Sept. 22, 1964 D. E. LANCASTER 3,149,561

APPARATUS FOR SUPERSONICALLY SPECIFICALLY LOCATING AND PRINTING ON OBJECTS

Filed Feb. 23, 1961 7 Sheets-Sheet 1

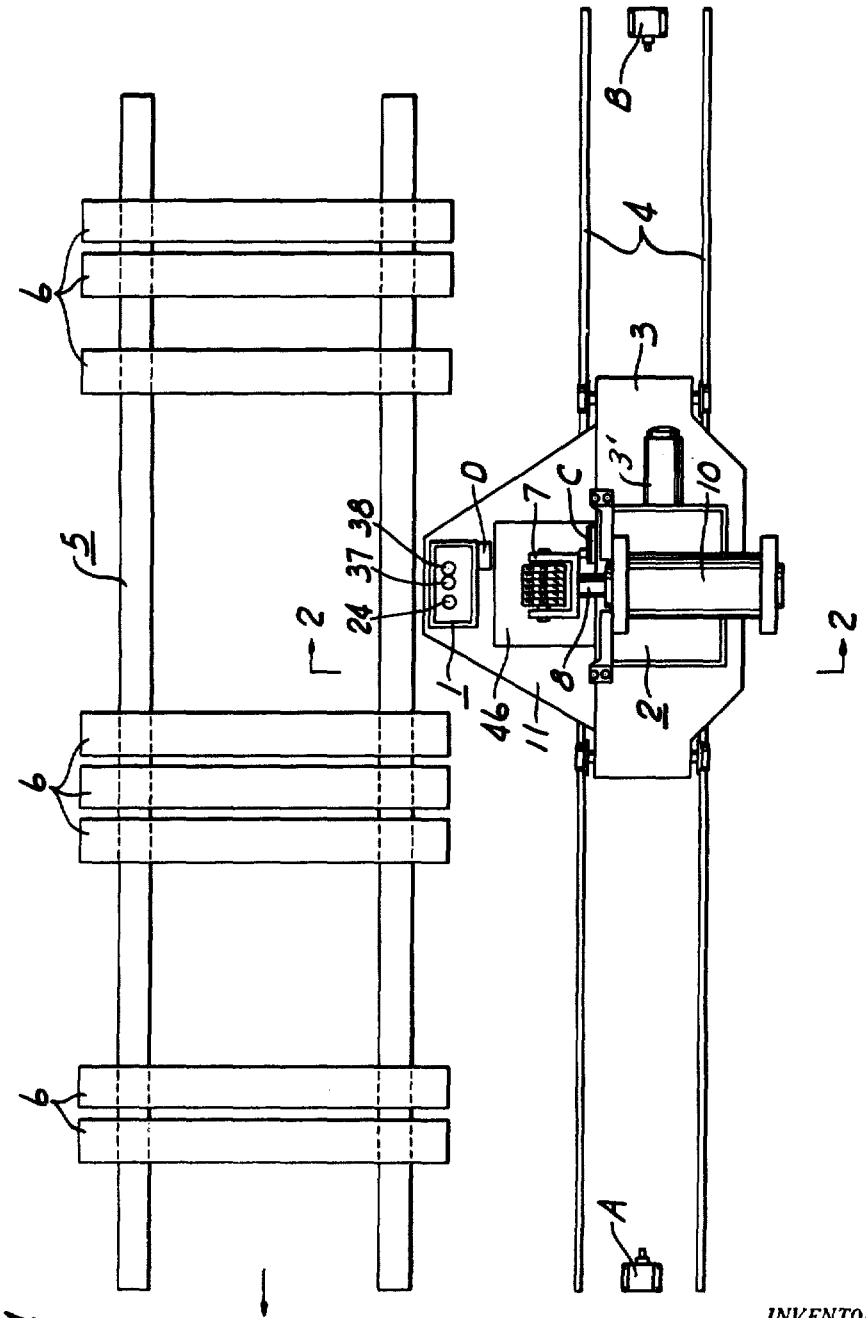

Fig. 1

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Filed Feb. 23, 1961 7 Sheets-Sheet 2

