Oct. 2, 1951 J. P. GULLIET 2,569,564

TUBE GAUGING AND SORTING MACHINE

Filed March 5, 1948 2 Sheets-Sheet 1

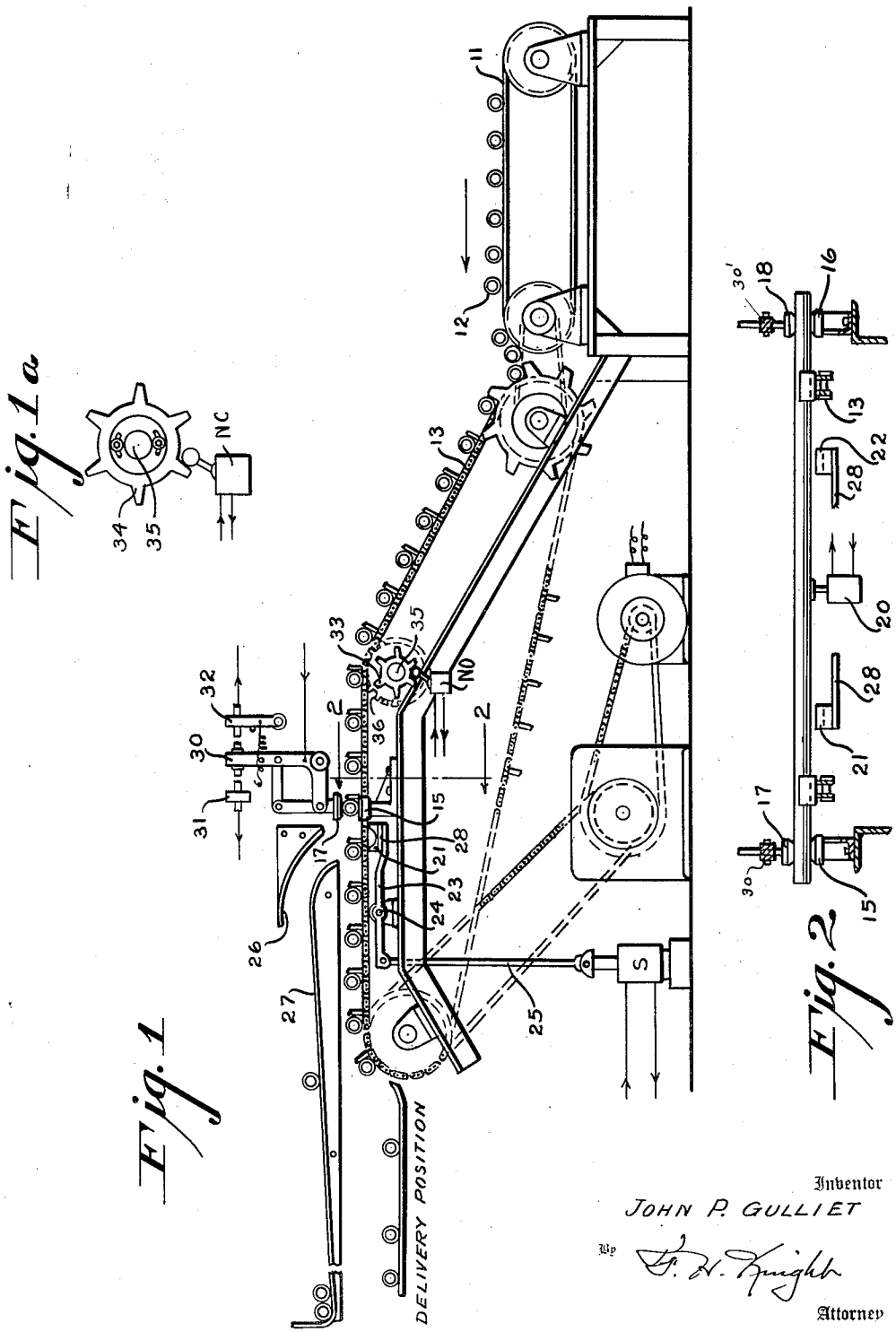


Fig. 1a

