Nov. 23, 1965 W. STEUERNAGEL ETAL 3,219,130

MECHANISM FOR RAPPING THE COLLECTING ELECTRODES IN ELECTROSTATIC PRECIPITATORS

Filed July 1, 1963 3 Sheets-Sheet 1

Fig. 1

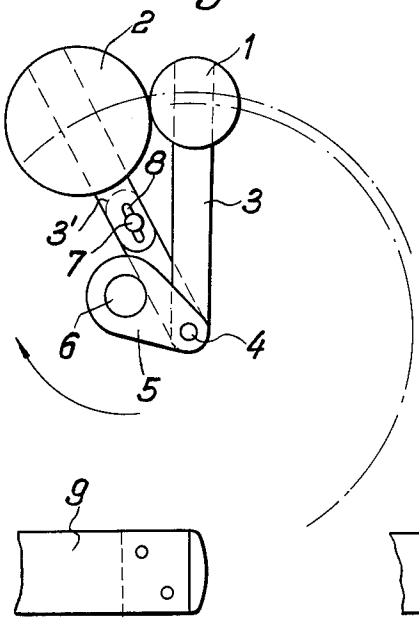


Fig. 2

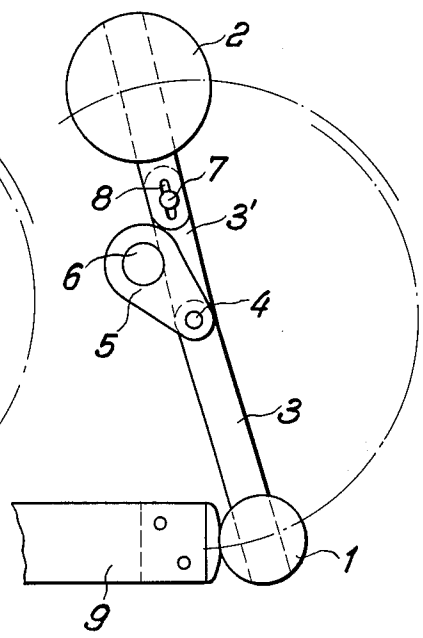
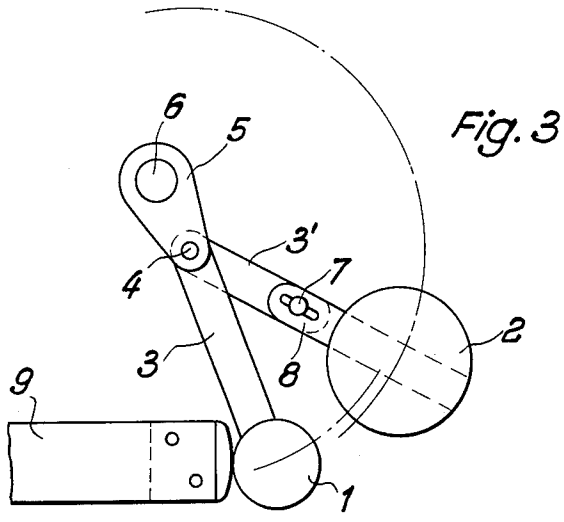


Fig. 3



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Nov. 23, 1965 W. STEUERNAGEL ETAL 3,219,130
MECHANISM FOR RAPPING THE COLLECTING ELECTRODES
IN ELECTROSTATIC PRECIPITATORS
Filed July 1, 1963 3 Sheets-Sheet 2

Fig. 4

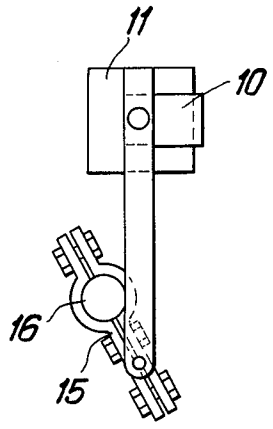
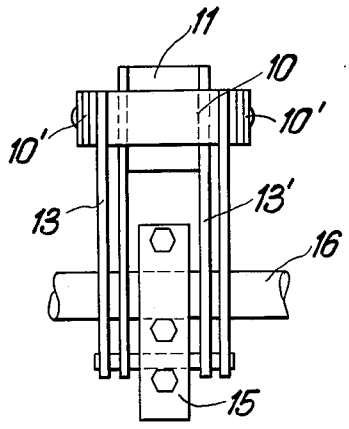


