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MAGNETIC AND RESONATOR SELECTOR FOR CARRIER CONVEYERS

Filed June 10, 1936

2 Sheets-Sheet 1

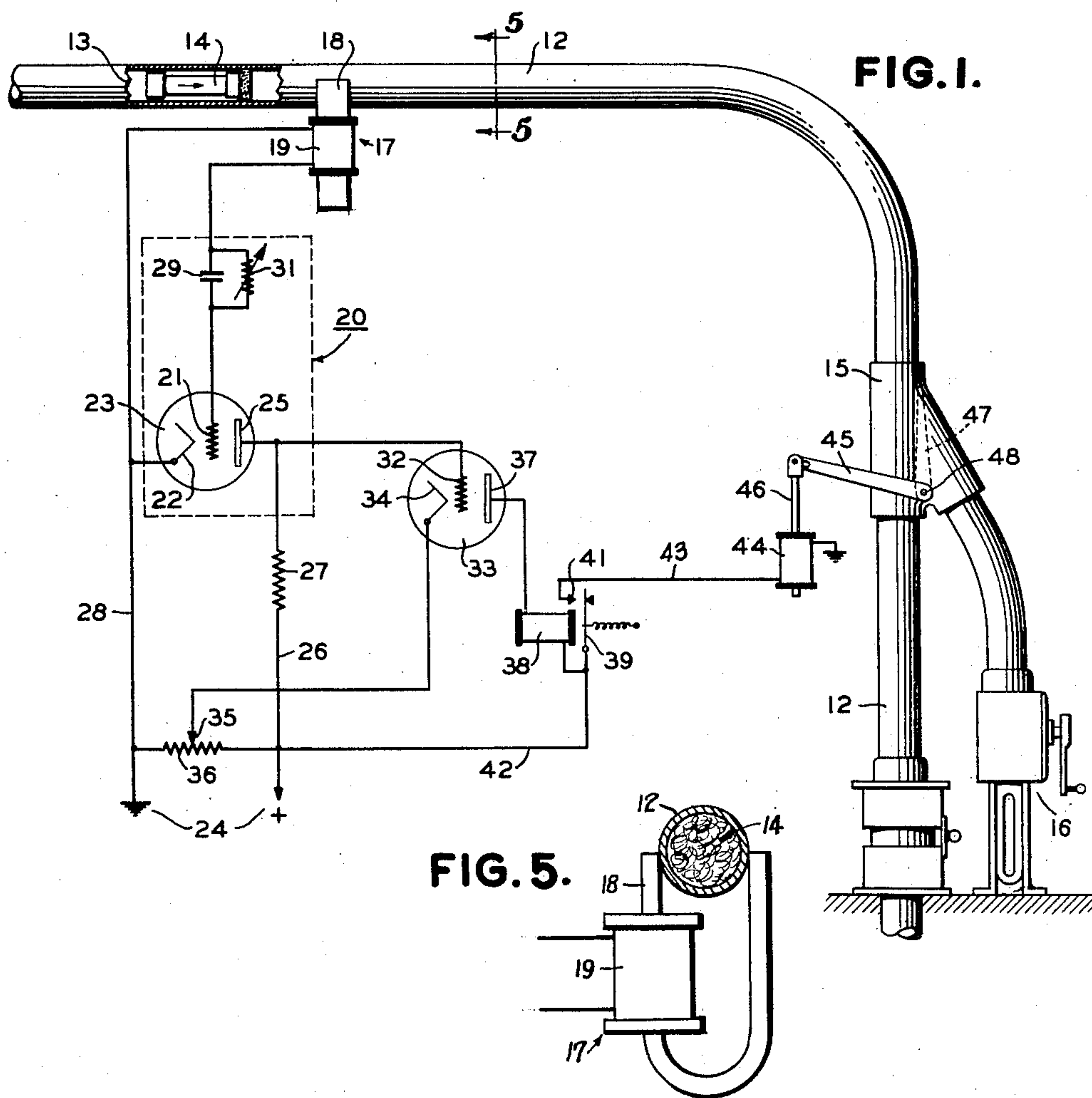


FIG. 1.

FIG. 5.