Fig. 1

Fig. 2

Inventor
JOHN P. GULLIET
By G. H. Knight
Attorney

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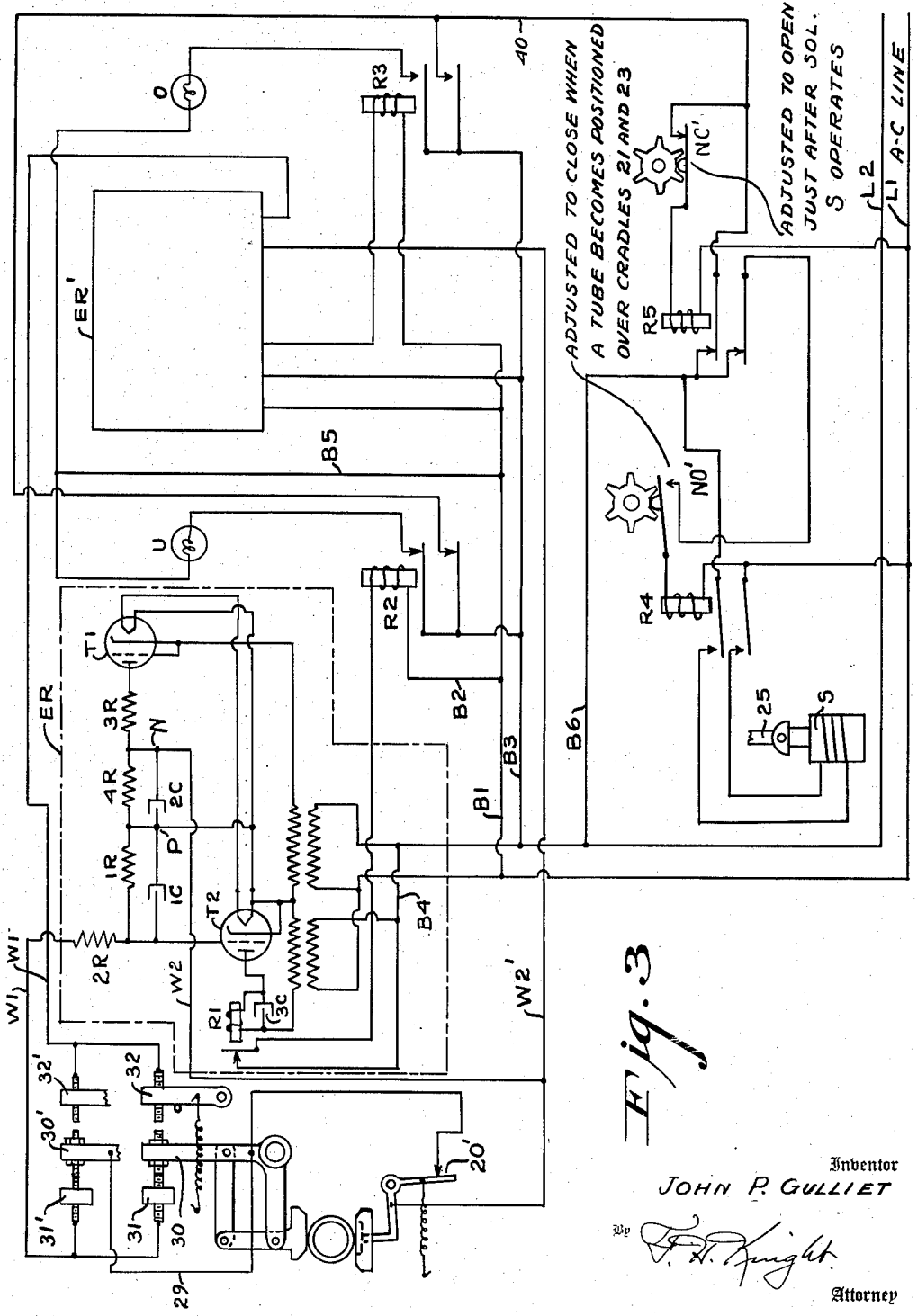


