United States Patent [19]

Gorius

[11] **3,878,815**

[45] **Apr. 22, 1975**

[54] **CONSTANT-FLOW SPRAY-GUN COATING MACHINE**

[75] Inventor: **Daniel Louis Marie Gorius,** Pont-A-Mousson, France

[73] Assignee: **Pont-A-Mousson S.A.,** Nanay, France

[22] Filed: **Apr. 17, 1974**

[21] Appl. No.: **461,770**

[30] **Foreign Application Priority Data**

May 18, 1973 France 73.18190

[52] **U.S. Cl.** **118/318;** 118/50; 118/313; 239/654; 239/675

[51] **Int. Cl.** **B05c 7/02**

[58] **Field of Search** 118/318, 50, 63, 313, 317; 239/654, 672, 675, 421

[56] **References Cited**

UNITED STATES PATENTS

2,170,314	8/1939	Williams	118/318
2,470,958	5/1949	Stromquist	118/318
2,821,164	1/1958	Ingala	118/317
3,563,475	2/1971	Emery et al.	239/654
3,717,752	2/1973	Warning	239/675
3,760,933	9/1973	Maldeis et al.	118/317

Primary Examiner—Mervin Stein
Assistant Examiner—Douglas Salser
Attorney, Agent, or Firm—Sughrue, Rothwell, Mion, Zinn & Macpeak

[57] **ABSTRACT**

The machine comprises a container for pulverulent or granular material to be coated for example on the inside of cast-iron pipes, and a screw conveyor for conveying the material to a tube which has a spraying means at its outlet end. A pneumatic driving means for the material is interposed between the conveyor and the tube. A case is disposed around the conveyor and the driving means and pressurizing means are connected to the container and to the case so as to create the same pressure in the case and container which is higher than atmospheric pressure. Means are provided for supplying the air in the case to the pneumatic driving means.

