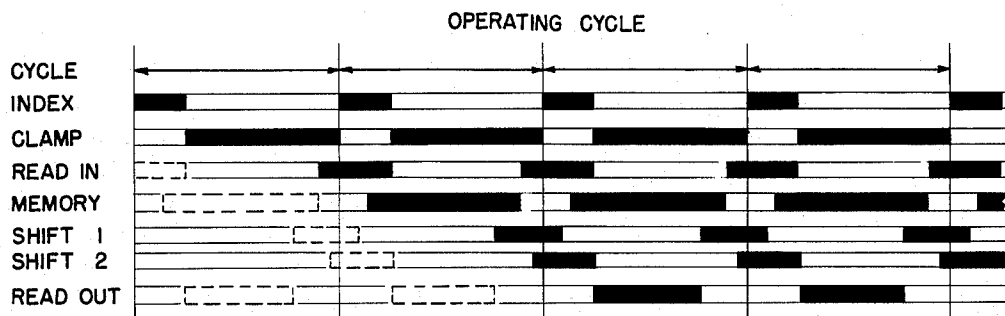


FIG.3

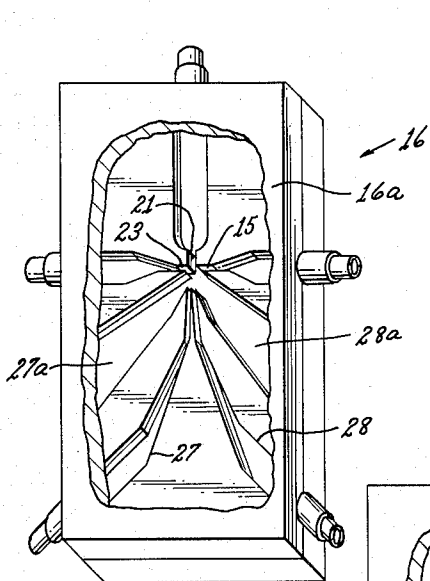


FIG.4

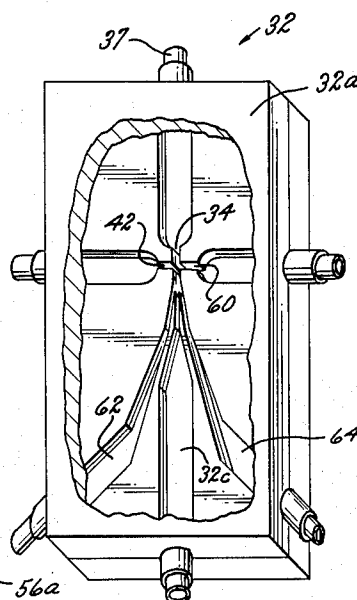


FIG.5

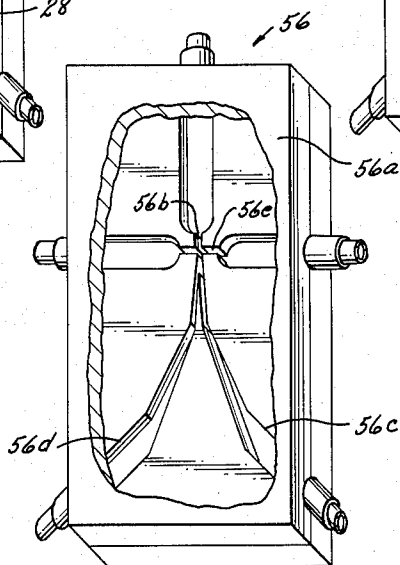


FIG.6

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3,258,118

FLUID APPARATUS

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Filed June 25, 1964, Ser. No. 377,816
11 Claims. (Cl. 209-74)

This invention pertains to fluid apparatus and more specifically to apparatus for handling fluid signals.

One object of this invention is the provision of apparatus for handling fluid signals which is of simple and compact construction and which can be operated economically and efficiently.

Another object of this invention is the provision of apparatus which handles signals as a function of input criteria and includes dynamically operating fluid means for transferring and storing such signals until the utilization thereof.

Another object of this invention is the provision of such an apparatus for signal storage and handling in which fluid signals are obtained as a function of input criteria and such signals are classified into a plurality of classes with signals in each class being successively and cyclically transferred in a dynamic fluid manner as a function of the classification thereof.

