(54) Title: WELDING RESOURCE TRACKING AND ANALYSIS SYSTEM AND METHOD
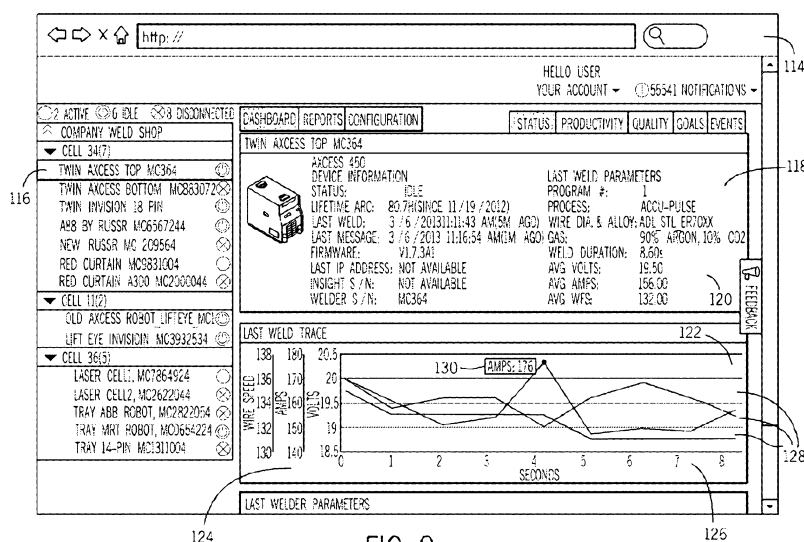
FIG. 9

(57) Abstract: Metal fabrication systems, such as welding systems and related equipment may be monitored and parameters sensed or calculated during metal fabrication operations. The parameter values are stored and transmitted to a web based analysis system. Sampled values of the parameters are used to generate graphical presentations that are used to populate user viewable pages. The pages may be configured by users, and systems and parameters of interest selected.

WELDING RESOURCE TRACKING AND ANALYSIS SYSTEM
AND METHOD

BACKGROUND

[0001]　The invention relates generally to welding systems and support equipment for welding operations. In particular, the invention relates to techniques for monitoring, storing, analyzing, and presenting performance parameters of welding resources.

[0002]　A wide range of welding systems have been developed, along with ancillary and support equipment for various fabrication, repair, and other applications. For example, welding systems are ubiquitous throughout industry for assembling parts, structures and sub-structures, frames, and many components. These systems may be manual, automated or semi-automated. A modern manufacturing and fabrication entity may use a large number of welding systems, and these may be grouped by location, task, job, and so forth. Smaller operations may use welding systems from time to time, but these are often nevertheless critical to their operations. For some entities and individuals, welding systems may be stationary or mobile, such as mounted on carts, trucks, and repair vehicles. In all of these scenarios it is increasingly useful to set performance criteria, monitor performance, analyze performance, and, wherein possible, report performance to the operator and/or to management teams and engineers. Such analysis allows for planning of resources, determinations of prices and profitability, scheduling of resources, enterprise-wide accountability, among many other uses.

[0003]　Systems designed to gather, store, analyze and report welding system performance have not, however, reached a point where they are easily and effectively utilized. In some entities limited tracking of welds, weld quality, and system and operator performance may be available. However, these do not typically allow for any significant degree of analysis, tracking or comparison. Improvements are needed in such tools. More specifically, improvements would be useful that allow for data to be gathered at one or multiple locations and from one or multiple systems, analysis

performed, and reports generated and presented at the same or other locations. Other improvements might include the ability to retrospectively review performance, and to see performance compared to goals and similar systems across groups and entities.

BRIEF DESCRIPTION

[0004]   The present disclosure sets forth systems and methods designed to respond to such needs. In accordance with certain aspects of the disclosure, a metal fabrication resource performance tracking method comprises accessing data representative of a parameter sampled during a metal fabrication operation of a metal fabrication resource via a web-based system remote from the metal fabrication resources. Via at least one computer processor, a graphical trace of the parameter is generated, and a user viewable report page is populated with graphical indicia representative of the trace and transmitting the user viewable report page to a user.

[0005]   Also disclosed is a metal fabrication resource performance tracking system that comprises a web-based communications component that in operation accesses data representative of a parameter sampled during a metal fabrication operation of a metal fabrication resource remote from the communications component. At least one computer processor generates a graphical trace of the accessed parameter, and populates a user viewable report page with graphical indicia representative of the trace. A web based transmission component transits the user viewable report page to a user.

DRAWINGS

[0006]   These and other features, aspects, and advantages of the present invention will become better understood when the following detailed description is read with reference to the accompanying drawings in which like characters represent like parts throughout the drawings, wherein:

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[0007]   FIG. 1 is a diagrammatical representation of exemplary monitoring system for gathering information, storing information, analyzing the information, and presenting analysis results in accordance with aspects of the present disclosure, here applied to a large manufacturing and fabrication entity;

[0008]   FIG. 2 is a diagrammatical view of an application of the system for a single or mobile welding system with which the techniques may be applied;

[0009]   FIG. 3 is a diagrammatical representation of an exemplary cloud-based implementation of the system;

[0010]   FIG. 4 is a diagrammatical view of an exemplary welding system of the type that might be monitored and analyzed in accordance with the techniques;

[0011]   FIG. 5 is a diagrammatical representation of certain functional components of the monitoring and analysis system;

[0012]   FIG. 6 is an exemplary web page view for reporting of a goals and performance of welding systems via the system;

[0013]   FIG. 7 is another exemplary web page view illustrating an interface for setting such goals;

[0014]   FIG. 8 is a further exemplary web page view of a goal setting interface;

[0015]   FIG. 9 is an exemplary web page view of an interface for tracing parameters of a particular weld or system;

[0016]   FIG. 10 is an exemplary web page view listing historical welds that may be analyzed and presented;

[0017]   FIG. 11 is an exemplary web page view of historical traces available via the system;

[0018]   FIG. 12 is an exemplary web page view of a status interface allowing for selection of systems and groups of systems for comparison; and

[0019]   FIG. 13 is an exemplary web page view of a comparison of systems and groups of systems selected via the interface of FIG. 12.