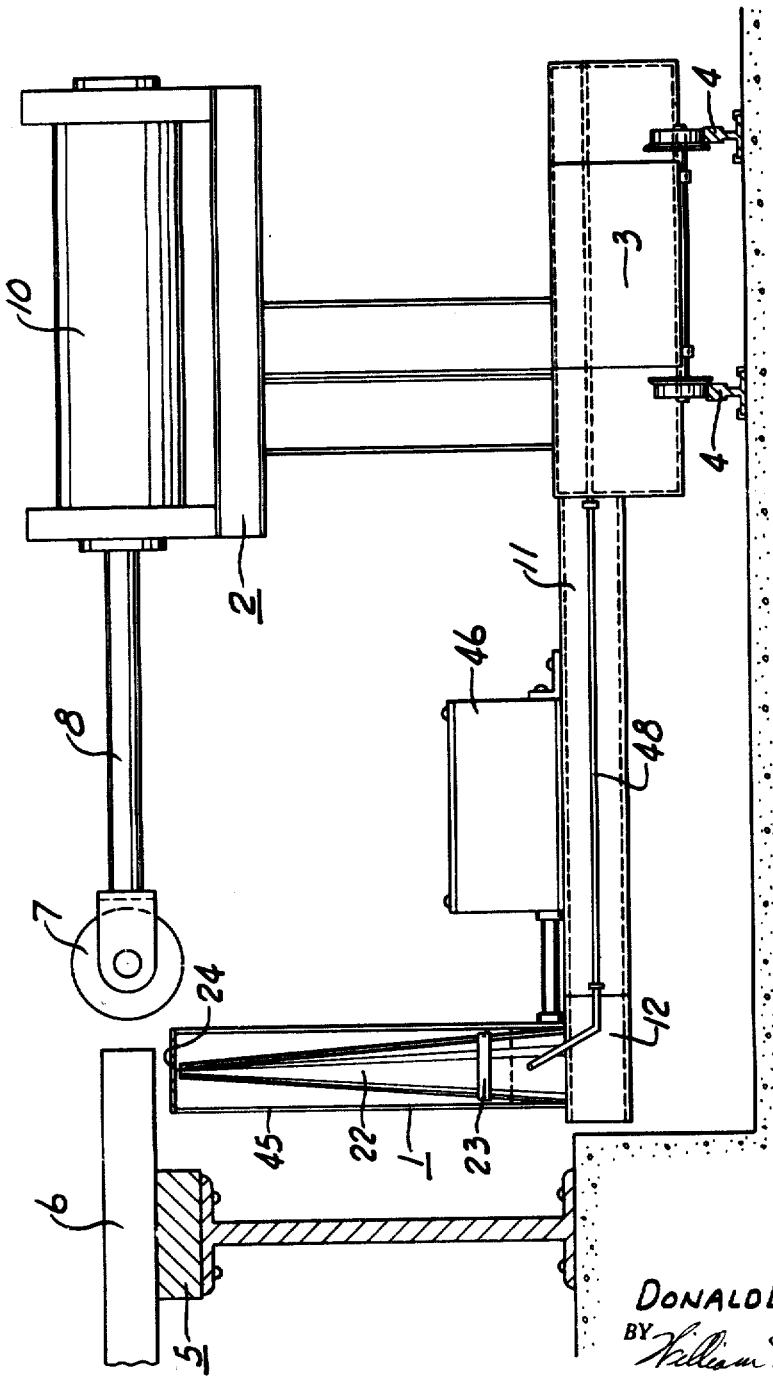

Fig. 2

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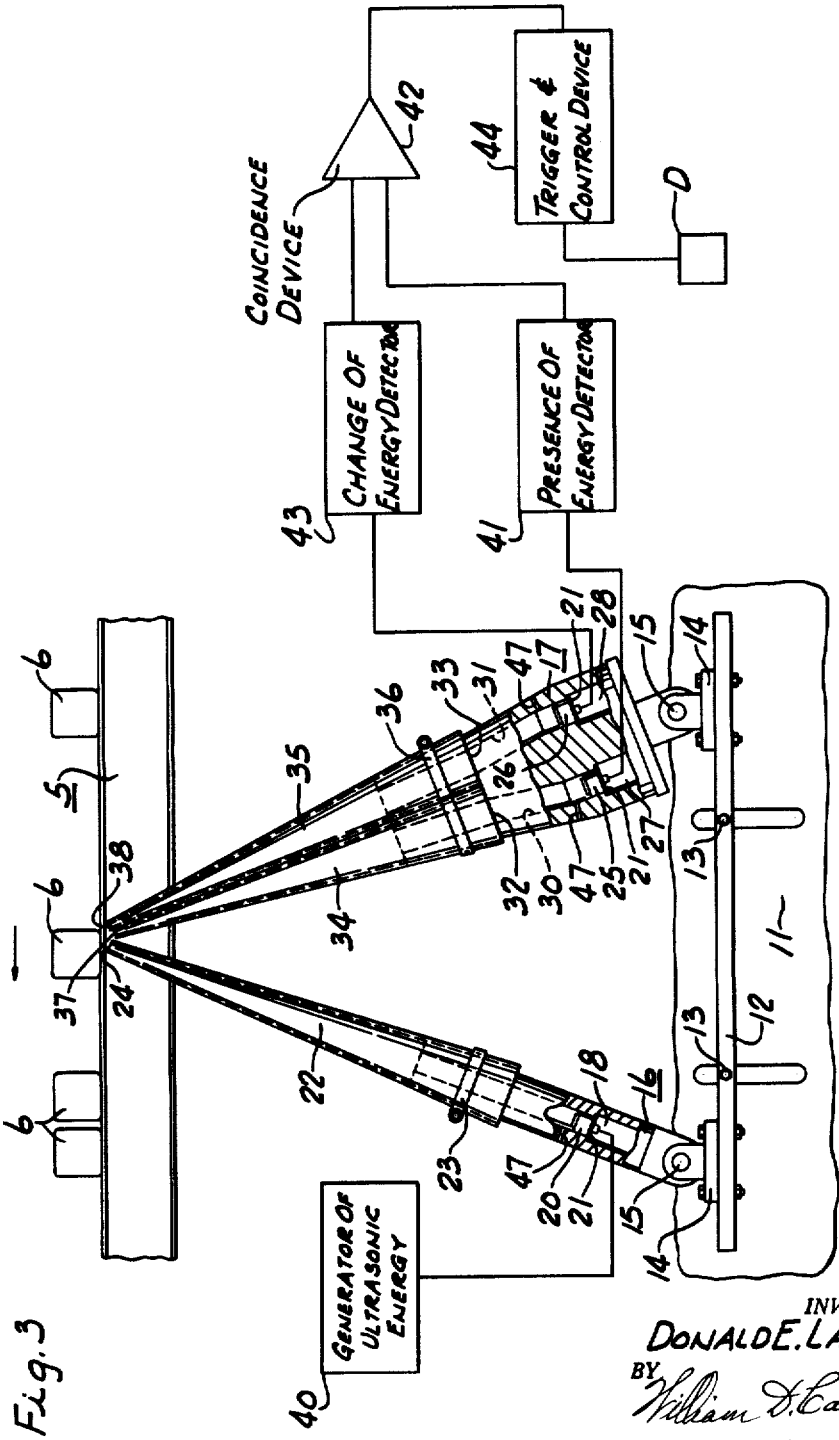

Fig. 3

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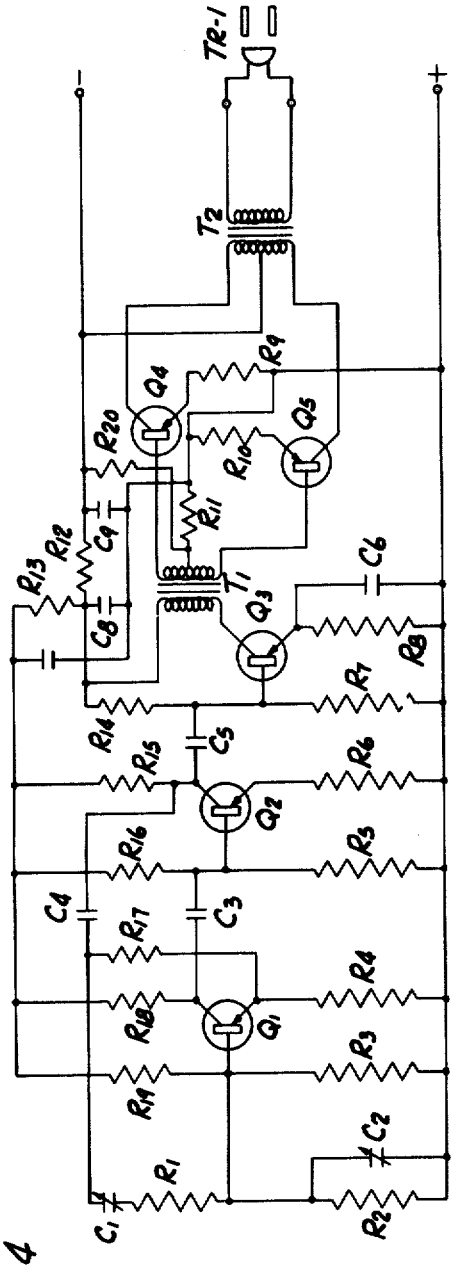

