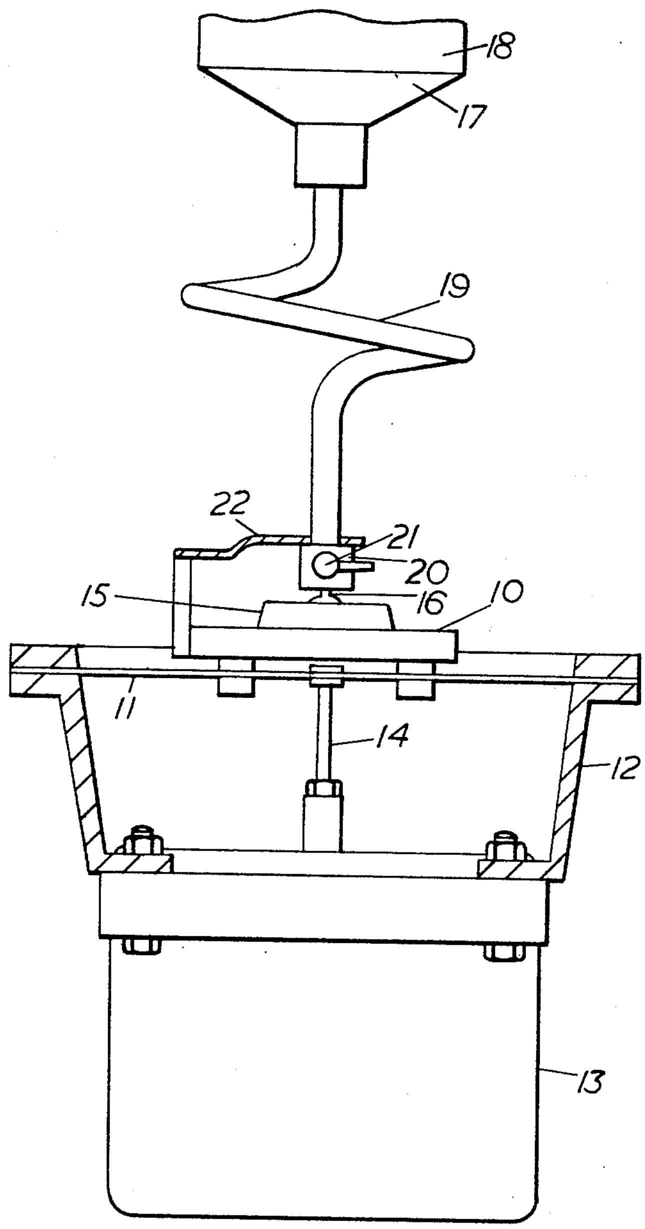
March 18, 1969 A. C. BEADLE ET AL 3,433,276

CARBON FILLING METHOD AND MACHINE

Filed Oct. 4, 1965 Sheet 1 of 2

FIG. 1.



Inventors
ANTHONY C. BEADLE
WILLIAM GARNER
By [signature]
Attorney

CARBON FILLING METHOD AND MACHINE

FIG.2.