Another object of this invention is the provision of such an apparatus including fluid operated memory units for each respective class determined in number by the desired delay in utilization of the signal from each such class and between which each such signal is sequentially transferred until the utilization thereof for storing a given signal from each class for subsequent use in a predetermined operating cycle.

Another object of this invention is the provision of such apparatus in which signal transferring shift unit means operatively connected between each sequential pair of memory units includes valve means energized in a predetermined cyclical manner as determined by the desired delay from the time the signal is obtained until the time it is used to energize suitable utilization means.

Other objects and advantages of the invention will be apparent from the following description, the appended claims, and the accompanying drawings, in which,

FIG. 1 is a schematic drawing showing an exemplary embodiment of the invention as applied to dimensional gaging in which a workpiece is classed into three dimensional categories,

FIG. 2 illustrates a portion of the machine cycling apparatus,

FIG. 3 is a chart of the operating cycle for the apparatus of FIG. 1,

FIG. 4 is a sectional perspective view of the proportional amplifier used in this exemplary embodiment,

FIG. 5 is a sectional perspective view of a typical flip-flop as used in this embodiment and two of which are illustrated in FIG. 1 of the drawing, and

FIG. 6 is a sectional perspective view of a unit which is typical of the read in, memory, and shift units illustrated in FIG. 1.

This invention may be used in many applications where it is desired to classify input signals and automatically store such signals and delay their utilization for a predetermined period determined by their classification. The fields of automatic inspection, parts sorting and segregating, and parts handling are examples of a few of the many fields where this invention may be applied.

The invention will now be described as applied in an illustrative embodiment to apparatus for automatically gaging and segregating parts into a plurality of categories while using a fluid, such as air, in a dynamic manner for gaging, gaging signal transfer and storage, and operating.

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Three categories of classification will be used in this example which for ease of explanation will be referred to as oversize, acceptable, and undersize. The part to be gaged is cyclically indexed or transferred to and from a gaging station and sequentially through selection stations.

Basically, the operating cycle is to index a workpiece or part into gaging position, clamp the part so that a gaging signal may be automatically obtained, read in the gaging information, store the gaging signal (i.e. memory), index the part to the next station, read out the gaging information and then either eject the part or continue to sequentially transfer and store the information until the proper station is reached before ejecting the part. The operation of the apparatus is preferably entirely pneumatic and in this example uses key components having no moving parts.

A pneumatic dimensional gaging circuit and amplifying circuit for the gaging signals are provided. In the exemplary system shown in the embodiment of FIG. 1 air for the gaging circuit is provided through a line 10 and is controlled by adjustable pressure regulator 11 and adjustable restrictor 12 installed therein. A typical back pressure circuit is illustrated in which air from regulator 11 flows through line 10 to a gage head or spindle 13. The gaging signal is transmitted through a line 14 to a control jet 15 to amplifying means illustrated as a proportional amplifier 16 having a housing 16a. An adjustable regulator 17 supplies primary air flow for the amplifying circuit through a line 20 to a supply passage 21 in housing 16a for flowing a supply jet of fluid there-through. Regulator 17 also supplies control jet 23 of amplifier 16 and is arranged opposite control jet 15. An adjustable restrictor 24 is installed in line 22 to vary the effectiveness of control jet 23. As enlarged sectional perspective of proportional amplifier 16 is shown in FIG. 4.

In the exemplary illustration spindle 13 is used for measuring or comparing the internal diameter 25 of a workpiece such as annular ring 26. As the internal diameter 25 decreases, for example, air flow out of spindle 13 decreases thereby increasing the pressure in line 14 and thus the energy of control jet 15 of amplifier 16. Similarly as the internal diameter 25 increases or with no part in the gaging station the energy of control jet 15 is correspondingly decreased.

It will be seen that the energy of the control jets in amplifier 16 control air flow therethrough, thus as the energy of control jet 15 increases for example, more flow from supply jet 21 will be diverted to a discharge passage 27 of amplifier 16 arranged generally opposite such supply passage. Likewise as the energy of control jet 15 decreases less flow from supply jet 21 will be diverted to passage 27 while more flow will be diverted by control jet 23 to a discharge passage 28 also arranged generally opposite supply passage 21 of amplifier 16. Dump passage means including passages 27a and 28a provide passages for dumping unused flow from supply passage or jet 21. Having described the amplifying means, of this example, a detailed tie-in thereof to the rest of the system is deferred until later in the disclosure.