8 Claims, 4 Drawing Figures

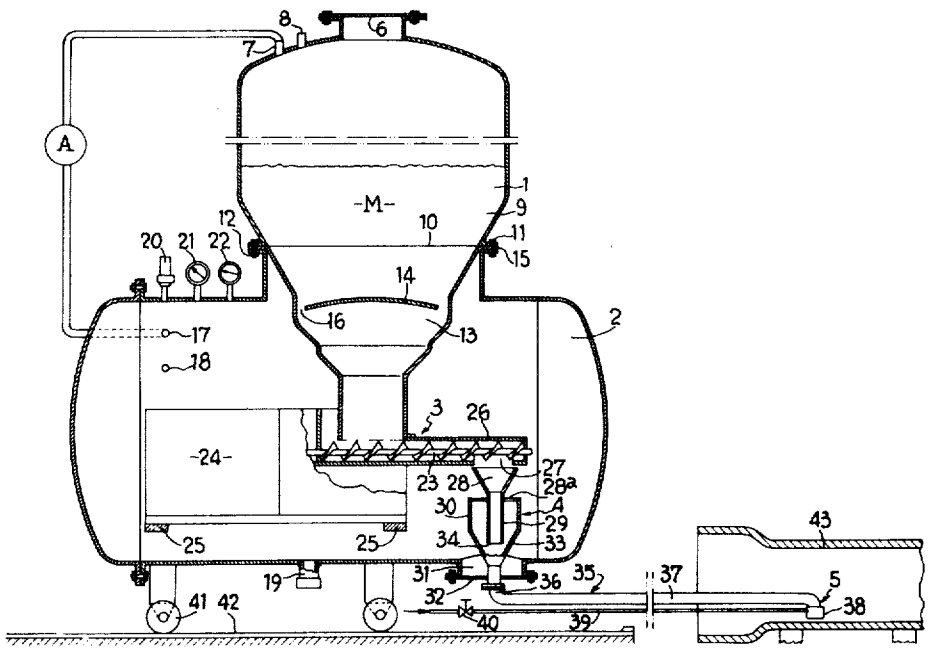


FIG. 1

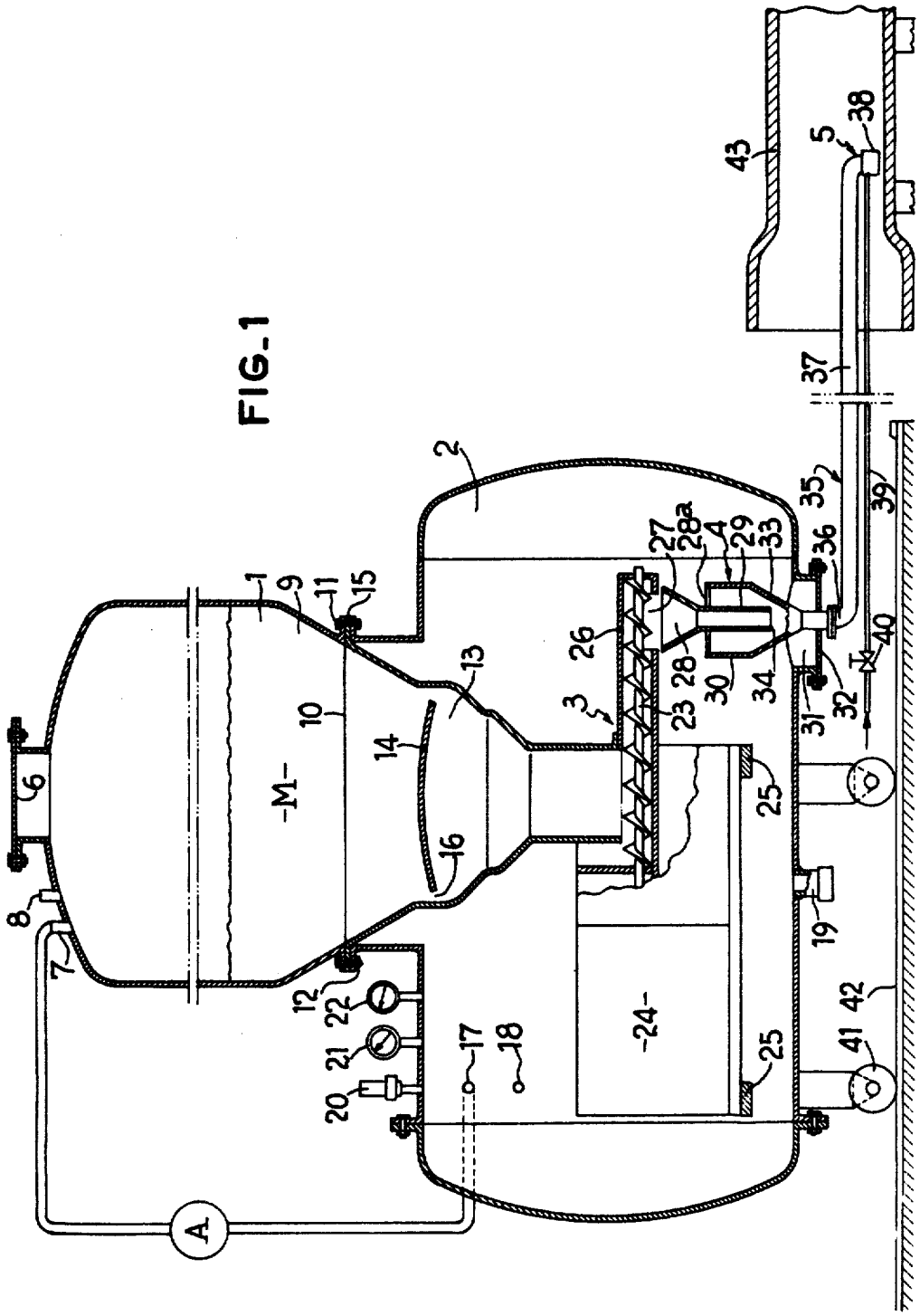

43
5
38
37
2
35
39
27
28a
4
29
33
36
1
9
11
15
26
28
30
34
40
31
32
13
3
23
10
-M-
14
16
6
8
7
12
22
21
20
17
18
-24-
25
19
41
42
A