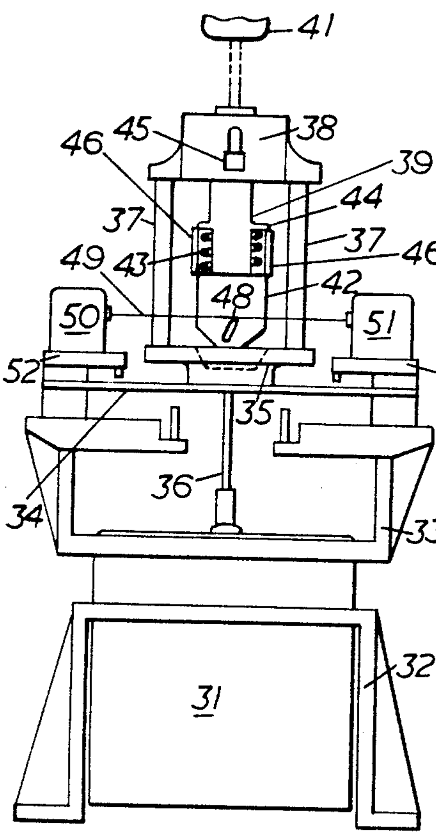
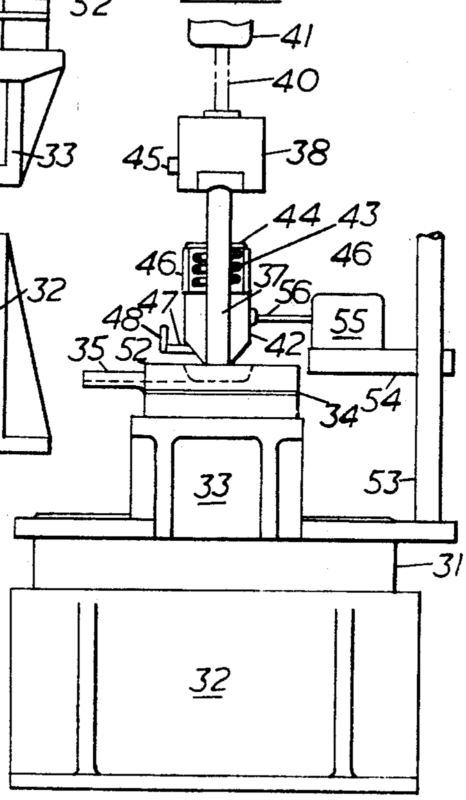


FIG.3.



Inventors
ANTHONY C. BEADLE
WILLIAM GARNER
By Percy P. Lantzy
Attorney

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CARBON FILLING METHOD AND MACHINE

Anthony Crisp Beadle and William Garner, Aldwych, London, England, assignors to International Standard Electric Corporation, New York, N.Y., a corporation of Delaware

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Int. Cl. B65b 1/22, 1/28; B01f 13/00

ABSTRACT OF THE DISCLOSURE

Method and apparatus for filling containers with granular material to a consistent percentage of full volume. The containers are mounted on horizontal strips of flexible material and vertically vibrated coincident with the container axis while granular material is allowed to fall freely into the containers. Subsequent to the vertical vibration the container is vibrated horizontally.

This invention relates particularly to methods of filling the carbon chamber of a carbon granule telephone transmitter and to apparatus for performing these methods, although the invention can be used in other applications where it is necessary to fill a container with a granular material with a high degree of accuracy.

An important factor in the production of carbon granule telephone transmitters is the introduction of the correct volume of carbon to the carbon chambers. Also, to obtain a uniform product it is desirable to fill the transmitters to a constant percentage of the carbon chamber volume thus catering for variation in volume between transmitters. It has been found satisfactory in the past to insert a fixed volume of carbon into the carbon chamber, because the carbon chambers have been sufficiently large that satisfactory characteristics have been obtained without the chamber having a very high percentage filling, and also small variations in the volume of the chamber or the volume of carbon introduced do not vary the percentage filling to an extent which critically affects the transmitter characteristics. However, some recent telephone transmitters have a lower carbon chamber volume which requires a very high percentage filling, that is to say in the region of 90% or above. A small difference in the volume of carbon introduced will have a greater effect on the percentage filling and is more likely to adversely effect the transmitter characteristics. In this case it has been proposed to completely fill the carbon chamber and then remove a fixed volume, correspondin to the mean free space required, to give a more accurate filling. The disadvantage of this method is that it requires two separate handling operations of the transmitter.

The present invention particularly aims to provide a method and apparatus for filling the latter type of low chamber volume transmitter to a consistent percentage of full volume, without close limits on chamber volume, in a single handling operation of the transmitter. The invention may also be used for high chamber volume transmitters and in other applications to fill a container with granular material.

Accordingly, this invention provides a method of filling a container with granular material which includes vibrating the container in a vertical direction while allowing the granular material to fall freely into the container.