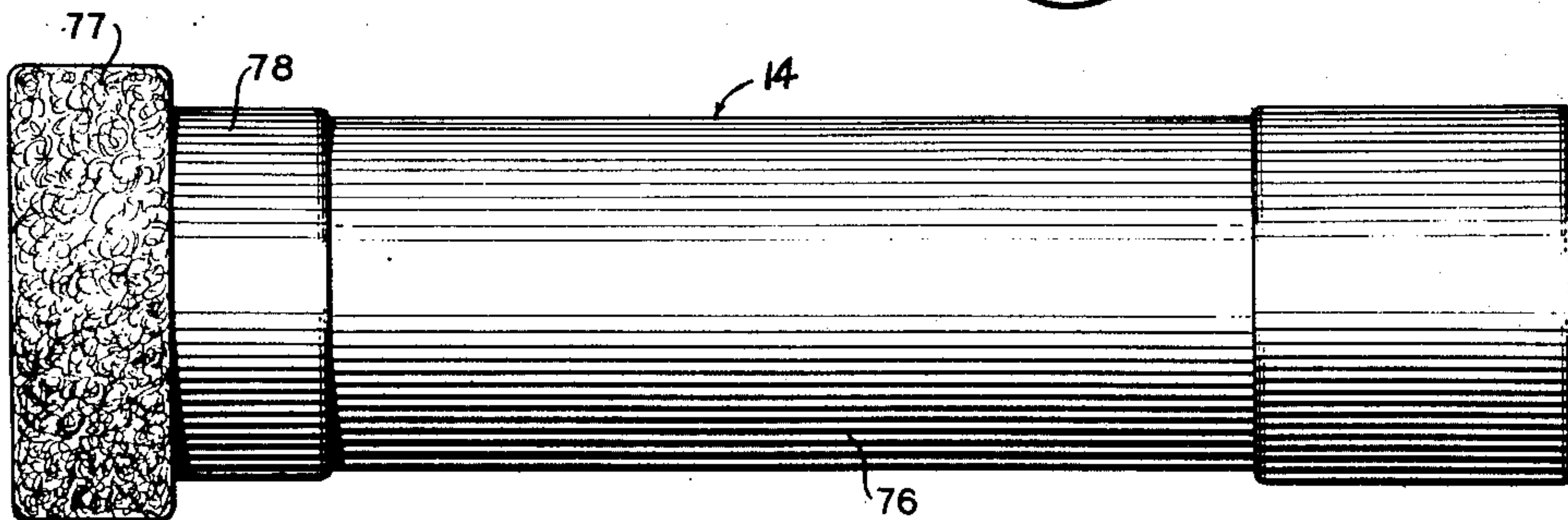


FIG. 3

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2 Sheets-Sheet 2

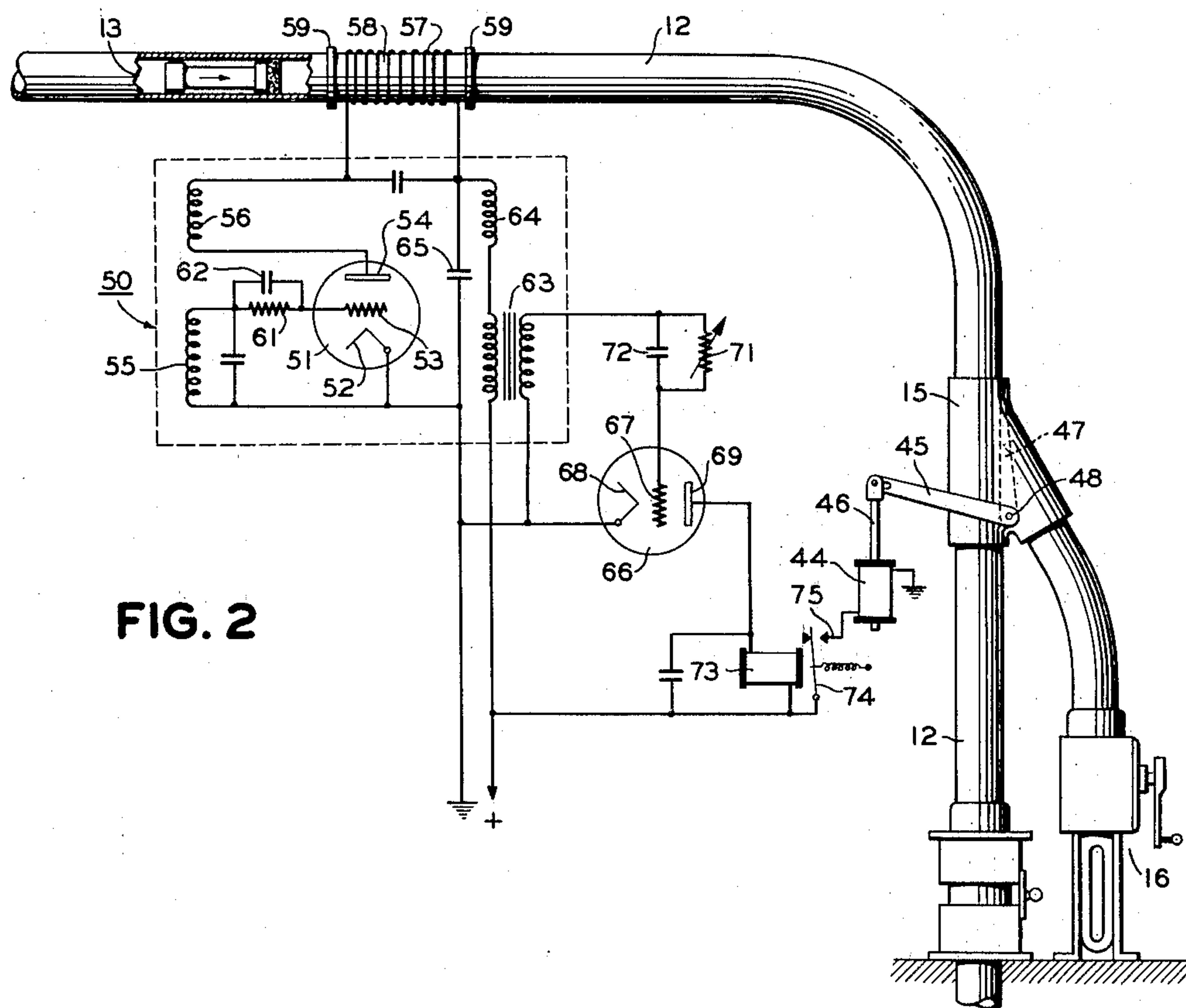


FIG. 2

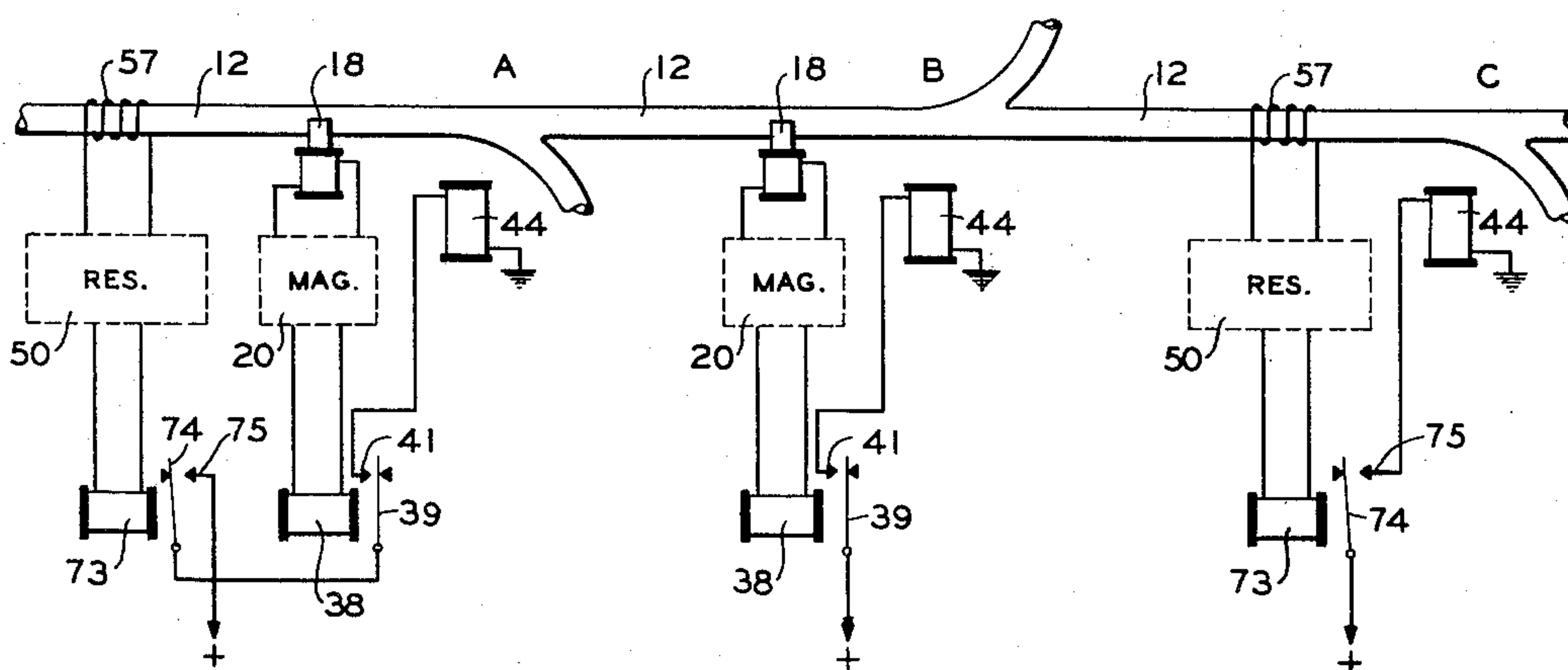


FIG. 4

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MAGNETIC AND RESONATOR SELECTOR
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5 Claims. (Cl. 243—16)

This invention relates, in general, to carrier dispatch systems employing guideways having one or more branches or points therealong at which the carriers are diverted or discharged, and has particular reference to a system in which means is provided for selectively diverting or discharging the carriers.

One of the principal objects of this invention is to provide a carrier selector system in which the carriers embody means cooperating with the selecting mechanism for indicating and producing the selective response desired in accordance with the predetermined destination of the carrier.

Another object is to provide carriers, to be employed with the selector system, possessing distinctive physical and electrical characteristics which will cooperate with the selector device to select or reject the carriers.

It is another object of this invention to provide a selective carrier switching apparatus which may be utilized in, or adapted to, present carrier installations with but a minimum alteration of the latter, and without impairing the usefulness, or materially affecting the capacity or efficiency of the same.

A further object is to provide a carrier selector system of sturdy and inexpensive construction, which will be non-critical to slight disturbances of the apparatus during operation.

