

AN IMPROVED WELDING MACHINE

FIELD OF THE INVENTION

- 5 The present invention relates to an improved welding machine that allows a user to collect and transmit data.

BACKGROUND OF THE INVENTION

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In the metal working industry, welders are normally paid on an hourly basis. However, the hourly wage paid does not necessarily translate to the actual quantity of work being performed, as the welders may not be doing actual welding work at all times when they are at work, even though the welders are being paid an hourly rate.

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In this situation, it is very difficult to estimate an actual cost incurred for welding works. For example, where welding is conducted in a shipyard, when a same amount of welding for two different projects is to be performed, the actual cost paid i.e. the cost incurred for the work to be done differs. This creates uncertainty for both the suppliers or contractors, and the shipyard owners. In another situation, where the amount of welding to be performed is fixed, the welders may delay performing their work, so that the actual time taken to complete the welding is lengthened. Advantageously, this will in turn, increase their wages. Therefore, as can be appreciated, a same amount of welding work may cost a shipyard owner differing costs. This situation is very unacceptable as it creates economic uncertainty, where the cost of welding is concerned.

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There have been attempts to improve this situation, mainly by providing an arc time counter to measure the time spent on performing welding. In this system, the arc time is merely displayed on the welding machine, and the displayed arc time will be noted down by a third party, for e.g. another worker, or a supervisor, to be used for calculation of a wage. Unfortunately, this system is very tedious, and it involves the accuracy, and integrity of the third party, to record the arc time. Errors may also occur where an incorrect welder is attributed to a particular arc time.

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- 35 It is therefore an object of the invention to ameliorate one or all of the above problems.

SUMMARY OF INVENTION

5 According to an aspect of the present invention, there is provided an improved welding machine, including a data detecting means to detect a desired data, a data collecting means for collecting the desired data, a data storage means, capable of storing data collected from the improved welding machine, wherein the improved welding machine further includes a data transmission means, for transferring data from the data storage means to an external device.

In a preferred embodiment, the data detecting means detects a current passing through the machine. Therefore, the data detecting means is able to detect the event when a weld is being performed.

15 Preferably, the data detecting means is a current transformer.

Still preferably, the current transformer further includes a secondary coil. In this arrangement, when a current passes through the improved machine and the current transformer, an electromotive force is induced in the secondary coil.

20 Preferably, data detecting means further includes a data converting means, to convert the electromotive force induced into a readable data.

25 In a preferred embodiment, the data converting means is a voltage level converter.

In the preferred embodiment, the voltage level converter outputs a logic value of "1" when an electromotive force is detected.

30 Alternatively, the voltage level converter outputs a logic value of "0" when no electromotive force is detected.

Preferably, the data collecting means is an arc time counter, which collects the time when a weld is being performed.

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Preferably, the arc time counter is powered by a microprocessor.

In a preferred embodiment, the data storage means is a database for storing at least an arc time.

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In an embodiment, the data transmission means is a transmission port and a data cable.

In a further embodiment, the data transmission means is a transmitter and a receiver.

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DESCRIPTION OF THE FIGURES

In order that the invention might be more fully understood, embodiments of the invention will be described by way of example only, with reference to the accompanying drawings, in which:

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Figure 1 shows an overall configuration of the improved welding machine,

Figure 2 shows the improved welding machine connected to a welding transformer,

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Figure 3 shows the improved welding machine in communication with an external device,

Figure 4 shows an overall view of the improved welding machine connected to a welding transfer, and in communication with an external device,

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Figure 5 shows the method of measuring the arc time according to the invention, and

Figure 6 shows the improved welding machine when arranged in a welding block.

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The attached drawings are not necessarily drawn to scale.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one of ordinary skill of the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, and features have been described in detail so as not to unnecessarily obscure aspects of the present invention.

In the following description, the improved welding machine arc events recorder is described only when collecting data relating to an arc time. However, it is to be appreciated that the invention may be used to collect other forms of data from a welding machine, for example, current or voltage, temperature of weld, etc.

The invention provides for an improved welding machine arc events recorder 100 as seen in Figure 1.

Figure 1 shows an overall configuration of the improved welding machine arc events recorder 100. The machine 100 includes a data detecting means 10, a data collecting means 20, a data storage means 30 and a data transmission means 40. As seen in Figure 1, the machine 100 further includes a power supply 60, and a data converting means 50. The data storage means 30 and the data collecting means 20 are run by a microprocessor 70. The machine 100, has an input current port 12 and an output current port 13, for electrical communication with a welding transformer. (shown in Figure 2)

A detailed description of the features mentioned above, will be described in the following paragraphs.