This invention also provides apparatus for filling a container which is symmetrical about a major axis with granular material, which apparatus includes a strip of

flexible material held by a rigid framework, means for mounting the container on said strip with its major axis vertical, a vibration generator with its drive connected to said strip so that it can vibrate the container in a vertical direction, and a source of the granular material with a tube leading therefrom having its open end located over an opening in the container when the container is on the strip.

The invention will now be described with reference to the accompanying drawings, which show two embodiments of an apparatus for filling the carbon chamber of a carbon granule telephone transmitter according to the invention, and in which:

FIG. 1 shows a simplified front view of the first embodiment,

FIG. 2 shows a simplified front view of the second embodiment, and

FIG. 3 shows a simplified side view of the second embodiment.

Referring to FIG. 1, a platform **10** is mounted about the centre of a flexible strip **11** of S.R.B.F. (synthetic resin bonded fabric). The strip **11** is clamped at either end to a framework **12** which is rigidly attached to the casing of a vibration generator (vibrator) **13**. The vibrator drive **14** is connected to the central point of the strip **11**. The arrangement is such that, when operated, the vibrator drive **14** moves along a vertical axis and vibrates the strip **11** about a position of rest in a horizontal plane. In its position of rest, the platform **10** is horizontal and it has a recess to carry a transmitter **15**, so that the axis of the transmitter **15** is vertical and coincident with the axis of the vibrator drive **14**. The filling hole **16** of the transmitter carbon chamber is on the axis of the transmitter and faces upwards. A bottle **17** is the source of carbon granules **18** and is connected by a flexible tube **19** to a nozzle **20** with a rotary tap **21** over the filling hole of the transmitter. The tube **19** is formed into a spiral to reduce the stiffness in the direction of vibration. The platform **10** has a spring clip **22** which clamps the nozzle **20** into the filling hole of the transmitter.

A method of working the above described apparatus is to perform the following sequence of operations, each operation being separately performed by the operator.

(1) Insert the empty transmitter into the recess in the platform and adjust the spring clip.

(2) Switch on the vibrator and adjust its output to the required value.

(3) Open the tap.

(4) Close the tap after the required time.

(5) Switch off the vibrator.

(6) Remove the transmitter.

Experimental studies have demonstrated the desirability of making the axis of vibration substantially coincident with the transmitter axis as in the above described apparatus. With the vibration in any other direction relative to the axis of the transmitter, e.g. at 90 degrees to the axis, the percentage volume filling of the carbon chamber varied greatly with small changes in the time of filling employed and was critically dependent on the vibration amplitude i.e. it did not remain consistent with small changes in the vibration generator current.

Tests with this apparatus have shown the desirability of having the transmitter axis substantially vertical. The volume of carbon retained in the transmitter was greater in this position; for example, where a 92% filling of the carbon chamber volume was obtained with the transmitter axis vertical then, with all other conditions the same, an 85% filling was obtained with the transmitter axis at 32° to the vertical and a 75% filling was obtained with the transmitter axis at 40° to the vertical. It was also found that with the transmitter axis vertical the percentage filling was not critically dependent on the amplitude of vibration. The percentage filling varied by only 0.5% when the vibrator amplitude of vibration was varied by a factor of 3. Furthermore, there was no significant variation in filling with time in the range 30 seconds to 2 minutes with transmitters whose carbon chamber volumes were approximately 0.5 cc.

The above-described apparatus gives a consistent percentage volume filling of carbon transmitters in spite of variation in carbon chamber volume due to the non-uniformity of the manufactured transmitter.

It was found as described above, that a percentage filling of between 90% and 91% was obtained with a particular transmitter that actually required a 94% filling for best operating characteristics. It was found possible to increase the percentage filling by the required amount by fitting an adaptor to the nozzle **20** to increase the length of the carbon tube below the tap **21**; the correct length of increase was found by experiment and gave consistent results.

