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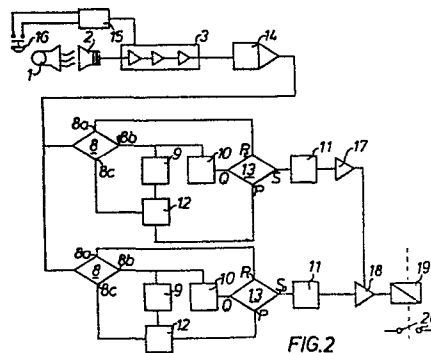
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(54) **Sound operated start circuit.**

(57) The invention is concerned with starting of electrical machines from a sound emitting device and is particularly concerned with safety circuits for the start of a coal getting machine on the sounding of a klaxon giving warning to mine workers underground that the machine is to be started and hence to keep clear. The signal from the klaxon is detected as to certain predetermined parameters including amplitude, frequency and the rate at which the klaxon is being operated since it would normally be controlled by a water driven pump. The signal is then fed to a discriminator circuit which then determines that these parameters are correct. Two such circuits are provided in parallel with each other and a signal to enable the machine to be started is only provided at an output terminal when the correct signal is found and detected by both circuits simultaneously.



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SOUND OPERATED START CIRCUIT

This invention is concerned with a safety start up circuit for use with electrically operated machines and in particular underground coal mining machines.

5 In underground mine workings, especially coal mines, it will be appreciated that in the confined space and lack of visibility it is necessary to ensure that no person is closely adjacent to a coal mining machine at the time of starting up of that machine. It is therefore necessary to give an adequate warning when a machine is to start up.

10 It will be appreciated that a coal face may extend for more than 250 yards or more and therefore audible warning means have to be provided which extend along the length of the face so that all may be given notice that the machine is to start up. A conveyor will be provided along the length of the face along which a coal winning machine can travel.

15 Hitherto the practice has been to provide a centralised warning system with amplifiers or other sound emitting devices throughout the underground mine working which are operated whenever any coal mining machine is to be started up.

20 The operatives underground have therefore not been able to ascertain which machine is to be started up.

One of the objects in the present invention is to provide a control circuit which enables a time delay from the sounding of an audible warning before the start up of a machine.

25 It is also known for a water warning circuit to be associated with the start up of a coal getting machine. The water jets are provided at specified localities which emit a fine spray of water for a period of time prior to the start up of the machine. Thus giving the coal miners a continued confined audible and physical (water) warning.

30 It is an object of this invention to ensure that the water warning jets are functioning correctly prior to the machine start up. The klaxon providing the audible warning is conveniently operated by a water driven motor as detailed hereinafter. Water under pressure issues from water warning

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jets on to the coal face and the present invention includes the steps of switching on the water jets, the sounding of an audible warning and after a predetermined interval of time the start up of the coal getting machine. It is also a feature of the present invention that the machine is not started unless a
5 predetermined flow of water to the jets has been established. It is possible for a break in a water pipe to occur in which event the water flow would be higher than the predetermined value. In the alternative one or more of the jets may be
10 blocked in which event the water flow would be below the predetermined value

According to the present invention there is provided electric control means for the operation of an electrical machine particularly a coal getting machine comprising means
15 for detecting sound of a quality within predetermined parameters, and for rejecting sound not within the predetermined parameters, providing an electrical signal consequent upon the detection of the correct sound, means for feeding said signal to a time delay circuit and providing the
20 sound is maintained within the predetermined parameters for a predetermined interval of time, providing a signal to start an electrical machine.

In the application of the present invention to underground coal mine workings a water operated klaxon is provided and the
25 coal getting machine is operated by firstly turning the water on to the klaxon and thence to the water warning jets of the coal machine. In circuit with the water supply is the klaxon so that sound is emitted from the klaxon. The sound is sensed by a microphone and fed to a amplifier thereafter to a filter
30 in order to ensure that only those frequencies which have previously been determined are passed by the filter. From the filter the sound is then fed to a signal splitter whence the signal is fed to two identical circuits. The signal received by the two identical circuits is firstly analysed to ensure
35 that its amplitude is within given values. The signal is then timed and provided all functions are correct a signal from each circuit is fed to an 'AND' gate. Thus if both of the identical

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circuits provide a signal simultaneously to the 'AND' gate a signal is fed to a relay or the like to start the electrical machine.

5 The two identical circuits include circuits which time out for a predetermined interval of time to ensure that the sound is emitted at the given amplitude and predetermined frequencies during the timing out period before a signal is fed to the 'AND' gate. No signal is fed to the 'AND' gate if either the amplitude of the sound is too high or too low or varies during
10 the timing out interval.

