In pneumatic drying processes in which the material to be dried, for instance grass, clover and the like or other vegetable, animal or mineral products, is introduced and spread into a current of hot gases and then carried with said gases until the desired degree of dryness is obtained, it is of the greatest importance that the material should be fed into the gas current in definite quantities in relation to the quantity and heat capacity of the drying gases, and further that the feeding takes place continually and uniformly. If more material is introduced than the quantity which can be supported and transported by the gases, a portion of the material necessarily will fall downwards and accumulate in the drying chamber or channel, whereby sooner or later the working or the apparatus will be disturbed.

But even if the total supply of material, reckoned with longer intervals, corresponds to the quantity and heat capacity of the gas used in such an interval, there will be difficulties, if the feeding of the material into the gas current is not continually uniform. If, thus, only in a short period of time the feeding of material exceeds the normal quantity, portions of the material will fall downwards and accumulate especially at such places in the drying channel where the gas current passes in a horizontal direction or is declined. If on the other side the feeding of the material into the gas current falls considerably below the normal quantity, the drying power of the gas will not be fully utilized, whereby the thermal economy of the process is correspondingly decreased, and further the material will run the danger of overheating.

In connection with such processes that work on the pneumatic principle, the purpose aimed at, therefore, has been to obtain means which secure a continually uniform introduction of the material to be dried into the gas current and which can be regulated in relation to the varying specific gravity and size of the particles of the material. Prior attempts to obtain a satisfactory continually uniform suspension of the material in the gas current have not been successful.

When treating nonhomogenous materials it is also to be considered that a minor portion of the material may be of such a weight that the particles cannot be supported and transported by a gas current which has a sufficient velocity to carry with it the other and main portion of the material in a state of suspension. In the hitherto known methods it has been practised in such cases to increase the velocity of the gas current so that also the heavier particles are carried away with the gases. This, however, has for a consequence that the quantity of gas necessary for drying a certain quantity of material is increased, which impairs the thermal economy of the process, and further a greater amount of energy is necessary for moving the gases.

It has also been proposed already to use a rotating device arranged in the drying channel and provided with wings, shovels and the like adapted to catch such material, that due to its weight cannot immediately be suspended in the gases but falls downwards, and throw it back upwards into the gas current.

The present invention now has for its object an improvement in connection with drying plants and devices of the afore-mentioned kind whereby it is rendered possible to carry out such pneumatic drying in a technically and economically perfect and rational way.

According to the invention said rotating and oscillating device is arranged in a widened chamber which towards the top decreases in cross-section and connects with a substantially vertical part of the gas pipe or channel through which the gas current runs in direction upwards, so that when passing upwards through the chamber the velocity of the gas current and, consequently, its supporting power for the material is increased in direction upwards.

By means of said arrangement according to the invention those parts of the material to be dried which at their admission into the chamber due to their weight can not immediately be supported and carried away by the gases but fall downwards towards the lower part of the chamber, will be caught by the rotating wings or the like and be automatically thrown upwards into the gas current and fall down again, in their upwards movement reaching higher and higher up into the range of increased velocity of the gases, until they have lost so much in weight due to the drying that they are carried away by the gases. Thereby it becomes possible to accommodate the quantity of gas used in relation to the condition of the material to be dried in such a way that the drying of a certain quantity of material can be effected with the least possible quantity of gas which in itself is an advantage with regard to the thermal economy of the process and the energy necessary for moving the gas.

Another advantage is that said heavier particles of the material which as a rule do not eas-
ily give off their water by said repeated introduction into the gas current at the place where the temperature of the gas is the highest at this early stage will be deprived of the greatest portion of their content of water, and the highest possible thermal economy and without any disintegrating operation involving extra cost. Due to this effective drying of said particles the dried product obtained according to the invention will be more uniform with regard to its degree of thoroughness than was the case in previous methods.

The greatest advantage connected with the above method might, however, consist therein that a uniform and automatically regulated transport of the material through the gas pipe or channel is obtained. More or heavier material than what the gas current can transport through the gas pipe in suspended state is not carried away from the chamber into which the material is introduced which might otherwise be the case if the velocity of the gas current were greater at the feeding place. Heavier particles and excess of material casually supplied will fall downwards out of the gas current and be again introduced into the same by means of said rotating or oscillating device as already described.

In order to prevent air or gas of lower temperature than that of the drying medium from passing into the gas current at the introduction of the material to be dried into the chamber, the introduction of the material may be effected by means of a transport screw, piston or the like, by which device the material is pressed forwards through a suitable channel, pipe or the like, which is connected with the chamber, so as to form a plug, which prevents such admission of air or gas to the chamber.

By way of example a suitable plant according to the invention is illustrated diagrammatically in the accompanying drawings.

Figs. 1 and 2 show two elevations of the plant taken at right angles to each other, and Figs. 3 and 4 a detail of somewhat different construction.

By means of the fan 1 the moist material to be dried is brought through the pipe 18 into the hopper 2 from where it by means of the transport screw 3 (indicated by dotted lines in the drawings) arranged in the channel 4 under formation of a plug is pressed forwards through the pipe 5. According as the plug is conveyed forwards the material passes into the chamber 6. Hot fire gases from the furnace 7 enter said chamber through the pipe 8 and are driven through the drying channel 9 by the fan 10. The material to be dried is, thus, introduced directly into the gas current and carried away with the gases in their way through the drying channel 9 to the fan 10 and further from there through the pipe 11 into the cyclone 12. In the cyclone the dried product and the gases are separated, so that the dried material is discharged through the opening 13 and the moist utilized gases leave at 14.

In the chamber 6 there is arranged a rotor 16 carried on the shaft 15. Said rotor 16 is provided with a suitable number of catching members in the form of wings 17 (indicated by dotted lines in the drawings). On the rotation of the rotor said wings catch such particles of the material fed into the chamber 6 which due to their weight cannot immediately be transported by the gases and throw them upwards into the upwards tapering part of the chamber 6 which forms a connection with and passes over into the drying channel 9. On account of the upwards tapering form of said connection room the velocity of the gases is increased successively from the centre of the chamber and upwards to the mouth of the drying chamber. As already described above the particles will be thrown upwards and fall down repeatedly until they finally are carried away by the gas current. By variation of the speed of the rotor 16 it is possible to accommodate the time and, consequently, the drying effect to which the particles are subjected before being carried away by the gases.

Figs. 3 and 4 show a somewhat different construction of the chamber 6. In this embodiment the hot drying gases enter the chamber tangentially whereby the rotor 16 with the wings 17 is better protected against heating by direct contact with the hot fire-gases. This may be of importance on the treatment of material especially sensitive to overheating which when using the construction according to Figs. 1 and 2 may run the danger of overheating by the contact with the heated wings of the rotor in said embodiment of the chamber.

Having now particularly described the nature of our invention and the manner of its operation what we claim is:

A drying plant comprising a drying channel having a portion thereof disposed vertically and having inlet and discharge ends, means for inducing flow of a gas current through said channel, a widened receiving chamber disposing in cross section upwardly to the dimension of and communicating with the inlet end of said channel, a rotary catching device located in the larger portion of said chamber, means for supplying hot gases to said chamber at the stage of said catching device, an inlet for the material to be dried arranged above the gas supply means and communicating with said widened chamber above the catching device whereby such parts of the material which, due to a large percentage of moisture do not immediately become entrained in the gas current and fall downwardly, are impinged by the catching device and repeatedly thrown upward into the gas current with increasing height according to the progress of the drying thereof until such material is finally entrained by the gas current and drawn upwardly in said channel.