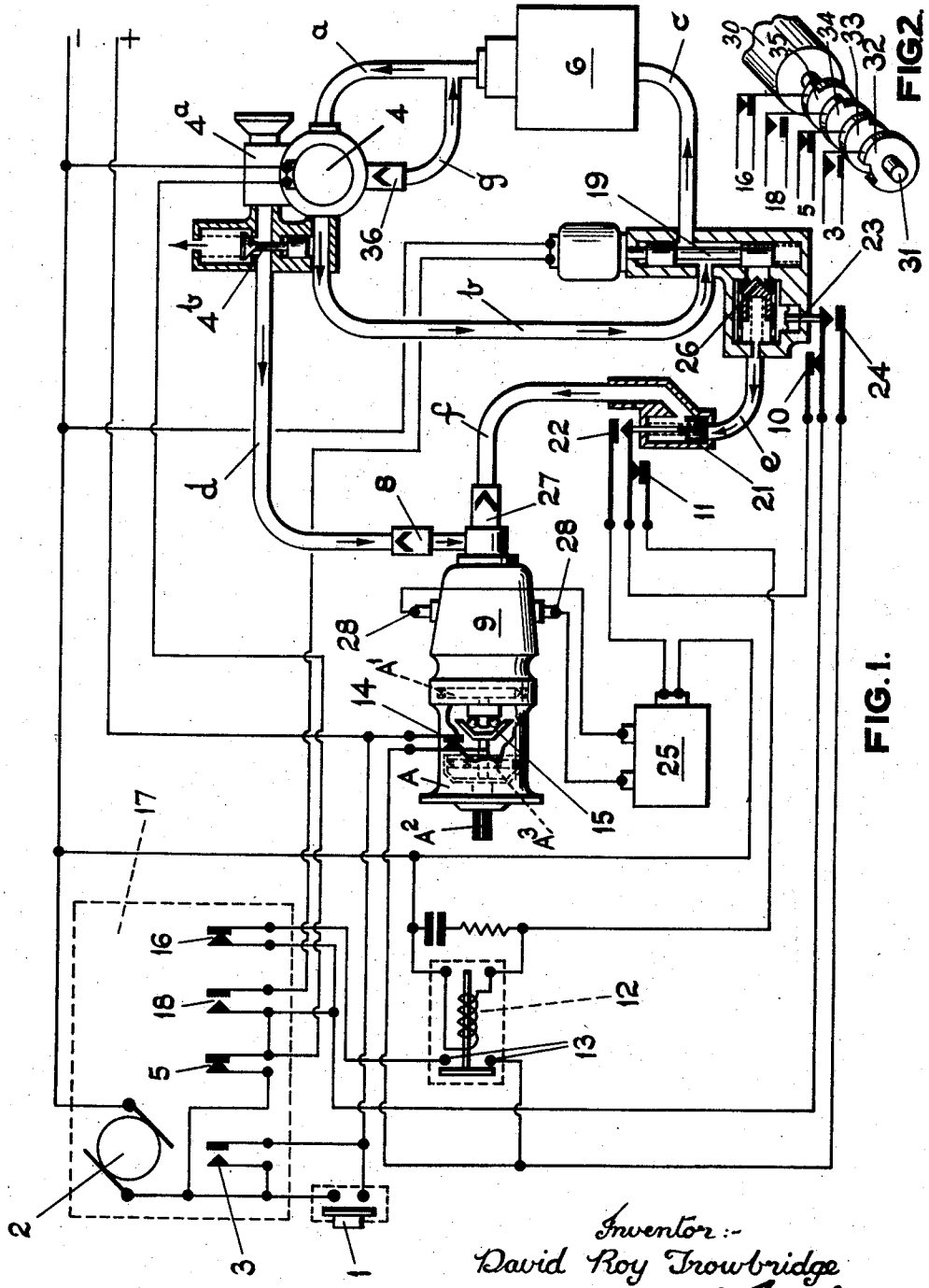
Sept. 9, 1958 D. R. TROWBRIDGE 2,850,874

CONTROL AND IGNITION SYSTEM FOR LIQUID FUEL COMBUSTION APPARATUS

Filed March 22, 1954



Inventor:-
David Roy Trowbridge
By:- William C. P. Bayly
Attorney.