Still another object is to provide a carrier selector system responsive to the momentary presence of a rapidly travelling carrier and embodying means for prolonging said response a predetermined interval, and for varying said interval as desired in order to allow sufficient time for the carrier to traverse the intervening space between the pick-up or selector and the switching mechanism.

A still further object is to provide a magnetic-field selector system responsive to carriers having predetermined magnetic properties, which response may be utilized to initiate the operation of suitable discharge or switching means.

Another object is to provide a novel resonator selector system not requiring the use of a grid controlled rectifier, and embodying an oscillator pick-up responsive to carriers having predetermined electro-conductive properties.

A further object is to provide a carrier system having a plurality of discharge or switching points intermediate its ends, and selector means at each of said intermediate points responsive to certain predetermined carriers to cause selective discharge of the same, and non-responsive to all

other carriers, so as to permit their uninterrupted passage along the carrier guideway.

These and other objects are effected by this invention, as will be apparent from the following description and claims taken in connection with the accompanying drawings forming a part of this application, in which:

Fig. 1 is a diagrammatic illustration showing a magnetic pick-up disposed in advance of a carrier discharge point, and the necessary selector circuit for causing selection or rejection;

Fig. 2 is a modified form of Fig. 1 employing an oscillator pick-up and a capacity coupling selector;

Fig. 3 is an illustration of one type of carrier adapted to be used with the present invention and embodying both magnetic and conductive properties; and