A pressure sensitive gage 29 can be installed in line 14 with markings thereon corresponding to a pressure setting which will be determinative of a corresponding size hole in a part being measured.

Means provided for classifying and segregating the gaging signals into a plurality of classes include an adjustable regulator 30 for supplying regulated air through a line 31 to a plurality of decision making elements or pneumatic flip flop devices 32 and 33. Because units 32 and 33 are identical, only unit 32 is illustrated in sectional perspective in FIG. 5. Each flip flop 32 and

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33 has a corresponding housing 32a and 33a and corresponding supply passages 34 and 35 respectively for flowing a supply jet of fluid therethrough. Supply jets 34 and 35 are supplied respectively by supply lines 36 and 37 which communicate with supply line 31. Lines 40 and 41 (including corresponding restrictors 44 and 45) communicate at one end with line 31 and supply corresponding control jets 42 and 43 of flip flops 32 and 33. The pressure point at which each flip flop is energized is set by such restrictors to correspond to the internal diameter of ring 26. Flip flop devices 32 and 33 operate in conjunction with valve devices such as pilot valve device 38 cooperating with a spring loaded valve device 39 to classify the part in this example into one of three categories. As illustrated in FIGS. 1 and 5 note that each flip flop 32 and 33 has a central dump passage 32c and 33d respectively arranged generally opposite its respective supply passage for dumping the excess flow not flowing through one or the other of discharge passages therein so that flow flips either through one discharge passage or the other depending on the energy of the associated control jet.

The fluid discharges of flip flop devices 32 and 33 and valve devices 38 and 39 are supplied to a plurality of read in elements 46, 47, and 48; and the gaging information for a given class part is read into one of these elements depending upon the size part, as will be more fully described subsequently. The air supply for read in elements 46, 47, and 48 is provided by energizing read in valve 52 installed in a line 53 and downstream of pressure regulator 54. Read in valve 52 is but one of a plurality of valve units which are automatically operated in a cyclical manner for carrying out the functions of the apparatus as later described.

After indexing ring 26 into the gaging station the ring is clamped and gaged as previously mentioned and a signal is fed through amplifier 16, flip flops 32 and 33, in cooperation with valve devices 38 and 39 to read in unit 46, 47, or 48 depending upon whether the part is oversize, acceptable, or undersize respectively. With the part still in the gaging station, valve 52 is energized to thus read in the signal from the part and dynamically hold such signal in element 46, 47, or 48 depending on its size classification.

Having thus classified a given gaging signal into a given class, by energizing a given read in element, the signal is now stored in the apparatus for later use in accordance with a preestablished operating cycle. Such storing is accomplished by use of memory means which includes a first memory bank having memory units 55, 56, and 57 which correspond respectively to units 46, 47, and 48. Inasmuch as above mentioned read in units and the memory units, and the shift units to be later described, are of identical construction, for simplicity of presentation a detailed description will only be given of typical memory unit 56 as more fully illustrated in FIG. 6. Such description is fully applicable to all such read in units, memory units, and shift units. Unit 56 includes a housing 56a and a supply passage 56b in said housing for flowing a supply jet of fluid therefrom. Discharge passage means in housing 56a include a discharge passage 56c which normally discharges fluid to ambient except upon receipt of a gaging signal from the next preceding unit and a discharge passage 56d. Control jet means in housing 56a include a control jet 56e which upon receiving flow from such next preceding unit diverts supply jet 56b from the passage discharging to ambient to the opposite passage, 56d in this illustration. Thus it is seen that a gaging signal transfer is accomplished through diversion of said supply jet by the control jet as it receives a gaging signal from the next preceding unit.

The fluid supply for memory units 55, 56, and 57 is provided by opening valve means such as air valve 70 installed in a line 71 and downstream of pressure

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regulator 72. With the signal thus retained in the first bank of memory units, read in valve 52 is closed which in effect resets units 46, 47, and 48 in preparation for another signal to be received from the next part to be gaged. From this point on in the operating sequence the manner in which the stored signal will be used will depend upon whether the part is oversize, acceptable, or undersize. If the part is oversize note that the pressure in line 14 is reduced hence the energy of control jet 15 is correspondingly reduced. This permits control jet 23 to deflect supply jet 21 of amplifier 16 so it discharges through its discharge passage 28 and in turn flow is provided to control jets 60 and 61 of flip flops 32 and 33 respectively. Control jets 60 and 61 divert flow from supply jets 34 and 35 to discharge passages 62 and 63 of units 32 and 33 respectively.