Figure 2 shows the machine 100, connected in series with a welding transformer 200 and when connected to an electrode 19 and base metal 300 forms a welding transformer loop.

In the embodiment as seen in Figure 2, the machine 100 has an input current port 12, and an output current port 13. The welding transformer 200 supplies an arc current to the machine 100 through the input current port 12. An electrode 19 for performing a weld, is connected to the output current port 13 of the machine 100 by a welding cable 504. An electrode holder in the form of a welding rod holder 18, is provided to allow a welder to safely perform a weld. Welding is performed by allowing the electrode 19 to contact a base metal 300, to form a weld.

As can be appreciated from Figure 2, when welding is performed, welding arc current flows from the welding transformer 200 through the machine 100, and to the electrode or welding rod 19, through the base plate and back to the welding transformer, forming a complete loop.

Forming a weld in this manner completes the circuit for the welding process.

In the preferred embodiment of the present invention, the machine 100 includes a data detecting means 10, a data collecting means 20, a data storage means 30, and a data transmission means 40. The data detecting means detects a desired data, and triggers the data collecting means 20 to collect the data, which is then stored in a data storage means 30, for subsequent transmission to an external device, using the data transmission means 40.

Data Detecting Means

In the embodiment shown in Figures 1 and 2, the data detecting means 10 further includes a data converting means 50. In the present embodiment, the data detecting means 10 is a current transformer 11.

When a weld is performed, i.e. when the electrode 19 is in contact with the base metal 300, a large welding current will flow from one terminal of the welding transformer 200 and returns to the other terminal of the welding transformer 200, forming a complete loop.

When a weld is being formed, current will flow through the machine 100.

The large current passing through the machine 100 passes through the current transformer 11, which further includes a current transformer secondary coil 14. The current transformer core of the current transformer 11 is made of a ferrite material. Any current flowing through the current transformer core 11 will generate a magnetic flux in the core, and in turn, this flux will induce an electromotive force in the current transformer secondary coil 14.

Advantageously, having a data detecting means 10 in the form of a current transformer 11 will allow the machine 100 to distinguish the time of actually performing a weld (i.e. when current passes through the current transformer core 11), and the time when the machine 100 is left idling. (i.e. when current is not passing through the current transformer core 11)

Specifically, when a weld is being performed, a current passes through the current transformer 11. An electromotive force is therefore induced in the transformer secondary coil 14. The induced electromotive force triggers a data converting means 50, which converts the electromotive force induced into readable data, which is then input into the data collecting means to begin collecting data. In the present embodiment, the data converting means 50 is in the form of a voltage level converter 51. The voltage level converter 51, when triggered, then converts the induced electromotive force input from the current transformer secondary coil 14, to a logic value "1" to the input of the data collecting means 20. When the logic "1" voltage level is detected, the data collecting means 20 begins to collect data. In the description, the data collected is an arc time or time when welding is being performed.

Conversely, when welding is not being performed, no current will flow through the current transformer, and therefore neither a magnetic flux nor an electromotive force will be induced in the current transformer secondary coil 14. In this situation, the voltage level converter will output a logic "0", and the data collecting means will not collect any data.

Advantageously, having a current transformer as a data collecting means enables the machine to distinguish the time when a welder is actually performing a weld, and when the welder is not performing weld. Therefore, only when welding is being performed will the data collecting means 20 begin to collect data.

Data Collecting Means

When a desired data is detected, the data collecting means 20 begins to collect the
5 desired data. As previously described, the desired data is an arc time, or the time when a
weld is being performed.

When the logic "1" voltage level is output from the data detecting means 10, the data
collecting means will begin collecting data.

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In the embodiment of Figure 2, the data collecting means 20 is a timer 21.

Therefore, when the logic "1" voltage level is detected, the data collecting means,
powered by a microprocessor 70 will begin to collect a time. As can be appreciated, only
15 when a current is passing through the machine 100 will the timer begin to calculate the
time. For ease of reference, this timer is also referred in the specifications as an arc time
counter, as the timer, in the illustrated embodiments, collects the time when an arc is
formed, i.e. a weld is being performed.

20 The arc time counter 21, controlled by the microcontroller 80, measures a cumulative time
when welding is performed. Therefore, a welder may take breaks in between a day, and
the arc time counter 21 will be able to cumulatively calculate the actual time spent on
welding. The arc time counter 21 may be any model or type available in the market.
However, in the present embodiment, the arc time counter 21 is implemented using a
25 crystal oscillator as a clock, and includes a microprocessor 70, as part of a
microcontroller 80, run at, in this embodiment, around 20 MHZ.