Fig. 4

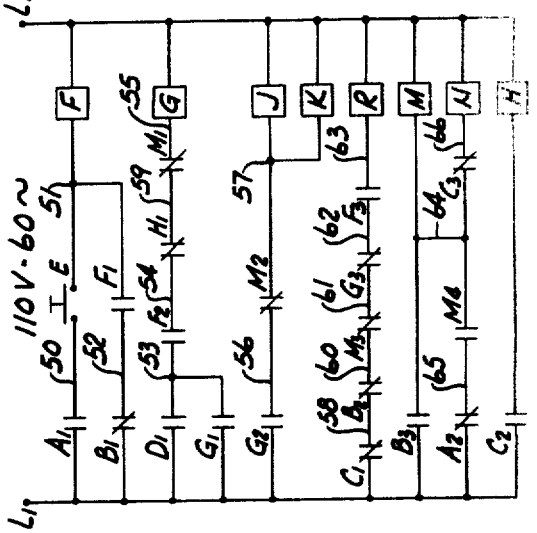

Fig. 6

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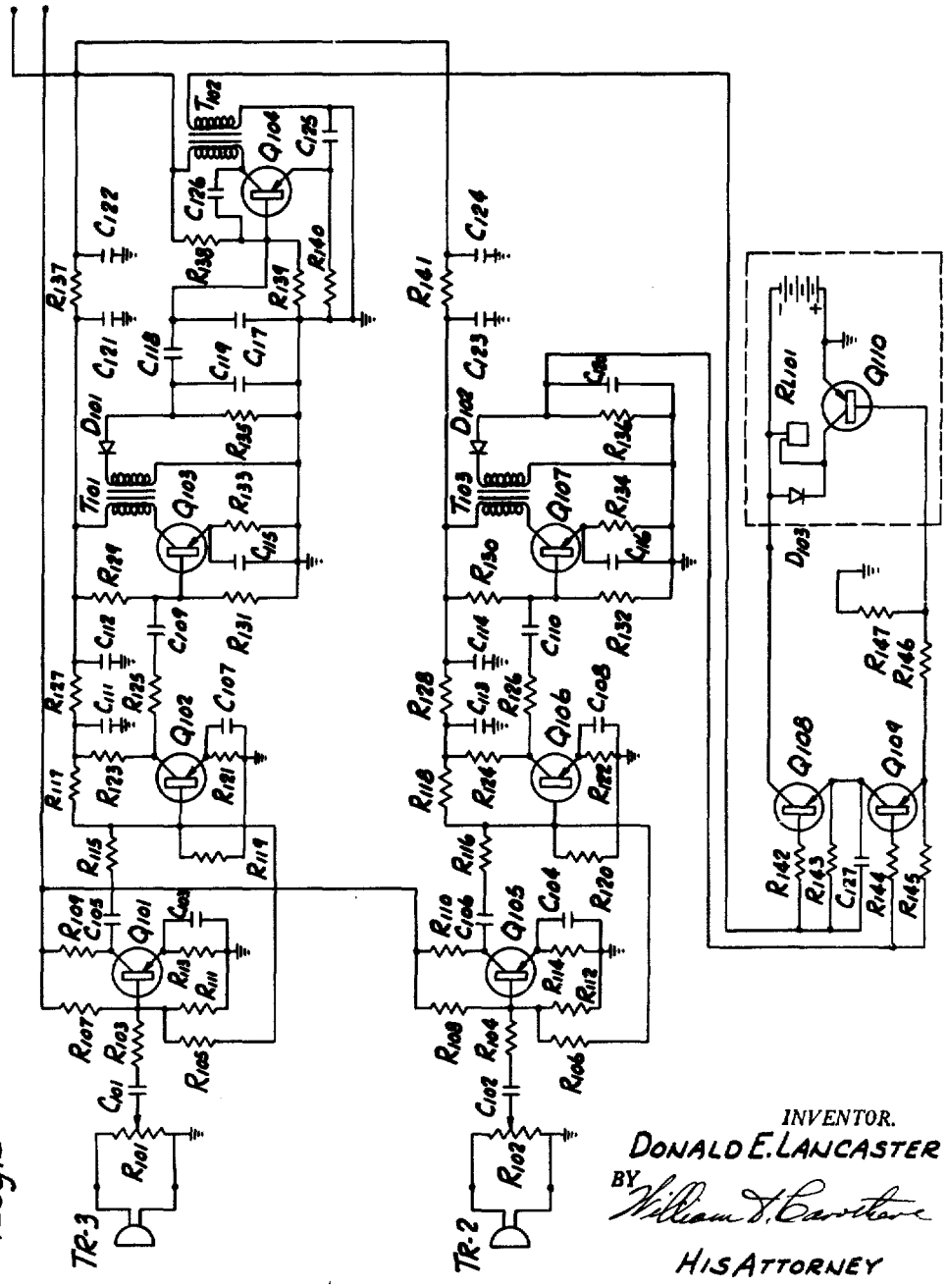

Fig. 5

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APPARATUS FOR SUPERSONICALLY SPECIFICALLY LOCATING AND PRINTING ON OBJECTS