Flow through passage 63 enters pilot valve 38; however, because there is no flow through a passage 64 from flip flop 32 the signal is lost at this point. The flow through passage 62 is transmitted to unit 46 and the signal is read in by energizing valve 52 and held for subsequent transfer to memory unit 55 for use later in the cycle.

If the part is acceptable the pressure in line 14 provides sufficient energy for control jet 15 that less flow is diverted through passage 28 of amplifier 16. The flow is such that control jet 60 of flip flop 32 will not divert its supply jet 34 thus permitting control jet 42 to divert flow to passage 64 and thence to valve 39. However, flow from passage 28 is sufficient to cause control jet 61 of flip flop 33 to divert flow from control jet 35 to output passage 63. Thus with flow provided to both valve 39 and pilot valve 38 the gaging signal is transmitted to memory unit 47 and the signal is read in by energizing valve 52. The signal is subsequently transferred to memory unit 56 for use later in the cycle.

If the part is undersize the pressure in line 14 is large compared to the previous two classes thus there is comparatively little flow from discharge passage 28 of amplifier 16 and control jets 42 and 43 of units 32 and 33 respectively will divert flow through such units to discharge passage 64 and 65 thereof respectively. Because there is no signal to pilot valve 38 the signal from passage 64 is canceled out and flow through passage 65 provides a signal which is read in to unit 48, and subsequently transferred to memory unit 57 for use later in the cycle.

The description of the exemplary embodiment of this invention has illustrated how a gaging signal for an oversize, acceptable, or undersize workpiece 25 is transmitted and initially stored in units 55, 56, or 57 respectively.

As previously explained, in this exemplary embodiment parts are continuously transferred through the system in indexing steps to the gaging station and from that station in order through oversize, acceptable, and undersize selection stations where they are ejected in accordance with their size classifications. The operating cycle is repeated for each index movement between each station. For each classification, memory units are provided which correspond in number to the number of cycles or index movements between the gaging station and the appropriate selection station. To provide the proper delay or signal storage, the signal for each classification is sequentially transferred between the memory units for that class to a terminal memory unit where it is applied for utilization to operate the associated selection mechanism at the corresponding station. The manner in which a given class part is ejected at the proper station will be apparent from FIGS. 1 and 2 of the drawing; however, to give a more complete description of this invention an acceptable part will be traced through the complete cycle.

With an acceptable part clamped in the gaging station a signal will be provided and read into unit 47 just before the start of the index operation. The part is then indexed

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to the next station with the signal held in unit 47 and before the next part is clamped in position in preparation to gaging and hence another signal. It will be seen from FIG. 3 that the signal from unit 47 is transferred to unit 56 in the first memory bank during index. This is achieved by energizing a valve 70 in a line 71 and downstream of adjustable pressure regulator 72 which regulates flow through such line. Note that as the part reaches the first station and with the signal held in unit 56 read in valve 52 is closed to cancel the gaging signal in the read in units, namely unit 47 in this instance and prepare such units for a signal from the next part to be indexed into position and gaged.

The next operation is to read out whatever signal is present in the memory units. This is achieved by opening a valve 80 located in a line 81 and downstream of regulator 82.

Of course, had the part been oversize a signal would be available from unit 55 and with the part physically positioned at the first station a signal would have been provided to utilization control means such as a pilot valve 83 and a valve 84 which control flow to utilizing means including actuator 85 to eject the part from indexing conveyor 86 into chute 87. Conveyor 86 is indexed in time relationship with the operating cycle.

With the gaging signal stored in the first memory bank, and specifically in unit 56 in this sequence for an acceptable part, fluid signal transfer means cooperating with said classifying means and memory means are provided for transferring the stored signals in accordance with the predetermined operating cycle. Such signal transfer means includes shift units and means for supplying fluid thereto and valve means therefor to thus transfer a given signal with the desired delay until utilization thereof. The acceptable part signal held in memory unit 56 is shifted from the first memory bank with the part still in the oversize selection station by opening a valve 73 located in a line 74 downstream of adjustable pressure regulator 75. The signal is thus transferred to unit 76 in a first shift bank having unit 76 and 77 therein, and subsequently the flow to the memory units is closed by closing valve 70 to effectively reset the memory units in preparation for another signal. Read in valve 52 is then opened in preparation for another signal to be provided as soon as another part is indexed into gaging position while simultaneously closing air flow to the memory units to effectively isolate the gaging signal from the new part introduced into the gaging station from the signal in the first shift bank.