Fig. 4 is a diagrammatic view of a carrier conveyor line having a plurality of discharge points embodying the magnetic and oscillator pick-up and a combination thereof for effecting selective discharge of the carriers at their predetermined destination.

Fig. 5 is a sectional view of the carrier conveyor line taken on the line 5—5 of Fig. 1 which shows the disposition of the magnetic pickup in its relation to the opposite sides of the conveyor tube.

Carrier conveyor lines of the pneumatic type herein described are quite extensively used for conveying material between various points in a large building, and even between two or more separate buildings remotely situated, and their usefulness and adaptability is greatly increased where a system of selective routing and discharge is employed. Such systems make it possible to provide a conveyor line extending between two remote points and having one or more intermediate branch lines or discharge stations therebetween. In this way a main line may be used to serve a plurality of intermediate points from a single sending station so as to effect an economy in construction costs and maintenance over a system in which separate lines must be used from the sending station to the various remote receiving stations.

Various methods have heretofore been employed for accomplishing selective discharge of the carriers, most of which entail a considerable departure in design over installations where only one remote point is to be served, thus necessitating a substantial expenditure in labor and materials for putting in new installations or for converting those already in operation.

Hence, I have provided a novel method of se-

lective discharge which will be economical to install and operate and which will be suitable for adaptation to present installations.