FIG_2

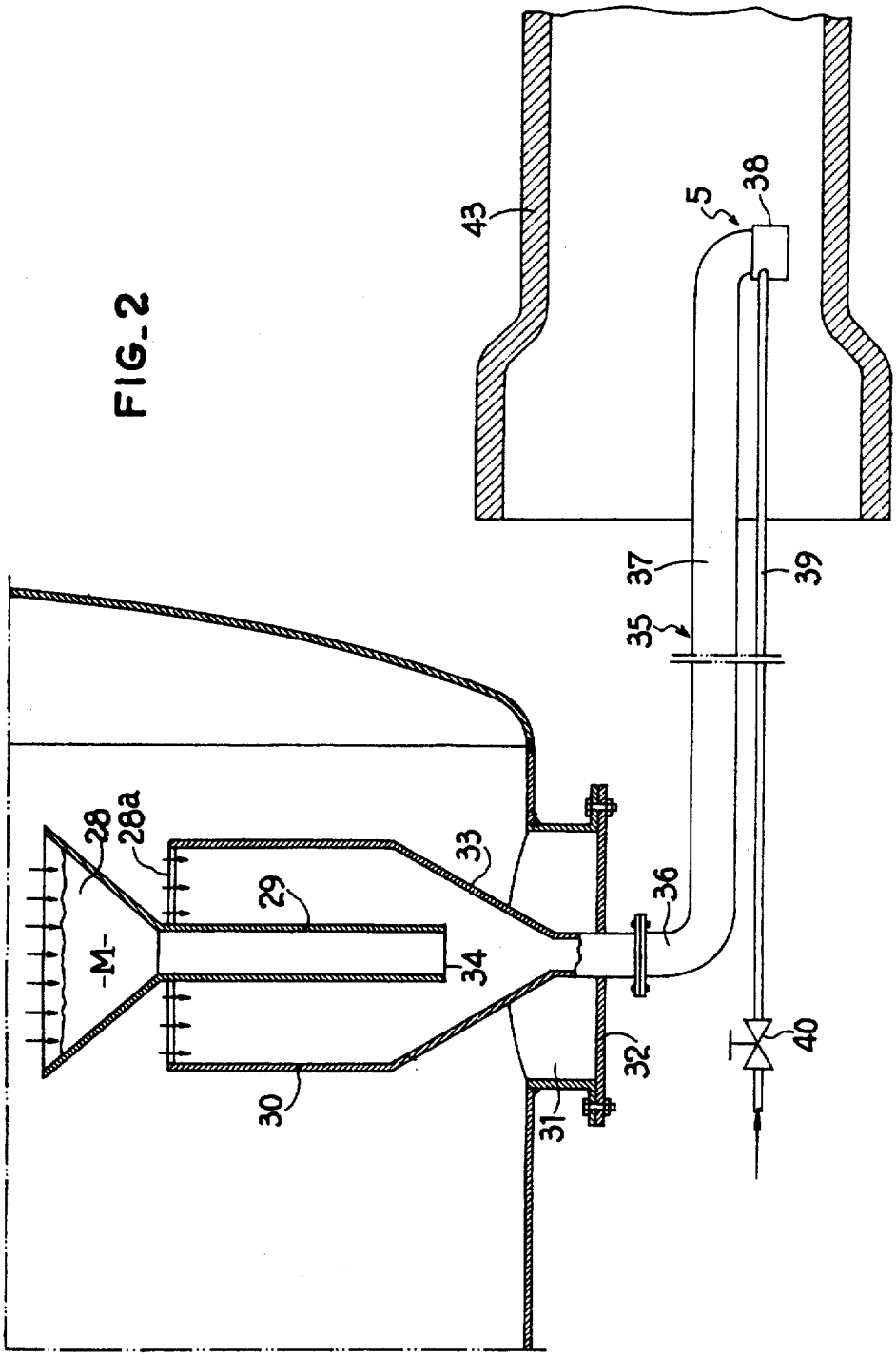


FIG_3