The gaging signal from the acceptable unit is then transferred to a unit 90 in a second shift bank which includes units 90 and 91 therein. Air flow to the second shift bank is provided by opening a valve 92 installed in a line 93 and downstream of adjustable pressure regulator 94. Air flow to the first and second shift banks is continued simultaneously for a short duration whereupon the acceptable part is indexed to the next position while generally simultaneously moving another part into the gaging station. During the index operation flow to the first shift bank is closed, while retaining flow and hence the signal in the second shift bank, unit 90 in this instance. Flow is provided to the memory units simultaneously with stopping flow to the first shift bank. The gaging signal for the acceptable part is thus effectively isolated in memory unit 90 in the second shift bank and transferred to unit 95 in the second memory bank while the gaging signal from a new part is obtained and held in the first memory bank.

The acceptable part gaging signal is read out by opening valve 80 which provides the source of motive energy, air in this example, for the utilization means or actuators in this example. With valve 70 still energized the signal from unit 95 is provided to utilization control means including a pilot valve 100 cooperating with valve 101 thereby energizing actuator 102 and ejecting the acceptable part, now positioned at the acceptable selection station, into a chute 103.

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Had the part been undersize its signal would have been transmitted to memory unit 57 and through repetitive cycles of shifting, the undersize signal would have been transmitted to memory unit 96 with similar steps as in transferring a signal to unit 95 for an acceptable part. Upon reading out the signal with the part in the acceptable selection station, no signal would be available to pilot valve 100 thus the undersize part would not be ejected at this point. From the operating cycle chart in FIG. 3, it will be seen that the next operation would be to stop flow to read out valve 80, followed by energizing valve 73 to provide flow to the first shift bank whereby the signal is transferred to unit 104 and after a subsequent shifting, indexing, and memory the undersize part signal is transferred through units 105 and 106 and the part is transferred to the undersize selection station whereupon the signal is read out by again energizing valve 80 as previously described. A signal from unit 106 is provided to pilot valve 110 which controls flow through a valve 111 to energize actuator 112 and eject the part into a chute 113.

Operating means provided for energizing the valve means including valves 52, 70, 73, 80, and 92 in a predetermined cyclical manner enable sequential holding of input signals from each respective class in the associated memory units and transferring signals therebetween and to the associated utilization control means with the desired delay. Means for energizing valves 52, 70, 73, 80, and 92 includes a motor 115 having a shaft 116 with cams 117, and 118 (see FIG. 2) and cams 119, 120, and 121 (not shown) fixed thereto and cooperating respectively with valves 52, 70, 73, 80, and 92. The respective cams are arranged on shaft 116 such that with shaft rotation the valves are energized in accordance with the timing chart shown in FIG. 3. FIG. 2 illustrates the arrangement of cams 117 and 118 and cooperating rollers 52a and 70a of valves 52 and 70 respectively. It will be appreciated that the other valves are similarly positioned to be actuated by corresponding cams to be driven by motor 115 such that they will be energized in accordance with the predetermined operating cycle and sequence.

The use of flip flop, read in, memory, and shift units which have no moving parts makes it possible to provide such units as an integral part of a single sheet of suitable hard material or several sheets fastened together with the desired passages for each given unit preformed in the material. This technique of using printed pneumatic circuit boards to form the majority of components of this invention makes it possible to provide units at greatly reduced costs. Furthermore, because the above mentioned units have no moving parts to wear or malfunction the apparatus operates with great reliability.

Thus it will be seen that a device is provided wherein a dynamic fluid system is used to provide pneumatic signals directly from an object under observation and that the information obtained from said object is progressively programmed and transferred in a systematic disciplined manner along with such object until such information reaches utilization means whereupon it is used to perform some function. While the apparatus has been illustrated and described in an exemplary embodiment as applied to dimensional gaging involving three classifications, it would have other applications and would be readily applied to gaging apparatus involving any desired number of classifications.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. Apparatus for signal storage and handling comprising, signal means providing signals in response to input criteria,

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classifying means operatively connected to said signal means for classifying said signals into a plurality of desired classes with each class defining a desired criteria,

a plurality of fluid operated memory means in series relationship cooperating with said signal means and said classifying means for storing said signals from each class for use in conjunction with a pre-established operating cycle,

utilizing means controlled by said operating cycle and cooperating with said fluid operated memory means, and fluid signal transfer means cooperating with said classifying means and with said fluid memory means for transferring said stored signals sequentially between said series arranged memory units in accordance with said operating cycle to said utilization means to enable utilization of said signals at predetermined intervals after receipt thereof.

