

FLUX CIRCULATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a flux circulator that collects and reuses flux.

2. Description of the Related Art

In submerged arc welding, a flux circulator is generally used. The flux circulator supplies flux in a powdery or granular form to a welding position so as to remove oxides and the like from base metal and filler metal and protect an arc-weld portion from the external environment. The flux circulator collects the used flux that remains after welding for reuse.

For example, Fig. 6 illustrates a flux circulator 100 described in Japanese Patent No. 3260259. In the flux circulator 100, first, flux F that has been used in submerged arc welding is sucked in by a suction force applied by a blower 200 through a suction pipe 111 from a joint portion that has been welded. The flow velocity of the flux F that has been sucked in is reduced when the flux F hits an impact plate 120 disposed in a first hopper 101, and then the flux F falls by gravity and is stored in the first hopper 101. The flux F is supplied to a joint portion that has not yet been welded through a supply pipe 140 and

is reused.

However, the flux circulator according to the related art has the following problem.

The flux that has been used in submerged arc welding is often mixed with solid bodies called slag. The slag is generated when the flux is melted and solidified. When the used flux is sucked in through the suction pipe, the slag is sucked in together with the flux. Since the slag appears in various shapes, when the slag is sucked in, there is a risk that the supply pipe will be clogged if the supply pipe is used for a long time. Even when the slag generated after welding is supplied to a weld portion in a subsequent welding process, the slag cannot play a role as the flux.

SUMMARY OF THE INVENTION

The present invention has been made in view of the above-described problem, and an object of the present invention is to provide a flux circulator capable of removing slag mixed with flux when the used flux is recycled.

To achieve the above-described object, according to the present invention, a flux circulator for use in submerged arc one-side automatic welding equipment includes a first hopper that contains flux; a second hopper that contains dust, the second hopper being connected in parallel with the first hopper such that the first hopper and the second

hopper communicate with each other through a common opening; a suction system provided on the first hopper and including a suction pipe having a suction port through which used flux is sucked in; a supply pipe connected to a bottom portion of the first hopper, the flux contained in the first hopper being supplied to a weld portion through the supply pipe; an exhaust system provided on the second hopper and including an exhaust pipe and a blower, the exhaust system sucking in air through the opening and exhausting the air to the outside; a filter disposed in the second hopper, the filter allowing the air to pass therethrough while capturing the dust; an impact plate disposed in the first hopper at a position where the impact plate faces an outlet of the suction pipe, the impact plate being connected to and hanging from a section around the ceiling of the first hopper; and a sieve disposed near a lower portion of the impact plate. The air sucked in through the suction port is caused to pass through the sieve and the filter and is exhausted by the exhaust system, so that the used flux is collected in the first hopper for reuse.

With this structure, the air in the second hopper and the first hopper is sucked by the blower, so that the air passes through the filter and is exhausted to the outside through the exhaust pipe. As the air is exhausted, the outside air and the used flux flow into the first hopper

through the suction pipe. Then, the air that has flowed into the first hopper from the outside flows into the second hopper through the communication opening, and the dust contained in the air is captured by the filter. The flux hits the impact plate disposed in the first hopper so that the flow velocity thereof is reduced, and then the flux falls by gravity into the sieve. The flux is sieved by the sieve, so that the slag mixed with the flux remains in the sieve and the flux from which the slag has been removed falls by gravity and is collected in the first hopper. Then, the flux that has been collected is re-supplied to the welding position through the supply pipe in the welding operation.

Thus, the slag mixed in the flux can be removed when the used flux is recycled. Therefore, the supply pipe through which the flux is supplied can be prevented from being clogged with the slag. In addition, in the welding operation, the slag generated in the previous welding operation can be prevented from being supplied to the weld portion. Therefore, effects of the flux can be easily exerted.

In the flux circulator of the present invention, an adjustable air damper may be provided on an outer surface of the first hopper or an outer surface of the second hopper.

With this structure, since the adjustable air damper is

provided, the suction force applied to the flux can be adjusted.