DETAILED DESCRIPTION

[0020]   As illustrated generally in FIG. 1, a monitoring system 10 allows for monitoring and analysis of one or multiple metal fabrication systems and support equipment. In this view, multiple welding systems 12 and 14 may be interacted with, as may be support equipment 16. The welding systems and support equipment may be physically and/or analytically grouped as indicated generally by reference numeral 18. Such grouping may allow for enhanced data gathering, data analysis, comparison, and so forth. As described in greater detail below, even where groupings are not physical (i.e., the systems are not physically located near one another), highly flexible groupings may be formed at any time through use of the present techniques. In the illustrated embodiment, the equipment is further grouped in a department or location as indicated by reference numeral 20. Other departments and locations may be similarly associated as indicated by reference numeral 22. As will be appreciated by those skilled in the art, in sophisticated manufacturing and fabrication entities, different locations, facilities, factories, plants, and so forth may be situated in various parts of the same country, or internationally. The present techniques allow for collection of system data from all such systems regardless of their location. Moreover, the groupings into such departments, locations and other equipment sets are highly flexible, regardless of the actual location of the equipment.

[0021]   In general, as represented in FIG. 1, the system includes a monitoring/analysis system 24 that communicates with the monitoring welding systems and support equipment, and that can collect information from these when desired. A number of different scenarios may be envisaged for accessing and collecting the information. For

example, certain welding systems and support equipment will be provided with sensors, control circuitry, feedback circuits, and so forth that allow for collection of welding parameter data. Some details of such systems are described below. Where system parameters such as arc on time are analyzed, for example, data may be collected in each system reflecting when welding arcs are established and times during which welding arcs are maintained. Currents and voltages will commonly be sensed and data representative of these will be stored. For support equipment, such as grinders, lights, positioners, fixtures, and so forth, different parameters may be monitored, such as currents, switch closures, and so forth.

[0022]   As noted, many systems will be capable of collecting such data and storing the data within the system itself. In other scenarios, local networks, computer systems, servers, shared memory, and so forth will be provided that can centralize at least at some extent the data collected. Such networks and support components are not illustrated in FIG. 1 for clarity. The monitoring/analysis system 24, then, may collect this information directly from the systems or from any support component that themselves collect and store the data. The data will typically be tagged with such identifying information as system designations, system types, time and date, part and weld specification, where applicable, operator and/or shift identifications, and so forth. Many such parameters may be monitored on a regular basis and maintained in the system. The monitoring/analysis system 24 may itself store such information, or may make use of extraneous memory.

[0023]   As described more fully below, the system allows for grouping of the information, analysis of the information, and presentation of the information via one or more operator interfaces 26. In many cases the operator interface may comprise a conventional computer workstation, a handheld device, a tablet computer, or any other suitable interface. It is presently contemplated that a number of different device platforms may be accommodated, and web pages containing useful interfaces, analysis, reports, and the like will be presented in a general purpose interface, such as a browser. It is contemplated that, although different device platforms may use different data

transmission and display standards, the system is generally platform-agnostic, allowing reports and summaries of monitored and analyzed data to be requested and presented on any of a variety of devices, such as desktop workstations, laptop computers, tablet computers, hand-held devices and telephones, and so forth. The system may include verification and authentication features, such as by prompting for user names, passwords, and so forth.

[0024] The system may be designed for a wide range of welding system types, scenarios, applications, and numbers. While FIG. 1 illustrates a scenario that might occur in a large manufacturing or fabrication facility or entity, the system may equally well applied to much smaller applications, and even to individual welders. As shown in FIG. 2, for example, even welders that operate independently and in mobile settings may be accommodated. The application illustrated of FIG. 2 is an engine-driven generator/welder 28 provided in a truck or work vehicle. In these scenarios, it is contemplated that data may be collected by one of several mechanisms. The welder itself may be capable of transmitting the data wirelessly via its own communications circuitry, or may communicate data via a device connected to the welding system, such as communications circuits within the vehicle, a smart phone, a tablet or laptop computers, and so forth. The system could also be tethered to a data collection point when it arrives at a specified location. In the illustration of FIG. 2 a removable memory device 30, such as a flash drive may be provided that can collect the information from the system and move the information into a monitoring/analysis system 32. In smaller applications of this type, the system may be particularly designed for reduced data sets, and analysis that would be more useful to the welding operators and entities involved. It should be apparent to those skilled in the art, then, that the system can be scaled and adapted to any one of a wide range of use cases.

[0025] FIG. 3 illustrates an exemplary implementation, for example, which is cloud-based. This implementation is presently contemplated for many scenarios in which data collection, storage, and analysis are performed remotely, such as on a subscription or paid

service basis. Here the monitored welding system and support equipment 34 communicate directly and indirectly with one or more cloud data storage and services entities 36. The entities may take any desired form, and significant enhancements in such services are occurring and will continue to occur in coming years. It is contemplated, for example, that a third party provider may contract with a fabricating or manufacturing entity to collect information from the systems, store the information off-site, and perform processing on the information that allows for the analysis and reporting described below. The operator interfaces 26 may be similar to those discussed above, but would typically be addressed to ("hit") a website for the cloud-based service. Following authentication, then, web pages may be served that allow for the desired monitoring, analysis and presentation. The cloud-based services would therefore include components such as communications devices, memory devices, servers, data processing and analysis hardware and software, and so forth.