According to my invention, I provide a carrier 5 conveyer line having one or more transfer junctions or discharge points intermediate the central sending station and the remote or end station on the conveyer line. Selective transfer or discharge 10 of the carriers is effected by means of a switching mechanism disposed at the juncture and operated by an electrical relay. This relay is selectively controlled by means adapted to impress a potential thereon whenever a carrier having predetermined physical properties passes a predetermined 15 point along the guideway. This point is located in advance of the juncture point and is sufficiently spaced therefrom to allow ample time for the proper functioning of the selector and switching mechanisms.

It has been found desirable to provide means 20 for prolonging the response of the selector mechanism to the carrier, sufficiently to permit the carrier to traverse the intervening space between the selector pick-up and the juncture point associated therewith, so that the switch will remain 25 in its desired position long enough to select or reject the carrier. This is accomplished, as will hereinafter be more fully described, by providing a suitable condenser and variable resistance shunt in the selector circuit instead of the usual mechanical timer.

Selection of the carriers according to their predetermined destination is accomplished by providing pick-up devices disposed along the carrier 35 guideway in advance of each intermediate station or branch juncture which will respond to certain predetermined physical properties of the carriers.

In one of the embodiments of this invention I provide a magnetic pick-up device which will respond only to carriers having predetermined magnetic 40 properties.

Another embodiment comprises a resonator pick-up or oscillation circuit responsive only to carriers having predetermined electro-conductive 45 properties.

Still another embodiment is obtained by combining the magnetic pick-up with the resonator pick-up to form a selector unit responsive to carriers embodying a combination of magnetic and 50 electro-conductive properties.

By employing a combination of these various embodiments a branch line conveyer may be constructed having a plurality of switching points, 55 each having one of the aforementioned embodiments. In this way carriers may be sent to intermediate stations in accordance with their physical characteristics.

Magnetic selector

Referring now to the drawings, Fig. 1 shows a 60 section of a pneumatic tube carrier conveyer system including a guideway 12, broken away at 13 to show a carrier 14 travelling therein in the direction indicated by the arrow, a juncture point 65 15, and an outlet station 16. A pick-up device 17 is spaced a short distance in advance of the juncture point 15. The pick-up comprises a permanent horseshoe magnet 18 disposed with the pole pieces on opposite sides of the track tube (see 70 Fig. 5) so that the latter passes through the field of the magnet in a manner to cut the maximum lines of force.

The magnet 18 is provided with an induction pick-up coil 19 in which currents may be induced 75 by carriers passing through the guideway 12. The

control mechanism for the pick-up is shown at 20. The winding of the pick-up coil is connected between the grid 21 and the cathode 22 of an amplifier (electronic discharge) tube 23.

The plate circuit of this tube is supplied with 5 a suitable potential from a local source 24. The positive lead 26 connects to the plate 25 and includes a load resistor 27. The cathode 22 of the amplifier tube 23 is connected to the negative lead 28.

When carriers having a construction embodying 10 a magnetic substance, preferably in the form of a ring or collar, pass through the magnetic field between the pole pieces 18 of the pick-up magnet 17, the field is momentarily strengthened and a voltage is induced in the winding 19. This causes 15 current to flow in the grid circuit. This current, passing through resistor 31, makes the grid 21 of the amplifier tube 23 negative with respect to the cathode 22.

With the carrier travelling at high speed the 20 effect of the metallic portion on the pick-up magnet is in the nature of a short impulse. The duration of this impulse is ordinarily insufficient to cause the proper functioning of the selecting and 25 switching mechanism. To prolong this response, a timing condenser 29 is employed in the grid circuit having a variable resistance shunt 31 so that, when the single impulse passes through, it will charge the condenser. By this means the potential in the grid circuit is maintained despite the 30 discontinuance of the initiating force and the charge is permitted to slowly dissipate through the resistance. By varying the value of the resistor and condenser the length of time required to dissipate the charge may be varied and the time 35 during which the switching operation takes place may be controlled.

With this type of timing device, a fixed maximum prolongation of the selection impulse is 40 maintained in the selector mechanism on all selections even though a subsequent impulse is received before the previous charge has become dissipated. The new impulse serves to replenish the 45 dissipated energy and restore the charge to maximum so that the last carrier will have sufficient time to reach the switching point. The advantage of using this method of timing is that where a plurality of carriers are to be sent from the 50 home station destined for the same branch station, they may all be inserted successively in the guideway without regard to spacing.