In the flux circulator of the present invention, a first atmosphere blocking valve capable of being air-tightly closed may be provided in the suction pipe included in the suction system, and a second atmosphere blocking valve capable of being air-tightly closed may be provided in the exhaust pipe included in the exhaust system.

With this structure, since the suction pipe and the exhaust pipe are provided with the respective atmosphere blocking valves, when the operation is stopped, the atmosphere blocking valves can be closed so as to prevent the air containing moisture from entering the first hopper and the second hopper through the suction system and the exhaust system.

In the flux circulator of the present invention, a third atmosphere blocking valve capable of being air-tightly closed may be provided between the adjustable air damper and the first hopper or between the adjustable air damper and the second hopper.

With this structure, since the third atmosphere blocking valve is provided, when the operation is stopped, the third atmosphere blocking valve can be closed so as to prevent the air containing moisture from entering the first hopper or the second hopper through the adjustable air

damper.

According to the flux circulator of the present invention, a heater may be provided on an outer surface of the first hopper.

With this structure, since the heater is provided on the outer surface of the first hopper, the first hopper can be heated by the heater when the temperature of the outside air is low. As a result, condensation on the inner wall surface of the first hopper can be prevented. Thus, the flux can be prevented from absorbing moisture, and welding failures due to moisture absorbed in the flux can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic diagram illustrating the structure of a flux circulator according to the present invention;

Fig. 2 is a schematic diagram illustrating the manner in which flux is sieved by a sieve included in the flux circulator according to the present invention;

Fig. 3 is a schematic diagram illustrating the structure of a flux circulator according to another embodiment of the present invention;

Fig. 4 is a table showing the relationship between the state of an adjustable air damper and a suction force;

Fig. 5 is a schematic diagram illustrating the structure of a flux circulator according to another embodiment of the present invention; and

Fig. 6 is a schematic diagram illustrating the structure of a flux circulator according to the related art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Flux circulators according to embodiments of the present invention will now be described with reference to the accompanying drawings. The sizes and positional relationships between the components illustrated in the drawings may be exaggerated to clarify the explanation. In the following description, the same or similar components are referred to by the same names and denoted by the same reference numerals, and explanations thereof are thus omitted.

Flux Circulator

A flux circulator according to the present invention is included in submerged arc one-side automatic welding equipment that performs one-side automatic welding along a welding line on a temporarily secured steel member that is to be welded.

Referring to Fig. 1, a flux circulator 1 includes a first hopper 10, a second hopper 20, and filters 30. The

first hopper 10 is provided with a suction system A that includes a suction pipe 11 having a suction port 11a. The second hopper 20 is provided with an exhaust system E that includes an exhaust pipe 21 and a blower 22. The air is exhausted from the filters 30 through the exhaust system E, so that the used flux F can be collected in the first hopper 10 for reuse. An impact plate 12 and a sieve 13 are disposed in the first hopper 10, and a supply pipe 14 is connected to the bottom portion of the first hopper 10. A dust discharge pipe 23 is connected to the bottom portion of the second hopper 20.

The structure of each component will now be described.

First Hopper

The first hopper 10 contains the flux F. The flux F is in a powdery or granular form, and is supplied to a welding position so as to remove oxides and the like from base metal and filler metal and protect an arc-weld portion from the external environment in submerged arc welding. The flux F contained in the first hopper 10 includes not only the used flux F but also newly supplied flux F that has not yet been used. The first hopper 10 is connected in parallel with the second hopper 20 such that the first hopper 10 and the second hopper 20 communicate with each other through a common opening, which is a communication opening 15 formed

in a common side wall. The suction pipe 11 has an introduction port 11b that opens into the first hopper 10 at an upper section of a side wall of the first hopper 10 that faces the communication opening 15. The shape of the first hopper 10 is not particularly limited, and may be any shape as long as the flux F contained therein can be supplied to the supply pipe 14.

The suction system A including the suction pipe 11 is connected to the first hopper 10.