Fig. 5



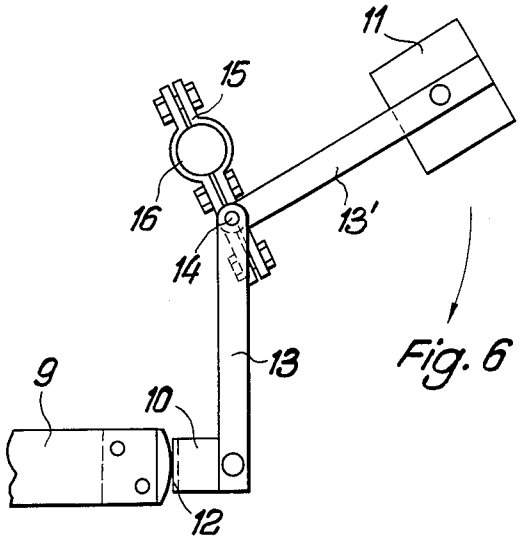


Fig. 6

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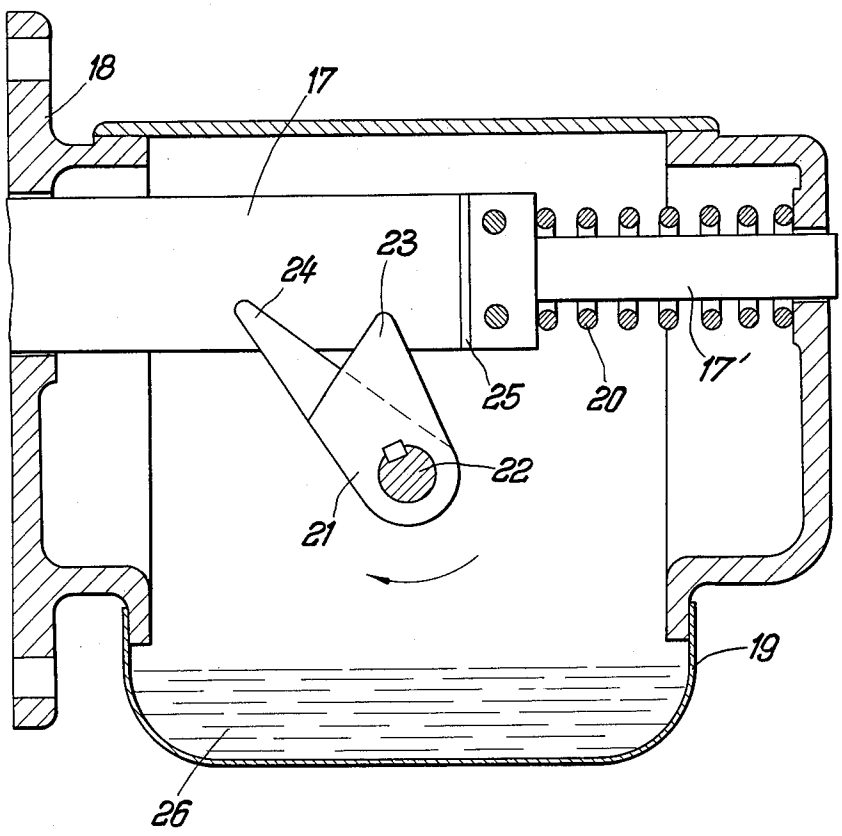
Nov. 23, 1965 W. STEUERNAGEL ETAL 3,219,130
MECHANISM FOR RAPPING THE COLLECTING ELECTRODES
IN ELECTROSTATIC PRECIPITATORS
Filed July 1, 1963 3 Sheets-Sheet 3

Fig. 7



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MECHANISM FOR RAPPING THE COLLECTING ELECTRODES IN ELECTROSTATIC PRECIPITATORS

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4 Claims. (Cl. 173—102)

This invention relates to a mechanism for rapping the dust collecting electrode plates in electrostatic precipitators.