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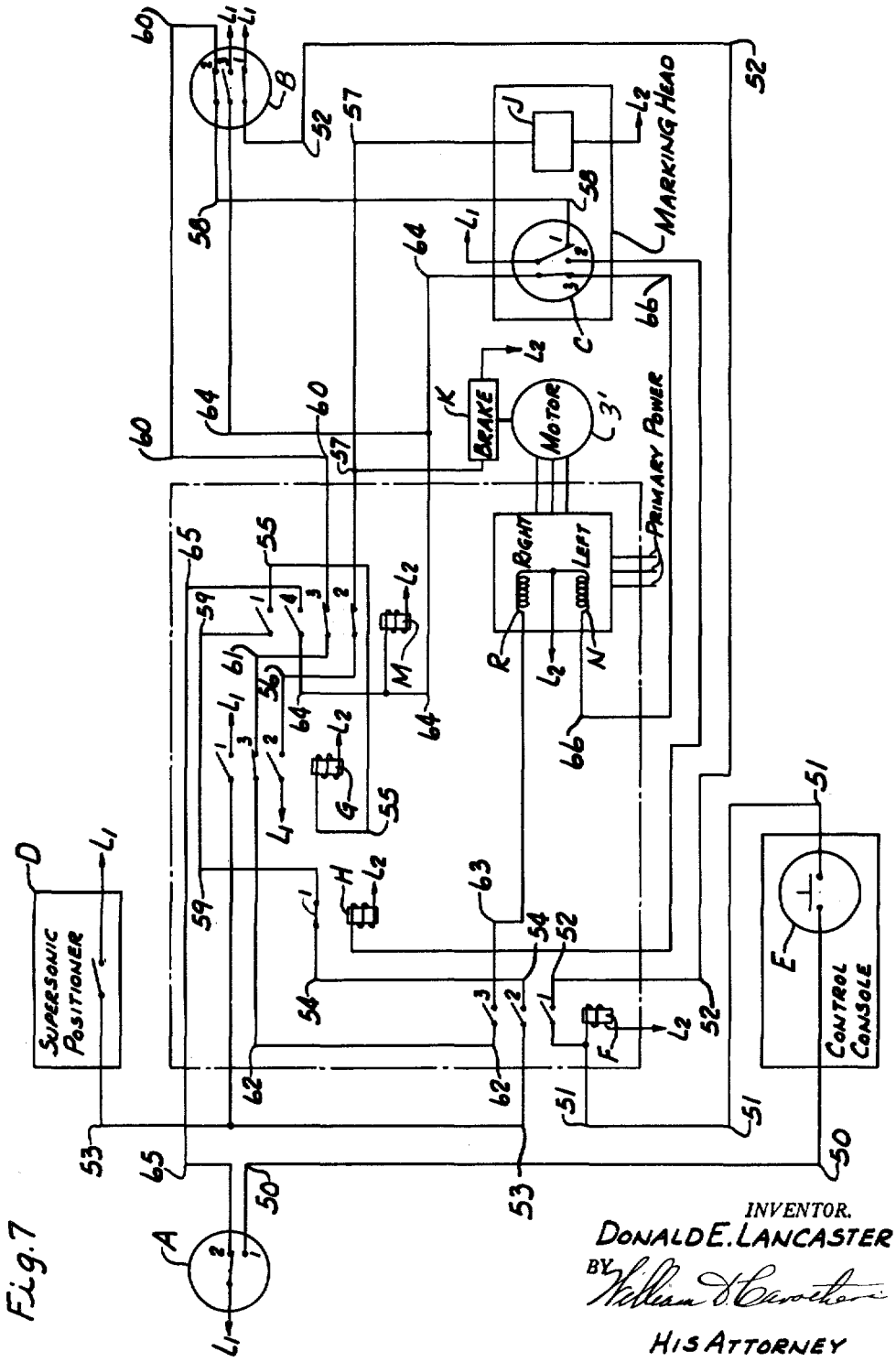

Fig. 7

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APPARATUS FOR SUPERSONICALLY SPECIFICALLY LOCATING AND PRINTING ON OBJECTS

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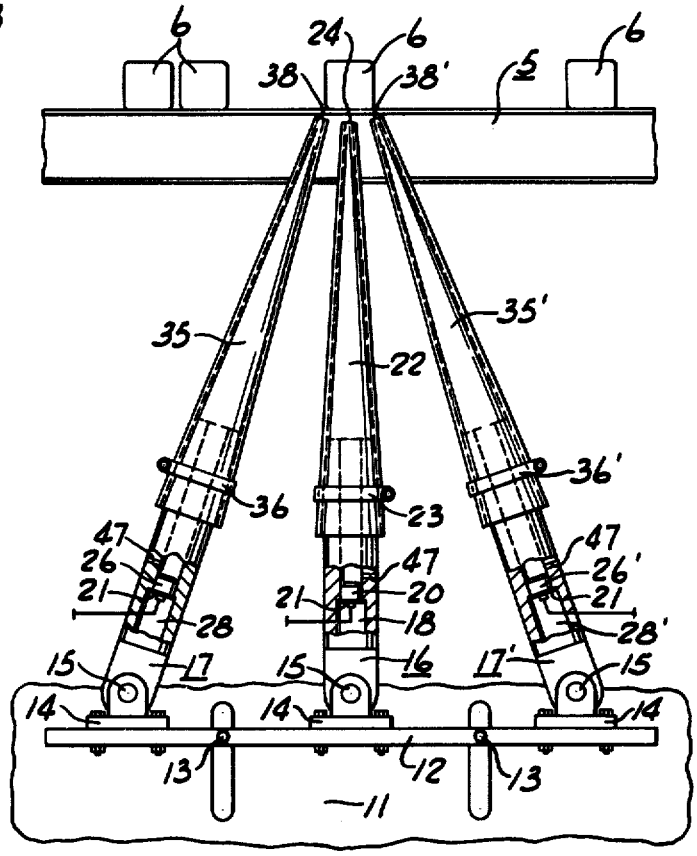
Fig. 8



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United States Patent Office 3,149,561 Patented Sept. 22, 1964

3,149,561
APPARATUS FOR SUPERSONICALLY SPECIFICALLY LOCATING AND PRINTING ON OBJECTS

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Filed Feb. 23, 1961, Ser. No. 91,057
21 Claims. (Cl. 101—43)

This invention relates generally to the method and apparatus for locating the specific position of one article whether alone or within a group to initiate an operation on the article located and more particularly to an improved supersonic method and apparatus of specifically locating articles or objects.

It is very difficult to precisely locate specific articles or objects that are alone or in a group particularly when such objects are heated to high temperatures such as steel ingots, billets, slabs, blooms or the like being processed while hot. Difficulties arise owing to their variations in temper and their scaling, warping, and constant changing in size. The mechanical as well as electrical methods and apparatus present considerable difficulty and are economically impractical making their use prohibitive.

The important object of this invention is the provision of a supersonic method and apparatus that simultaneously checks the indirect dual supersonic reflections of the body of the article or object together with the immediate change of the reflected signal strength due to a change in its topography such as a slot, corner or edge. These dual signals when simultaneously received initiate an operational control to perform work on the body or to move it in a process.

Another object is the provision of a dual supersonic locating device to initiate the control of a marker to mark the located object. This is particularly advantageous when locating heated metal ingots, billets, slabs, and blooms to mark the same.

The importance of this locator is that it relies upon a dual signal having indirect reflections depending upon the actual presence of the object or the changing of the signal depending upon the alteration of the reflected signal showing a change in topography of the object which predetermines its specific location permitting work to be performed relative thereto. This provides a true locator regardless of the temperature, surface roughness, minor irregularities or transparency. Within generous tolerances the distance between the object to be worked upon and the locator is made more accurate than with mechanical locators.

Another object is the provision of a supersonic locating device that relies on a dual reception of supersonic waves simultaneously to determine the location of an article upon which work can be performed. By employing dual reception of the same or different reflected supersonic waves the exact location of the article is determined and work such as moving, cutting, marking or the like may then be performed on the article. If both receivers pick up a constant or full reflected signal it could indicate that the surface adjacent both edges are in focus as the article either passes, approaches or is leaving the focal point depending upon the setting of the receivers. Movement one way or the other indicating a change in the surface will show that the article is out of focus. Thus

the receivers would be tuned to operate on a signal reflected from adjacent the opposite edges of the article. If on the other hand both receivers are set for reflections closely adjacent each other and relative movement between them and the article may indicate in the leading receiver that one edge of the article, is reached to specifically locate the article the other received signal is nothing or a constant reverberation showing it is adjacent the same corner. This represents an important improvement in this invention as the signal relies on a change in the reflection in both instances, or the beginning or ending of the change in reverberation of the supersonic wave. Thus the mere presence of a reverberated supersonic signal in dual receivers may not always specifically locate the article for work with regard to the same. If the distance between the receivers and the article is known and the distance between the receivers is known then as long as constant signals are received, then a work operation upon the article can be accomplished. If the article is small and space is limited then one received signal should operate on a change and the other on a constant signal when reverberation for both is close together.