Suction System

The suction system A includes the suction pipe 11 having the suction port 11a through which the used flux F is sucked in. The suction pipe 11 introduces the air and the flux F that have been sucked in to the first hopper 10. The suction port 11a is provided at an end of the suction pipe 11 and is positioned behind the welding point so that the flux F can be sucked in and collected together with the air.

The impact plate 12 is disposed in the first hopper 10 so as to face the outlet of the suction pipe 11 in the suction system A.

Impact Plate

The impact plate 12 is disposed at a position where the impact plate 12 faces the introduction port 11b, which is

the outlet of the suction pipe 11, and is connected at one end thereof to a section around the ceiling of the first hopper 10 so as to vertically hang from the section around ceiling. The flux F that flows into the first hopper 10 through the introduction port 11b hits the impact plate 12, so that the flow velocity of the flux F is reduced. Accordingly, the flux F falls by gravity into the sieve 13, which is disposed near the lower portion of the impact plate 12.

The structure in which the impact plate 12 is connected to the section around the ceiling includes the structure in which the impact plate 12 is connected to the ceiling and the structure in which the impact plate 12 is connected to, for example, an additional member that is attached to the ceiling when such a member is provided. The impact plate 12 may be provided at a position where the flux F that has flowed into the first hopper 10 through the introduction port 11b can hit the impact plate 12 and the flow velocity of the flux F can be reduced.

Sieve

Referring to Figs. 1 and 2, the sieve 13 removes slag S from the flux F collected through the suction system A, and is disposed near the lower portion of the impact plate 12.

The position near the lower portion of the impact plate

12 is a position where the flux F that hits the impact plate 12 and falls by gravity can be received by the sieve 13. This position is, for example, below the impact plate 12 at the front side (at the introduction-port-11b side). However, the position of the sieve 13 is not particularly limited as long as the sieve 13 can receive the flux F that hits the impact plate 12 and falls by gravity, and may be appropriately adjusted in accordance with the shape, size, etc., of the sieve 13. The shape and size of the sieve 13 are also not particularly limited, and may be appropriately adjusted in accordance with the size and shape of the first hopper 10. With regard to the size of the sieve 13, the width thereof may be 150 to 300 mm, the length thereof may be 300 to 700 mm, and the height thereof may be 50 to 200 mm. There is preferably no gap between the wall surface of the first hopper 10 and the sieve 13. Thus, the slag S is prevented from passing through the gap and mixing with the flux F in the first hopper 10.

With regard to the material of the sieve 13, the main body may be made of a steel plate and a sieving portion may be made of stainless steel. .

The sieve 13 preferably includes a mesh M having mesh openings with a size of 2.8 to 9.0 mm (in other words, the dimension of each side of each square opening formed in the mesh is 2.8 to 9.0 mm). When the mesh M has the above-

mentioned size, the slag S can be prevented from passing through the mesh M and the flux F can easily pass through the mesh M and fall.

The sieving portion of the sieve 13 may be vibrated by air or electricity. In such a case, the vibration may be either continuous or intermittent. The direction of vibration is preferably horizontal or a combination of horizontal and vertical directions. The period of vibration is preferably short enough to allow the slag S to move along the mesh. The amplitude of vibration is preferably as large as possible within a limit based on the dimensions of the apparatus.

The sieve 13 is detachable from the first hopper 10, so that the slag S that has accumulated in the sieve 13 can be removed by detaching the sieve 13 from the first hopper 10. An opening (not shown) that can be opened or closed is formed in a side surface of the first hopper 10, and an operator can grab a handle on the sieve 13 and pull out the sieve 13 while the opening is opened. The pressure in the first hopper 10 is set to a negative pressure while the flux circulator 1 is in operation. Therefore, a gasket is provided along the periphery of a lid that covers the opening, so that the first hopper 10 can be sealed when the opening is closed. The sieve 13 may include two parts that can be separated from each other so that the sieve 13 can be

easily detached.