[0026] As noted above, many different types and configurations of welding systems may be accommodated by the present techniques. Those skilled in the welding arts will readily appreciate that certain such systems have become standards throughout industry. These include, for example, systems commonly referred to as gas metal arc welding (GMAW), gas tungsten gas arc welding (GTAW), shielded metal arc welding (SMAW), submerged arc welding (SAW), laser, and stud welding systems to mention only a few. All such systems rely on application of energy to workpieces and electrodes to at least partially melt and fuse metals. The systems may be used with or without filler metal, but most systems common in industry do use some form of filler metal which is either machine or hand fed. Moreover, certain systems may be used with other materials than metals, and these systems, too, are intended to be serviced where appropriate by the present techniques.

[0027] By way of example only, FIG. 4 illustrates an exemplary welding system 12, in this case a MIG welding system. The system includes a power supply that receives incoming power, such as from a generator or the power grid and converts the incoming

power to weld power. Power conversion circuitry 38 allows for such conversion, and will typically include power electronic devices that are controlled to provide altering current (AC), direct current, pulsed or other waveforms as defined by welding processes and procedures. The power conversion circuitry will typically be controlled by control and processing circuitry 40. Such circuitry will be supported by memory (not separately shown) that stores welding process definitions, operator-set parameters, and so forth. In a typical system, such parameters may be set via an operator interface 42. The systems will include some type of data or network interface as indicated at reference numeral 44. In many such systems this circuitry will be included in the power supply, although it could be located in a separate device. The system allows for performing welding operations, collecting both control and actual data (e.g., feedback of voltages, currents, wire feed speeds, etc.). Where desired, certain of this data may be stored in a removable memory 46. In many systems, however, the information will be stored in the same memory devices that support the control and processing circuitry 40.

[0028]   In the case of a MIG system, a separate wire feeder 48 may be provided. The components of the wire feeder are illustrated here in dashed lines because some systems may optionally use wire feeders. The illustrated system, again, intended only to be exemplary. Such wire feeders, where utilized typically include a spool of welding wire electrode wire 50 and a drive mechanism 52 that contacts and drives the wire under the control of a drive control circuitry 54. The drive control circuitry may be set to provide a desired wire feed speed in a conventional manner. In a typical MIG system a gas valve 56 will allow for control of the flow of the shield and gas. Setting on the wire feeder may be made via an operator interface 58. The welding wire, gas, and power is provided by a weld cable as indicated diagrammatically at reference numeral 60, and a return cable (sometimes referred to as a ground cable) 62. The return cable is commonly coupled to a workpiece via a clamp and the power, wire, and gas supplied via the weld cable to a welding torch 64.

[0029] Here again, it should be noted that the system of FIG. 4 is exemplary only, the present techniques allow for monitoring and analysis of performance of these types of cutting, heating, and welding systems, as well as others. Indeed, the same monitoring analysis system may collect data from different types, makes, sizes, and versions of metal fabrication systems. The data collected and analyzed may relate to different processes and weld procedures on the same or different systems. Moreover, as discussed above, data may be collected from support equipment used in, around or with the metal fabrication systems.

[0030] FIG. 5 illustrates certain functional components that may typically be found in the monitoring/analysis system. In the notation used in FIG. 5, these components will be located in a cloud-based service entity, although similar components may be included in any one of the implementations of the system. The components may include, for example, data collection components 68 that receive data from systems and entities. The data collection components may "pull" the data by prompting data exchange with the systems, or may work on a "push" basis where data is provided to the data collection components by the systems without prompting (e.g., at the initiation of the welding system, network device, or management system to which the equipment is connected). The data collection may occur at any desired frequency, or at points in time that are not cyclic. For example, data may be collected on an occasional basis as welding operations are performed, or data may be provided periodically, such as on a shift basis, a daily basis, a weekly basis, or simple as desired by a welding operator or facilities management team. The systems will also include memory 70 that store raw and/or processed data collected from the systems. Analysis/reporting components 72 allow for processing of the raw data, and associating the resulting analysis with systems, entities, groups, welding operators, and so forth. Examples of the analysis and reporting component operations are provided in greater detail below. Finally, communications components 74 allow for populating reports and interface pages with the results of the analysis. A wide range of such pages may be provided as indicated by reference numeral 76 in FIG. 5, some of

which are described in detail below. The communications components 74 may thus include various servers, modems, Internet interfaces, web page definitions, and the like.

[0031]   As noted above, the present techniques allow for a wide range of data to be collected from welding systems and support equipment for setup, configuration, storage, analysis, tracking, monitoring, comparison and so forth. In the presently contemplated embodiments this information is summarized in a series of interface pages that may be configured as web pages that can be provided to and viewed on a general purpose browser. In practice, however, any suitable interface may be used. The use of general purpose browsers and similar interfaces, however, allows for the data to be served to any range of device platforms and different types of devices, including stationary workstations, enterprise systems, but also mobile and handheld devices as mentioned above. FIGS. 6-13 illustrate exemplary interface pages that may be provided for a range of uses.