For effectively cleaning off the deposited dust from the electrode plates in electrostatic precipitators, it is the practice to apply a sequence of raps of different strengths at controllably variable intervals to the rapper bar which is common to a plurality of electrode plates. The power required for producing the raps is usually electromagnetically generated, whereby the intensity of the raps and their frequency are controlled by electronic means. This is described for instance in "Combustion," July 1960, pages 5 and 6.

In order to maintain the dust collection efficiency of the electrostatic precipitator, the collecting electrode plates must be kept substantially free from adhering deposits of dust. Large volumes of gas containing high concentrations of dust precipitate considerable volumes of dust on the collecting electrode plates within a very short time. In order to prevent the cleaning operation from swirling the dust back into the gas stream, it is advisable to rap the electrode plates in such a way that the dust will detach itself from said plates in large flakes and fall into the dust box without raising a cloud. This can be achieved by applying gentle raps. However, thin layers of dust always remain on the electrode plates which refuse to be detached by gentle raps and which then continue to reduce the dust collection efficiency of the plates. These coatings of dust cannot be removed otherwise than by the application of hard raps to the plates. It is therefore the practice to clean off the dust from the plates by applying raps of increasing intensity, and this will then avoid the dust from being whirled up in clouds. Although mechanical rapping is preferable to rapping the plates electromagnetically because mechanical rapping devices are of simpler construction and more reliable, and the rapping devices may be located inside the dust chamber and will then readily collect dust themselves, efficient mechanical rapping devices for applying variable intensity raps have not heretofore been made. An object of the present invention is to provide a mechanism which satisfies this particular need.

According to the present invention, there is provided a mechanism for rapping collecting electrode plates in electrostatic precipitators by the application of raps to an end of a rapper bar by means of at least two tumbling or somersaulting hammers, wherein the hammers are of consecutively increasing weight and are eccentrically mounted on the same axis of a rotary member in such manner that rotation of the rotary member causes the hammers to rap the rapper bar such that a series of raps is produced each consisting of a number of raps of increasing intensity.

The mechanism has tumbling hammers which are of a spherical or a cylindrical disc-like shape so arranged that each tumbling hammer is attached to a movable arm and adapted to strike centrally the rear face of the preceding hammer which has already struck the rapper bar.

Alternatively, the tumbling hammers have a cube or brick shape, and only one side of the hollow cube or brick, which may lack a bottom, top and rear face, may form a hammer face so contrived that consecutively operating hammers can strike the back of the preceding hammer face, one hammer fitting into the other. In this way, the entire impact can be directly transferred to the rapper bar without loss of a lateral component of momentum.

A further modified form of this invention is composed of a spring-urged rapping bar, and means for moving the rapping bar against the spring for at least two distances, and subsequently releasing the rapping bar so that the latter effects the rapping of the electrode plates under the influence of the spring, the intensity of the rap being proportional to the distance moved by the rapping bar against the spring, and the arrangement being such that a series of raps is produced each consisting of a number of raps of increasing intensity.

Another modified form of this invention has the rapping bar moved by a rotating cam having at least two extensions each being of different length and arranged so that rotation of the cam causes the extensions in turn to bear upon upon a plate fixed to or integral with the rapping bar and thus move the bar against the pressure of the spring.

The means by which the objects of this invention are obtained are described more fully with reference to the accompanying diagrammatic drawings in which:

FIGURES 1, 2 and 3 are side views showing one embodiment of a mechanism constructed in accordance with the invention in successive positions;

FIGURE 4 is a side view showing another embodiment of this invention;

FIGURE 5 is an end view of the mechanism shown in FIGURE 4;

FIGURE 6 is a view similar to FIGURE 4 showing the hammer in another position; and

FIGURE 7 is a cross-sectional view showing a further embodiment of this invention.