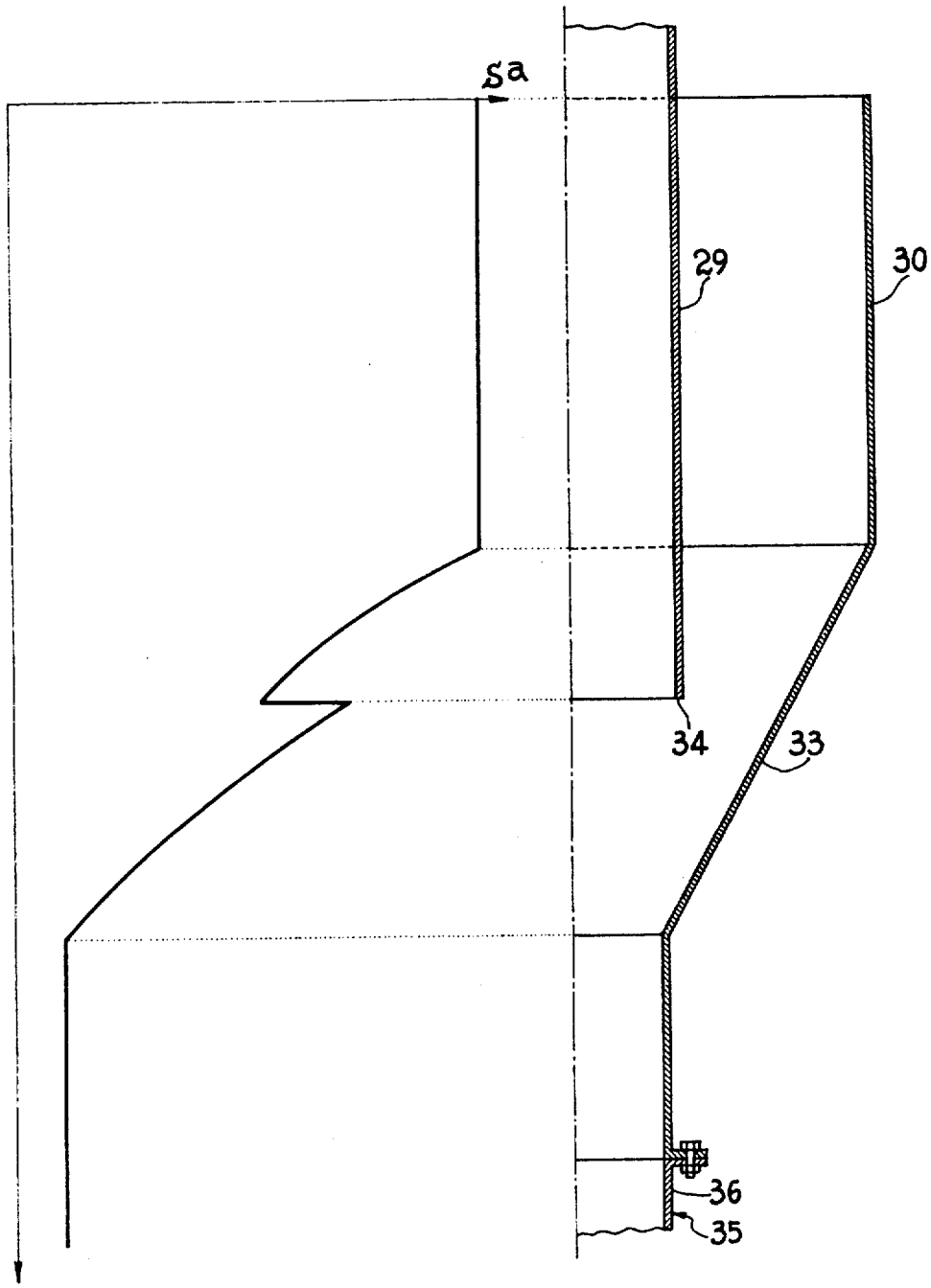
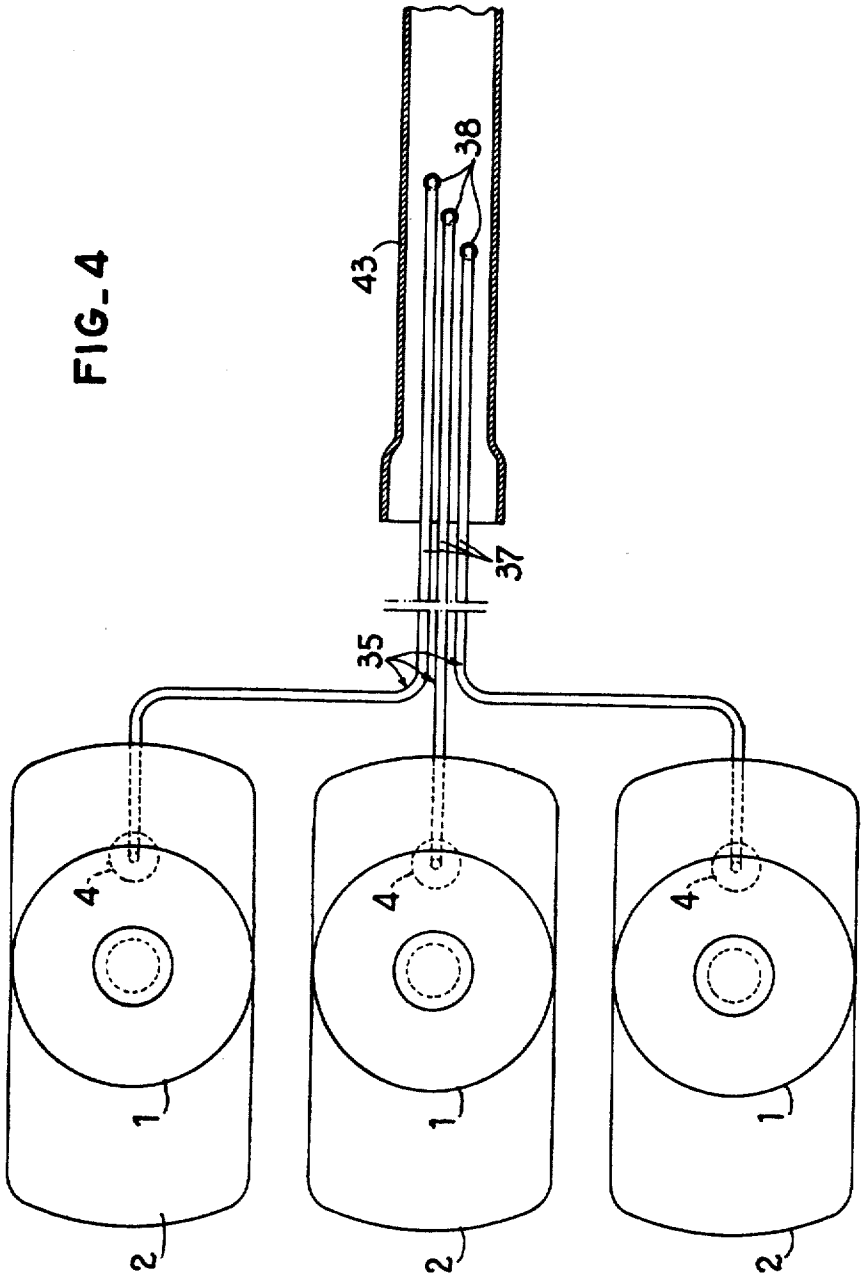