[0032]   Referring first to FIG. 6, a goal report page 78 is illustrated. This page allows for the display of one or more welding system and support equipment designations as well as performance analysis based upon goals set for the systems. In the page illustrated in FIG. 6, a number of welding systems and support equipment are identified as indicated at reference numeral 80. These may be associated in groups as indicated by reference numeral 82. In practice, the data underlying all of the analyses discussed in the present disclosure are associated with individual systems. These may be freely associated with one another, then, by the interface tools. In the illustrated example, a location or department 84 has been created with several groups designated within the location. Each of these groups, then, may include one or more welding systems and any other equipment as shown in the figure. The present embodiment allows for free association of these systems so that useful analysis of individual systems, groups of systems, locations, and so forth may be performed. The systems and support equipment may be in a single physical proximity, but this need not be the case. Groups may be created for example, based on system type, work schedules, production and products, and so forth. In systems where

operators provide personal identification information, this information may be tracked in addition to or instead of system information.

[0033]   In the illustrated embodiment status indicators are illustrated for conveying the current operational status of the monitored systems and equipment. These indicators, as designated by reference numeral 86, may indicate, for example, active systems, idle systems, disconnected systems, errors, notifications, and so forth. Where system status can be monitored on a real-time or near real-time basis, such indicators may provide useful feedback to management personnel on the current status of the equipment. The particular information illustrated in FIG. 6 is obtained, in the present implementation, by selecting (e.g., clicking on) a goals tab 88. The information presented may be associated in useful time slots or durations, such as successive weeks of use as indicated by reference numeral 90. Any suitable time period may utilized, such as hourly, daily, weekly, monthly, shift-based designations, and so forth.

[0034]   The page 78 also presents the results of analysis of each of a range of performance criteria based upon goals set for the system or systems selected. In the illustrated example a welding system has been selected as indicated by the check mark in the equipment tree on the left, and performance on the basis of several criteria is presented in bar chart form. In this example, a number of monitored criteria are indicated, such as arc on time, deposition, arc starts, spatter, and grinding time. A goal has been set for the particular system as discussed below, and the performance of the system as compared to this goal is indicated by the bars for each monitored parameter. It should be noted that certain of the parameters may be positive in convention while others may be negative. That is, by way of example, for arc on times, representing the portion of the working time in which a welding arc is established and maintained, a percentage of goal exceeding the set standard may be beneficial or desirable. For other parameters, such as spatter, exceeding a goal may actually be detrimental to work quality. As discussed below, the present implementation allows for designation of whether the analysis and presentation may consider these conventionally positive or conventionally

negative. The resulting presentations 94 allow for readily visualizing the actual performance as compared to the pre-established goals.

[0035] FIG. 7 illustrates an exemplary goal editing page 96. Certain fields may be provided that allow for setting of standard or commonly used goals, or specific goals for specific purposes. For example, a name of the goal may be designated in a field 98. The other information pertaining to this name may be stored for use in analyzing the same or different systems. As indicated by reference numeral 100, the illustrated page allows for setting a standard for the goal, such as arc on time. Other standards and parameters may be specified so long as data may be collected that either directly or indirectly indicates the desired standard (i.e., allows for establishment of a value for comparison and presentation). A convention for the goal may be set as indicated at reference numeral 102. That is, as discussed above, certain goals it may be desired or beneficial that the established goal define a maximum value targeted, while other goals may establish a minimum value targeted. A target 104 may then be established, such as on a numerical percentage basis, an objective (e.g., unit) basis, relative basis, or any other useful basis. Further fields, such as a shift field 106 may be provided. Still further, in some implementations it may be useful to begin goal or standard setting with an exemplary weld known to have been done and possess characteristics that are acceptable. Goals may then be set with this as a standard, or with one or more parameters set based on this weld (e.g., +/- 20%).

[0036] FIG. 8 illustrates a goal setting page 108 that may take established goals set by pages such as that illustrated in FIG. 7 and apply them to specific equipment. In the page 108 of FIG. 8, a welding system designated "bottom welder" has been selected as indicated by the check mark to the left. The system identification 110 appears in the page. A menu of goals or standards is then displayed as indicated by reference numeral 112. In this example, selections include placing no goal on the equipment, inheriting certain goals set for a particular location (or other logical grouping), selecting a pre-

defined goal (such as a goal established by a page such as thus shown in FIG. 7), and establishing a custom goal for the equipment.

[0037]   The present techniques also allow for storing and analyzing certain performance parameters of systems in tracking or trace views. These views can be extremely informative in terms of specific welds, performance over certain periods of time, performance by particular operators, performance on particular jobs or parts, and so forth. An exemplary weld trace page 114 is illustrated in FIG. 9. As indicated on this page, a range of equipment may be selected as indicated on the left of the page, with one particular system being currently selected as indicated by reference numeral 116. Once selected, in this implementation a range of data relating to this particular system is displayed as indicated by reference numeral 118. This information may be drawn from the system or from archived data for the system, such as within an organization, within a cloud resource, and so forth. Certain statistical data may be aggregated and displayed as indicated at reference numeral 120.

[0038]   The weld trace page also includes a graphical presentation of traces of certain monitor parameters that may be of particular interest. The weld trace section 122, in this example, shows several parameters 124 graphed as a function of time along a horizontal access 126. In this particular example, the parameters include wire feed speed, current, and volts. The weld for which the cases are illustrated in the example had duration of approximately 8 seconds. During this time the monitored parameters changed, and data reflective of these parameters was sampled and stored. The individual traces 128 for each parameter are then generated and presented to the user. Further, in this example by a "mouse over" or other input the system may display the particular value for one or more parameters at a specific point in time as indicated by reference numeral 130.

