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ELECTRIC RAPPER FOR PRECIPITATORS

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FIG. 1.

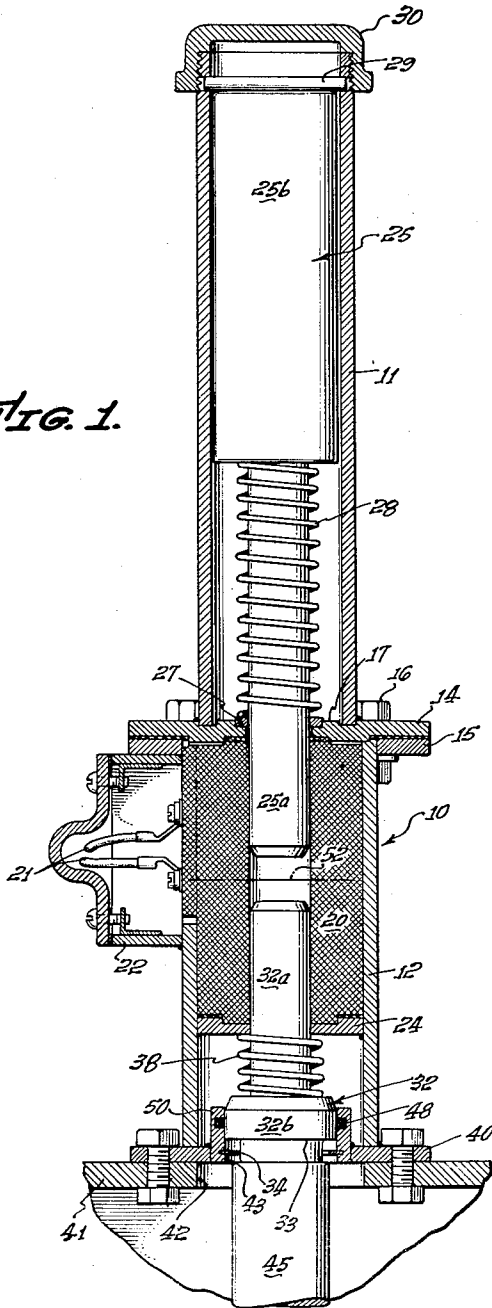
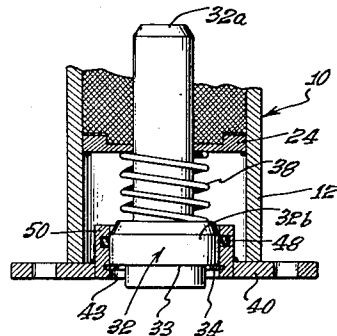


FIG. 2.



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ELECTRIC RAPPER FOR PRECIPITATORS

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4 Claims. (Cl. 183—7)

The present invention relates generally to electrical precipitators and more especially to an electro-magnetic rapper for rapping or vibrating an electrode assembly of the precipitator to clean the assembly of dust adhering to it.

In an electrical precipitator, a stream of gas containing suspended particles which are to be removed is passed through the precipitator and, by the action of an electric field, the particles are caused to migrate to and be deposited upon a collecting electrode. Under normal circumstances, the deposited dust particles accumulate on the electrode and it then becomes necessary periodically to clean the electrode by rapping or vibrating the electrode. In the past, this has been done by various mechanical or pneumatic means. However, it has been found that an electro-magnetic hammer is advantageous for the purpose of vibrating the electrodes since it provides a sharp blow of a magnitude that can easily be adjusted to be heavy enough for the purpose of cleaning the electrodes.

It is a general object of my invention to provide an electro-magnetic rapper of the character described which is so located with respect to the precipitator shell as to be easily accessible for service and repair or replacement.

It is also an object of my invention to provide an electro-magnetic rapper of the character described which is a self-contained unit that can easily be mounted upon or detached from the precipitator for removal of the entire unit.

Another object of my invention is to provide for a precipitator an electro-magnetic rapper that is of unitary construction and which may be mounted externally upon the precipitator shell without the need for accurate or critical axial alignment of parts of the rapper with an element of the electrode assembly which is to be rapped.