The sieve 13 may be configured to inform the operator when the amount of the slag S accumulated therein reaches a predetermined amount. As a method for detecting that the amount of the accumulated slag S has reached the predetermined amount, the following methods may be used. That is, for example, the weight of the sieve 13 may be measured by a load cell, the rotational state of a rotational sensor provided above the sieve 13 may be detected (rotation of the rotational sensor stops when the sieve 13 is filled with the slag S), or a laser sensor provided above the sieve 13 may be used (a laser beam is blocked when the sieve 13 is filled with the slag S). As a display method for informing the operator that the amount of slag S has reached the predetermined amount, the following methods may be used. That is, for example, a display may be presented on a touch panel screen of the welding equipment, a lamp may be turned on, or a warning sound may be emitted from a speaker.

Supply Pipe

The supply pipe 14 supplies the flux F contained in the first hopper 10 to a weld portion, and is connected to the bottom portion of the first hopper 10. More specifically, the supply pipe 14 is connected to the bottom portion of the

first hopper 10 such that a supply opening of the supply pipe 14 is set at the welding position. The supply pipe 14 guides the flux F contained in the first hopper 10 to the welding position by allowing the flux F to fall by gravity. The supply pipe 14 is provided with a supply-pipe valve 16 that can be air-tightly closed. The supply-pipe valve 16 sets itself to a closed state while the operation is stopped, thereby preventing the flux F from falling.

Second Hopper

The second hopper 20 contains dust D that has been captured by the filters 30 and removed from the filters 30.

The second hopper 20 is connected in parallel with the first hopper 10 such that the second hopper 20 and the first hopper 10 communicate with each other through the common opening, which is the communication opening 15 formed in the common side wall. The exhaust pipe 21 is connected to an upper section of a side wall of the second hopper 20, and communicates with an exhaust-pipe connection member 32 through which the air is sucked from the filters 30. The shape of the second hopper 20 is not particularly limited, and may be any shape as long as the dust D contained therein can be supplied to the dust discharge pipe 23.

The exhaust system E including the exhaust pipe 21 and the blower 22 is connected to the second hopper 20.

Exhaust System

The exhaust system E includes the exhaust pipe 21 and the blower 22. The exhaust pipe 21 is provided to suck in air through the above-mentioned opening and exhaust the air to the outside. The exhaust pipe 21 is connected to the blower 22, so that the air flows in the second hopper 20 and the first hopper 10. The blower 22 sucks in the air from the second hopper 20 and the first hopper 10 through the exhaust pipe 21 and the filters 30, and exhausts the air to the outside. More specifically, owing to the suction force applied by the blower 22, the air flows into the second hopper 20 from the first hopper 10, passes through the filters 30 and filter suction pipes 33, which are connected to the respective filters 30 and suck in the air from the filters 30, and is exhausted through the exhaust-pipe connection member 32 and the exhaust pipe 21.

Filters

The filters 30 are disposed in the second hopper 20, and allow the air to pass therethrough while capturing the dust D in the air. The air that has been sucked in through the suction system A and that has passed through the communication opening 15 passes through the filters 30, so that the dust D is removed from the air.

As a plurality of filter cartridges, four filters (only two filters are illustrated in the figure), for example, are attached to a cell 31 which accommodates and protects the filters 30 and which is divided into two sections (only one section is illustrated in the figure).

The dust D that adheres to the filters 30 falls by gravity in the form of a lump and is stored in the second hopper 20 when the amount of dust D that accumulates on the filters 30 reaches a certain amount. Alternatively, the dust D may be removed from the filters 30 by applying intermittent jet pulses, that is, by blowing air contained in an air tank (not shown) toward the filters 30. However, when the filters 30 are used for a long time, the filters 30 becomes clogged with the dust D and the suction force will be reduced. The reduction in the suction force can be checked with a differential pressure gage (not shown) installed in the flux circulator 1. For example, when the differential pressure gage indicates a value above 150 mmAq, the filters 30 may be removed for cleaning or replacing.

The filters 30 are disposed in the second hopper 20 provided next to the first hopper 10. Therefore, even when the dust D captured by the filters 30 is removed from the filters 30, the dust D falls and is stored in the second hopper 20. Thus, the dust D is prevented from mixing with the flux F contained in the first hopper 10.