When the apparatus is used to obtain very high percentage filling such as 94%, as described in the previous paragraph, or above it is found that the carbon charge does not always settle evenly. This makes it difficult for a stopper to be pressed home into the filling hole of the carbon chamber, and it may even result in some of the carbon charge overflowing the carbon hole. It has been found that the settlement of the carbon charge may be assisted by imparting a small shock vibration to the transmitter after the closure of the carbon nozzle tap. This also aids the fall of carbon remaining in the tube below the carbon tap after the closure of the tap. One way of imparting this shock vibration is to lightly tap the transmitter case with the gong hammer of a telephone set ringer.

FIGS. 2 and 3 show a modified form of the apparatus shown in FIG. 1. The vibration generator (vibrator) **31** (which is the same type is shown in FIG. 1) is held in a rigid framework **32** and a framework **33** is rigidly attached to the vibrator casing. A strip **34** of S.R.B.F. is clamped at either end to the framework **33**. A platform **35** is mounted on the centre of the strip **34** and the vibrator drive **36** is attached to the centre of the strip **34** and holds the platform **35** to the strip **34**. The platform **34** has a recess (shown dotted) to hold a transmitter and extends forward (see FIG. 3) so that the transmitter may be slid into position from the front of the apparatus.

Two pillars **37** are mounted on the platform **35** and support a bridge-piece **38** which is generally cylindrical with side pieces for attachment to the pillars **37**. The bridge-piece **38** has a vertical cylindrical aperture through which passes a thick-walled rigid tube **39**. A tube **40** leading from a bottle of carbon granules **41** is fixed to the top opening of the tube **39**. A hollow cylindrical member **42** is mounted over the lower part of the tube **39**, and a helical compression spring **43** is held between the top of the member **42** and a flange **44** on the tube **39**. A key **45**, held in a channel in the bridge-piece **38**, connects with the tube **39**, and can be moved up to lift the tube **39** and member **42** to allow a transmitter to be inserted in the recess in the platform **35**, after which the key **45** can be moved down and locked to clamp the transmitter in position. The lower ends of the tube **39** and the member **42** are shaped to fit over a mound-shaped protuberance containing the filling hole of the transmitter. When clamped in position the transmitter compresses the spring **43**. A spacing ring **46** determines the depth to which a nozzle on the end of the tube **39** can penetrate into the filling hole of the transmitter.

A rotary tap **47** (FIG. 3) in the end of the tube **39** extends through a hole in the member **42**. The tap **47** has an arm **48** rotatable in a vertical plane about the tap **47** as an axis. A horizontal cable **49** is attached to the end of the arm **48** away from the tap **47**. The cable **49** can be moved across the apparatus to rotate the arm **48** and so

open and close the tap **47** by means of two solenoids **50** and **51** (shown in FIG. 2) mounted on platforms **52** on the framework **33**.

FIG. 3 shows a column **53** and platform **54** supporting a second vibrator **55**, which is a modified uniselector having an arm **56** extending horizontally as far as the member **42**. When this second vibrator is switched on the arm **56** vibrates horizontally and imparts a horizontal vibration to the member **42** and hence the transmitter held in the platform **35**.

A preferred method of working the apparatus described above with reference to FIGS. 2 and 3 is to perform the following sequence of operations.

(1) Place the empty transmitter on the platform **35** and slide it into position.

(2) Lower the key **45** to clamp the transmitter to the platform **35**.

(3) Switch on the vibrator **31**.

(4) Open the tap **46** by operating the solenoids **50** and **51**.

(5) Close the tap **47** by operating the solenoids **50** and **51**.

(6) Switch off the vibrator **31** after the required time.

(7) Switch on the vibrator **55**.

(8) Switch off the vibrator **55** after the required time.

(9) Raise the key **45** to unclamp the transmitter.

(10) Remove the transmitter from the platform **35**.

