Nov. 8, 1955 L. M. ROBERTS ET AL 2,722,992

RAPPING DEVICE

Filed Feb. 10, 1954

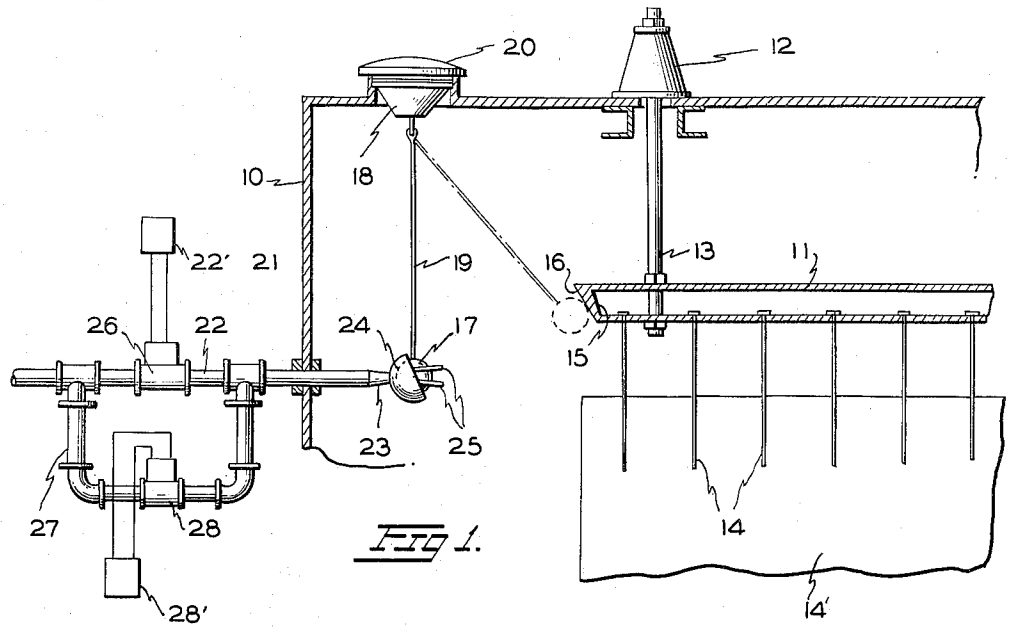


Fig 1.

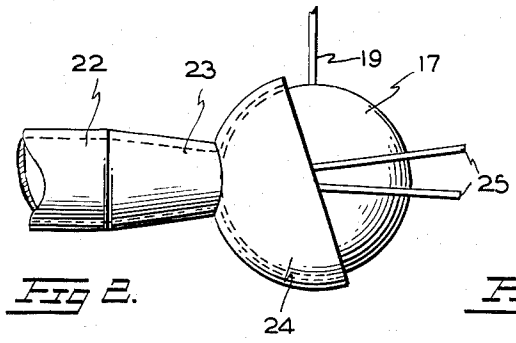


Fig 2.

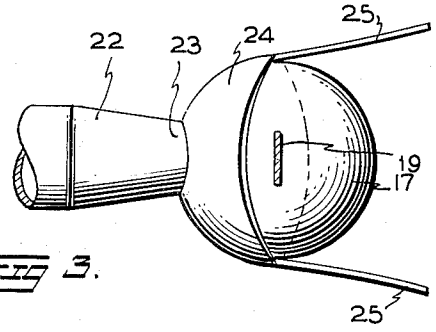


Fig 3.

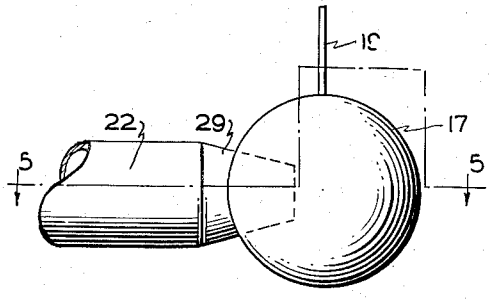


Fig 4.

