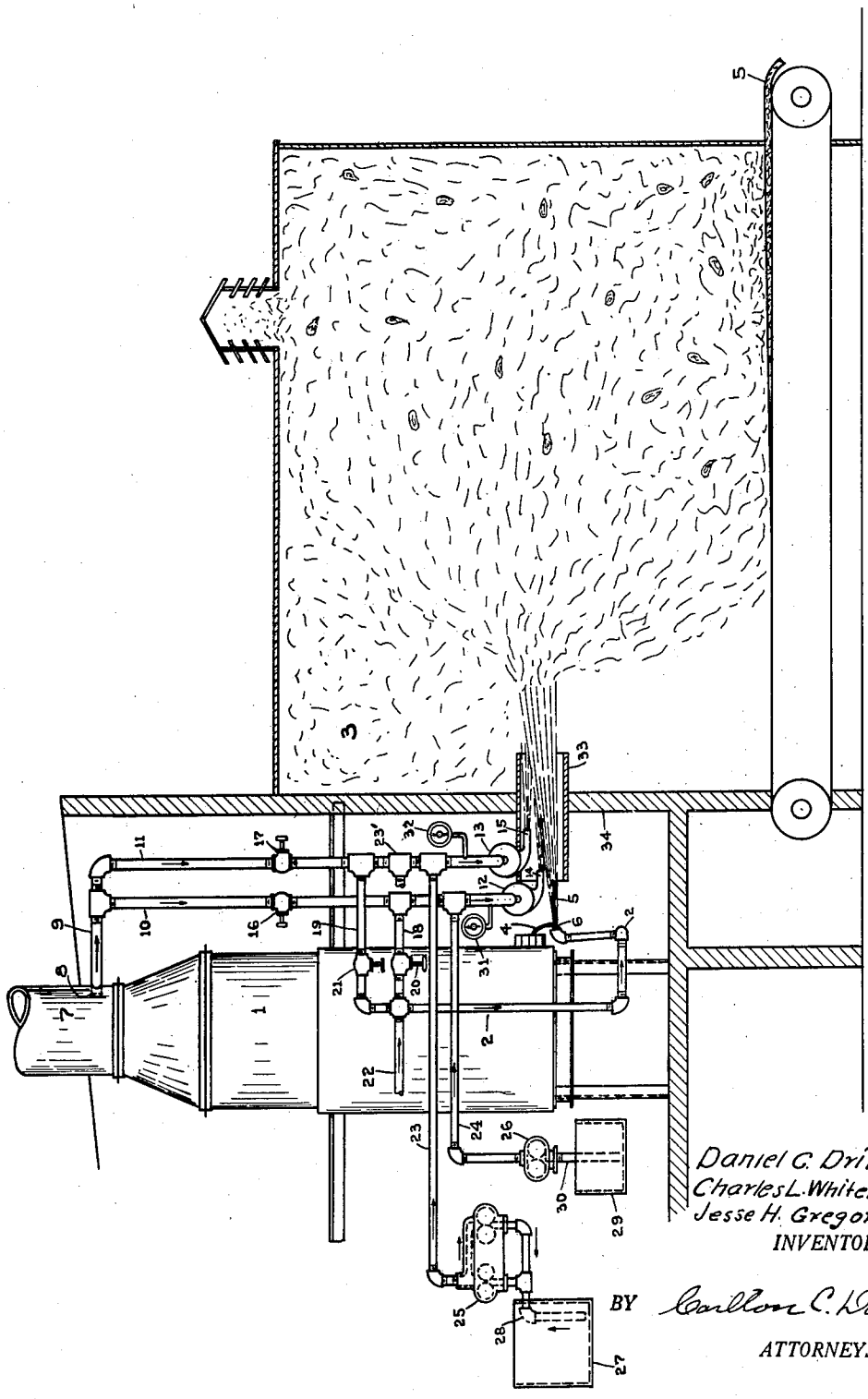
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METHOD OF APPLYING BINDING MATERIALS

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METHOD OF APPLYING BINDING MATERIALS

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Our invention generally relates to methods of applying binding materials in the production of felted mineral wool strips, blankets, and batts, hereinafter, for convenience termed "batts."

In order that a more perfect understanding of our invention may be had, a brief description of the methods usually followed in manufacturing mineral wool batts will be given.

Mineral wool is made of wool rock, or slag, to which a special fusing rock may be added. The raw material is mixed with coke in a cupola or furnace and heated to a temperature of (say, approximately 3000° F.), at which the material becomes molten and is permitted to pour out in a continuous stream of approximately one-half inch in diameter. This stream is subjected to a blast of steam of sufficient power to shred the molten material into fibers. The blast is directed into an adjacent blow chamber which is preferably provided with a movable base or conveyor. The length of the settling chamber is sufficient to permit the blast to leave the fibers in suspension, swirling in the heated vapors and gases of the chamber, above the conveyor.