United States Patent Office 2,850,874 Patented Sept. 9, 1958

2,850,874

CONTROL AND IGNITION SYSTEM FOR LIQUID FUEL COMBUSTION APPARATUS

David Roy Trowbridge, Hornchurch, England, assignor to The Plessey Company Limited, Ilford, England, a British company

Application March 22, 1954, Serial No. 417,769

2 Claims. (Cl. 60—39.14)

This invention relates to a control and ignition system for liquid fuel combustion apparatus which is particularly applicable for gas turbines used as starting turbines.

An object of the present invention is to provide an improved system which enables the starter turbine to run for a pre-determined time.

According to the present invention the control and ignition system for liquid fuel combustion apparatus comprises an electrical circuit operating a time switch unit which in turn actuates an electromechanical fuel supply means to inject fuel into a combustion chamber, a flow or low pressure switch and a high pressure switch being incorporated in the fuel supply system, whereby the rise in fuel pressure due to fuel being forced through atomizers, causes the flow of low pressure switch to operate and switch on the ignition unit and said high pressure switch closes when the fuel pressure rises still further due to a rise of combustion chamber pressure on ignition and wherein after ignition the high pressure switch operates to cut out the ignition also to supply an alternative electrical supply.

The advantage of this arrangement is the isolation of the ignitaon system after the liquid fuel in the turbine has been ignited.

The control and ignition system for liquid fuel combustion apparatus will now be described with reference to the accompanying drawing in which—

Fig. 1 is a schematic diagram of the system and

Fig. 2 is a detail of the time switch.

Referring to the drawing—

Upon depression of the push button **1** supply from the negative line to the time switch motor **2** is made available. Contacts **3** in the time switch close thereby supply to the time switch motor **2** is continued via these contacts independent of the push button **1.**

Supply is made available to the pump and blower unit motor **4** via contacts **3** and **5** in the time switch unit **17** thereby causing fuel to be drawn from the fuel tank **6** by the pump **4** via conduit *a* and passed back to the tank **6** via conduit *b* the solenoid by-pass valve **19** and conduit *c*. Air from the air blower 4^a is delivered into the combustion chamber **9** through air conduit *d* and non-return valve **8** which scavenges the chamber **9** of any fumes from the previous start and providing clean air for initial combustion conditions to occur.

Another source of electrical supply is available via contacts **3** and **5** in the time switch unit **17**, contacts **10** in the high pressure switch **23**, and contacts **11** in the flow switch **21**, thereby energising the delay relay **12** closing contacts **13.**

The closing of contacts **13** makes available an alternative supply to the pump and blower motor **4** via contacts **14**, in the speed control governor **15**, contacts **13**, and contacts **16** in the time switch **17**. Also an alternative supply to the delay relay **12** is available via contacts **14, 13, 16, 10** and **11**. Contacts **5** in the time switch unit **17** now open, thus continuation of supply is maintained.

After a pre-set time, contacts **18** in the time switch unit **17** close operating the solenoid by-pass valve **19** via contacts **14, 13, 16** and **18.** This diverts the fuel from the by-pass into the combustion chamber **9** via the anti-dribble valve **26**, conduit *e*, the pressure sensitive flow switch **21**, conduit *f* and the fuel non-return valve **27.**

On liquid fuel passing through the pressure sensitive flow switch **21**, contacts **11** open and contacts **22** close.