[0039]   The trace pages may be populated, as may any of the pages discussed in the present disclosure, in advance or upon demand by a user. This being the case, the trace pages for any number of systems, and specific welds may be stored for later analysis and presentation. A history page 132 may thus be compiled, such as illustrated in FIG. 10. In

the history page illustrated, a list of welds performed on a selected system 116 (or combination of selected systems) is presented as indicated by reference numeral 134. These welds may be identified by times, system, duration, weld parameters, and so forth. Moreover, such lists may be compiled for specific operators, specific products and articles of manufacture, and so forth. In the illustrated embodiment, a particular weld has been selected by the user as indicated at reference numeral 136.

[0040] FIG. 11 illustrates an historical trace page 138 that may be displayed following selection of the particular weld 136. In this view, an identification of the system, along with the time and date, are provided as indicated by reference numeral 140. Here again, monitored parameters are identified as indicated by reference numeral 124, and a time axis 126 is provided along which traces 128 are displayed. As will be appreciated by those skilled in the art, the ability to store and compile such analyses may be significantly useful in evaluating system performance, operator performance, performance on particular parts, performance of departments and facilities, and so forth.

[0041] Still further, the present techniques allow for comparisons between equipment on a wide range of bases. Indeed, systems may be compared, and presentations resulting from the comparison may be provided any suitable parameter that may form the basis for such comparisons. An exemplary comparison selection page 142 is illustrated in FIG. 12. As shown in this page, multiple systems 80 are again grouped into groups 82 for a facilities or locations 84. Status indicators 86 may be provided for the individual systems or groups. The status page illustrated in FIG. 12 may then serve as the basis for selecting systems for comparison as illustrated in FIG. 13. Here, the same systems and groups are available for selection and comparison. The comparison page 144 displays these systems and allows users to click or select individual systems, groups, or any sub-group that is created at will. That is, while an entire group of systems may be selected, the user may select individual systems or individual groups as indicated by reference numeral 146. A comparison section 148 is provided in which a time base for a comparison may be selected, such as on an hourly, daily, weekly, monthly, or any other range. Once

selected, then, desired parameters are compared for the individual systems, with the systems being identified as indicated at reference numeral 152, and the comparisons being made and in this case graphically displayed as indicated by reference numeral 154. In the illustrated example, for example, system on time has been selected as a basis for the comparison. Data for each individual system reflective of the respective on time of the system has been analyzed and presented in a percentage basis by a horizontal bar. Other comparisons may be made directly between the systems, such as to indicate that one system has outperformed another on the basis of the selected parameter. More than one parameter could be selected in certain embodiments, and these may be based on raw, processed or calculated values.

[0042]   While only certain features of the invention have been illustrated and described herein, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.

CLAIMS:

1.   A metal fabrication resource performance tracking method, comprising:

accessing data representative of a parameter sampled during a metal fabrication operation of a metal fabrication resource via a web-based system remote from the metal fabrication resources;

via at least one computer processor, generating a graphical trace of the parameter;

via the at least one computer processor, populating a user viewable report page with graphical indicia representative of the trace; and

transmitting the user viewable report page to a user.

2.   The method of claim 1, comprising accessing data for a plurality of parameters sampled during the metal fabrication operation, and generating graphical traces for each of the multiple parameters, wherein the user viewable report page comprises graphical indicia representative of each of the multiple parameters over a time duration of the metal fabrication operation.

3.   The method of claim 2, wherein the multiple parameters comprise at least two parameters selected from the group consisting of voltage, current, and wire feed speed.

4.   The method of claim 1, wherein the user viewable report page includes indicia identifying a plurality of metal fabrication resources, and wherein the steps are performed for a metal fabrication resource selected by the user via the identifying indicia.

5.   The method of claim 1, wherein the data is stored in a cloud resource.

6.   The method of claim 1, wherein the graphical trace is generated and the user viewable report page is populated in a cloud resource.

7.   The method of claim 1, wherein the user viewable report page comprises a web page viewable in a browser.

8.   The method of claim 1, wherein the data is stored for multiple metal fabrication operations, and wherein at least one user viewable page transmitted to the user is configured to receive a user selection of a particular metal fabrication operation for the user viewable report page.

9.   The method of claim 1, wherein the data is stored for multiple metal fabrication resources, and wherein at least one user viewable page transmitted to the user is configured to receive a user selection of a particular metal fabrication resource for the user viewable report page.

10.   The method of claim 1, wherein the user viewable report page comprises indicia identifying the metal fabrication resource, and the metal fabrication operation.

11.   A metal fabrication resource performance tracking system, comprising:

a web-based communications component that in operation accesses data representative of a parameter sampled during a metal fabrication operation of a metal fabrication resource remote from the communications component;

at least one computer processor that in operation generates a graphical trace of the accessed parameter, and populates a user viewable report page with graphical indicia representative of the trace; and

a web based transmission component that in operation transits the user viewable report page to a user.

12.   The system of claim 11, wherein the communications component accesses data representative of a plurality of parameters sampled during the metal fabrication operation, and wherein the at least one computer processor generate a trace of each of the

plurality of parameters, and populates the user viewable report page with graphical indicia representative of each of the traces.

13.   The system of claim 11, wherein the parameter comprises at least one of voltage, current, and wire feed speed.

14.   The system of claim 11, wherein the user viewable report page includes indicia identifying a plurality of metal fabrication resources, and wherein the trace is generated and the report populated for a metal fabrication resource selected by the user via the identifying indicia.