FIG_4



CONSTANT-FLOW SPRAY-GUN COATING MACHINE

The present invention relates to constant-flow spray-gun coating machines, for example for the internal coating of cast iron pipes with mortar, and more particularly concerns machines of the type comprising a container for granular or pulverulent material, a screw conveyor for said material located under the outlet of the container and pneumatic drive means for driving the material disposed between the screw conveyor and a tube provided with spraying means at the outlet end of the tube.

When it is desired to obtain a coating of very high quality as concerns for example the constancy of the thickness and of the compactness and the evenness of the surface of the coating, known machines of this type possess a number of drawbacks. First, the spraying means is hand controlled and this requires great skill on the part of the operator and results in high labour cost. The tube carrying the spraying means is flexible and its deformation adversely affects the regularity of the air-material stream. As moreover the supply of the screw conveyor is not controlled, pulsatory phenomena occur in the tube and lumps of material are formed at the inlet end of the tube.

An object of the present invention is to overcome these drawbacks and to provide a machine which is simple in construction and reliable, ensures a regular flow of material and does not require the intervention of an operator for the spraying of the material.

The invention provides a machine of the aforementioned type further comprising a case in which are disposed the screw conveyor and the pneumatic drive means and pressurizing means connected to the container and to the case so as to create the same pressure therein, which pressure is higher than atmospheric pressure, the pneumatic drive means being so adapted as to be supplied with the air contained in the case.