Operations 3 to 8 of the above sequence are controlled electrically rather than directly by hand, and it is possible to perform these operations automatically by a timing mechanism. The timing mechanism can be, for example, a slow running motor associated with a set of cams which successively operate microswitches to perform the operations 3 to 8 in the desired sequence and at the required intervals.

While the principles of the invention have been described above in connection with specific apparatus and applications, it is to be understood that this description is made only by way of example and not as a limitation on the scope of the invention.

We claim:

1. A machine for filling containers to a consistent percentage of full volume with granular material, said machine comprising a rigid framework, a horizontal strip of flexible material held by said rigid framework, means for mounting a granular material outlet nozzle on said strip such that at least one of said containers will be clamped into filling position on said strip by said nozzle on said strip so that the major axis of said container is vertical, first vibrator means connected to said strip to cause said mounted container to vibrate in a vertical direction, a source of said granular material, and flexible hollow member means leading from said source to said nozzle, which nozzle in turn communicates with an opening in said mounted container for transferring said granular material from said source to said mounted container to enable the free fall of said granular material into said container while the container is vibrating.

2. A machine for filling containers to a consistent percentage of full volume with granular material,

said machine comprising a rigid framework,

a horizontal strip of flexible material held by said rigid framework,

means for mounting at least one of said containers on said strip so that the major axis of said container is vertical,

first vibrator means connected to said strip to cause said mounted container to vibrate in a vertical direction,

a source of said granular material,

flexible hollow member means leading from said source to an opening in said mounted container for transferring said granular material from said source to said mounted container to enable the free fall of said granular material into said container while the container is vibrating, and second vibrator means couplied to said hollow member means to horizontally vibrate said hollow member means and said container after the filling process.

3. The machine of claim 2 wherein said hollow member means includes rotary tap valve means for controlling opening and closing of said hollow member means and solenoid means coupled to said rotary tap valve means for controlling the opening and closing of said hollow member means with said tap means.

4. A method of filling containers with granular material to a consistent percentage of full volume, said method comprising the steps of clamping at least one of said containers between a horizontal resilient platform and an outlet nozzle mounted on said platform with its vertical axis normal to said platform, coupling said container via said nozzle to a source of granular material which material is fed to said container and nozzle through a flexible coupling so that said material can free fall into said container, vertically vibrating said horizontal resilient platform at a certain amplitude for a fixed period of time, and decoupling the container to remove it from said platform.

5. The method of filling containers of claim 4 including the steps of opening a tap on the coupling between the source of granular material and the container to enable the granular material to free fall into said container during the vertical vibration of said platform and of closing said tap after said fixed period of time.

6. A method of filling containers with granular material to a consistent percentage of full volume,

said method comprising the steps of clamping at least one of said containers on a horizontal resilient platform with the vertical axis normal to said platform,

coupling said container into a source of granular material through a flexible coupling so that said material can free fall into said containers,

vertically vibrating said horizontal resilient platform at a certain amplitude for a fixed period of time,

opening a tap on the coupling between the source granular material and a container to enable the granular material to free-fall into said container during the vertical vibration of said platform,

closing said tap after said fixed period of time,

terminating the vertical vibration of said container after said fixed period of time,

horizontally vibrating said container for a certain time period, and

decoupling the container to remove it from said platform.

7. A method of filling containers with granular material to a consistent percentage of full volume,

said method comprising the steps of clamping at least one of said containers onto a horizontal resilient platform,

coupling said container to a source of granular material so that said material can freely fall into said container,

vertically vibrating said horizontal resilient platform at a certain amplitude for a fixed period of time,

opening a rotary tap valve on the coupling between said source of granular material and the container to enable the granular material to freely fall into said container during the vertical vibration of said platform,

closing said rotary tap valve after said fixed period of time,

horizontally vibrating said container for a certain period of time after said fixed period of time, and

unclamping said container to remove it from said platform.

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LAVERNE D. GEIGER, *Primary Examiner.*

EDWARD J. EARLS, *Assistant Examiner.*

U.S. Cl. X.R.

141—74; 259—91