The dust D contained in the second hopper 20 is discharged to the outside through the dust discharge pipe 23 provided at the bottom portion of the second hopper 20 when it is determined that the amount of dust D contained in the second hopper 20 has reached a predetermined amount or when a predetermined time interval has elapsed.

Dust Discharge Pipe

The dust discharge pipe 23 discharges the dust D contained in the second hopper 20 to the outside, and is connected to the bottom portion of the second hopper 20. More specifically, the dust discharge pipe 23 is connected to the bottom portion of the second hopper 20, and guides the dust D contained in the second hopper 20 to the outside by allowing the dust D to fall by gravity. The dust discharge pipe 23 is provided with a dust-discharge-pipe valve 24 that can be air-tightly closed. The dust-discharge-pipe valve 24 is used to discharge or stop discharging the dust D contained in the second hopper 20.

Although an embodiment of the present invention has been described above, the present invention is not limited to the above-described embodiment. Other embodiments of the present invention will now be described with reference to the accompanying drawings. Components similar to those described above are denoted by the same reference numerals,

and explanations thereof are thus omitted.

Adjustable Air Damper

Referring to Fig. 3, an adjustable air damper 40 is preferably provided on the outer surface of the first hopper 10 or the outer surface of the second hopper 20. Fig. 3 illustrates the case in which the adjustable air damper 40 is provided on the outer surface of the first hopper 10.

When the adjustable air damper 40 is provided, the suction force of the flux F can be adjusted.

Referring to Fig. 4, four communication holes 40a are formed in the adjustable air damper 40, and the suction force is adjusted in accordance with the opening degree of the communication holes 40a. The suction force decreases as the opening degree of the communication holes 40a increases, and the suction force increases as the closed area of the communication holes 40a increases. More specifically, referring to Fig. 4, the adjustable air damper 40 includes a panel 41 which has first holes 41a, and a panel 42 which has second holes 42a and which is stacked on the panel 41. When the first holes 41a and the second holes 42a completely overlap so that the four communication holes 40a are fully open ("fully open" in the figure), the suction force is at a minimum. When the second holes 42a are rotated by rotating the panel 42 such that the four communication holes 40a are

fully closed ("fully closed" in the figure), the suction force is at a maximum, so that the flux F is collected by a maximum force. When the second holes 42a are rotated by rotating the panel 42 such that the four communication holes 40a are half closed ("intermediate" in the figure), the suction force is at an intermediate level between that in the fully open state and that in the fully closed state.

The operation of opening or closing the communication holes 40a by rotating the panel 42 may be performed either automatically or manually. The adjustable air damper 40 may be disposed at any position as long as the operation of the flux circulator 1a is not interfered by the adjustable air damper 40.

Atmosphere Blocking Valve

As illustrated in Fig. 3, the suction pipe 11 is preferably provided with a first atmosphere blocking valve 51 that can be air-tightly closed.

In the case where the first atmosphere blocking valve 51 is provided, when the operation of the welding equipment is stopped, the first atmosphere blocking valve 51 can be closed so as to prevent the air containing moisture from entering the first hopper 10 through the suction system A.

The exhaust pipe 21 is preferably provided with a second atmosphere blocking valve 52 that can be air-tightly

closed.

In the case where the second atmosphere blocking valve 52 is provided, when the operation of the welding equipment is stopped, the second atmosphere blocking valve 52 can be closed so as to prevent the air containing moisture from entering the second hopper 20 through the exhaust system E.

In addition, a third atmosphere blocking valve 53 that can be air-tightly closed is preferably provided between the adjustable air damper 40 and the first hopper 10 or between the adjustable air damper 40 and the second hopper 20. More specifically, the third atmosphere blocking valve 53 is provided on the outer surface of the first hopper 10 or the outer surface of the second hopper 20, and the adjustable air damper 40 is provided on the third atmosphere blocking valve 53.