These and other objects of my invention are attained by providing an electro-magnetic rapper which includes a housing having an opening at one end. The housing is detachably mounted on the outside of the precipitator shell in such a position that the opening in the rapper housing is in registration with an opening in one wall of the precipitator shell. Within the rapper housing is an axially movable hammer actuated by an electro-magnetic coil and adapted to strike against axially movable anvil means also contained within the rapper housing. The anvil means projects into the coil, as does the hammer, and also to or through the open end of the rapper housing. At this point the anvil engages a suitable blow-receiving element on the electrode assembly, which element is in or adjacent to the opening in the wall of the precipitator shell. Suitable spring means associated with the anvil keeps it in continuous engagement with the element of the electrode assembly by resisting the pull on the anvil when the coil is energized. Other spring means are provided to return the plunger to its normal rest position after each stroke against the anvil.

The rapper housing is provided with stop means adapted to engage the anvil and prevent it from being forced out of the housing under the influence of the associated spring

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when the rapper is removed from the precipitator shell. In order to protect the interior of the rapper against dirt or corrosive gases, the housing is provided near its open end with a suitable type of sealing means which engages the anvil to isolate the interior of the rapper housing from the interior of the precipitator shell.

How the above objects and advantages of my invention, as well as others not specifically mentioned herein, are attained will be better understood by reference to the following description and to the annexed drawings, in which:

Fig. 1 is a longitudinal median section through an electro-magnetic rapper constructed according to my invention and shown mounted upon the top wall of a precipitator shell in operating position; and

Fig. 2 is a fragmentary section similar to Fig. 1 showing the position occupied by the anvil relative to the rapper housing when the rapper is detached from the precipitator shell.

Referring now to the drawings, the elongated housing of the rapper is generally indicated at 10. It is preferably divided into an upper section 11 and a lower section 12 both of which are conveniently circular in cross section, although not necessarily so, and are coaxial with respect to each other. Since the rapper is usually mounted in an upright position with its axis vertical, or nearly so, it is herein shown and described as in that position; but it will be understood that reference to various parts as "upper" or "lower" is purely for descriptive purposes and is not limitative upon the invention.

Housing sections 11 and 12 are provided with outwardly extending complementary flanges 14 and 15 respectively through which pass bolts 16 by means of which the two housing sections are joined together. Flange 14 on the upper housing section is preferably an integral extension of wall member 17 which extends transversely across the housing and has a central opening, for purposes which will be further described.

Coil 20 is annular in cross section and is located within lower housing section 12. It is of any suitable design and size to provide an electro-magnetic field of desired strength and suitably energized. Power is supplied to coil 20 through electric conductors 21 which are brought into connection box 22 mounted on one side of the rapper housing. The lower housing section is also provided with a transversely extending wall 24 which has a central opening. Coil 20 is held in place by and between the two transverse walls 17 and 24. Walls 17 and 25, as parts of the metal housing, also act to complete the magnetic flux path at each end of the coil. The end walls engage the outer wall of housing 12, also part of the flux path.

Hammer 25 is located within upper housing section 11 and is adapted for movement in and axially of coil 20. Hammer 25 consists of a lower section 25a of relatively smaller diameter which projects into the hollow center of coil 20. This part of the hammer is a movable core within the coil which because of its location relative to the electro-magnetic field established by the coil is forced inwardly of the coil when the coil is energized. The hammer also comprises an upper section 25b which is of relatively larger diameter. This section not only gives added mass to the hammer but has a diameter substantially equal to the inside diameter of the upper housing section so that the hammer is guided at its upper end by the housing to travel axially of the coil. The lower or smaller end of the hammer projects through the central opening in upper wall 17, which opening is in alignment with the central opening of core 20. There is preferably mounted on wall 17 a guide or bearing ring 27 which slidably engages the hammer at its lower end to direct it axially of coil 20. Ring 27 may be of any suitable

type, typically being a porous metal member impregnated with graphite.