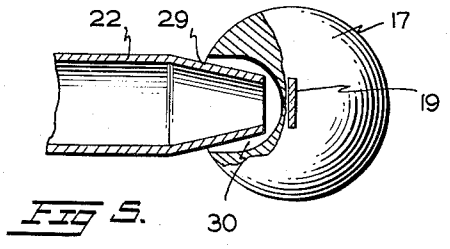


Fig 5.

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2,722,992

Patented Nov. 8, 1955

2,722,992

RAPPING DEVICE

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Application February 10, 1954, Serial No. 409,427

5 Claims. (Cl. 183—7)

The present invention relates to a free swinging fluid actuated hammer and more particularly to a rapping device for use on an apparatus for the electrical precipitation of materials suspended in gases.

Certain prior art devices for the same general purpose have included free ball piston hammers movable within fixed cylinders under fluid or mechanical propulsion to rap precipitation apparatus for the purpose of dislodging deposited materials thereon.

Other prior art constructions have included fixed lever hammers operated by fluid or mechanical means to effect a rapping of precipitation apparatus for the purpose of cleaning the same.

In all of these prior art devices there have been substantial disadvantages evidenced by the fact that such devices can only rap a precipitation apparatus in a fixed direction of force without ability to rap in a combination of directions which is necessary for maximum efficiency.

Additional disadvantages are inherent in these prior constructions in the complicated and expensive arrangement of parts and construction which render such prior devices extremely costly in initial installation as well as costly in maintenance and repair.

It is, therefore, a general object of the present invention to provide a free swinging hammer construction which overcomes and eliminates substantially all of the disadvantages inherent in the prior devices aforementioned.

It is a principal object of the present invention to provide an improved free swinging, fluid actuated hammer which is particularly adapted for cleaning and removing precipitated and deposited materials from the electrodes of electrical precipitators.

A particular object of the present invention is to provide a means for the efficient cleaning of the electrodes of an electrical precipitator by mechanically rapping or hammering the electrode supporting apparatus with a combination of horizontal and vertical rapping forces by means of a single mechanism.

Another object of the present invention is the provision of a rapping device which can be automatically operated to provide either continuous or intermittent operation and which includes simple control apparatus for controlling the intensity of the rapping forces struck by the rapping device.

Still another object of the instant invention is the provision of a rapping device construction which can be easily and inexpensively installed in any existing or new precipitation apparatus and which includes a minimum of working parts and which relies partially on gravity in the operation of the device for the purpose of returning the rapping hammer to a cocked position and which also provides means for cushioning the hammer in its return to a cocked position to prevent undue wear to the rapping device construction.

A further object of the present invention is to provide a rapping device construction which includes simple and inexpensive parts and arrangements of said parts which

minimizes the costs and time of initial installation and greatly reduces and minimizes the costs and time in repair, replacement and general maintenance of the apparatus.

Still another object of the present invention lies in the provision of a free swinging rapping hammer of the type generally defined which is inexpensive of design and manufacture and which is efficient and durable in operation.

These and other objects and advantages of the present invention will become readily evident to those skilled in the art when the following specification is read in the light of the accompanying drawings.

The nature of the present invention may be stated in general terms as including an electrode rapping device comprising a frame supporting electrodes in spaced relationship therefrom, said frame providing an anvil portion thereon, a pendulous hammer located to position the anvil portion of the frame in the path of the arc of travel of said pendulous hammer, and fluid jet means positioned in the normal arc of travel of said pendulous hammer in spaced relationship to said frame for propelling said hammer through its normal arc to strike the anvil portion of said electrode supporting frame.

The present invention will be more particularly described with reference to the illustrative embodiments of the invention shown in the accompanying drawings, in which:

Fig. 1 is an elevation view of a precipitation apparatus including the rapping device constituting the present invention;

Fig. 2 is an enlarged fragmentary elevation of the propelling means and the associated pendulous hammer;

Fig. 3 is a top plan view of Fig. 2;

Fig. 4 is an elevation similar to Fig. 2 illustrating a modified form of the hammer propelling means and associated hammer;

Fig. 5 is a horizontal section taken on line 5—5 of Fig. 4.