2. Apparatus for signal storage and handling using fluid as the operating and signal medium comprising,

fluid signal means providing signals varying in response to input criteria,

classifying means cooperating with said signal means for defining said signals into a plurality of classes with each class establishing a desired criteria,

a plurality of fluid operated memory units operatively connected to said classifying means for storing said signals from each class for subsequent use in a predetermined operating cycle,

utilization means having a source of motive energy controlled by said operating cycle and selectively triggered by said signals,

and fluid signal transfer means cooperating with said classifying means and with said memory units including fluid operated shift units for transferring said stored signals in accordance with said predetermined operating cycle and in a preselected sequence for use of a given class signal to trigger said utilization means as said given signal is transferred into cooperating relationship therewith, whereby a given fluid signal is dynamically held and sequentially transferred for triggering application to said utilization means.

3. Apparatus for signal storage and handling using fluid as the operating and signal medium comprising,

fluid signal means providing signals varying in intensity in response to product criteria,

classifying means operatively connected to said signal means for segregating said signals into a plurality of classes with each class classifying the desired criteria within a range,

fluid operated memory means operatively connected to said classifying means for storing a given signal from each class for subsequent use in a predetermined operating cycle,

utilization means controlled by said operating cycle and selectively triggered by said signals,

fluid signal transfer means including fluid operated shift units and fluid valve means operatively connected to said shift units, memory means, and utilization means for transferring said stored signals in accordance with said predetermined operating cycle and in a preselected sequence for use of said signals to trigger said utilization means as a given class signal is transferred into cooperating relationship with said utilization means whereby a given stored signal is held and sequentially moved through said apparatus until it reaches a desired utilization position,

and fluid supply means operatively connected to said valve means and therethrough to said memory means, utilization means, and shift units to enable cyclical operation thereof in accordance with said predetermined operating cycle.

4. Apparatus for signal storage and handling using fluid as the operating and signal medium for use in gaging

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and transferring products to selection stations in accordance with the product criteria gaged comprising,

fluid signal means providing signals varying in intensity in response to product criteria,

classifying means operatively connected to said signal means for segregating said signals into a plurality of classes with each class establishing the desired criteria within a range,

fluid operated memory means operatively connected to said classifying means for storing a given signal from each class for subsequent use in a predetermined operating cycle, said memory means including memory unit banks corresponding in number to the number of stations between gaging and selection,

common fluid supply means for said memory means operatively connected to all memory banks for simultaneous energization thereof,

utilization means for each selection station controlled by said operating cycle and selectively triggered by said signals,

fluid supply means operatively connected to said utilization means and providing a source of motive energy therefor,

fluid signal transfer means including fluid operated shift units and fluid valve means operatively connected to said shift units, memory means, and utilization means for transferring said stored signals from one memory bank to the next as required in accordance with said predetermined operating cycle and in a preselected sequence for use of said signals to trigger said utilization means for product selection as a given class signal is transferred into cooperating relationship with said utilization means, whereby a given stored gaging signal is held and sequentially moved through said apparatus until the gaged product reaches the desired selection station,

and fluid supply means operatively connected to said valve means and therethrough to said memory means, utilization means, and shift units to enable cyclical operation thereof in accordance with said predetermined operating cycle.

5. Apparatus for signal storage and handling using fluid as the operating and signal medium comprising,

fluid signal means providing signals varying in response to input criteria,

classifying means operatively connected to said signals means for segregating said signals into a plurality of classes with each class defining a desired criteria,

fluid operated memory means operatively connected to said classifying means for storing a given signal from each class for subsequent use in a predetermined operating cycle, said memory means including a number of memory units for each respective class as determined by the desired delay in utilization of the signal from each such class and between which each such signal is sequentially transferred,

fluid supply means operatively connected to said memory units including selectively operated first valve means for supplying fluid thereto and enabling thereof,

utilization control means operatively connected to the terminal memory unit for each signal class including means for supplying fluid thereto and second valve means therefor,

shift units including means for supplying fluid thereto and third valve means therefor operatively connected between each sequential pair of memory units,

and means for operating said first and third valve means in a predetermined cyclical manner for sequentially holding input signals from each respective class in the associated memory units and transferring signals therebetween and to the associated utilization control means with the desired delay.