In the case where the third atmosphere blocking valve 53 is provided, when the operation of the welding equipment is stopped, the third atmosphere blocking valve 53 can be closed so as to prevent the air containing moisture from entering the first hopper 10 or the second hopper 20 through the adjustable air damper 40.

Owing to the operation of the atmosphere blocking valves, it is not necessary to collect the flux F in the first hopper 10 after the operation has been stopped to prevent moisture absorption.

Heater

Referring to Fig. 3, a heater 60 is preferably provided on the outer surface of the first hopper 10.

When the heater 60 is provided, the heater 60 can be operated so as to heat a partition wall of the first hopper 10, so that the partition wall of the first hopper 10 can be prevented from being suddenly cooled by the outside air even in cold seasons. As a result, condensation on the inner wall surface can be prevented. Therefore, it is not necessary to collect the flux F in the first hopper 10 after the operation has been stopped.

As illustrated in Fig. 3, the heater 60 is sheet-shaped and is bonded to an inclined wall at the periphery of the bottom portion of the first hopper 10. The heater 60 heats the partition wall of the first hopper 10. Preferably, the heater 60 is capable of being set to a desired heating temperature by a temperature-setting controller (not shown), so that the first hopper 10 can be heated in accordance with the temperature of the outside air.

Others

A lower limit detector and an upper limit detector (not shown) are preferably provided in the first hopper 10.

If the amount of flux F in the first hopper 10 is too

small, the lower limit detector informs the operator of the situation by, for example, showing a warning on a welding operation board. If the amount of flux F in the first hopper 10 is too large, the upper limit detector informs the operator of the situation by, for example, showing a warning on the welding operation board.

When the amount of flux F in the first hopper 10 is too small, the flux F will be sucked in through the supply pipe 14 by the negative pressure in the flux circulator 1. If the amount of flux F is too large, there is a risk that the flux F contained in the first hopper 10 will enter the second hopper 20 through the communication opening 15. Therefore, to appropriately adjust the amount of flux F in the first hopper 10, the lower limit detector and the upper limit detector are preferably provided.

Referring to Fig. 5, the flux circulator may be a two-port flux circulator 1b in which an end portion of a first hopper 10a is divided into two ports and two supply pipes 14 are provided. Further, although not shown in the figure, the flux circulator may be a three-port or four-port flux circulator.

Method for Operating Flux Circulator

An example of the operation of the flux circulator will now be described using the structure illustrated in Fig. 3

as an example.

In the case where the welding equipment is automatically operated, when the welding equipment is moved and the suction port 11a of the suction pipe 11 reaches a welding start position after the welding operation is started, the first atmosphere blocking valve 51 and the second atmosphere blocking valve 52 are opened and the blower 22 is operated by operation instruction signals output from a control device (not shown) or by a manual operation performed by the operator. Accordingly, the air in the second hopper 20 and the first hopper 10 is exhausted and the outside air is sucked in through the suction port 11a of the suction pipe 11. When the blower 22 is operated, the third atmosphere blocking valve 53 is opened and the suction force is adjusted by adjusting the opened/closed state of the communication holes 40a (see Fig. 4) in the adjustable air damper 40.

Next, the supply-pipe valve 16 is opened by an operation instruction signal output from the control device (not shown) or by a manual operation performed by the operator. Accordingly, the flux F contained in the first hopper 10 is supplied to the welding position through the supply pipe 14. The flux F serves to remove oxides and the like from base metal and filler metal and protect the surface of the base metal in the welding operation. The

flux F that remains after the welding operation is sucked in together with the air at a position behind the welding point. The flux F that has been sucked in flows through the suction pipe 11 and enters the first hopper 10 from the introduction port 11b. Then, the flux F hits the impact plate 12 that faces the introduction port 11b, so that the flow velocity thereof is reduced. Consequently, the flux F falls by gravity, passes through the sieve 13, and is stored in the bottom portion of the first hopper 10.