 Furthermore no signal is fed to the 'AND' gate if there is a fault in either of the two identical circuits. It will be appreciated that in underground mine workings the electrical circuits are operated by low voltage D.C. and in the event of a
15 circuit component failure the circuit may fail either to a 'voltage' condition or to a 'no voltage' condition. If only one circuit were provided and a component failed there would be a real possibility of the machine being started when the predetermined condition did not exist i.e. fail to a 'voltage'
20 condition. With two identical circuits the correct condition must exist for the second circuit to pass a signal to the 'AND' gate.

 In a modified embodiment the rate of flow of water to the spray jets is monitored by the sound emitted from the klaxon.
25 The klaxon consists of a water driven motor having a striker which strikes the face of a metal plate or diaphragm. The frequency of sound emitted is determined by the size and positioning of the metal plate and the amplitude of the sound by the force of the striker on to the metal plate. However the
30 frequency of impact of the striker is dependent on the flow of water through the water driven pump. Accordingly in this embodiment a frequency to voltage device is provided which determines the frequency of impact of the striker and provides a signal in the form of voltage as a result thereof. If the
35 frequency is too high the voltage will be too high and the machine not started. This would indicate a break in a water pipe. Similarly if the frequency is too low the voltage will

be too low and again the machine not started. This would indicate a condition of a blocked jet. In either case the water warning of the impending start of the coal machine is inadequate.

5 In order that the present invention may be better understood reference is now made to the accompanying drawings, in which:-

Figure 1 is a block circuit diagram according to the present invention; and

10 Figure 2 is a block circuit diagram of an alternative embodiment.

15 The circuit diagram of Figure 1 has a sound emitting device 1 which conveniently will be a klaxon that is water operated. The sound from the klaxon is sensed by a microphone 2 and the signal from the microphone is fed to a filter circuit 3. The filter circuit ensures that only the predetermined frequencies are passed through in the form of a signal. Should the frequencies of the sound emitted by the klaxon 1 not
20 contain the predetermined frequencies then no signal will emerge from the filter circuit 3.

Assuming that the sound is of the correct frequency then the signal will be passed by the filter circuit 3 to a peak holding circuit 4 (explain please) and thence to a signal
25 splitter 5. The peak holding circuit provides a signal for a short period of time at the magnitude of the peak of an applied signal. Thus if the klaxon is producing a sound of variable amplitude the peak holding circuit will provide a signal commensurate with the peak of the applied signal for a given
30 period of time until another signal of the same or greater amplitude is applied thereto.

On the right of Figure 1 a series of components have the suffix B and on the left an identical circuit has components with the suffix A. The two circuits are identical as will
35 appear hereinafter and in order to start the machine it is necessary for both the circuits A and B to pass a signal to an AND gate 6. If signals from the A and B circuits are received simultaneously by the AND gate 6 then a signal is passed to a

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relay 7 and thence electrical connection made to a electrical machine, as for example a coal winning machine.

Hereinafter, the description will relate only to one of the two circuits A and B, the other being identical.

5 The signal from the signal splitter 5 is fed to an amplitude detector 8. The amplitude detector determines that the amplitude of the signal emitted by the klaxon 1 and passed by the filter 3 is of the correct amplitude or is above or below the predetermined values for amplitude.

10 Three outputs are available from the amplitude detector 8a, 8b, and 8c. 8c gives a signal when no signal is received by the detector. In other words this is a signal if the amplitude determined by the amplitude detector is either too low or does not exist. No signal exists at 8c if the amplitude is correct or too high. A signal at 8a is given if the
15 amplitude determined by the amplitude detector is too high. If the amplitude of the signal is within the predetermined values then a signal is provided by the amplitude detector at 8b. The output terminal 8b of the amplitude detector is connected to
20 two timers. One timer 9 designated TTB and the other timer 10 designated T1B.

 A signal applied to timer 9 triggers the timer and produces a signal at the output of the timer which is then fed to an AND gate 12 which also receives a signal from 8c of the
25 amplitude detector 8 for reasons hereinafter described.

 Once the timer 9 has received a signal from 8b it is triggered and will continue to provide a signal to the AND gate 12 for a predetermined period of time which conveniently is 14 seconds.

30 The other signal from 8b is fed to timer 10 T1B and this timer needs a signal to be provided to it all the time for it to continue timing. Providing a signal is continuously fed to timer 10 then after a timed period, for example, 7 seconds timer 10 will provide a signal to timer 11 designated T2B and a
35 signal will be passed through timer 11 to terminal Q of a logic gate 13. Timer 11 will allow that signal to pass through to terminal Q for a predetermined period of time, conveniently 4

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seconds providing the correct signal is appearing at the 8_b of the amplitude detector 8 and hence is being passed through timer 10.