With reference to the accompanying drawings in which like numerals designate similar parts throughout the several views, there is disclosed in Fig. 1 a general arrangement of the parts and constructions constituting the present invention wherein **10** generally designates the usual casing or shell of an electrical precipitator having opposed discharge and collecting electrodes **14** and **14'**. Within the casing there is supported a high tension frame member **11** which is suspended transversely within the precipitator casing by means of insulator members **12** and hanging bars **13** which are supported from the insulator members and which are connected to the frame member **11**.

The high tension frame member **11** consists of a substantially tubular bar or rod from which the discharge electrodes **14** are suspended in spaced relationship transversely of the precipitator. The ends of the tubular frame are formed with a thickened wall portion **15** which is inclined at an angle downwardly and inwardly of the end of the frame to present an anvil face **16** on the end of the frame.

Located within the precipitator shell beyond the end of the high tension frame is a rapping device which includes a ball hammer **17** suspended in pendulous fashion from a support frame **18** by means of an elongated link member **19**. The ball hammer support frame **18** is located and supported within the mouth of an access door or opening **20** in the precipitator casing and the suspending link **19** whereby the rapper may be easily replaced without shutting down the precipitation equipment. The link **19** is preferably of a flat construction to prevent twisting and turning of the ball, and is pivotally hung to the underside of the frame **18** to suspend the ball hammer **17** in a pen-

dulous manner so that it is free to swing in a fixed arc beneath the supporting frame and within the precipitator casing.

In the support of the ball hammer within the casing, the supporting frame is so located in the precipitator casing as to position the ball hammer **17** in its normal at-rest position at the lowermost point in its normal arc of travel at a spaced distance from the end of the frame. The length of the suspending link **19** places the ball hammer in a position within the precipitator casing such that the anvil end of the high tension frame is in the path of the normal arc of the hammer as it swings beneath the supporting frame **18**.

Thus, when the ball hammer is propelled from a point adjacent its normal at-rest position upwardly through its normal arc it will strike the anvil face **16** on the extremity of the high tension frame **11** thereby jarring the frame and its suspended discharge electrodes to dislodge the precipitated materials adhering thereto.

The means which is provided for propelling the ball hammer **17** upwardly through its arc to strike or rap the high tension frame **11** is generally designated at **21** and includes in its preferred embodiment as illustrated in Figs. 1, 2 and 3 a fluid pressure medium inlet line **22** extending from a point outside the precipitator casing through the casing to terminate within the casing at a point adjacent the normal at-rest position of the ball hammer **17**. The innermost end of this gas inlet line **22** is provided with a nozzle construction directed against the ball hammer **17** in its at-rest position and in general alignment with the normal arc of travel of said hammer in the direction of the high tension frame **11**. In addition to the nozzle construction a semicircular cup or hood **24** is mounted on the inlet line **22** concentrically about the nozzle thereof to provide a receiving chamber for a portion of the ball hammer. The inner diameter of the cup or hood **24** is such that the ball hammer will fit closely therein when the hammer has assumed its at-rest position under an influence of gravity. Additionally, opposed side portions of the hood **24** are provided with spaced curved finger members **25** which extend outwardly from the open face of the hood which fingers serve to guide the ball hammer into the hood member as it returns to its at-rest position.

Externally of the precipitator casing the gas inlet line **22** is provided with a primary control valve **26** which controls the flow of pressure fluid such as air or steam, to the nozzle **23** for the purpose of propelling the ball hammer **17** upwardly in its arc to strike the high tension frame **11**. A timer for controlling the sequence of operation of the valve **26** is generally shown at **22'**.

In addition to the primary control valve **26** a by-pass arrangement **27** is provided around the primary valve and an auxiliary valve **28** having a timer **28'** is located in the by-pass. This auxiliary valve is controlled in timed relationship from the control of the primary valve so as to remain in open condition for a longer period than the primary control valve thus permitting a lesser gas force to reach the nozzle during the period when the ball hammer is returning from a striking position to its at-rest position and this lesser gas force emitting from the nozzle within the hood **24** provides a cushioning force for the hammer causing it to seat gently within the hood prior to a second striking operation.