The method of measuring the arc time will be described in detail later, with reference to
Figure 5.

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In a preferred embodiment of the invention, the arc time counter 21 includes an arc time
display 15. This display allows welder to have visual access to the actual time spent on
performing a weld.

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Data Storage Means

Data collected by the arc time counter 21 described above, controlled by the microcontroller 80, is stored in a data storage means 30 in the form of a microcontroller
5 memory or database 31. The data storage means 30 further includes a processing means, to process the data stored, in the form of a microcontroller processor 70.

The microcontroller memory 31 stores the cumulated arc time from the arc time counter 21 processed by the microprocessor 70. In the present embodiment, the microcontroller
10 memory 31 is designed to store multiple data, and allows tagging to be done on the data. For e.g. the date of the data may be tagged onto the actual data itself.

In another embodiment, the machine 100 further includes a reader (not shown in figure) for reading identifying parameters. For e.g., the reader may be in the form of a scanner to
15 scan the identity bar code of a welder or any other identifying parameters of a welder, identifying and correctly attributing an arc time to a particular welder. Other variations for identifying parameters include biometrics – voice recognition, fingerprinting, retina analysis, etc.

20 Therefore, the data that may be stored in the microcontroller memory 31 include the arc time, the date, and the identifying parameter of a welder. The microcontroller memory 31 may also store multiple data, for e.g. arc times of a same welder on different dates, or of different welders on different dates. Therefore, the invention provides for an accurate attribution to a welder, on the actual work performed.

25 Further, to provide a level of security to the data to prevent fraud or tempering, the data collected may be secured by way of encrypting the data, or by imposing passwords to access the data, or by specifying a method of uploading or transmitting the data to the external device.

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Data Transmission Means

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The machine 100 provides for a data transmission means 40 in the form of a data transmission port 41 and cable 42. The data transmission means – provides data transmission to an external device 400.

- 5 As can be appreciated, the transmission method may also be modified in any way to transmit the data, without departing from the spirit of the invention.

Figure 3 shows an embodiment of the invention where the data transmission means 40, in the form of a transmission port 41 and data cable 42. The data cable 42 is in
10 communication with an external device 400, shown in Figure 3 as a data processing device. The data processing device is shown in the form of a personal computer 410. The data transmission cable 42 allows the transmission of the data, from the microcontroller 80 to the personal computer 410, for subsequent manipulation, for e.g. calculating the wages for each welder.

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In Figure 3, the data transmission means 40 is in the form of a data cable 42. However, it is envisioned that the data transmission may also be achieved in other forms, for example where data transmission is performed by way of infrared technology, or blue tooth technology. In these two further examples, the data transmission means 40 will be in the
20 form of a transmitter, and a receiver, where the transmitter is integrated or in communication with the machine 100, and the receiver is integrated or in communication with the external device 400.

Further, it is also envisioned, that the external device 400, may be other forms of data
25 processing devices, for example, handheld computer devices, or personal digital assistants, and not necessarily a personal computer 40, as shown in Figure 3.

Data Management

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In the present embodiment, the microcontroller memory 31 will store the current welder's data, the welder's ID, arc time data, date data, or fraud data if there are any. For example, in stick welding, the arc time collected by the microcontroller may be compared, with a known time to complete a particular electrode. Therefore, if the arc time measured

is more than the known time for an electrode of that size and material to last, then the arc time may be identified as fraud data.

5 An example of the method of managing the database 31 to prevent fraud is described in the following paragraph.

10 A backup database is created and stored in the same memory. This backup database holds the data of the welder on the previous and the data of the welder of two days before. Therefore, upon transmission of data through the data transmission means 40 and receipt of the data from the machine's microcontroller memory 31, the external data device 400 will store three separate sets of data. When the next transmission and receipt of transmission is performed, the transmission data set will again include the current data, data of a day before, and data of two days before. At a subsequent transmission on the next day, for example, it may be easily understood that the previous current data becomes the data of a day before tomorrow. In this way, the data may be matched on at least two records. Should there be discrepancies, it can be detected. Therefore, the data stored in the backup database may be verified.

20 Figure 4 shows an embodiment of the machine 100 in use, with the welding loop and external device 400 for use in the present invention.

Figure 5 shows the microcontroller programme, or the method of measuring the arc time, or time when welding is performed, using the features of the invention. Specifically, and as illustrated in Figure 5, the microprocessor 70 continuously monitors the input of the data collecting means 20 for a logic '1' or '0'. Voltages possible are 0V ~ 1.5V for a logic '0', and 3.5V ~ 5V for a logic '1'.