5 The logic gate 13 permits a passage of signal from terminal Q to terminal S providing no signal is applied at either terminal P connected to the AND gate 12 or terminal R connected to 8_a of the amplitude detector 8. Thus providing there is no signal being received from the AND gate 12 or an amplitude high signal received from the 8_a the signal which has
10 been timed through timer 10 and timer 11 will be passed through the logic gate 13 to the AND gate 6 for a period determined by timer 11, i.e. 4 seconds.

 It will be understood that if the amplitude of the signal detected by the detector 8 falls below the given value while
15 timer 10 is timing the AND gate 12 will receive a signal from timer 9 and from 8_a and hence pass a signal to terminal P of logic gate 13 and thereby prevent the passage of a signal from Q to P.

 Since the A circuit is identical to the B circuit then a
20 signal of equal intensity and nature will appear at the AND gate 6 from the two circuits A and B and providing both such signals are received by the AND gate a signal is fed to the relay 7 and the machine started.

 Reference is now made to Figure 2 of the accompanying
25 drawings which is substantially the same circuit operating in substantially the same manner as that described with reference to Figure 1 and like components have been given like numbers and components with output terminals have been given like references at the output terminals. There are differences in
30 this circuit and a description of the circuit will now be made with reference to those differences.

 Firstly the circuit is powered by a timer 15 connected to a battery so that when the machine is to be operated, the operative has firstly to power the timing out circuit and to do
35 this he presses the button 16. Only when button 16 is pressed will timer 15 operate and connect power to the circuit. This saves battery drain and ensures that the circuit is only

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powered for the 15/20 seconds, or thereabouts that it is used to determine that the conditions are correct for the start up of the machine.

In place of the peak holding circuit 4 there is a
5 frequency to voltage converter 14 after the filter 3. The purpose of the frequency to voltage converter is to determine the frequency of impact of the striker of the water driven motor of the klaxon onto the plate or diaphragm of the klaxon and only when that frequency of impact is correct will the
10 correct signal in the form of a voltage be passed by correcter 14. If that voltage is too high then it will create a high level abort signal to terminal R of gate 13, and if too low to create a voltage at terminal P of the gate 13.

The description of the timers and the gates 8, 9, 10, 11,
15 12 and 13 has been made with reference to Figure 1. In Figure 2 the timer 11 is placed after the gate 13 rather than before it but this otherwise has no significance.

The other difference is that the signal from the timer 11 in the first circuit passes to a gate 17 which then provides a
20 signal to a gate 18 in the form of a power signal. Thus if everything is in order a signal is provided from 17 to power 18 but no signal is passed by 18 until such time as everything is in order from the similar circuit. Thus a signal from the timer 11 of the second circuit to gate 18 will itself not
25 result in a signal being passed by 18 until the signal from 17 has powered 18. Once 18 is correctly powered then a signal is passed to a start device 19 which enables an operative then to close a switch 20 for passing power the necessary electrical machine. The term correct sound as used herein defines the
30 sound which falls within the said predetermined parameters.

It is thought that the present invention is of particular value in ensuring safety in underground mine workings but it will be appreciated that the present invention is applicable to any other machine which it is desired to start or control by a
35 sound emitting device.

CLAIMS

1. Eletrical control means for the operation of an electrical machine, particularly a coal getting machine comprising means for detecting sound within predetermined parameters and for rejecting sound not within said predetermined
5 parameters;
providing an electrical signal consequent upon the detection of the correct sound; and
means for feeding said signal to a time delay circuit and providing the sound is maintained within the predetermined
10 parameters for a predetermined interval of time, providing a signal to start an electrical machine.
2. Electrical control means according to Claim 1 having two identical circuits for rejecting sound not within the said
15 predetermined parameters and for providing a signal consequent upon the detection of the correct sound so that only when both said circuits are functioning correctly is an output signal provided to start the said electrical machine.
- 20 3. Control means according to Claim 1 or Claim 2 in which the sound predetermined parameters include amplitude, frequency and in the case where the sound is created by a hammer driven diaphragm the frequency of impact of said hammer.
- 25 4. Control means according to Claim 3 including filter means for determining that the frequency of the emitted sound is within the predetermined parameters and a frequency to voltage converter for determining the rate of impact for creating said sound.
- 30 5. Control means according to any of the preceding claims having water warning jets to indicate the impending start up of a coal getting machine including;
means for connecting a klaxon in circuit with the supply
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of water to said water jets, said klaxon including a water driven motor having a striker impinging upon a diaphragm for creating a sound; and

means for ensuring that sound is provided for a
5 predetermined period of time before the coal getting machine may be started.

6. Control means according to Claim 5 which includes no power
10 to any part of the circuit except on the operation of a timed powered circuit firstly to be operated prior to the operation of the control means for the said electrical machine.