Interposed between the enlarged section of the hammer and wall 17, is compression spring 23 which has sufficient force to return the hammer, after each downward power stroke, to its normal rest position, shown in Fig. 1, in which the hammer is raised to the upper end of housing 11. The upward travel of the hammer under the influence of return spring 28 is limited by suitable stop means, here shown as pin 29 extending transversely across the housing, the pin being inserted through holes bored in the housing walls for this purpose. The upper end of housing 11 is preferably closed by cap 30 which is connected to the housing by suitable screw threads. Pin 29 is located in the threaded area of the housing so that when the cap is screwed into position, it prevents the pin from being dislodged endwise. Of course, other means, such as the cap itself, may be used as stop means to limit the upward travel of hammer 25; but this arrangement is preferred because it accurately positions the hammer in its rest position.

There is also located within the rapper housing anvil 32, the anvil being contained in the lower section of the housing at the end opposite to hammer 25. Like the hammer, anvil 32 is mounted within the housing for movement axially of coil 20 but, as will be described, this movement is comparatively limited and infrequent. The anvil comprises an upper section 32a of reduced diameter which extends into the hollow center of coil 20 through a central opening in lower housing wall 24. The anvil projects into the coil to a position within the range of travel of the hammer to be struck thereby. Since during ordinary operation, there is no relative movement of the anvil and wall 24 no particular bearing means is required here other than the wall itself which acts as guide to position the anvil at this point. At the lower end of the anvil is section 32b which is of relatively larger diameter and provides a downwardly facing shoulder 33. Shoulder 33 is adapted to engage a spring retainer ring 34 which is mounted on the housing and acts as stop means to limit outward travel of the anvil.

Compression spring 38 bears against the under side of wall 24 and the upper face of enlarged portion 32b of the anvil, exerting a force upon the anvil in a direction to move it outwardly of coil 20 and housing 10. When the rapper is detached from the shell of the precipitator, the anvil is free to move outwardly of the coil under the influence of spring 38 until shoulder 33 engages stop means 34, as shown in Fig. 2. The parts are so proportioned that the anvil then projects out of the housing for a short distance beyond the face of flange 40 at the end of the housing. By means of flange 40, the rapper is mounted to the outside face of wall 41 of the rapper shell. Wall 41 is herein shown as being the top wall of the precipitator shell and the rapper is mounted thereon with its axis vertical; but my invention is not limited to any particular position or location for the rapper. Wall 41 of the precipitator shell is provided with an opening 42 and the end of the rapper housing at flange 40 is likewise provided with an opening 43 through which anvil 32 projects. The rapper is mounted on wall 41 at such a location that openings 42 and 43 are in registration.

Inside the precipitator shell, the precipitator is provided with one or more assemblies of collecting electrodes which may be of any construction and which are not shown in detail in this application since they are well known in the art. Each electrode assembly, or group of assemblies, to be rapped, is provided with an element indicated at 45 which is located at opening 42 in the shell and is adapted to be engaged by the outer end of anvil 32. In a preferred arrangement, element 45 of the electrode assembly has its end face flush, or substantially so, with the outer face of shell wall 41. When the rapper housing is then bolted in place with flange 40 in contact with wall 41, the outer end face of anvil 32 engages the end of electrode assembly element 45. Be-

cause element 45 is stationary, the anvil moves a short distance inwardly of the housing and coil 20, to some position such as shown in Fig. 1. In this position shoulder 33 is spaced from stop 34 and spring 38 exerts a continuous pressure on the anvil maintaining it always in engagement with electrode assembly element 45. The complementary faces of the element 45 and the anvil may be ground flat and perpendicular to the axis of the anvil, or to any other desired shape, to obtain good contact between them.

The interior of the precipitator, which is the space underneath wall 41, is usually filled with gases which may be corrosive or carrying in suspension particles which are undesirable within the rapper. The gases inside the precipitator are frequently at superatmospheric pressure. It is thus desirable to provide on the rapper a seal which isolates the interior of the rapper housing from the interior of the precipitator and prevents the entrance of undesirable gases or suspended particles into the rapper. For this purpose, sealing ring 48 is provided which is in fluid-tight engagement with the outer surface of enlarged section of 32b of the anvil. Sealing ring 48 may be mounted upon the housing by any convenient means, the mounting means here being sleeve 50 which is attached to a short inward projection of flange 40. The interior of this sleeve defines opening 43 at the lower end of the housing. Sleeve 50 also serves as a guide means for anvil 32 to position the lower end of the anvil.