15.   The system of claim 11, wherein the data is accessed from a cloud-based data storage system.

16.   The system of claim 11, wherein the at least one computer processor comprises a cloud-based system.

17.   A metal fabrication resource performance monitoring interface, comprising:

        at least one user viewable report page defined by computer executed code transmitted to a user viewing device via a web based component, the report page comprising user viewable indicia identifying at least one metal fabrication resource, a time period of interest, and at least one graphical trace of a sampled parameter of a metal fabrication operation performed on a metal fabrication resource of interest against time during the metal fabrication operation.

18.   The interface of claim 17, wherein the code is executable by a processor for viewing in a general purpose browser.

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19.   The interface of claim 17, wherein the user viewable report page is configured to receive user selections of any one of a plurality of metal fabrication resources for generation of the trace.

20.   The interface of claim 17, comprising at least one user viewable page configured to permit a user to select a historical metal fabrication operation from a plurality of metal fabrication operations performed, and wherein the user viewable report is generated and transmitted for a selected one of the historical metal fabrication operation.
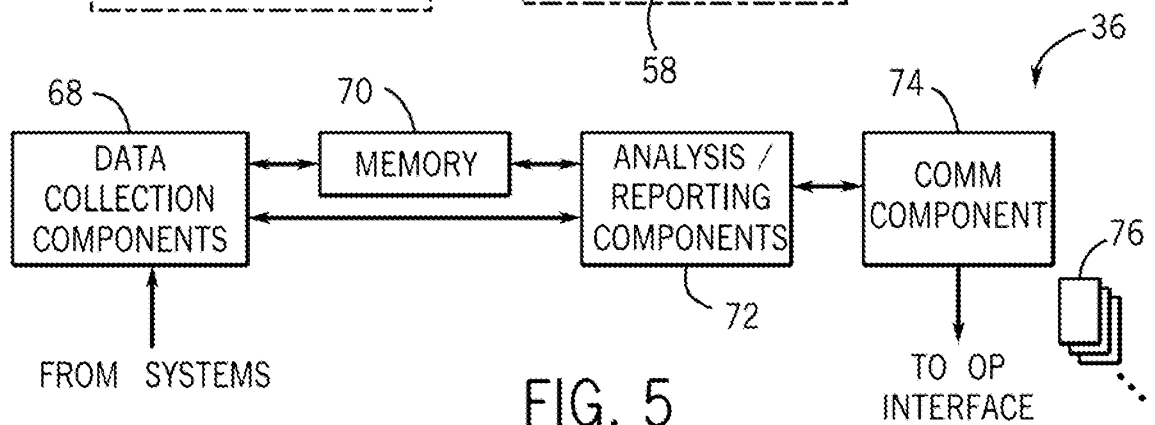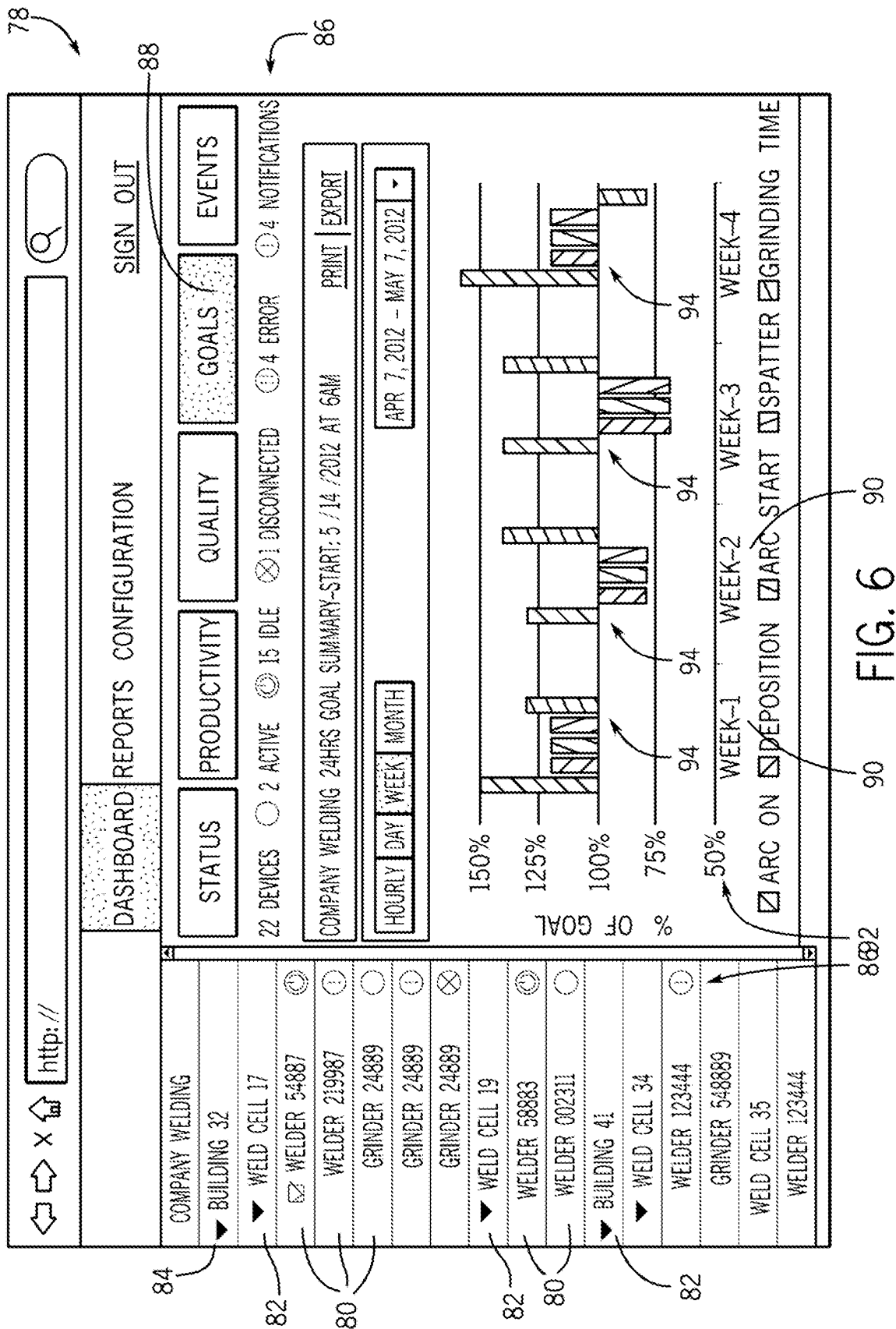
1 / 10