6. Apparatus for signal storage and handling using fluid as the operating and signal medium comprising,

fluid signal means providing signals varying in response to input criteria,
 classifying means operatively connected to said signal means for segregating said signals into a plurality of classes with each class defining a desired criteria, 5
 fluid operated memory means operatively connected to said classifying means for storing a given signal from each class for subsequent use in a predetermined operating cycle, said memory means including a number of memory units for each respective class as determined by the desired delay in utilization of the signal from each such class and between which each such signal is sequentially transferred, 10
 fluid supply means operatively connected to said memory units including selectively operated first valve means for supplying fluid thereto and enabling thereof, 15
 utilization control means operatively connected to the terminal memory unit for each signal class including means for supplying fluid thereto and second valve means therefor, 20
 signal shift means operatively connected between each sequential pair of memory units, means supplying fluid to said shift means, third valve means for controlling the fluid supply means to said shift means, 25
 and operating means for energizing said first and third valve means in a predetermined cyclical manner for sequentially holding input signals from each respective class in the associated memory units and transferring signals therebetween and to the associated utilization control means with the desired delay, said operating means including means for energizing said valve means for said shift means to transfer a given class signal from a memory unit through said shift means to the next sequentially associated memory unit while keeping other signals in said associated memory units operatively isolated from said given signal. 30
 7. Apparatus for signal storage and handling using fluid as the operating and signal medium comprising, 40
 fluid signal means providing signals varying in response to input criteria,
 classifying means operatively connected to said signal means for segregating said signals into a plurality of classes with each class defining a desired criteria, 45
 fluid operated memory means operatively connected to said classifying means for storing a given signal from each class for subsequent use in a predetermined operating cycle, said memory means including a number of memory units for each respective class as determined by the desired delay in utilization of the signal from each such class and between which each such signal is sequentially transferred, 50
 fluid supply means operatively connected to said memory units including selectively operated first valve means for supplying fluid thereto and enabling thereof, 55
 utilization control means operatively connected to the terminal memory unit for each signal class including means for supplying fluid thereto and second valve means therefor, 60
 a plurality of shift units operatively connected between each sequential pair of memory units, means supplying fluid to said shift units, 65
 third valve means for controlling the fluid supply means to each of said shift units,
 each of said memory units and shift units comprising, a housing,
 a supply passage in said housing for flowing a jet of fluid therefrom communicating with said fluid supply means and controlled by said first and third valve means, 70
 discharge passage means in said housing,
 control jet means in said housing arranged to flow fluid 75

transverse said supply jet to divert fluid therefrom to said discharge passage means,
 and means placing the control jet of each unit in receiving communication with the discharge passage means of the preceding unit, whereby signal transfer is accomplished through diversion of said supply jet and coordinated operation of said valve means associated therewith,
 and operating means for energizing said first and third valve means in a predetermined cyclical manner for sequentially holding input signals from each respective class in the associated memory units and transferring signals therebetween and to the associated utilization control means with the desired delay, said operating means including means for energizing said third valve means for said shift units such that a given class signal is transferred from a memory unit through said shift units to the next sequentially associated memory unit while keeping other signals in said associated memory units operatively isolated from said given signal.
 8. Apparatus for gaging and segregating products into a plurality of dimensional categories using fluid as the gaging signal, gaging signal transfer, and operating medium for transferring such products to selection stations in accordance with product dimensions gaged,
 fluid signal means including a gage head for operative association with a given product and fluid gaging signal amplifying means operatively connected to said gage head for amplifying said gaging signals,
 classifying means including a plurality of pneumatic flip flop devices and valve devices operatively connected at their inlets to said amplifying means for classifying gaging signals into output fluid discharges representative of part classifications,
 fluid operated memory means operatively connected to the discharges of said classifying means for storing a given gaging signal from each class for subsequent use in a predetermined operating cycle, said memory means including a number of memory units for each respective class as determined by the desired delay in utilization of the gaging signal from each such class and between which each such signal is sequentially transferred,
 fluid supply means operatively connected to said memory units including selectively operated first valve means for supplying fluid thereto and enabling thereof,
 utilization control means operatively connected to the terminal memory unit for each gaging signal class including means for supplying fluid thereto and second valve means therefor,
 a plurality of shift units operatively connected between each sequential pair of memory units,
 means supplying fluid to said shift units,
 valve means for controlling the fluid supply means to each of said shift units,
 and operating means for energizing said first and third valve means in a predetermined cyclical manner for sequentially holding input gaging signals from each respective class in the associated memory units and transferring gaging signals therebetween and to the associated utilization control means with the desired delay, said operating means including means for energizing said third valve means for said shift units such that a given class gaging signal is transferred from a memory unit through said shift units to the next sequentially associated memory unit while keeping other signals in said associated memory units operatively isolated from said given gaging signal.
 9. Apparatus as set forth in claim 8 in which said amplifying means comprises,
 a housing,
 a supply passage in said housing for flowing a jet of fluid therefrom at high velocity,