Basically, sections 25a and 32a of the hammer and anvil respectively are core members located within the center space of the electro-magnetic coil 20. It is preferable that these two members extend into the coil to terminate at positions on opposite sides of and substantially equally spaced from the mid-point 52 of the coil, measured lengthwise. The force exerted upon movable core 25a by the magnetic field established by coil 20 when energized, reaches its maximum value during the forward or power stroke as the leading end of the core passes mid-point 52 of the coil. Accordingly, the anvil is located shortly beyond the mid-point of the coil from the hammer so that the blow delivered to the hammer is substantially the maximum possible. The duration and other characteristics of the electric field established are so designed that the field dies away rapidly after the hammer hits the anvil. The blow is delivered to the anvil when or very shortly after, the hammer reaches its maximum velocity. Furthermore, the hammer does not remain attracted to the anvil and it returns immediately after the power stroke to the normal rest position under the influence of return spring 28.

During the normal operation of the rapper, there is no movement of the anvil 32. Spring 38 is strong enough that it resists the tendency of the magnetic field to draw the anvil into the core. Spring 38 keeps the anvil firmly seated at all times against the end of element 45a of the electrode assembly to be rapped. This engagement causes the full strength of the hammer blow on the anvil to be transmitted to element 45 of the electrodes to vibrate the electrodes.

Since the hammer and the anvil against which it strikes are a part of the rapper mechanism itself at all times, their relative position and alignment can be closely maintained when once established since the rapper is a completely self-contained unit adapted for attachment to a precipitator shell. The rapper can be mounted upon the wall of the shell without the need of securing critical angular or lateral alignment or positioning of the rapper relative to the element of the electrode assembly. This is important when mounting the rapper under field conditions when it is impractical to work to a high degree of accuracy. This advantage is attained by eliminating the need for having any portion of the electrode assembly extend into the rapper housing, and more especially into the coil, but without any sacrifice in the strength of the blow delivered by the hammer.

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From the foregoing description, it will be apparent that various changes in the arrangement of parts may be made without departing from the spirit and scope of my invention. Accordingly, it is to be understood that the foregoing description is considered to be illustrative of, rather than limitative upon, the appended claims.

I claim:

1. In an electrical precipitator, the combination comprising: a precipitator shell having an opening in one wall; an electrode assembly within the shell and having an element of the assembly located at the opening in the shell; a rapper housing detachably mounted on and in contact with the exterior of the shell at the opening therein, said housing having an opening in registration with the opening in the shell; hammer means within the rapper housing; anvil means within the rapper housing adapted to be struck by the hammer means and engageable with a face of the element of the electrode assembly through the registering openings in the shell and housing; and spring means within the housing holding the anvil in continuous engagement with said face of the element of the electrode assembly.

2. The combination as in claim 1 that also includes stop means mounted on the rapper housing to engage the anvil and limit outward movement of the anvil caused by the spring means when the rapper housing is detached from the shell.

3. The combination comprising: a shell having a wall with an opening therein; a member within the shell

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having one element thereof located at the opening with an end face of the element substantially flush with the exterior face of the shell wall; a rapper housing mounted on the exterior face of the shell wall covering said opening in the wall; electro-magnetically actuated hammer means within the housing; an elongated anvil adapted to be struck at one end by the hammer means and in engagement at the other end with said end face of the element, the engaging faces being in a plane perpendicular to the direction of the blow delivered by the hammer and permitting the anvil to be shifted relative to the element in said plane; and resilient means within the rapper housing exerting a continuous thrust on the anvil to hold it in engagement with the element inside the shell.

4. The combination as in claim 3 that also includes sealing means mounted in the housing and slidably engaging the anvil member near the outer end of the housing to seal the housing interior against the entry of foreign matter from the opening in the shell wall.

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