Fig. 3

Inventor
JOHN P. GULLIET

By F. H. Knight

Attorney

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TUBE GAUGING AND SORTING MACHINE

John P. Gulliet, North Providence, R. I., assignor to Corning Glass Works, Corning, N. Y., a corporation of New York

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The present invention relates to gauging and sorting machines and, more particularly, to machines for gauging and sorting cylindrical articles such as glass tubing and cane.

One of the objects of the invention is a machine that rapidly and accurately mechanically gauges the articles.

Another object is a machine which gauges the articles at both ends.

A further object is a machine which separates articles outside a desired size range from those within such size range.

A still further object of the invention is a gauging and sorting machine which operates one or a combination of signals in accordance with the off-size characteristic of an article being gauged.

In the accompanying drawings,

Fig. 1 illustrates in side elevation the essential elements of a machine embodying the invention.

Fig. 1*a* is an enlarged view of a circuit switching mechanism of the machine.

Fig. 2 is a view taken on line 2—2 of Fig. 1.

Fig. 3 is a wiring diagram illustrating auxiliary electrical apparatus employed and its association with parts of the machine.

Referring now to the drawings in detail, the gauging and sorting machine includes a conventional belt conveyor 11 on which tubes 12, from a suitable source of supply, are arranged transverse to the conveyor. The conveyor 11 carries the tubes 12 to a conveyor 13 whereon they become arranged in equally-spaced relation transverse of the conveyor. As the conveyor 13 advances the tubes toward a delivery position, the ends of each tube 12 pass between fixed gauge blocks 15 and 16 and associated movable gauge blocks 17 and 18. A switch 20 is arranged between gauge blocks 15 and 16 and has contacts 20' (Fig. 3) adapted to be closed by a tube 12 as such tube becomes arranged over blocks 15 and 16. Gauge blocks 17 and 18 are connected to bell cranks 30 and 30' (Figs. 1 and 3) respectively, which have circuits under their control via contacts 31, 31', 32, or 32' as will be described later, for bringing about the operation of signals indicating the undersize or oversize of a tube being gauged, and for initiating the operation of a mechanism for ejecting from conveyor 13 any tube outside the desired size range.

In brief, the arrangement is such that initiation of signalling and ejecting operations depends on contacts 20' being closed, and upon

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the diameter of a tube being either too small to move one of the bell cranks 30 or 30' clear of its break contact, or being so large that at least one of the bell cranks is moved into engagement with its make contact. Tubes of the proper size range separate the bell cranks from their break contacts before contacts 20' close and are of insufficient diameter to bring the bell cranks into engagement with their make contacts.

Arranged just in advance of the gauging blocks are tube-ejecting cradles 21 and 22 (Figs. 1 and 2). These cradles are connected to the ends of a bar 28 arranged transversely and fixed to one end of a lever 23 pivoted at 24, and at the other end connected to a link 25 coupled to an ejecting solenoid S. Arranged above conveyor 13 over the space occupied by cradles 21 and 22 are tube deflectors, such as the deflector 26, for directing an ejected tube onto associated inclined rails, such as the rail 27, so that an ejected tube rolls down the inclined rails to a point at which a number of such tubes may be gathered from time to time.