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- a regulated fluid supply in communication with said supply passage,
- dump passage means in said housing arranged generally opposite said supply passage for dumping unused flow from said supply passage,
- discharge passage means in said housing arranged generally opposite said supply passage, said discharge passage means including passage means in communication with the inlets of said classifying means,
- a first control jet in said housing in communication with said regulated fluid supply and arranged to flow fluid against and transverse said supply jet,
- a second control jet acting in opposition to said first control jet and flowing fluid generally transverse and against said supply jet, said second control jet being operatively connected to said gaging head such that a gaging signal from said gaging head diverts flow from said supply jet to said discharge passage means as a function of said gaging signal to thus amplify the signal to said classifying means.
10. Apparatus as set forth in claim 8 in which each flip flop device comprises,
- a housing,
- a supply passage in said housing in fluid communication with a source of regulated fluid under pressure for flowing a supply jet of fluid therefrom at high velocity,
- a pair of discharge passages in said housing arranged generally opposite said supply passage, each discharge passage being operatively connected to flow fluid to said memory means,
- a central dump passage in said housing arranged generally opposite said supply passage for dumping excess flow not diverted to one of said discharge passages such that depending on the intensity of said gaging signal flow is flipped to either one discharge passage or the other,
- a first control jet in said housing in communication with said regulated fluid supply and arranged to flow fluid against and transverse said supply jet,
- and a second control jet acting in opposition to said first control jet and flowing fluid generally transverse and against said supply jet, said second control jet being operatively connected to said discharge passage of said amplifying means such that an amplified signal therefrom energizes at least one of said flip flop devices as determined by the intensity of the gaging signal to provide an effective signal to the memory units of a given class.
11. Apparatus for gaging and segregating products into a plurality of dimensional categories using fluid as the gaging signal, gaging signal transfer, and operating medium for transferring such products to selection stations in accordance with the product dimensions gaged comprising,
- fluid signal means providing gaging signals varying in intensity in response to such product dimensions,

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- classifying means operatively connected to said signal means for segregating said signals into a plurality of classes with each class establishing the desired dimensional characteristic within a given gaging tolerance range,
- indexing means controlled by a predetermined operating cycle for sequentially moving a product to the proper selection station,
- a plurality of fluid operated memory units operatively connected to said classifying means for storing a given signal from each class for subsequent use in accordance with said predetermined operating cycle, said memory means including memory unit banks corresponding in number to the number of stations between gaging and selection,
- common fluid supply means for said memory means operatively connected to all memory banks for simultaneous energization thereof,
- utilization means for each selection station controlled by said operating cycle and selectively triggered by said signals,
- fluid supply means operatively connected to said utilization means and providing a source of motive energy therefor,
- fluid signal transfer means including fluid operated shift units and fluid valve means operatively connected to said shift units, memory means, and utilization means for transferring said stored signals from one memory bank to the next as required in accordance with said predetermined operating cycle and in a preselected sequence for use of said signals to trigger said utilization means for product selection as a given class signal is transferred into cooperating relationship with said utilization means whereby a given stored signal is held and sequentially moved through said apparatus until the gaged product reaches the desired selection station,
- and fluid supply means operatively connected to said valve means and therethrough to said memory means, utilization means, and shift units to enable cyclical operation thereof in accordance with said predetermined operating cycle.

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