The plate 25 of the amplifier tube 23 is also 55 connected to the grid 32 of a second amplifier tube 33. The cathode 34 of this tube is supplied with an operating potential from the movable contact 35 of a voltage divider 36 connected between the power leads 24. In circuit with the plate 37 60 of the tube is a relay 38 having a normally open armature 39 and a front contact 41. The armature 39 is connected in circuit with the relay and both are supplied with current from the source 24 by means of conductor 42. The front contact 41 is connected by conductor 43 to a switching 65 solenoid 44 disposed adjacent the juncture 15 of the tube guideway. A connecting arm 45 joins the moving plunger 46 of the solenoid to the switch plate 47 pivoted at 48.

Normally the amplifier tube 23 is operating with 70 zero grid bias and the circuit is adjusted, by means of the voltage divider 35 and the resistor 27, so that amplifier tube 33 will have no current flow in its plate circuit, which includes the relay 38.

Irrespective of the manner in which the wind- 75

ing of the pick-up magnet 17 is connected in the grid circuit of tube 23 the induced current impulse which is permitted to flow in the grid circuit by the unilateral conductivity of tube 23 results in a negative bias on the grid 21. This causes a decrease in the plate current of tube 23 and a consequent increase in plate potential. Since the grid of tube 33 is connected to the plate of tube 23, when plate 25 becomes more positive, the potential of the grid 32 of amplifier tube 33 becomes more positive or, in other words, has its negative bias decreased. This causes current to flow in the plate circuit of tube 33 and the relay 38 becomes energized. The armature 39 is then drawn against its front contact 41 and current is thereby supplied to the solenoid 44. The energization of the solenoid operates the switching mechanism and causes the carrier to be deflected from the main guideway 12 to the outlet branch 16.

Resonator selector

Referring now to Fig. 2, a modification of the selector control mechanism is shown. The unit illustrated comprises an oscillation generator 50 adapted to be responsive to carriers having predetermined metallic properties.

In a copending application, Ser. No. 10,734, filed March 12, 1935, by Adam Drenkard, Jr., this type of oscillator pick-up is fully described.

Briefly, the oscillator pick-up comprises a three-element tube 51 provided with a cathode 52, a grid 53 and an anode 54. A tuned inductance or coil 55 is placed in the grid circuit, and a feed-back coil 56 in the anode circuit inductively coupled to the grid circuit. In series with the feed-back coil 56 is a pick-up coil 57 the latter being disposed around a portion of the conveyer tube 12 in advance of the switching point 15. The pick-up coil comprises preferably a single helical layer wound about a non-metallic portion 58 of the tube 12. The non-metallic portion is suitably insulated from the main carrier guideway as shown at 59.

The circuit is adjusted so that it is normally just below the oscillating point and arranged so that a carrier having predetermined metallic characteristics will, in passing through the pick-up coil 57, bring the circuit into resonance. A grid leak is provided comprising a resistance 61 shunted by a condenser 62 so that the tube 51 will normally pass its minimum current; that is, when the circuit is not in oscillation.

The anode circuit of tube 51 includes the primary of a transformer 63. The high frequencies are filtered out of the circuit by means of the well known arrangement of a choke coil 64 and condenser 65.

The secondary of the transformer 63 is connected in the grid circuit of a second three-element tube 66 comprising a grid 67, a cathode 68 and an anode 69. This tube is preferably of a type having a relatively high cathode to grid conductance. The well known type #53 tube has been found very suitable although any other make possessing the same characteristics may be used.

The grid circuit of tube 66 is provided with a variable resistor 71 shunted by a condenser 72, the purpose of which is to prolong the response of the tube to the momentary presence of a metallic carrier in the pick-up coil so that sufficient time will be allowed for the carrier to traverse the distance between the pick-up coil and the switching point before the circuit returns to normal.

This arrangement provides a simple, inexpensive, and efficient means for timing the switching operation where varying local conditions make it necessary to have a non-uniform spacing between selector unit and switching point.

In series with the anode circuit of the tube 66 is included the winding of a relay 73. An armature 74 is responsive to the relay and serves to supply a source of potential through its back contact 75 to the solenoid 44.

The tube 66 is normally operated at zero grid bias and is adjusted so that current will normally flow in the plate circuit. This causes the relay 73 to be normally energized and the armature 74 consequently held away from its back contact 75 so that no current is supplied to the solenoid 44.