These fibers are inherently tacky and rapidly combine in myriads of loose, fluffy bunches which slowly settle on the moving base of the conveyor to become incorporated with the forming batt. While the fibers are naturally tacky, they do not cling to each other sufficiently to provide a batt which may be moved about without falling to pieces. For this reason, a suitable binding material must be used.

Experience has taught that in order to obtain the desired results, the binding material must be more evenly distributed upon the surfaces of the individual fibers, before they have had an opportunity to combine in bunches, and best practice indicates that the binding material should be applied to the blast of steam and molten material before it enters the settling chamber.

The oldest and most widely used method is that of simply permitting the binding material to drop or pour directly upon the blast before it enters the settling chamber. This method, however, has numerous disadvantages, one of them being that the rate of flow of the material is not dependable when applied in this manner. One reason for this is that the character of the binding material is such that it tends to stick to the inside walls of the pipe through which it flows and almost invariably prevents the proper functioning of any valves which may be used to regulate and control its flow.

Another disadvantage found in using this method is that the binding material is not atomized before it falls upon the blast, and consequently falls upon only one portion of the blast in such a manner that it does not become evenly distributed on the forming fibers.

Heretofore, numerous other methods have been devised to achieve the even distribution necessary to the proper production of mineral wool batts but, insofar as applicants are aware, all of these methods leave much to be desired.

The chief object of our invention is to provide methods whereby any suitable binding material may be evenly distributed on the surfaces of the individual fibers before they become deposited on the base of the settling chamber.

Another object is to provide a method whereby two or more fluids may be so applied that a film or coating of binding material will be evenly precipitated, formed or deposited on the surface of each individual fiber before it is incorporated into the batt.

A still further object is the provision of methods whereby the binding materials may be discharged into the settling chamber under ideal conditions for distribution on the mineral wool fibers.

A further object is the provision of a method whereby both the temperature and the rate of flow of the binding material may be controlled as desired.

The full nature of our invention and its other objects and advantages will be understood from the accompanying drawing and the following description and claims.

The drawing is a side elevational and partly sectional view of a cupola and a blow chamber of a mineral wool plant having one of many embodiments of our invention operatively associated therewith.

In carrying out our invention we make use of any suitable cupola 1, blast means 2, and a blow chamber 3, which are operatively associated together for the production of mineral wool batts.

The mineral wool is produced by melting wool rock, or slag, in the cupola 1 with coke or gas and pouring the molten material in a stream 4 which is subjected to the action of a shredding steam blast 5 which issues from a nozzle 6 of the steam blast means 2.

The above described apparatus for producing the untreated mineral wool is, of course, old, the entire novelty of our invention residing in our improved ways whereby the mineral wool is treated with a binder or stiffening material to provide a satisfactory batt.

In adapting this apparatus to serve the purposes of our invention the stack 7 of the cupola 1 is provided with an open portion 8 for receiving the open end of a conduit 9. This conduit is connected to conduits 10 and 11, the lower ends of which are connected to centrifugal blowers 12 and 13. These blowers are preferably driven by any suitable motors (not shown) and are provided with exhaust tube portions 14 and 15 through which the atomized binding material or materials is or are blown into the settling chamber.

The conduits 10 and 11 are provided with suitable valve means 16 and 17 whereby the flow of gases through these conduits may be controlled. Below these valves the conduits 10 and 11 are respectively coupled to steam conduits 18 and 19 which are provided with any suitable valves 20 and 21. Each of these steam conduits is connected to a steam supply pipe 22 through which the steam is provided for the blast means 2.

The conduits 10 and 11 are respectively connected to binding material pipe lines 23 and 24. The pipe line 23 and the pipe line 24 are connected to the exhaust ports of preferably rotary pumps 25 and 26. Each of these pumps may be driven in any suitable manner but are preferably coupled to some suitable variable speed transmission means (not shown). The exhaust port of the pump 25 is operatively connected to a fluid supply tank 27 by a fluid intake pipe 28. The pump 26 is similarly connected to a tank 29 by an intake pipe 30.

The conduit 11 is preferably provided (for a purpose hereinafter described) with a second binding material supply pipe 23'. This pipe line is operatively connected to a pump and reservoir supply tank (not shown) which may be similar in construction to the pump 25 and the reservoir 27.

From the foregoing description of the various parts of the apparatus embodying our invention, it is apparent that two chemically mutually reactive liquid substances may be simultaneously discharged into the blow chamber 3 upon the blast 5 and that the apparatus may be adapted to make use of any number of other liquids by merely operatively connecting other pumps and other sources of fluid supply to the conduits 10 and 11. It is also apparent that two different liquids may be simultaneously discharged into the conduit 11, mixed together by the blower 13, and thereafter discharged to the settling chamber 3.