FIG. 1

FIG. 2

2 / 10

MONITORED
WELDING SYSTEMS
& SUPPORT
EQUIPMENT
34

CLOUD
DATA STORAGE
& SERVICES
36

FIG. 3

OPERATOR
INTERFACE
26

12

REMOVABLE
MEMORY
46

DATA / NET
INTERFACE
44

POWER
CONVERSION
CIRCUITRY
38

CONT / PROC
CIRCUITRY
40

OPERATOR
INTERFACE
42

48

50   52

60   64

54

DRIVE
CONTROL

62

56

GAS VALVE

FIG. 4

OPERATOR
INTERFACE
58

36

DATA
COLLECTION
COMPONENTS
68

MEMORY
70

ANALYSIS /
REPORTING
COMPONENTS
72

COMM
COMPONENT
74

76

FROM SYSTEMS

TO OP
INTERFACE

FIG. 5

3 / 10

COMPANY WELDING

▼ BUILDING 32

　▶ WELD CELL 17

　　☑ WELDER 54887　　⊙

　　WELDER 219987　　①

　　GRINDER 24889　　○

　　GRINDER 24889　　①

　　GRINDER 24889　　⊗

　▶ WELD CELL 19

　　WELDER 58883　　⊙

　　WELDER 002311　　○

▼ BUILDING 41

　▶ WELD CELL 34

　　WELDER 123444　　⊙

　　GRINDER 548889

　　WELD CELL 35

　　WELDER 123444

DASHBOARD | REPORTS CONFIGURATION　　　　SIGN OUT

STATUS | PRODUCTIVITY | QUALITY | GOALS | EVENTS

22 DEVICES ○ 2 ACTIVE ◎ 15 IDLE ⊗ 1 DISCONNECTED ◎ 4 ERROR ⊙ 4 NOTIFICATIONS

COMPANY WELDING 24HRS GOAL SUMMARY-START: 5/14/2012 AT 6AM　　PRINT | EXPORT

HOURLY | DAY | WEEK | MONTH　　　　　　　　APR 7, 2012 – MAY 7, 2012 ▸

150%

125%

100%

75%

50%

% OF GOAL

WEEK-1　　WEEK-2　　WEEK-3　　WEEK-4
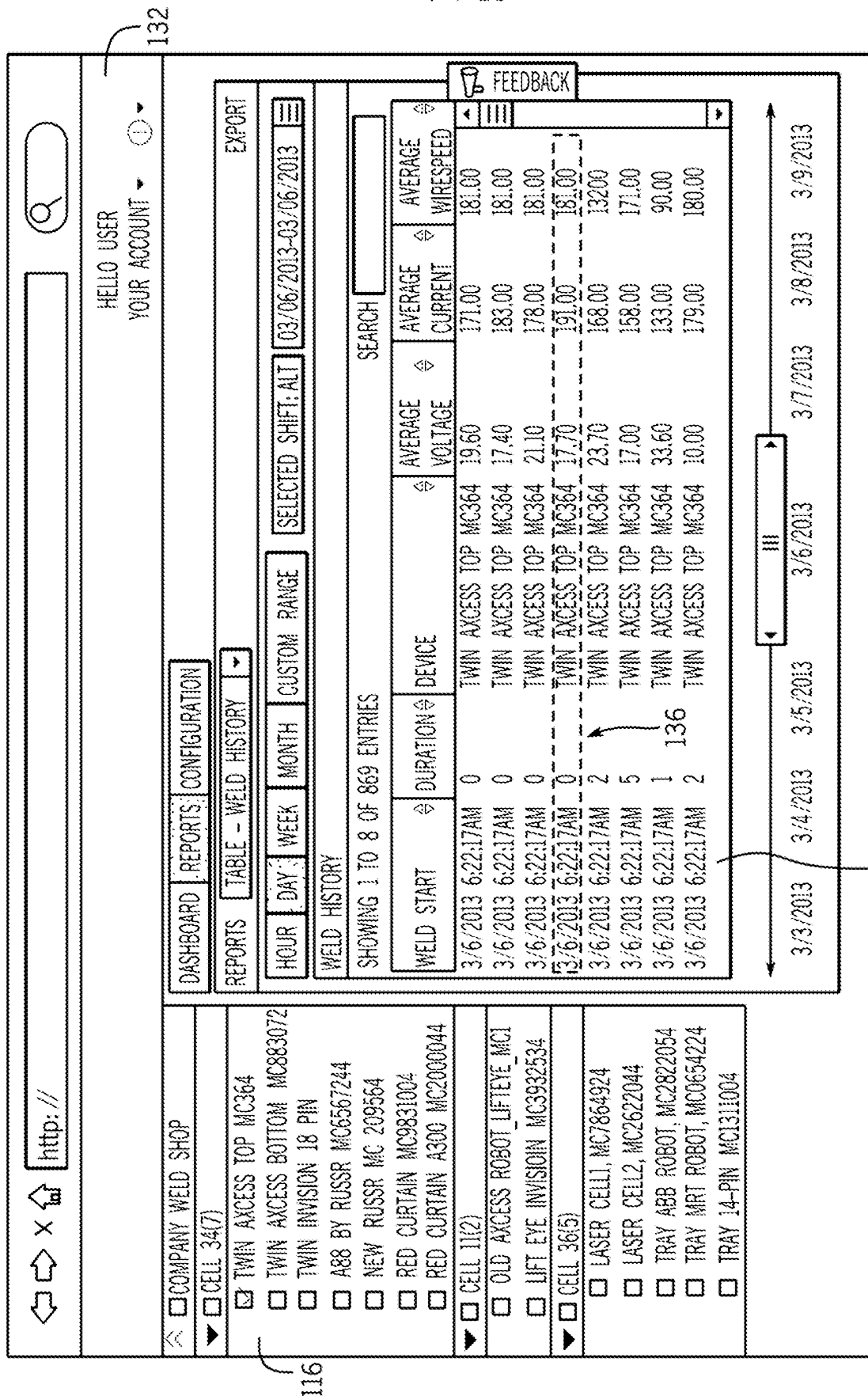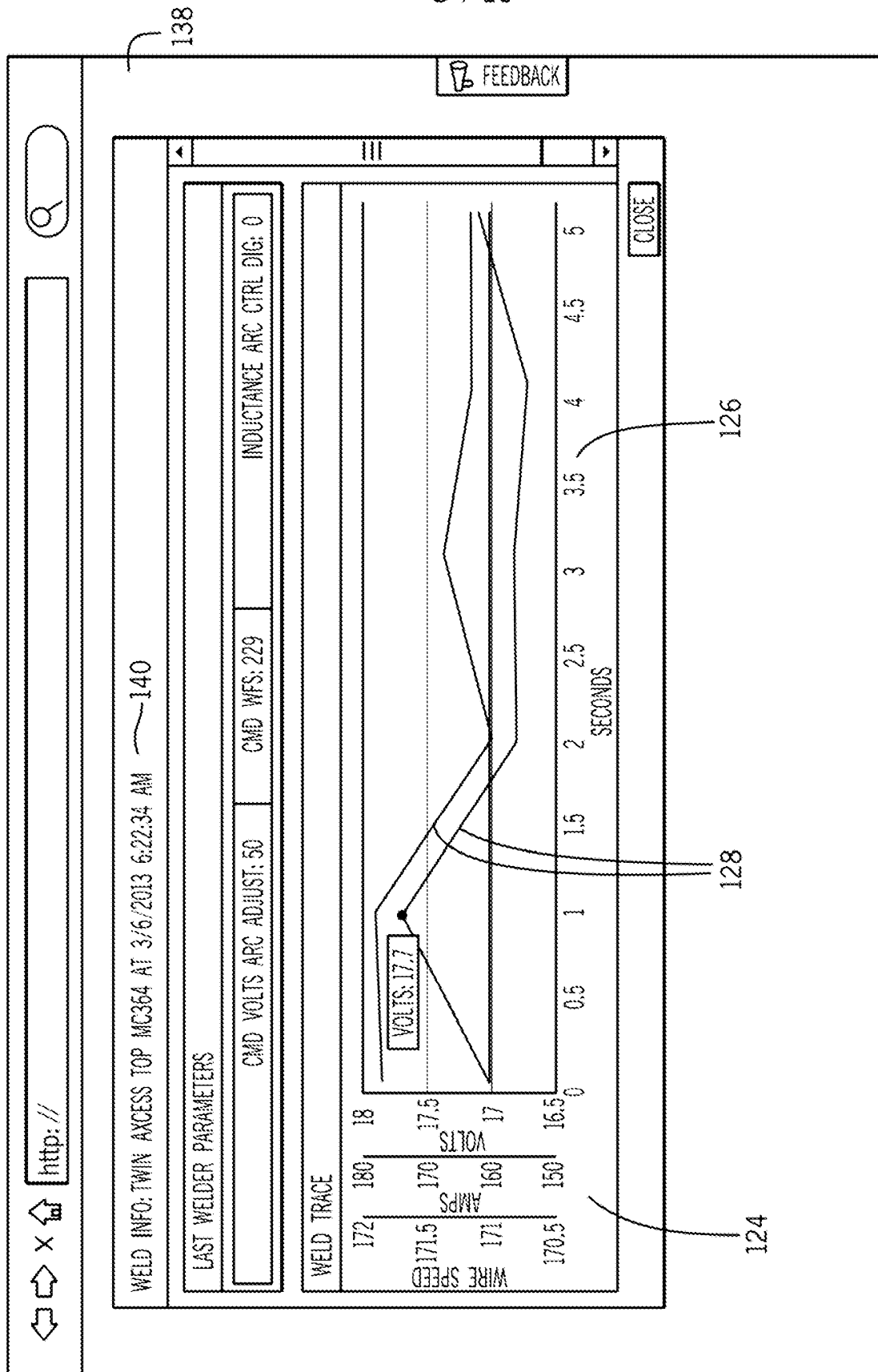
☑ ARC ON ☑ DEPOSITION ☑ ARC START ☑ SPATTER ☑ GRINDING TIME

FIG. 6

FIG. 7

FIG. 8

FIG. 9

FIG. 10

FIG. 11

FIG. 12

FIG. 13