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NOZZLE FOR GUNNING REFRACTORY MATERIAL

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This invention relates to a device for use in the placing of flowing refractory materials and the repair of furnaces, boilers, cupolas and the like by means of a gunning apparatus.

It has long been known to apply granular refractory materials to furnace linings and the like, either hot or cold, by means of gun devices. One such device includes means for supplying a flow of such granular material under pressure and in a current of air to a nozzle device where the refractory material is mixed with water and air, and then the mixture flows forwardly through the nozzle and is projected therefrom onto the desired location. One of the problems involved in the use of devices for applying air-emplaced materials, such as refractory gunning and castable mixes, is the so-called "fogging." Use of the conventional prior art nozzle devices wherein the dry refractory materials are admixed with air and water just prior to ejection from a nozzle, to cause these materials to have the desirable plastic consistency whereby they will stick to the surfaces which are to be covered or coated, has resulted in this "fogging" disadvantage. Fogging results from improper or insufficient mixing of the water and air with the dry material, so that as the refractory or other similar material is ejected from the nozzle device, portions of such material are ejected in a substantially dry state, whereby there results a dust-like cloud, known as fogging; and another disadvantage is the high amount of rebound of the material from the surface being treated, with consequent loss thereof. The result, among other disadvantages, is a wastage of the material being applied; and a serious disadvantage of fogging is the prevention of visual inspection of the areas or surfaces to which the material is being applied by means of the nozzle device.

According to the present invention it has been found that by use of the device to be described herein the fogging noted above is substantially eliminated, and rebound is substantially reduced or minimized. The elimination of this fogging is attained by use of a means for conducting fluent granular refractory material in a restricted path and especially as having a fitting incorporated in a nozzle device which has also two water-and-air injection means spaced from each other, in such a manner that a turbulent or cyclonic mixing zone is provided between such injection means, to thereby admix the dry materials and the water prior to discharge thereof in a wet state from the nozzle. This turbulence zone, or cyclonic mixing zone, insures a substantially complete wetting of the material with the water or tempering liquid. It can also eliminate upstream premixing or wetting of the materials as well as the clogging problems which have hitherto occurred in the hoses employed in this operation. The use of the instant device also eliminates haphazard application of the material and wastage of the material, and insures better consistency of the refractory mix as it is applied.

The device according to the present invention is illustrated in the annexed figures as follows:

FIGURE 1 shows an axial sectional view of the nozzle and the cyclonic mixing zone or turbulence zone thereof;

FIGURE 2 is an axial sectional view of another embodiment of the turbulence or cyclonic mixing zone as included in the nozzle device;

FIGURE 3 is an end view of one embodiment of the turbulence fitting of a nozzle device, according to the present invention;

FIGURE 4 is a sectional view of the device of FIGURE 3 taken on line 4—4 of FIGURE 3;

FIGURE 5 is a perspective view of an assembled device.

In FIGURES 1 and 2 there is shown a device, indicated generally at **10**, which includes a sleeve **11** adapted to receive and hold a feed conduit or tube **12** for the introduction of fluent granular refractory material to and through the nozzle. Preferably, tube **12** is more tightly affixed to sleeve **11** by means of any desired number of screws **65**. A fitting or housing **13** is threadedly connected to the outlet of sleeve **11** and is provided at its inner face with an annular channel **14** which contains annular partition wall **15**, serving to subdivide channel **14** into two smaller channels **16** and **17**, the purposes of which will be later described. Threadedly connected to the forward end of housing **13** is turbulence fitting **18**, which is of short length and is coaxial with fitting **13** and tube **12**. A second housing **19** is threadedly connected to the forward end of turbulence fitting **18** and likewise contains an annular channel **20**, subdivided by radially disposed partition wall **21** into two smaller channels or subchannels **22** and **23**. An outlet tube **24** is suitably, e.g. threadedly, connected to the forward end of fitting **19**.

As noted above, annular channels **14** and **20** are respectively subdivided into smaller channels **16**, **17** and **22**, **23**, and into subchannels **16** and **22** water is introduced, while air is introduced into subchannels **23** and **17**.

For instance, water is introduced through inlet pipe **25**, the flow thereof to channel **16** being taken off through pipe **26** and passage **47**; and the flow to channel **22** being effected through connecting pipe **27** and passage **49**. Flow of water is further controlled by suitable valves **28** and **29**, which are preferably ball valves.

Air is introduced to the device through an air pipe **30** which is connected to a suitable source of compressed air, or air under pressure, and flows through connecting pipe **31** and passage **48** to air channel **17**; and through connecting pipe **32** and passage **50** to air channel **23**. Flow of air is suitably controlled by valves **33** and **34** which are preferably needle valves. As air flows into channels **17** and **23**, respectively, it is forced upwardly past the interior faces or ends of radially disposed partition walls **15** and **21** respectively into water channels **16** and **22** where it is admixed with the water coming in from water pipes **26** and **27**, respectively.

Water rings **35** and **36** are longitudinally disposed annular walls and are disposed over the inner faces of annular channels **14** and **20**, respectively. The rear face of water ring **35**, which is an annulus or ring tapering in longitudinal section inwardly toward the axis of the device in the direction of flow of the material, is seated against a gasket **37** which in turn rests agaist the forward end of hose sleeve **11** and the ring is thereby sealed to hose ring **11**. The forward end of water ring **35** seats against a gasket or sealing ring **43** which rests against shoulder **38** in the forward end of housing **13**. Ring **35** is provided with a number of holes or passageways **39** which are directed inwardly and are inclined in the direction of flow of material through the device. These passageways open at their outer ends into water channel **16** and at their inner ends into the interior of the nozzle device, whereby the mixture of water and air described hereinabove issues into intimate contact with the fluent granular refractory material passing through the device. Any suitable or desired number of passages **39** are provided in water ring **35**.