There are available for use numerous chemically mutually reactive substances which, if mixed together, would chemically combine to produce a suitable binder for a mineral wool batt, except for the fact that due to precipitation, polymerization or other causes, the combined material becomes hard, lumpy, granular, or otherwise unfit for even distribution on the individual mineral wool fibers. Many of these individual substances, however, may be liquefied and coated evenly upon the fiber surfaces if they are separately applied, or are mixed together and are applied before the combined material becomes unfit for use; for instance, a solution of either sodium silicate or alum may be readily distributed upon the surfaces of the mineral wool fibers, but after these two solutions are mixed and allowed to remain together, granules of silica are precipitated out of the combined solutions which in practice cannot be evenly coated upon the fibers.

If first one, and then the other of these two solutions is distributed upon the fibers, they combine together to make a suitable coating of binding material which will hold the fibers together when they become deposited on the base of the blow chamber.

A binding material consisting of animal glue and formaldehyde may be likewise separately applied to the mineral wool fibers. If, however, a solution of animal glue and a solution of formaldehyde are mixed together in a fluid supply container, tanning of the glue takes place and these two water-soluble solutions form a more or less water-insoluble substance which, in practice, cannot be properly applied to the mineral wool fibers.

The apparatus herein disclosed is adapted to make use of two methods, each of which is adapted to apply the binding materials before they become unfit for being evenly spread upon the fibers. In one method the individual substances are separately applied to the fibers. In the other method, the substances are mixed immediately before they are applied to the fibers.

In carrying out the first method, one suitable substance "A" is placed in the container 27, and another suitable substance "B" is placed in the container 29. Each of these substances, of course, must be such that it can be liquefied by suitable solvents, or by heat. If they are to be liquefied by the application of heat, some means must be provided for keeping them at the proper temperature. For this purpose, either one of the tanks may be provided with any suitable heating coil means (not shown).

The liquid substance "A" is drawn through the pump 25 and forcibly discharged into the conduit 11. The liquid substance "B" is forced through the pump 26 and the pipe line 24 and is discharged into the conduit 10. These conduits, by construction, are adapted to be supplied either with steam from the supply pipe 22, or with the products of combustion from the cupola stack 7, or both.

These two fluid substances are drawn down the conduits 10 and 11 into the blowers 12 and 13, the rotors (not shown) of which intimately mix and atomize the substances in the steam, or the products of combustion, or in the combined mixture of the two. One of the blowers is preferably placed in front of the other of the blowers, in order that one of the substances may be first applied to the forming fibers in the blast.

The second method takes advantage of the fact that in certain instances, and under certain conditions, some of the substances do not harden, granulate or otherwise become unfit for application to the surfaces of the mineral wool fibers immediately after the substances are mixed together. The second method has certain advantages, one of which is that, in using this method, the two substances are thoroughly mixed together in the blower. In applying this method, one of the substances may be discharged into the conduit 11 through the pipe line 23, and the other of the substances may be discharged into the conduit 11 through the pipe line 23' which is operatively connected to a before-mentioned pump and a supply tank (not shown). In this case, of course, the substances are mixed by the blower 13 and are immediately thereafter discharged upon the forming fibers in the blast 5.

It will be understood, of course, that whether the substances are mixed before or after application, the heated products of combustion and the steam may be advantageously mixed with the binding material substances before they pass

through the blowers, as these substances atomize more readily when they are first mixed in a wet-heated gas. The steam also prevents the cementitious substances from drying in the hot products of combustion, and to a certain extent, prevents their adhering to the conduits 10 and 11 and the blowers 12 and 13.

The steam blast 5 carrying the molten shredded material and the atomized binding material, if desired, may be shielded by a tubular guide means 33 which preferably extends substantially as shown into the blow chamber 3. This guide means not only restricts the admission of cool air into the blow chamber, but protects the operator from any molten particles which might otherwise strike and rebound from the rear wall 34 of the blow chamber 3.

It will be observed, by referring to the accompanying drawing, that the pressure gauges 31 and 32 are placed immediately above the blowers 12 and 13, where they can be readily observed by the cupola operator. These gauges indicate the amount of the steam or heated gas which is being mixed with the binding materials.

The rate of flow of the binding material substances is, of course, proportional to the speed of the pumps which may be ascertained in any suitable manner such as, for instance, by noting the position of the control means on the variable speed transmission (not shown) which is old in the art and requires no detailed description.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results are attained.