30 When a weld is not being performed, no current passes through the current transformer 11, and no electromotive force is induced. Therefore, the voltage level converter outputs a logic level '0' to the input of the data collecting means. When the logic '0' is detected, the microprocessor will continuously recycle to the start of the program, i.e. to monitor the input of the data collecting means 20.

35 When a weld is being performed, current passes through the current transformer 11 and therefore, an electromotive force is induced. The voltage level converter outputs a logic

level '1'. When the logic '1' is detected at the input of the data collecting means 20, the microprocessor 70 will begin to collect data.

The logic '1' is input to the data collecting means 20 input by the voltage level converter.

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When logic level '1' is detected at the data collecting means 20 input, the microprocessor 70 marks a "Start Time", to begin recording the arc time.

Microprocessor 70 now goes back to monitoring this logic '1' state at the input of the data collecting means 20.

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When this logic '1' changed to logic '0', i.e. a condition when there is no arc current or welding that is being performed, the microprocessor 70 will mark a "Stop Time".

The microprocessor will now calculate the length of time period from the "Start Time" to the "Stop Time" and store this time period as arc time data in the data storage means 30.

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The microprocessor 70 will then go back to start point of the microcontroller program.

Figure 6 shows the machine 100, when arranged in a welding transformer block of 8 machines. The welding block is powered by a power source 600, and the power is distributed through the power distribution board 500.

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In a further embodiment, the machine 100, further includes a data controller means (not shown in figure) to toggle between two function modes - a data collection mode, where data may be collected by the machine 100, or a data communication mode, where data may be communicated to a external device 400.

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In this embodiment, when the machine 100 is turned on, the programme codes in the microcontroller program will instruct the microprocessor 70 to read the input of the data collecting means 20 for the function mode. The status of the logic state will cause the microprocessor 70 to branch either to a data collection mode, where data may be collected by the machine 100, or in data communication mode, where data may be communicated to a external device 400.

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On branching to the data collection mode, the microprocessor 70 will read another input of the data collecting means 20, where if a logic '0' is read, the microprocessor 70 will go back to the starting point of the program and re-execute. And logic '1' at this input, will cause the microprocessor 70 to begin the collecting the arc time data, as will be further elaborated below, with Figure 5.

Alternatives

Data controller means

Alternatively the microprocessor 70 may branch to the data transfer mode where communication with the external device may begin, and ends with a return to the starting point of the microcontroller program.

Data collecting means

Alternatively, the data collecting means 20 may be incorporated into the microcontroller 80. In this alternative embodiment, the microprocessor 70 is programmed to collect the data, i.e, the arc time, and functions as an arc time recorder.

The embodiments have been advanced by way of example only, and modifications are possible within the scope of the invention as defined by the appended claims.

Claims

1. An improved welding machine, including
 - a data detecting means to detect a desired data;
 - 5 a data collecting means for collecting the desired data;
 - a data storage means, capable of storing data collected from the improved welding machine;
 - wherein the improved welding machine further includes a data transmission means, for transferring data from the data storage means to an external device.
- 10 2. An improved welding machine according to claim 1, wherein the data detecting means detects a current passing through the machine.
2. An improved welding machine according to any one of claims 1 or 2, wherein the data
 - 15 detecting means is a current transformer.
3. An improved welding machine according to claim 3, wherein the current transformer further includes a secondary coil.
- 20 4. An improved welding machine according to any one of claims 3 or 4, wherein the current transformer induces an electromotive force when a current flows through the machine.
5. An improved welding machine according to any one of claims 1 to 5, wherein the data
 - 25 detecting means further includes a data converting means, to convert the electromotive force induced into a readable data.
6. An improved welding machine according to claim 6, wherein the data converting means is a voltage level converter.
- 30 7. An improved welding machine according to claim 7, wherein the voltage level converter outputs a logic value of "1" when an electromotive force is detected.

8. An improved welding machine according to any one of claims 1 to 8, wherein the voltage level converter outputs a logic value of "0" when no electromotive force is detected.
- 5 9. An improved welding machine according to any one of the preceding claims, wherein the data collecting means is an arc time counter.
- 10 10. An improved welding machine according to claim 10, wherein the arc time counter is powered by a microprocessor.
11. An improved welding machine according to any one of the preceding claims, wherein the data storage means is a database for storing at least an arc time.
12. An improved welding machine according to any one of the preceding claims, wherein
15 the data transmission means is a transmission port and a data cable.
13. An improved welding machine according to any one of claims 1 to 12, wherein the data transmission means is a transmitter and a receiver.