The closing of contacts **22** will switch on the ignition unit **25** via contacts **14, 13, 16, 10** and **22,** thus supplying the sparking plugs **28.**

The opening of contacts **11,** discontinues the supply to the delay relay **12** but contacts **13** will not open at once due to the pre-set delay time. It is during this period that successful ignition will occur resulting in the pressure in the combustion chamber **9** rising. This will have a corresponding effect on the fuel line pressure, thus effecting operation of the high pressure switch **23** thereby opening contacts **10** and closing contacts **24.** At the same time the rise in pressure in the fuel line, upon ignition of the combustion chamber **9,** causes an air valve 4^b to open in the air conduit *d* thereby exhausting air to the atmosphere as its passage to the combustion chamber **9** will be blocked by the closure of the air non-return valve **8,** caused by the high pressure gases in the chamber **9.**

The opening of contacts **10** shuts off the ignition unit **25.**

The closing of contacts **24** provides an alternative supply when contacts **13** in the delay relay **12** open. When this occurs, supply to the pump and blower motor **4** is maintained via contacts **14,** and **24,** also supply to the solenoid by-pass valve **19** continues via contacts **14, 24** and **18.**

A turbine unit A is incorporated with the combustion chamber **9.** Said unit contains the overspeed governor **15** which is connected to a rotary turbine blade A^1, and the drive from said blade A^1 to the shaft A^2 is through a reduction gearing A^3.

Contacts **16** in the time switch provide an overriding safety on contacts **13** in the delay relay **12** against sticking, and open at a pre-set time after contacts **13** have opened.

The whole system continues to run until the starter has reached a pre-set speed which will operate the speed control governor **15** opening contacts **14.** This will effectively close down the system.

In the event of the combustion chamber **9** failing to ignite, the system will be shut down by contacts **13** in the delay relay **12** opening. There will be no continuation of supply via contacts **24** in the high pressure switch **23** as this unit has not operated due to there being no fuel line pressure rise.

Fig. 2 shows a time switch for use in connection with the system consisting of an electric motor **30,** driving shaft **31** fitted with a series of cams **32, 33, 34, 35** and the contacts **3, 5, 18** and **16** are actuated by rotation of the cam shaft **31.**

A pressure relief valve **36** is connected to the delivery side of the pump unit **4,** whereby the pump is relieved of excessive pressure which is returned via conduit *g.*

I claim:

1. A control and ignition system for liquid fuel combustion apparatus comprising in combination an electrical circuit, a starting switch, a time switch unit operated by the electrical circuit, an electro-mechanical fuel supply means actuated by said time switch, a combustion chamber having liquid fuel injected therein by said electro-mechanical fuel supply means, a starter turbine incorporated in said combustion chamber, an ignition unit incorporated in the system for initial igniting of the fuel in said combustion chamber, a low pressure switch and a

high pressure switch arranged in said system whereby the rise in liquid fuel pressure causes the low pressure switch to operate and switch on said ignition unit and said high pressure switch responsive to a further rise in fuel pressure to cut out the ignition circuit and close an electrical supply to the system, a speed control governor operatively associated with the turbine unit, a switch means co-operating with said governor for shutting off the electrical supply to the system at a predetermined speed of the turbine unit, and said time switch unit de-energising the system after a predetermined time.

2. A control and ignition system for liquid fuel combustion apparatus comprising in combination an electrical circuit, a starting switch, a rotary time switch unit operated by the electrical circuit, a series of cams fitted to said rotary time switch unit, a separate switch contact for each cam for closing the electrical circuit in proper sequence, an electro-mechanical liquid fuel supply means actuated by said time switch, a combustion chamber having liquid fuel injected therein by said electro-mechanical fuel supply means, a starter turbine incorporated with said combustion chamber, an ignition unit incorporated in the system for initial igniting of the liquid

fuel in said combustion chamber, a low pressure switch and a switch sensitive to liquid fuel pressure arranged in said system whereby the rise in fuel pressure causes the low pressure switch to operate and switch on said ignition unit and said sensitive switch closes when the fuel pressure rises a pre-set amount thereby cutting out the ignition circuit and closing an electrical supply to the system, a speed control governor operatively associated with the turbine unit, a switch means co-operating with said governor for shutting off the electrical supply to the system at a predetermined speed of the turbine unit, and said time switch unit de-energizing the system after a predetermined time.

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