7. Control means according to any of the preceding claims
15 whereby the circuit includes means for inhibiting the passage of a signal to start up said electrical machine in the event that either the frequency of the klaxon is too high or is too low or in any other way the sound does not fall within the predetermined parameters.

8. Control means according to any of the preceding claims
20 which includes an 'AND' gate which has to be fed by an output from the two identical controlled circuits before an output from said gate is fed to means to start the electrical machines.

9. Control means according any of Claims 1 to 7 wherein one
25 of the said identical circuits has a gate which has to be fed (a) by a signal from said circuit and (b) a signal from the other identical circuit before an output signal is obtained
30 from said gate to start the said electrical machine.

10. Control means for the operation of an electrical machine,
particularly a coal getting machine substantially as described
and illustrated herein with reference to the accompanying
35 drawings.

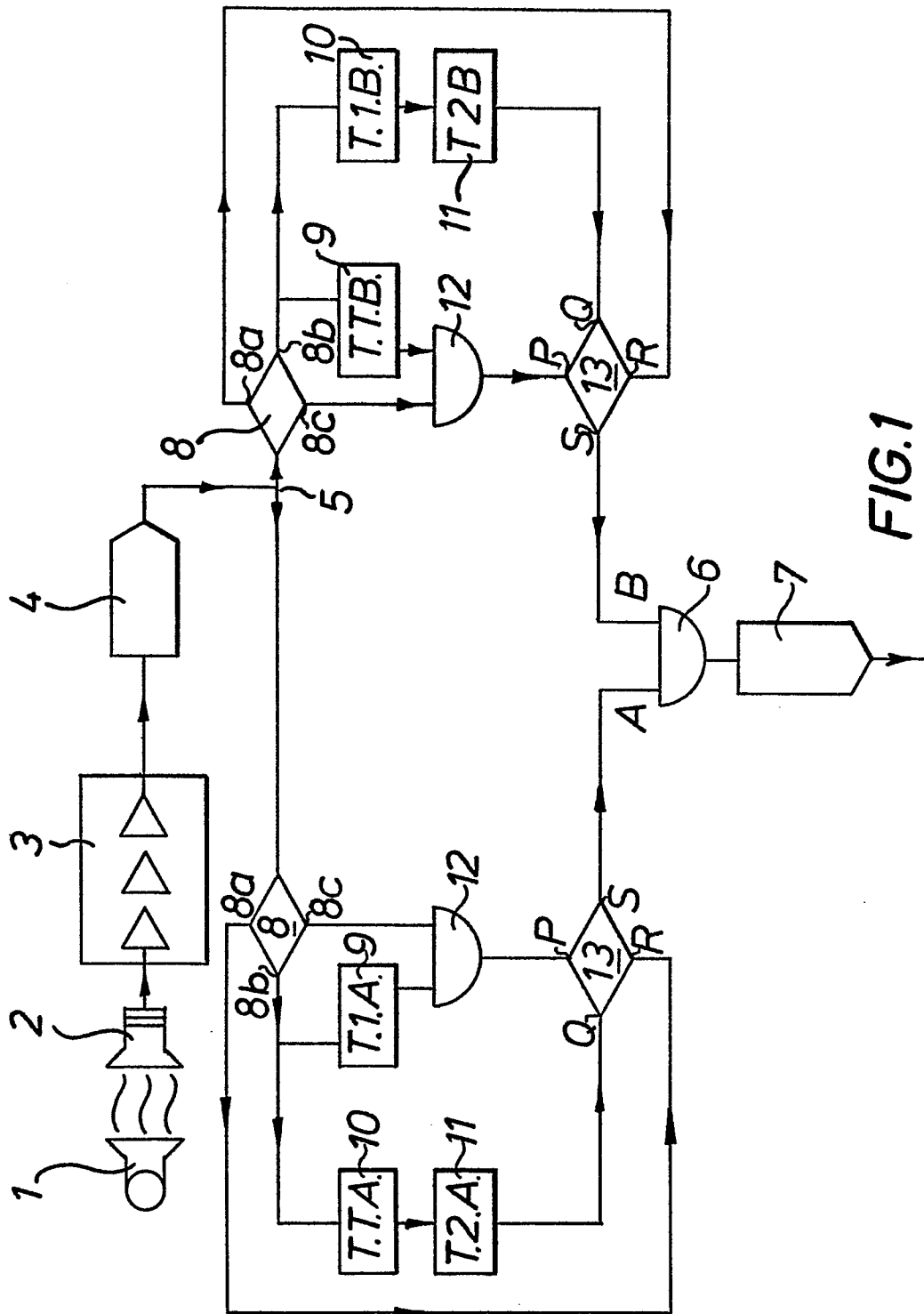


FIG. 1