Although, as stated, initiation of a tube-ejecting operation is under control of the bell cranks 30 and 30', the time of energization of solenoid S to effect such operation is determined by a normally open switch NO. This switch is adapted to be actuated by a switch actuator 33 carried by a shaft 35, driven by a sprocket wheel 36 in mesh with the chain of conveyor 13, and is adjusted to close its contacts NO' (Fig. 3) just as a tube arrives over cradles 21 and 22. The time of release of the solenoid S is determined by a normally closed switch NC (Fig. 1*a*) operated by an actuator 34 which is similar to 33 and carried on the opposite end of shaft 35. Contacts 20' are connected in series with a common circuit through bell cranks 30 and 30', as traced hereinafter, and serve to prevent initiation of signaling and ejecting operations irrespective of the positions of bell cranks 30 and 30' when there is no tube arranged between the gauge blocks.

As will be appreciated, for greatest sensitivity of the gauging apparatus, the equipment actuated over circuits passing through contacts engaged by the bell cranks 30 and 30' must respond to current of very small intensity because contact resistance will be high between the bell cranks and their contacts when certain size tubes are encountered, and accordingly electronic relays ER and ER' are used for this purpose. The electronic relay ER is shown in detail within the interrupted line enclosure; whereas, the elec-

tronic relay ER' is merely represented by a rectangle. Electronic relays ER and ER' are alike and therefore a description of relay ER will suffice. Relay ER consists of two triodes T1 and T2, triode T1 being used as a half-wave rectifier to produce direct current voltage across a resistance 4R and capacitor 2C. The positive side is at P and the negative side is at N.

The triode T2 is controlled by the potential on the grid. A normally open circuit to the grid of T2 and to negative point N includes a resistor 2R, wire W1, the break contacts 31 and 31' and their associated bell cranks in parallel, a conductor 29, contacts 20' and wire W2. When wires W1 and W2 are open, as in the case when no tube is between the gauge blocks, or when the tube between the gauge blocks is within a desired size range, as already described, the grid is at cathode potential so that triode T2 allows a half-wave rectified current to flow. This current is filtered by a capacitor 3C so that a substantial direct current flows through an associated relay R1, holding the same energized. When either end of a tube is under the desired size range, one of the bell cranks remains in engagement with its break contact so that when contacts 20' are closed by the tube, the traced circuit is completed between wires W1 and W2, and negative potential at N appears at the grid, cutting off the flow of current through T2, thus causing the relay R1 to become de-energized. The resistance of 2R is relatively low, causing a capacitor 1C between it and P to take a new charge rapidly whenever a circuit is closed between wires W1 and W2. When, however, the connection between wires W1 and W2 is opened, the charge of capacitor 1C has to leak off through an associated resistance 1R. This requires some time because this resistor is of relatively high ohmic value. Consequently, the relay R1 will not pick up until after a short time delay. Accordingly, when the connection between wires W1 and W2 opens and closes in rapid succession, as may occur due to vibration of the equipment when the diameter of the tube is very close to the allowable size range, the relay will remain de-energized.

As will be appreciated from the foregoing, when there is a tube between the gauge blocks under the desired size range, as illustrated in Fig. 3, a circuit is established from wire W1 to wire W2 by way of contact 31, the bell crank 30, conductor 29, contacts 20' of the switch 20 to wire W2. Accordingly, relay R1 is de-energized, as described, and closes a circuit from line conductor L1 through branches B1 and B2, through a relay R2, the contacts of relay R1, and the branch conductor B4 to line conductor L2. Relay R2 is accordingly energized and completes circuits for the lamp U and relay R5 respectively. The circuit for lamp U extends from line conductor L1 through branch conductors B1 and B5, the lamp U, the inner contacts of relay R2, and branch conductor B3 to line conductor L2, so that lamp U lights up and serves to indicate that at least one end of the tube being gauged is under the desired size range.