When a carrier having predetermined metallic properties, such as an all-metal body, or a metallic conductive surface coating, or metallic band or collar, passes through the pick-up coil, it will increase the capacitive coupling between the turns of the coil 57. The presence of a metallic body within the envelope of the coil causes a change in the amount of current passed through the plate circuit of the tube 51.

The effect is to cause a material decrease of the current in the plate circuit of the oscillator. This sudden change causes a current pulse to be passed through the primary of the transformer 63. A voltage is thereby simultaneously induced in the secondary of the transformer, which voltage causes current to flow in the grid circuit of tube 66. The passage of this current through the variable resistor 71 charges the condenser 72 and impresses a negative bias on the grid 67.

The current in the plate circuit now drops to zero and the resulting deenergization of the relay 73 causes the armature 74 to be released and drawn against its back contact 75. This in turn operates the solenoid 44 to effect the switching operation. The charge in the condenser 72 is dissipated slowly through the resistor 71, shunted across it until the current in the plate circuit is built up sufficiently to operate the relay 73 and remove the current source from the solenoid 44. By varying the value of this resistor, the time during which the relay 73 is deenergized and the switch plate 47 held in its discharge position may be controlled.

Fig. 3 shows a type of carrier proposed to be employed in the carrier conveyer system herein described. As stated, it is one of the objects of this invention to provide a system embodying a minimum of departure from present design and equipment so that the selector pick-up devices and carriers cooperating therewith may be easily placed in present installations. To that end I provide a carrier 14 of conventional design, and made in substantially the same dimensions as carriers now employed in the systems which do not have selective discharge.

The carrier illustrated is of a type that embodies characteristics that will produce a response in both the magnetic pick-up shown in Fig. 1 and the resonator pick-up shown in Fig. 2. That is it comprises portions of both magnetic and electro-conductive material. It is obvious that either of these portions may be eliminated to provide a carrier that will cause only one of the aforementioned selector devices to operate. As illustrated, the carrier embodies a main body portion 76 of electro-conductive non-magnetic material which may be in the form of an all-metal body or a fibre body having a light coating of metal foil. The head of the carrier is provided with the usual

buffer member 77 of fibrous material. Adjacent the buffer member 77 is placed a narrow collar 78 of magnetic material sufficient in size to produce the necessary response in the magnetic pick-up.

Referring now to Fig. 4, I have shown a section of a carrier conveyer line having three branch or juncture points intermediate the sending station and the remote receiving station.

At each of the juncture points, designated A, B and C, respectively, a selector pick-up is provided so that predetermined carriers designated for a particular station will be selectively discharged thereat and all carriers not so designated will be rejected to continue their uninterrupted passage along the main guideway 12.

The selector devices are illustrated diagrammatically and only the operating solenoid 44 of the switching apparatus at each juncture is shown.

At station A, the selector mechanism comprises a combination of the resonator pick-up 50 and the magnetic pick-up 20. The resonator pick-up coil 57 is disposed in advance of the pick-up magnet 18. The control relays 73 and 38 of the selector devices have their armatures 74 and 39 respectively connected together. The back contact 75 of the relay 73 serves as a current supply for both armatures. The front contact 41 of relay 38 is in circuit with the switching solenoid 44. The operation of the mechanism is as follows.

Suppose a carrier, of the type illustrated in Fig. 3, is passing along the guideway 12. As previously stated, the carrier embodies both electro-conductive and magnetic properties. As it passes through the coil 57, its conductive body portion causes the resonator selector to respond and the relay 73, which is normally energized, releases its armature 74. The armature is pulled against its back contact 75 thereby supplying current to the armature 39 of relay 38. It will be remembered that means has been provided for maintaining the relay 73 in its deenergized state until the carrier has passed the switch mechanism. The carrier next passes between the pole pieces of the permanent magnet 18 and immediately the magnetic selector mechanism is caused to function because of the magnetic material comprising the collar portion 78 of the carrier. The relay 38 is thereby energized and its associated armature 39 is drawn against its front contact 41. This now places current in the solenoid circuit and the switch at point A is thrown over to deflect the carrier from the main tube 12 to the branch tube or outlet station. The circuit then automatically returns to normal. It is obvious that the circuit as arranged will not permit selection at point A unless both the resonator pick-up and the magnetic pick-up are excited, so that all carriers possessing neither, or only one, of the physical properties mentioned will continue past the point A.

Since one type of carrier has now been diverted from the guideway 12, only carriers having magnetic or electro-conductive properties or neither will approach point B. At this point is disposed a magnetic pick-up and all carriers having a magnetic collar will be selected, as explained in connection with Fig. 1, for discharge at station B.