As many changes could be made in carrying out the above description without deviating from the scope of our invention, it is intended that all matter incorporated in the above description, or shown in the accompanying drawing, shall be interpreted as illustrative, and not in a limiting sense.

We claim:

1. The herein described method of applying a binder made of a plurality of mutually chemically reactive substances to mineral wool fibers in the production of mineral wool batts, said method comprising forcibly moving a fluid stream of each of said substances of which the binder is made into the presence of a heated gas or vapor, intimately mixing each of said substances with said gas or vapor, and immediately thereafter discharging said substances upon a stream of mineral wool fibers.

2. The herein described method of applying a binder made of a plurality of mutually chemically reactive substances to mineral fibers in the production of mineral wool batts, said method comprising forcibly moving a fluid stream of each of said substances of which the binder is made and separately mixing each of said substances with heated gas or vapor, and immediately thereafter discharging the mixture upon a stream of mineral wool fibers.

3. The herein described method of applying a binder made of a plurality of mutually chemically reactive substances to mineral wool fibers in the production of mineral wool batts, said method comprising forcibly moving a fluid stream of each of said substances of which the binder is made, and intimately mixing the substances in each of said streams with each of the other of said substances in the presence of heated gases or vapors in a manner adapted to atomize said substances in the heated gas or vapor, and immediately thereafter discharging said mixed atomized substances upon the forming mineral wool fibers.

4. The herein described method of applying a binder made of a plurality of mutually chemically reactive substances to mineral wool fibers, in the production of mineral wool batts, said method comprising forcibly moving a fluid stream of each of said substances of which the binder is made, into the presence of heated gaseous products of combustion and mixing said substances with said gaseous products of combustion and immediately thereafter discharging the mixture upon a stream of mineral wool fibers.

5. The herein described method of applying a binder made of a plurality of mutually chemically reactive substances to mineral wool fibers, in the production of mineral wool batts, said method comprising forcibly moving a fluid stream of each of said substances of which the binder is made into the presence of heated gaseous products of combustion and mixing said substances with each other and with said gaseous products of combustion, and immediately thereafter discharging the mixture upon a stream of mineral wool fibers.

6. The herein described method of applying a binder in the production of mineral wool batts, which binder is formed of a plurality of mutually chemically reactive substances, said method comprising separately pumping and discharging said substances into a single stream of heated vapor or gas, mechanically mixing said substances intimately with each other and with said heated vapor or gas, and immediately thereafter forcibly discharging said mixture upon a blast of mineral wool fibers.

7. The herein described method of applying a binder in the production of mineral wool batts, which binder is formed of a plurality of mutually chemically reactive substances, said method comprising separately pumping in a fluid form, each of said substances, separately mixing each of said substances intimately with heated vapor or gas, and immediately thereafter discharging each of the mixtures separately upon a blast of mineral wool fibers.

8. The herein described method of applying a minderal wool binder which is made of a plurality of mutually chemically reactive substances, said method comprising moving a stream of each of said substances into the presence of heated gas or vapor, intimately mixing the substances with heated gas or vapor to utilize the gas or vapor as a carrying agent and immediately thereafter discharging the substance laden gas or vapor upon the mineral fibers.

9. The method of applying a binder to mineral wool fibers comprising separately and successively discharging a plurality of mutually chemically reactive substances in an uncombined state upon a stream of highly heated mineral wool fibers to produce, when said substances are mingled together on the fibers, a binder therefor.

10. The method of applying a binder to mineral wool fibers comprising separately and successively discharging a plurality of chemically mutually reactive substances upon a stream of mineral wool fibers formed by a blast of gas on a stream of lava, said substances chemically mutually reacting with each other to produce a binder for said fibers.

11. The method of applying a binder for mineral wool fibers formed by a blast of gas or steam on a stream of lava and directed into a chamber which consists in separately and successively discharging chemically mutually reactive substances

to the stream of fibers prior to the entry of the fibers into the chamber to produce a binder for said fibers.

12. The method of applying a binder to mineral wool fibers formed by a blast of gas or steam on a stream of lava and directed into a chamber which consists in separately and successively discharging chemically mutually reactive substances on the stream of fibers prior to the entry of the fibers into the chamber to produce a binder for said fibers, one of said substances being mixed with a heated gas prior to discharging said substances on said stream of fibers.

13. The method of applying a binder to mineral wool fibers formed by a blast of gas or steam on a stream of lava and directed into a chamber which consists in separately and successively discharging chemically mutually reactive substances on the stream of fibers prior to the entry of the fibers into the chamber to produce a binder for said fibers, one of said substances being mixed with a heated gas prior to discharging said substance on said stream of fibers, and one of said substances being mixed with heated gaseous products of combustion prior to discharging said substance on said stream of fibers.

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