Other objects and advantages of this invention appear hereinafter in the following description and claims.

The accompanying drawings show for the purpose of exemplification without limiting this invention or the claims thereto, certain practical embodiments illustrating the principles of this invention; wherein

FIG. 1 is a plan view of a hot metal stamping machine illustrating the principles of this invention.

FIG. 2 is a view taken on the line 2—2 of FIG. 1.

FIG. 3 is a partial sectional view of the supersonic emitter and dual detection members together with a diagrammatic indication of the circuit.

FIG. 4 is a circuit diagram of the supersonic signal emitter.

FIG. 5 is a circuit diagram of the dual detection members and their integrating circuit.

FIG. 6 is a line circuit diagram of the hot metal marking machine shown in FIG. 1.

FIG. 7 is a layout circuit diagram of the marking machine.

FIG. 8 is a view showing a modified form of the arrangement of the emitter and receiver transducers.

Referring to FIG. 1 the article focusing device is indicated at 1 and forms a part in this particular disclosure of the marking machine 2 all of which is mounted on the carriage 3 that is movable along the track 4 between the stops A and B at opposite ends of the track which stops represent limit switches hereinafter specifically referred to in the circuitry.

In order to illustrate this invention a billet table 5 is denoted by spaced parallel rails on which is positioned a series of billets indicated at 6. These billets when moved to the table 5 are ordinarily up to working temperature and are quite hot. They are moved along the billet table in the form of the spaced rails by a drag line conveyor or any other type of conveying means. However, the billets may at times be widely separated or uniformly separated or even disposed at an angle with one another. The particular location of the billet table 5 is immediately following the shear which cuts the billets into convenient lengths for operation in the mill. Because of their extreme heat it is almost impossible to accurately gauge the position of these billets by mechani-

cal means or by photocell means because of the dirt and constantly changing temperature scale and other factors that produce incorrect operating indications.

As shown herein the carriage **3** is provided with a reversible brake type motor **3'** that drives it in opposite directions and the sonic focusing device **1** energizes circuits to arrest the motion of the carriage **3** when the marking device has been accurately aligned relative to a billet. This accurate alignment first stops the carriage **3** or causes it to travel with the billet if the latter is moving, ordinarily the billet is stationary. When the carriage **3** is stopped or let us say, aligned with the billet, a circuit is initiated to actuate the marking device which pre-sets the marking head **7** so as to include indicia with a code which indicates the heat number, the furnace, the plant, steel analysis, the size, the manufacturer, the base type of steel, the date of production and other necessary information. The marking device **7** does not per se constitute a part of this invention. However, it is remotely controlled to automatically change the marking head **7** before each operation if need be, even to the extent to enumerate the billets marked. The marking device is such that the head **7** is swiveled on the end of the piston **8** so that it may be extended by energization of the cylinder **10** by a circuit actuated by the relay J to engage the end of a billet **6**. When the head engages the end of an object such as a billet a hammer action within the piston causes a blow to be struck to indent the markings on the end of the billet. The marking of course may be accomplished without the hammer effect by merely extending the piston **8**, all of which are servo means to actuate a stamp.

The installation shown contemplates a series of billets to be spread out along the billet table **5** from the shears and these billets may be as hot as 1800° F. so that it is difficult with most any device and even by sight to properly align the marking head with the end of the billet. When a series of billets have been placed on the billet table **5** the marking device may be energized to proceed in one direction or the other for consecutively marking each billet from one end of the table to the other. In view of the fact that the sonic device **1** quickly positions and stops the carriage **3** with its marking head **7** at each billet, the marking device may be made to operate in a very short period of time to mark each of the billets all along the stretch of the billet table **5**.

As shown in FIGS. 2 and 3 the sonic device **1** is mounted on an extension **11** of the carriage **3** which extension is adjustable vertically relative to the carriage and even laterally as indicated by the platform **12** which is adjustably mounted on the end of the extension **11** by means of the bolts **13**. The platform **12** has mounted thereon the pivot members **14** which are adjustable relative to each other to vary the spacing between the emitter and the receivers or between spaced receivers and an emitter, all of which constitute a mounting means.

Each of the pivot members **14** are provided with a pivot pin **15** which adjustably locks the supersonic emitter housing or tube **16** and the supersonic receiver or detector **17** relative to the platform **12**. Thus the emitter and the receiver may be varied arcuately relative to each other. The emitter **16** is a tubular member having a chamber **18** within which is mounted the emitting transducer **20** that is preferably in the form of a piezoelectric crystal or other similar transducer which crystal is provided with spaced electrodes for receiving connecting lines that energize the crystal for oscillation in the supersonic field which is preferably from thirty to fifty kilocycles and which is preferably operated at the midpoint of forty kilocycles. The emitting transducer **20** has a mounting flange **21** which supports the same within the chamber **18** and the vibrating supersonic waves are emitted outwardly through the tube **16** the outer end of which is shaped to fit the sonic directional member **22** which is frusto conical in shape and is adjustable along

the tube **16** being clamped in place by the clamp members **23**. Thus the waves emitted from the transducer **20** are forced through a small orifice **24** at the outer end of the frusto conical tube **22** and are caused to strike and reverberate from the underside of the end of the article or object **6**. The sonic wave striking the surface of the object **6** will reverberate regardless of its temperature or position and these reflected waves will be received by the supersonic receiver or detector **17** which is shown in FIG. 3. The receiving detectors are represented by the transducers **25** and **26** that are similar to the emitting transducer and are mounted by the flanges **21** in the chambers **27** and **28**. The receiver **17** having dual passages **30** and **31** are obviously fixed relative to each other in the structure shown in FIG. 3. However, they may be independently mounted so as to be adjustable relative to each other. In FIG. 3 the single receiver member **17** is provided with dual extensions **32** and **33** for receiving the independent sonic directioners **34** and **35** each of which is frusto conical and adjustably mounted on the extensions **32** and **33** being held in place by the clamp member **36**. Each of the members **34** and **35** are frusto conical and their outer ends are provided with small openings **37** and **38** and as shown in FIG. 3 the opening **37** is adjusted so as to receive the reverberations from the flat under side of the billet **6**, whereas the opening **38** is adjusted to receive reverberations from the curved portion or the corner of the billet **6**. Thus the two sets of reverberations received by the transducers **25** and **26** distinguish and interpretate from each other the intelligence received from the reflected waves discharged from the emitter **16** and determine the relative position of the under face and the corner of the billet. The receivers thus accurately locate the corner of the billet. Thus by this accurate location of the billet the carriage **3** may be immediately stopped and the marker **2** actuated to mark the end of the billet and thus complete its operation. Of course, the marker merely provides one form of operation which has been chosen to disclose this invention. However, any other operation may be initiated when the same requires the pre-location of the billet.