Another object of the invention is to provide an apparatus comprising a plurality of said machines for the coating of a pipe with a plurality of different layers of mortar.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings.

In the drawings:

FIG. 1 is a diagrammatic vertical sectional view of a spray-gun coating machine according to the invention;

FIG. 2 is a sectional view of a detail of this machine;

FIG. 3 is a diagram of the variation in the section along this detail, and

FIG. 4 is a diagrammatic plan view of an apparatus comprising three spray-gun coating machines.

The apparatus shown in FIG. 1 for mixing a pulverulent material M with compressed air and thereafter spraying this mixture, comprises a container 1 having a vertical axis, a case 2 having a horizontal axis, a screw conveyor 3, a head 4 for mixing the material M with compressed air, and a spraying device 5.

The container 1 is of steel and has a generally cylindrical shape. In the presently-described embodiment, it has a volume of 500 litres and is constructed to withstand a pressure of 8 bars.

This container 1 is closed hermetically in its upper part by a cover 6. Provided in the vicinity of the cover are a compressed air supply orifice 7 and a decompression orifice 8. The container 1 has a frustoconical lower part 9 defining an opening 10 which is provided with an outer flange 11 for securing the container 1 to the case 2, the latter having on its upper generatrix an opening which is of the same diameter as the opening 10 and provided with an outer flange 12.

The material M contained in the container 1 is a mixture of sand and cement having a sand/cement ratio which is suitable for the desired quality of the mortar. The generally cylindrical case 2 is also of steel and has, in the presently-described embodiment, a volume of about 500 litres and is designed to withstand a test pressure of 8 bars. A hopper 13, associated with a vibrating deflector 14, is secured to the opening of the case 2 by an outer flange 15, this device being known commercially under the trademark "Bin-Activator". The adjustment of the vertical position of the deflector 14 enables an annular space 16, putting the container 1 in communication with the case 2, to be defined.

The case 2 is provided laterally with a compressed air supply orifice 17 and a decompression orifice 18. A source of compressed air A is connected to the orifice 7 of the container 1 and the orifice 17 of the case 2. The latter has, located at a low point thereof, an orifice 19 for draining off any water of condensation which might be present. A safety valve 20, a pressure gauge 21 and a thermometer 22 are also provided on the case 2.

The screw conveyor 3 is disposed under the lower opening of the hopper 14 on the axis of the case 2 and the screw 23 of the conveyor is driven at an adjustable speed by an electric motor 24, the assembly bearing on horizontal girders 25 which extend transversely in fixed position inside the case. The screw conveyor is commercially available under the trade mark "Vibrascrew".

The screw 23 is rotatably mounted in a vibrating sleeve 26 whose end remote from the motor 24 has a downwardly-facing notch 27. Disposed under the notch 27 is a hopper 28 whose upper part is frustoconical and whose lower part 29 is cylindrical and surrounded by a cylindrical upper part 30 of the mixing head 4, the diameter of the part 30 being distinctly greater. Three horizontal bars 28" support the hopper 28 and maintain a constant annular space between the latter and the upper part 30 of the mixing head 4. This mixing head, which extends through an opening 31 formed in the lower part of the case 2 and is provided with a sealing cover 32, is extended by a convergent frustoconical part 33. The lower end 34 of the hopper 28 is located in the region of this frustoconical part 33. A rigid cranked tube 35 is secured to the lower cylindrical end of the mixing head 4 and has a vertical portion 36, a horizontal portion 37 and a downwardly-open, vertical end portion provided with spraying means 38. A flexible water pipe or hose 39, connected to a water tank through a pump (not shown), opens into the spraying means 38. The water flow is controlled by a valve 40.

The whole of the machine is carried by wheels 41 and movable along rails 42. Reference numeral 43 designates a cast-iron pipe intended to be internally coated with mortar.

FIG. 2 shows diagrammatically the mixing head 4 and FIG. 3 is a diagram of the variation along this head 4 of the cross section S" through which the air travels through this mixing head. The section S" is first constant, rapidly decreases in the frustoconical part 33,

suddenly increases in the region of the end **34** of the inner hopper **28**, and then decreases to the value of the section of the cranked tube **35**.