As shown in FIGURES 1, 2 and 3, two rapping weights or hammers **1** and **2** in the form of spheres or cylindrical heavy discs of which disc **1** is lighter than **2** are rotatably attached by arms **3** and **3'**, respectively, to an eccentric pivot pin **4** on a crank **5**, which is itself fixed to a shaft **6** for driving the same. Moreover, the outer member of the divided arm **3'** has a joint **7** including an elongated slot **8** where the joint is formed, permitting either or both the angular setting of the outer member and the overall length of the arm to be varied. In FIGURE 1, the rotating crank has lifted both weights to the point where weight **1** is just ready to fall. FIGURE 2 shows the moment when the minor weight **1** has just struck the rapper bar **9**. FIGURE 3 shows how the further rotation of crank **5** causes the heavier weight to fall.

In the modified form of construction shown in FIGURES 4, 5 and 6, two hammers **10** and **11** are brick-like or eccentric in shape. The lighter hammer **10** is composed of two lateral members as well as a hammer face **12** which can be struck by the second heavier hammer **11**. Hammer **11** fits into hammer **10** and against hammer face **12** both for striking and lifting the same. In this latter position, the two sets of hammer arms **13** and **13'** which are both hinged to the same pivot pin **14** will be in full alignment when viewed from the side. This arrangement has the advantage that supplementary weights **10'**, which can be clearly seen only in FIGURE 5, can be attached to the outer sides of the lateral members of hammer **10**. The functions of crank **5** in FIGURES 1, 2 and 3 are performed in FIGURES 4, 5 and 6 by a strap **15** clamped to shaft **16**. Naturally the strap **15** could be replaced by a suitable alternative means of attachment, such as a wide lug or a tie bolt.

For the sake of simplicity only two rapper hammers are shown in the two embodiments described above, but preferably there should be three.

In the modification of FIGURE 7, different intensity raps are generated by means of a rapper bar **17** outwardly displaceable from a center position. A casing **18** encloses the rapper mechanism which comprises a spring **20** embracing the reduced end **17'** of the rapper bar **17**. A cam member **21** which revolves together with shaft **22** has two finger-shaped extensions **23** and **24** adapted to bear consecutively against the projecting cross member **25** on rapper bar **17**, the short finger, by urging the bar against the compression spring, generating a weaker rap and the following longer finger **24**, by urging the bar a greater distance and thus more strongly compressing the spring, generating a much more powerful rap. The lower part **19** of the box **18** is detachable and filled with a protective liquid **26**, preferably oil.

The described mechanism permits electrical and electromagnetic rapper elements or vibrators to be dispensed with and raps of graduated power to be generated by mechanical means for cleaning off the collecting electrode plates without whirling up dust.

Having now described the means by which the objects of this invention are obtained, we claim:

1. Mechanism for rapping collecting electrode plates in electrostatic precipitators by the application of hammer raps to an end of a rapper bar engageable with said plates, comprising a rapper bar, a rotary driving member, at least two tumbling hammers, said hammers being of consecutively increasing weight means mounting said hammers on the same axis eccentrically joined to said rotary driving member in such manner that rotation of the rotary driving member causes a light hammer to first hit said bar and a following heavier hammer to then hit said first light hammer so that the hammers rap the rapper bar with a series of raps each consisting of a number of raps of increasing intensity.

2. Mechanism as in claim **1**, said tumbling hammers being of spherical or cylindrical disc-like shape, and said means mounting said hammers comprising movable arms joined to said hammers for said heavier hammer centrally striking the rear face of the preceding hammer which has already struck the rapper bar.

3. Mechanism as in claim **2**, further comprising means for increasing the weight of at least one of the hammers. one of the movable arms.

4. Mechanism as in claim **3**, further comprising means for increasing the weight of at lease one of the hammers.

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