The emitting transducer **20**, also shown in FIG. 3, is energized by the generator of the ultrasonic energy indicated at **40**, whereas the receiver in the form of the transducer **25** supplies its energy to the detector amplifier circuit **41**, also illustrated by the TR2 circuit of FIG. 5, which in turn feeds its output to the coincidence or integrating device **42**, illustrated by the transistor Q108 and **109**, and the receiving transducer **26** supplies its energy to detector amplifier circuit **43**, also illustrated by the TR3 circuit of FIG. 5, the output of which is fed to the coincidence or integrating device **42**. The output of the latter is fed to the trigger control or circuit operating device **44** which operates the relay D, both of which are also illustrated within the dotted lines of FIG. 5, for controlling the operations to be performed by this focusing device.

As shown in FIG. 3 the transducer receivers **25** and **26** are set to show the presence of energy from the under surface of the billet **6** and the change of energy from the corner of the billet **6** thus precisely locating the billet. The presence of energy and the change of energy are both required to be integrated and when they occur in proper progression they will operate the trigger control device **44** to energize the relay D. The directional feature may be controlled through the circuits so that the device may mark the billets when traveling from A to B or from B to A and in each instance the proper sequence of the output of these receiving transducers is required to initiate the circuit.

Referring again to FIG. 2 the frusto conical members **22**, **34** and **35** may be enclosed by a protective shroud **45** that will prevent these members from being struck or moved from their pre-set position so as to disrupt their accurate operation. The generator and receiver circuit

members are all contained within the housing 46 on the platform 11 which is secured to the carriage 3.

As shown in FIG. 3 lateral openings 47 are provided in both the emitter and receiver transducer members 16 and 17 for the receipt of air which is piped thereto by means of the pipes 48 that obtains air from a suitable source on the carriage 3. The air enters the passages and blows outwardly through the frusto conical members to thereby maintain the emitter and receiver transducers cool and insure a clear throat through the frusto conical members.

The circuit of the generator 40 of the ultrasonic frequency is shown in FIG. 4.

Referring to FIG. 4 which shows the generating emitter circuit that produces the source of supersonic energy comprising an oscillating circuit wherein Q1 and Q2 consist of solid state transistors, the output frequencies of which are determined by bridging components R1, C1 and R2, C2 which denote the resistance and capacitance which may be identical in value, the frequency is adjustable over a moderate range by varying C1 or C2 or both. The junction of the frequency determining components is directly connected to the base of transistor Q1. This same base is biased by resistor R3 and stabilized thermally by resistor R19 which is selected to provide a proper corresponding bias value for the first transistor. R4 is an emitter stabilizing resistor. R18 is the collector load resistor. R17 serves as a stabilizing resistor which permits a loop gain suitable to allow stable oscillator operation by allowing degenerative feedback to take place. The collector of transistor Q1 is capacitively coupled through C3 to the base of transistor Q2. The base of transistor Q2 is biased by the resistor R5 and thermally stabilized by resistor R16. R6 serves as an emitter bias resistor of Q2 while R15 serves as the collector load for Q2. From the collector junction of transistor Q2 feedback is provided through condenser C4 to the original frequency determining components C1 and R1 and this completes the oscillator loop.

Q1 and Q2 thus serve as a stable generator of supersonic energy without the use of inductors. The output of the phase shift oscillator, that is, Q1 and Q2 and associated components is removed from the collector Q2 through coupling condenser C5 which couples to the base of Q3 a conventional transistor voltage amplifier. The base of Q3 is biased by R7 and thermally stabilized by resistor R14. R8 and C6 in parallel serve as the emitter bias source for transistor Q3. Transformer T1 serves as the collector load for transistor Q3 and also serves as a means of phase splitting the output signal allowing driving of push-pull transistors Q4 and Q5. Biasing of the push-pull stage is accomplished by R20 and R11 for base biasing and emitter resistors R9 and R10 for emitter biasing. Transformer T2 serves as the collector load for both Q4 and Q5 and the coupling of the high level supersonic generated signal to transducer TR1. Normal frequency of operation is forty kilocycles and may readily be varied from thirty-seven to forty-three kilocycles.

D.C. power for the circuit is derived from a conventional solid state, regulated low voltage, high current power supply. The input D.C. is filtered by condenser C9. R12 serves as a dropping and isolating resistance and further filtering is accomplished by condenser C8. Further dropping and isolating is accomplished by R13 and C7 thus providing three differing and isolating voltage levels for the circuit operation.

The circuitry for the two receivers generally indicated in FIG. 3 from 41 to 44 inclusive is also shown in FIG. 5.

Referring to FIG. 5 considering first the change circuitry 43, the transducer TR3 develops its signal across R101 a variable resistance which serves as a gain control. This signal is then coupled through coupling capacitor C101 and impedance matching resistor R103 to the base of transistor Q101. This stage serves as a low level amplifier The base of transistor Q101 is biased by resistance R111 and thermally stabilized by resistor R107. Emitter biasing is accomplished by the parallel combination of R113 and C103. R109 serves as the collector load of this stage. This amplified signal is now sent to the base of the second stage transistor Q102 for further amplification by means of coupling condensers C105 and impedance matching resistance R115. From this point degenerative feedback is returned through resistor R105 to the base of Q101 and provides a stabilizing factor in this feedback. With the exception of the feedback loop consisting of R105, stage Q102 is in all respects identical to stage Q101 serving as additional voltage amplification of the received forty kilocycle change signal. Q103 is again similar to stages Q101 and Q102 with the exception that it is a high powered stage and transformer T101 serves as both the collector load, impedance and the output signal coupling device. The D.C. level of the amplified forty kilocycle change signal now flows from the diode D101 with its associated filter network R135, C117, C118 and C119. This varying D.C. level directly proportional to signal level is sent to the base of transistor Q104, a differentiating stage, which provides approximately the derivative of the input signal or, in other words, notes the presence of a change of signal strength. A negative change is favored in this application. The transistor is biased by resistor R139 and thermally stabilized by R138. Emitter biasing is accomplished by the parallel connection of R140 and C125. Approximate differentiation is accomplished by condenser C126 which serves as a high frequency feedback loop from collector to base of transistor Q104 thus providing very high gain for high frequencies or rapid input changes and thus approximating the derivative or rate of change of the input signal. Transformer T102 serves as a collector load resistor and a means of coupling the output signal which at this stage is a pulse proportional in change to the rate of change of the input signal to the succeeding stages. The input to Q101 is a very low level 40 kilocycle audio signal. This is amplified with negligible distortion through stages Q102 and Q103. This appears across T101 greatly amplified. Diode D101 then extracts the D.C. signal level and provides a D.C. signal proportional to the strength of the original forty kilocycle input signal. Any sudden change in this signal is differentiated approximately in stage Q104 providing an impulse proportional to the amount of change of the input signal. Thus at this point a pulse exists when and only when a change takes place in the input forty kilocycle signal which is the desired result of this change detector.