The machine operates in the following manner :

With the pulverulent material M in the container **1**, the horizontal part **37** of the tube **35** is inserted in the pipe **43** and the container **1** and the case **2** are put under the same pressure, for example between **2** and **3** bars, by means of the common source of compressed air A.

The height of the vibrating deflector **14** defining the annular space **16** for the passage of the material M is adjusted to allow through a given amount of the material into the hopper **30**. This material falls onto the screw conveyor **3** and is conveyed, without accumulation owing to the action of the vibrating sleeve **26**, to the notch **27** of the latter. It then falls with a known and regular flow into the hopper **28**.

The air, maintained at constant pressure in the case **2**, tends to escape to the atmosphere by way of the mixing head **4** and tube **35**. It is accelerated by the reduction in the section in the frustoconical part **33** of the mixing head and the air flow/material flow ratio is high so that the particles of material have no tendency to gather together. The mixture of air and material reaching the spraying means **38** of the tube **35** is moistened by a spray of water having a suitable rate of flow coming from the flexible pipe **39** and is sprayed over the wall of the pipe **43**. This pipe is driven in rotation at low speed by suitable means (not shown) while the machine travels along the rails **42**. Pressure gauges (not shown) enable the pressure along the tube **35** to be controlled.

A smoothing device for compacting and smoothing the deposited mortar may be provided in the vicinity of the spraying means **38**.

It is also possible to employ a plurality of machines of the type described hereinbefore, each machine furnishing a mixture of given composition to the tube **35**, the spraying means being staggered as shown in FIG. **4**. This enables a pipe to be coated, with a plurality of layers of mortar having different characteristics, in one passage or travel of the machines.

The large capacity of the case **2** with respect to the flow of air ensures an excellent constancy of this flow. The machine enables the mortar to be metered precisely and evenly and consequently achieves coatings of well-defined characteristics exempt of defects as concerns thickness (precision to within 5%), compactness, adherence to the pipe and evenness of the surface of the coating. The machine is simple to construct and is highly reliable.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

1. A spray-gun coating machine, in particular for internal coating of cast-iron pipes with mortar, comprising a container for pulverulent or granular material, means defining an outlet in the container for outlet of the material, a screw conveyor for said material disposed under the outlet of the container, a tube which is provided at an outlet end with spraying means, pneumatic material driving means mounted between the screw conveyor and the tube, a case in which are disposed the screw conveyor and the pneumatic material driving means, pressurizing means connected to the container and to the case so as to create the same pressure in the container and the case, which pressure is higher than atmospheric pressure, and means for supplying the air contained in the case to the material driving means.

2. A machine as claimed in claim **1**, further comprising a flow-regulating device mounted between the outlet of the container and the screw conveyor.

3. A machine as claimed in claim **1**, wherein the volume of the case is very large with respect to the volume of air supplied to said pneumatic material driving means per unit time.

4. A machine as claimed in claim **1**, wherein said pneumatic material driving means comprise means defining an air passage, means defining a material passage opening onto the air passage, the air passage having a very large section with respect to the section of the material passage in the region in which the mixture is effected.

5. A machine as claimed in claim **4**, wherein the air passage is disposed annularly with respect to the material passage, the section of the air passage on the whole decreasing in the direction of movement of the air to the screw conveyor.

6. A machine as claimed in claim **1**, wherein said tube is rigid.

7. A machine as claimed in claim **1**, wherein the machine is movable on wheels.

8. A spray-gun coating apparatus comprising a plurality of coating machines, each of which machines comprising a container for pulverulent or granular material, means defining an outlet in the container for outlet of the material, a screw conveyor for said material disposed under the outlet of the container, a tube which is provided at an outlet end with spraying means, pneumatic material driving means mounted between the screw conveyor and the tube, a case in which are disposed the screw conveyor and the pneumatic material driving means, pressurizing means connected to the container and to the case so as to create the same pressure in the container and the case, which pressure is higher than atmospheric pressure, and means for supplying the air contained in the case to the material driving means, the spraying means of said machines being in staggered relation to each other so as to permit the application of a plurality of superposed layers of coating in a single operation.

* * * * *