The circuit for relay R5 extends from line conductor L1 through relay R5, contacts NC', conductor 40, the outer contacts of relay R2, and branch conductor B3 to line conductor L2. Relay 5, upon operating, at its inner contacts completes a locking circuit for itself through branch conductor B6 to line conductor L2 independent of the circuit closed by relay R2, and at its outer contacts prepares an operating circuit for a relay R4, but which is still held open at contacts NO'. As soon as the tube being gauged is advanced by the conveyor 13 to a position directly over the ejecting cradles 21 and 22, contacts NO' close so that relay R4 becomes energized and completes an operating circuit for the ejecting magnet S. This circuit extends from line conductor L1 through the outside contacts of relay R4, the winding of solenoid S, the inside contacts of relay R4, and branch conductor B6 to line conductor L2. The solenoid S accordingly energizes to eject the undersize tube from conveyor 13. Substantially immediately after the operation of solenoid S, contacts NC' are opened and thus break the locking circuit of relay R5 which immediately breaks the operating circuit of relay R4 which drops and thus opens the circuit of solenoid S, so that it also restores to its initial position.

If the tube being gauged is within the desired size range, the bell cranks 30 and 30' will break away from their associated contacts 31 and 31' respectively, before a tube closes contacts 20'. Under these circumstances, since no connection is established between wires W1 and W2, initiation of the operation of the signaling and ejecting equipment will not take place.

If the tube being gauged is outside the desired size range at either end, bell crank 30 will engage its contact 32 or bell crank 30' will engage its contact 32' to initiate the operation of the electronic relay ER' via wires W1' and W2' in exactly the same manner as such operation is initiated when the tube being gauged is under a desired size range. The relay ER' then brings about the operation of a relay R3 which closes circuits similar to those closed by relay R2 to initiate the tube-ejecting operation, and also closes a circuit through lamp O to give an indication that the tube being gauged is outside the desired size range.

It will be appreciated that there may be times that a tube being gauged is under the desired size range at one end and over the desired size range at the opposite end. Under these circumstances the operations will be as already described except that both lamps U and O will be operated to indicate the abnormal characteristics of the tube being gauged, and both relays R2 and R3 will be operated to initiate the ejecting operation.

From the foregoing it will be appreciated that the invention provides a ready means of consecutively gauging and sorting cylindrical articles such as glass tubing and cane, and the like, in a rapid and efficient manner.

What is claimed is:

1. In a tube gauging apparatus, gauging devices, a conveyor for passing the ends of a tube through said devices, there being a gauging device at each end of the tube, while tubes are arranged transverse to the conveyor and are being conveyed toward a delivery position, a member associated with each of said devices, said member having make and break contacts, a pair of contacts adapted for closure by a tube of any diameter while said tube is arranged in gauging relation with said gauging devices, a device for ejecting from said conveyor a tube gauged outside a desired size range by either gauging device, apparatus included in a circuit including said pair of contacts, one of said members, and one of its associated contacts for preparing an operating circuit for said ejecting device, means in-

cluding a contacting device mechanically associated with and actuated by the conveyor for completing the prepared operating circuit after the tube is advanced from between said gauging devices, and a second contacting device mechanically associated with and actuated by the conveyor for disabling said means following the ejecting operation.

2. In a tube gauging and sorting apparatus a fixed gauge block, a movable gauge block arranged adjacent and facing said fixed gauge block and spaced therefrom a distance less than the diameter of tubes desired, a pair of break contacts associated with said movable gauge block separated in response to the passage between said blocks of a tube of a diameter at least as great as desired, a pair of make contacts associated with said movable block closed by a tube between said blocks of a diameter exceeding those desired, a pair of contacts closed by a tube between said blocks irrespective of the tube diameter, a conveyor passing tubes between said blocks consecutively, two relays each having an operating circuit one of which is closed whenever either of said first two pairs of said contacts and said last pair are closed, a third relay having an operating circuit closed upon the operation of either

of said two relays, a locking circuit for said third relay independent of said first relays, a fourth relay having an operating circuit prepared for it by said third relay, means for completing the prepared circuit for said fourth relay after said conveyor has advanced a tube from between said gauge blocks, means for thereafter ejecting such tube from said conveyor, an operating circuit for said last means closed by said fourth relay, and means for breaking said locking circuit after the operation of the ejecting means.

JOHN P. GULLIET.

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