It should be borne in mind that for an effective control signal the simultaneous appearance of both presence and change control signals must appear. With this in mind the change impulse is fed to one-half of the summing amplifier consisting of transistor Q108 and Q109. Resistor R143 serves to bias the stage with R142 serving to protect the transistor against surges. C127 serves to lengthen the impulse from the differentiator Q104 into a workable form. No output can be derived from this stage unless both the presence and change signals appear across this stage.

In considering the presence detection components 41 they are in great respect similar to the change detection circuitry with the exceptions that transducer TR2 replaces transducer TR3. Stage Q105 replaces stage Q101 with the same comparative components. In like manner voltage amplifier stage Q106 is very similar to stage Q102 and power amplifier stage Q107 is again similar to stage Q103. Thus the components in these several stages have reference characters one digit higher than their corresponding components in the change detector circuit. Again the D.C. level of the signal is extracted this time from diode D102 filtered by resistance R136 and capacitance C120 in parallel. At this point we have a D.C. level proportional to the input forty kilocycle signal which is the desired result of the presence channel of the detector.

The signal is then sent to the other half of the summing amplifier specifically through surge resistor R134 to the base of transistor Q109. Q109 is biased by resistance R145. R146 serves as the emitter load resistance. A signal will appear at this point if and only if a simultaneous presence of a forty kilocycle signal appears at the presence transducer and a sudden negative change of forty kilocycle energy appears at the same instance to the change transducer. This control signal is thus a gating signal allowing control of contactor RL101, referred to as relay D, through means of power transistor Q110 operating as a conventional high level power switch biased by resistor R147 and providing the control output. Power for the entire circuit is derived from a source similar to that of the generator emitter. Filtering isolation and voltage reduction is accomplished by networks consisting of resistor R141, C123, C124 and R137, C121 and C122 conventional Pi supply network filter circuitry.

Referring to FIGS. 6 and 7 once the relay D is energized the circuit is initiated to operate the marker or other device being controlled. As shown in FIG. 6 the diagrammatic view illustrates L1 and L2 which are preferably 110 volt sixty cycle control line and line L1 is connected through a contactor of the limit switch A which is a front contact indicated at A1 the other side of which is connected by the line 50 to the pushbutton E that initiates the starting of the operation of the marking device from left to right in FIG. 1 and which can only be initiated when the limit switch A is closed by the carriage 3. The pushbutton E then connects line 50 to line 51 on one side of the operating coil of the control relay F the other side of which is connected to L2. As soon as the control relay F is energized its front contact F1 connects line 51 to line 52 the latter of which is connected through a back contact or normally closed contact B1 of the limit switch B and thence to line 1. Thus front contact F1 is a stick or holding contact of the F relay and maintains the same energized until the carriage 3 traverses the whole of the distance and engages the limit switch B at the right end of FIG. 1 thereby opening contact B1 and deenergizing the relay F. Under this condition it is impossible to again energize relay F.

When relay F is energized it closes its contact F2 which connects a circuit from L1 through a front contact D1 of relay D to line 53 and thence through the front contact F2 to line 54 and thence through normally closed contact H1 to line 59 and thence through back contact M1 and the line 55 which then energizes check control relay G the opposite side of its coils being connected to L2.

Contact D1 of course cannot close until relay D has been energized by the focusing or locating circuit. When relay G is energized its normally open front contact G1 is closed which is in multiple with the front contact D1 to form a stick circuit and hold the check control relay G energized as long as F2 remains closed and H1 remains closed and M1 remains closed.

The firing or stamp operating circuit is controlled by the relay J. This relay is connected in multiple with the relay K that controls the operation of a brake on the motor 3' of the carriage 3. The relay J is energized from line 1 through the normally open front contact G2 to the line 56 thence through the normally closed contact M2 to the line 57 or one side of the operating coils of the relays J and K the opposite side of which are connected to line 2.

The motor 3' as depicted in FIGS. 1 and 7 has a brake combined therewith such as found in U.S. Patents 2,735,029 and 2,905,289 wherein the brake is applied to the rotary member by means of a constant pressure device such as a spring and an electromagnet is employed to compress this spring and brake the rotary action on the rotary member when the same is energized, which ordinarily is substantially the same time as the energization of the motor. When the energy to the motor and electromagnet is interrupted, the spring immediately applies the brake to stop further movement of the motor. In this manner high speed electric motors may be brought to a standstill in relatively few revolutions.

The motor as previously described is connected to move the carriage 3 back and forth on the track 4 and when the motor 3' is energized to operate, the carriage 3, the brake is released at the same time as described above and the motor is energized as described hereinafter.

The forward motor start relay R is controlled through a normally closed contact C1 wherein C is indicated as a limit switch in FIG. 1 when the head 7 is fully returned and when fully returned contact C1 is closed to admit current from L1 to line 58 and through the normally closed limit switch B2 to the line 60 through the normally closed contact M3 to the line 61 and through the normally closed contact G3 to the line 62 and through the normally open front contact F3 to the line 63 and thence to the right energizing coil of the relay R the other side of which is connected to L2.

The reversing motor relay N is energized through the normally open or front contact B3 of the limit switch which connects L1 to line 64 and one side of the energizing coils of the reversing motor control relay M the other side of which is connected to the line L2. Thus the relay M may only be energized when the carriage 3 at the extreme right position as shown in FIG. 1 engages the limit switch B.

The line 64 may also be connected to line 1 through the circuit including the normally closed contact A2 of the limit switch A connecting L1 to line 65 which in turn may be connected to line 64 through the front contact M4 which is a stick or holding contact of the motor reverse relay M.

The reverse motor start for the left coil is controlled through the relay N which gets its current from the line 64 through the back contact C3 that connects 64 to 66 and thence to the coil N the other side of which is connected to line 2. This C relay or limit switch is closed by the head 7 of the marker when it is retracted as shown in FIG. 1 and when the head is out this back contact C3 is open but when the head is retracted as shown in FIG. 1 the contact C3 is normally closed.

The last circuit shown in FIG. 6 connects the rapid closing slow opening relay H which is connected by the normally open head return limit switch contact C2.