As the remaining carriers approach point C, the resonator selector placed at that point will cause all carriers having an electro-conductive body to be discharged or switched from the main guideway 12. Carriers made entirely of fibre or other

material that is non-magnetic and non-conductive will pass through the entire system from the sending station to the remote end of the conveyor line.

From the above it will be seen that the system of selective discharge constructed according to this invention may readily be applied to pneumatic conveyer systems already in use with but slight change in apparatus. The carriers, in addition, are of substantially the same dimensions as those now in use and the latter may be easily and inexpensively adapted to be used with this invention.

Thus, I have provided a system of selective control for carrier conveyer systems which is not only less expensive to install and operate than systems heretofore used, but which is less critical in its functioning and which does not necessitate the use of a grid controlled rectifier or complicated timing mechanism.

While this invention has been shown in but three forms, it will be obvious to those skilled in the art that it is not so limited but is susceptible to various other changes and modifications without departing from the spirit thereof, and it is desired therefore, that only such limitations shall be placed thereon as are imposed by the prior art or as specifically set forth in the appended claims.

What is claimed is:

1. In a conveyer system comprising, a guideway embodying a branch outlet and deflector means, carriers adapted to travel in said system and embodying conductive bodies having predetermined degrees of permeance, a valve provided with a cathode, anode and grid to control said deflector means and thereby control the path of said carriers, means for normally maintaining the potential of said grid substantially at the potential of said cathode, means responsive to the passage of said carriers to increase the negative potential of said grid, and energy storage means in circuit with said grid to sustain said increased grid potential for a predetermined time not less than the time required for the passage of said carrier from the responsive means to the deflector means.

2. In a conveyer system embodying selective routing, the combination of a main guideway having three branch outlets therefrom each having a deflector for diverting predetermined carriers from said guideway into said branch outlets, four types of carriers adapted to travel through said system, the first embodying both magnetic and electro-conductive properties, the second embodying magnetic properties, the third embodying electro-conductive properties, and the fourth embodying neither of the aforementioned properties, a grid controlled valve associated with each of said outlets and having an output circuit to control said deflector, means associated with each of said outlets disposed in advance thereof along said main guideway to control the potential of the grid of said valve and thereby alter its impedance, the means for said first outlet being responsive only to carriers having both magnetic and electro-conductive properties, said second outlet means responsive only to carriers having magnetic properties and said third outlet means responsive only to carriers having electro-conductive properties, carriers having neither of said properties being permitted to continue uninterruptedly along said main guideway and resistance shunted condensers in said grid circuits to prolong the altered impedance conditions of said valves.

3. In a conveyer system embodying selective routing, the combination of a main guideway having three branch outlets therefrom each having a diverting deflector, a grid controlled valve associated with each of said outlets and having an output circuit to control said deflector, means associated with each of said outlets and disposed in advance thereof adjacent to said main guideway to control the potential of the grid of said valve and thereby alter its impedance, the means for said first outlet including a selector responsive to both magnetic and electro-conductive influences, the second outlet means including a selector responsive only to magnetic influences, and said third outlet means including a selector responsive only to electro-conductive influences.

4. In a conveyer system, comprising a guideway embodying a branch outlet and deflector means, carriers adapted to travel in said system and embodying conductive bodies having predetermined degrees of permeance, a valve provided with a cathode, anode and grid to control said deflector means and thereby control the path of said carriers, means for normally maintaining the potential of said grid substantially at the potential of said cathode, selector means including a magnet with its field embracing a section of said guideway, said selector means being responsive to

the passage of said carriers to increase the negative potential of said grid, and energy storage means in circuit with said grid to sustain said increased grid potential for a predetermined time substantially equal to the time required for the passage of the carrier from the selector means to the deflector means.

5. In a conveyer system, comprising a guideway embodying a branch outlet and deflector means, carriers adapted to travel in said system and embodying conductive bodies having predetermined degrees of permeance, a valve provided with a cathode, anode and grid to control said deflector means and thereby control the path of said carriers, means for normally maintaining the potential of said grid substantially at the potential of said cathode, selector means including a resonator coil with its convolutions enveloping a section of said guideway, said selector means being responsive to the passage of said carriers to increase the negative potential of said grid, and energy storage means in circuit with said grid to sustain said increased grid potential for a predetermined time slightly in excess of the time required for the passage of the carrier from the selector means to the deflector means.

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