By the foregoing arrangement a gas jet may be directed against the ball hammer **17** to propel it upwardly causing it to strike or rap the high tension frame in any timed arrangement which is found desirable by the expedient of timing the opening and closing of the primary and auxiliary valves **26** and **28** respectively. Thus a pattern of operation of either intermittent or continuous rapping may be obtained.

In addition, the fact that the ball hammer is suspended in pendulous fashion the path of travel of the ball hammer from the propelling means to its point of impact with the anvil face of the high tension frame is arcuate and the striking forces of the hammer on the frame at the time and point of contact are therefore a combination of vertical and horizontal vectors.

Referring to Figs. 4 and 5 there is shown a modified form of the nozzle portion of the hammer propelling means which modification includes a tapered nozzle **29** on the inner end of the gas inlet line **22** and a recessed area **30** in the ball hammer **17** which area opens inwardly through the outer face of the ball at a point which normally coincides with the tapered nozzle **29** when the ball hammer is in its lowermost, at-rest position.

This modified arrangement of nozzle and ball hammer provides a compression chamber within the ball which upon activation of the propelling means provides for an intensified propelling force at the time of the initiation of movement of the ball in its striking operation.

From the foregoing description it will be seen that the present invention provides an improved free swinging gas actuated hammer which when adapted to a rapping device for electrical precipitators provides a greatly improved means for cleaning and removing precipitated material from the electrodes of the precipitator and whereby the obejcts and advantages heretofore set forth are fully satisfied and accomplished.

It will be evident to those skilled in the art that various modifications may be made in the construction and arrangement of the parts of the device constituting the present invention without departing from the spirit and scope of the invention. For example, the rapping device of the present invention may be employed equally well to rap the collecting electrodes of the precipitator without any substantial change therein as neither the link **19** or the fluid supply line need to be insulated from the high voltage when rapping high tension discharge electrodes, as long as the support **18** is constructed of insulating material.

Still further modifications are fully contemplated and the scope of the present invention is to be limited only by the hereinafter appended claims in which we claim:

1. In an electrical precipitator having a frame supporting electrodes in spaced relationship, an electrode rapping device including a pendulous hammer, the normal arc of said hammer being intersected by a portion of the frame at a point in said arc spaced above the lowest point thereof, and gas jet means at a point in the normal arc of said hammer below said frame for impelling the hammer upwardly in its normal arc, whereby said hammer will strike said frame with a combination of horizontal and vertical vectors of force.

2. Precipitator electrode rapping apparatus as defined in claim 1 wherein said gas jet means includes a nozzle directed against said hammer substantially in alignment with the normal arcuate path of hammer travel, a hood member surrounding the outlet end of said nozzle, said hood member being adapted to receive and seat said hammer member, whereby an initial impelling charge will be built up within the hood member to act on a substantial surface area of said hammer upon initiation of an impelling jet from said nozzle.

3. Precipitator electrode rapping apparatus as defined in claim 1 wherein said hammer is provided with a recessed chamber opening into a portion of the surface thereof, and said gas jet means includes a nozzle shaped to receive the recess in said hammer telescopically thereover, whereby an initial impelling charge will be built up within the hammer recess upon initiation of an impelling jet from the nozzle.

4. Precipitator electrode rapping apparatus as defined in claim 1 wherein said gas jet means is provided with a first control valve for selectively admitting gas under pressure to said jet to provide rapping movement of said hammer, and a second valved control means to provide for a cushioning jet force for the return stroke of said hammer.

5. In an electrical precipitator an electrode rapping device including a pendulous hammer, means in the normal arc of travel of said hammer for impelling the hammer through a portion of its normal arc, said means including a gas jet and valved control means for selectively admitting gas under pressure to said impelling jet, and a second valved control means selectively operable to provide an additional jet emission to that provided by said first valved control means, whereby a cushioning jet force will be provided for the return stroke of said hammer.

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