As illustrated in Fig. 2, the flux F is sieved when the flux F passes through the sieve 13. Therefore, the slag S mixed with the flux F remain in the sieve 13, and the flux F from which the slag S has been removed falls by gravity and is collected in the first hopper 10. Then, the flux F that has been collected is re-supplied to the welding position through the supply pipe 14.

Dust D flows into the first hopper 10 together with the flux F. Since the relative density of the dust D is extremely small, the dust D floats in the first hopper 10 and moves into the second hopper 20 through the communication opening 15 together with the air flow. The dust D is captured by the filters 30. When the amount of the accumulated dust D reaches a certain amount, the dust D falls by gravity in the form of a lump or is removed from the filters 30 by applying intermittent jet pulses. Thus,

the dust D is stored in the second hopper 20. Then, when it is determined that the amount of dust D has reached a predetermined amount or when a predetermined time interval has elapsed, the dust-discharge-pipe valve 24 is opened so that the dust D is discharged to the outside.

When the operation is to be stopped, the first atmosphere blocking valve 51 and the second atmosphere blocking valves 52 are closed and the blower 22 is stopped by operation instruction signals output from the control device (not shown) or by a manual operation performed by the operator. Prior to this, the supply-pipe valve 16 is closed. In addition, the third atmosphere blocking valve 53 on the adjustable air damper 40 is also closed. Accordingly, the inner spaces of the first hopper 10 and the second hopper 20 are air-tightly blocked from the outside, and the outside air containing moisture can be prevented from entering the inner spaces. Therefore, moisture absorption of the flux F does not increase over time. As a result, even when the operation is stopped for a long time, welding failures due to moisture absorption can be prevented when the operation is restarted.

The control device operates the heater 60 so as to heat the partition wall of the first hopper 10 when the welding operation is not being performed. Therefore, the partition wall of the first hopper 10 can be prevented from being

suddenly cooled by the outside air even in cold seasons. As a result, condensation on the inner wall surface can be prevented.

In addition, as explained above in the description of the operation, the dust D captured by the filters 30 falls by gravity and is stored in the second hopper 20 even when the operation is stopped. Therefore, the dust D is prevented from mixing with the flux F contained in the first hopper 10. Therefore, moisture absorption of the flux F is prevented from being accelerated by the dust D, which has high moisture absorbency.

WHAT IS CLAIMED IS:

1. A flux circulator for use in submerged arc one-side automatic welding equipment, the flux circulator comprising:

a first hopper that contains flux;

a second hopper that contains dust, the second hopper being connected in parallel with the first hopper such that the first hopper and the second hopper communicate with each other through a common opening;

a suction system provided on the first hopper and including a suction pipe having a suction port through which used flux is sucked in;

a supply pipe connected to a bottom portion of the first hopper, the flux contained in the first hopper being supplied to a weld portion through the supply pipe;

an exhaust system provided on the second hopper and including an exhaust pipe and a blower, the exhaust system sucking in air through the opening and exhausting the air to the outside;

a filter disposed in the second hopper, the filter allowing the air to pass therethrough while capturing the dust;

an impact plate disposed in the first hopper at a position where the impact plate faces an outlet of the suction pipe, the impact plate being connected to and

hanging from a section around the ceiling of the first hopper; and

a sieve disposed near a lower portion of the impact plate,

wherein the air sucked in through the suction port is caused to pass through the sieve and the filter and is exhausted by the exhaust system, so that the used flux is collected in the first hopper for reuse.

2. The flux circulator according to claim 1, wherein an adjustable air damper is provided on an outer surface of the first hopper or an outer surface of the second hopper.

3. The flux circulator according to claim 1, wherein a first atmosphere blocking valve capable of being air-tightly closed is provided in the suction pipe included in the suction system, and a second atmosphere blocking valve capable of being air-tightly closed is provided in the exhaust pipe included in the exhaust system.

4. The flux circulator according to claim 2, wherein a third atmosphere blocking valve capable of being air-tightly closed is provided between the adjustable air damper and the first hopper or between the adjustable air damper and the second hopper.

5. The flux circulator according to claim 1, wherein a heater is provided on an outer surface of the first hopper.