This diagrammatic circuit is shown with relation to the members schematically positioned relative to the arrangement shown in FIG. 1 wherein the circuit is illustrated in FIG. 7. In FIG. 7 each of the lines indicated and described in regard to the contacts in the single line diagram of FIG. 6 is shown and laid out in the relative position of each of the relays and contacting members in FIG. 7.

Referring to FIG. 8 the emitting transducer 20 is placed in the center and each of the receiving transducers 26 and 26' are mounted on opposite sides of the emitter and are adjustable relative to each other and relative to the emitter. It will be noted that each of the open throats 38 and 38' of the frusto conical members 35 and 35' respectively are positioned so that they receive the reverberations from adjacent the bottom corners of the ingot 6. Thus the receivers 26 and 26' must both record a change which signals are integrated when received simultaneously to function in energizing the relay D. By varying the relative height of the receivers 26 and 26' one may tune the same to billets of varying width for accurately focusing on the billet to determine its exact position. The circuits of FIG. 5 need very little changing to operate the structure shown in FIG. 8 and the receivers may be made to be selective as to direction. In other words, the device may be made to operate only when the receiver 26 precedes the receiver 26' in proceeding across the articles to be focused for marking or other operations.

I claim:

1. An article locating device comprising a pair of supersonic receivers mounted to have a known relation to each other, a supersonic signal generator positioned to emit signals which when reverberated from an article at a location relative to said receivers energizes said receivers, a coincidence circuit simultaneously coordinating the signals from said energized receivers, trigger means actuated by said coincident circuit when receiving a predetermined signal from each receiver due to the relative location of the article and said receivers, and a control circuit operated by said trigger means to initiate an operation on the located article.

2. The locating device of claim 1 which also includes support means to independently position said receivers to direct them toward points on the located article and provide a reflected signal from one part of the surface representing one change in the direction of the surface of the located article for one receiver signal and a reflected signal from another part of the surface representing another change in the direction of the surface of the located article in the other receiver indicating two surface changes such as the edges of the article.

3. The locating device of claim 1 which also includes marking means actuated by said trigger means to mark said article.

4. The locating device of claim 1 which also includes support means to independently position said receivers to direct them toward adjacent points on the located article and receive a reflected signal from one part of the surface of the located article for one receiver signal and a reflected signal from another part of the surface representing a change in the direction of the surface of the located article for the other receiver signal indicating one surface change such as an edge of the article.

5. The locating device of claim 4 characterized in that said support means for said generator and receivers are pivotally mounted to direct their position to any predetermined point on the surface of the article.

6. The locating device of claim 1 which also includes means to provide for relative movement between the article and said receivers so that their received signals due to the located article energizes said trigger means.

7. The locating device of claim 6 characterized in that said means to provide relative movement between the article and said receivers produce a movement that is lateral relative to the article.

8. The locating device of claim 6 characterized in that said means to provide relative movement includes means to provide relative movement along parallel planes between the article and said receivers to produce a lateral movement with respect to the article.

9. The locating device of claim 4 which also includes marking means to mark said article when said trigger means is initiated.

10. The locating device of claim 6 which also includes circuit means actuated by said trigger means to arrest the relative movement between the article and said receivers.

11. The locating device of claim 10 which also includes servo means to operate on said article when the relative movement has ceased, and second circuit means actuated by said trigger means to initiate said servo means to operate on said article.

12. The locating device of claim 10 characterized in that said servo means is a marking mechanism to stamp the article.

13. The locating device of claim 1 characterized in that said generator and receivers each include tubular means channeled to pass the supersonic waves, and a transducer in said tubular means.

14. The locating device of claim 13 characterized in that said tubular means has lateral ports therein, and means to supply forced air to said lateral ports to maintain said transducers cool.

15. The locating device of claim 13 characterized in that said generator is mounted in one tubular means and said receivers are mounted in a dual tubular means having converging channels.

16. The locating device of claim 13 which also includes a sonic director in the form of a frusto conical tube mounted on said tubular means to channel the supersonic waves therefor.

17. The locating device of claim 16 which also includes clamp means to adjustably secure said frusto conical tube on said tubular means.

18. A method of locating an article which comprises the steps of emitting a directional supersonic energy wave signal, providing dual supersonic receivers with one receiver responsive to the mere presence of a constant reflected signal and the other receiver responsive to an abrupt change in the direction of the surface of the article, positioning the emitter and the dual receivers so that the emitted signals reflected from an article are responsive to locate a predetermined position of the article to be located by receiving both the reflected constant and changing signals, and providing relative movement between the article and the positioned emitter and dual receivers to determine the position of the article.

19. An article locating device comprising a conveying device for receiving and moving articles upon which work is to be performed, a locator mechanism having a supersonic energy wave directional signal emitter and dual receivers having one receiver responsive to the mere presence of a constant reflected signal and the other receiver responsive to an abrupt change in a reflected signal, mounting means to locate said emitter and each of said dual receivers to enable the detection of a predetermined area of the articles to be located, and circuit means energized by the reception of the reflected supersonic energy waves received by said dual receivers to initiate an operation on the article at the located area.

20. An article locating device comprising a pair of supersonic receivers, one a presence receiver detector and the other a change receiver detector, mounted to have known spaced relation to each other, a supersonic signal generator positioned to emit signals which when reverberated from an article energizes the receivers, each of said receiver detectors having a low level amplifier circuit, a second voltage amplifier supplied by the output of said low level amplifier and having a regenerative feed back, a high powered stage amplifier supplied by said second voltage amplifier and having a transformer primary winding as the load and having a secondary winding, a diode and filter network connected to said secondary winding to produce a D.C. level signal, said receiver detector circuit having in addition a differentiating stage to note the presence of a change of signal strength which is connected to feed the primary of a transformer collector load and the signal provides a pulse proportional in change to the rate of change of the reverberated input signal, an amplifier-and-gate consisting of two transistors one for each receiver signal output having their emitters and collectors connected in series, a rectifier and a high level switch and a relay connected between said collector and emitter of said last two transistors energized when the receiver signals simultaneously appear with a presence and change control signal indicating a surface change of the article to thereby locate the same.

21. An amplifier-and-gate consisting of two transistors each having a base and a collector and an emitter and an independent input signal line connected to their base, a resistance in each input signal line, a biasing resistance connecting each emitter to its respective input signal line, the collector of one transistor connected to the emitter of the other transistor, an output circuit including a diode and a transistor switch having its collector and base connected in series with said diode and the emitter of said one transistor and the collector of said other transistor, a source of power connected between the emitter of said transistor switch and said diode, and a relay connected

in parallel with said diode to be closed by said switch when triggered by said two transistors.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,149,561 September 22, 1964

Donald E. Lancaster

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 9, line 53, for the claim reference numeral "4" read -- 6 --; line 63, for the claim reference numeral "10" read -- 11 --.

Signed and sealed this 12th day of January 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents