

(No Model.)

F. E. DUCKHAM.
PNEUMATIC APPARATUS.

No. 533,281.

Patented Jan. 29, 1895.

FIG. 1.



FIG. 2.

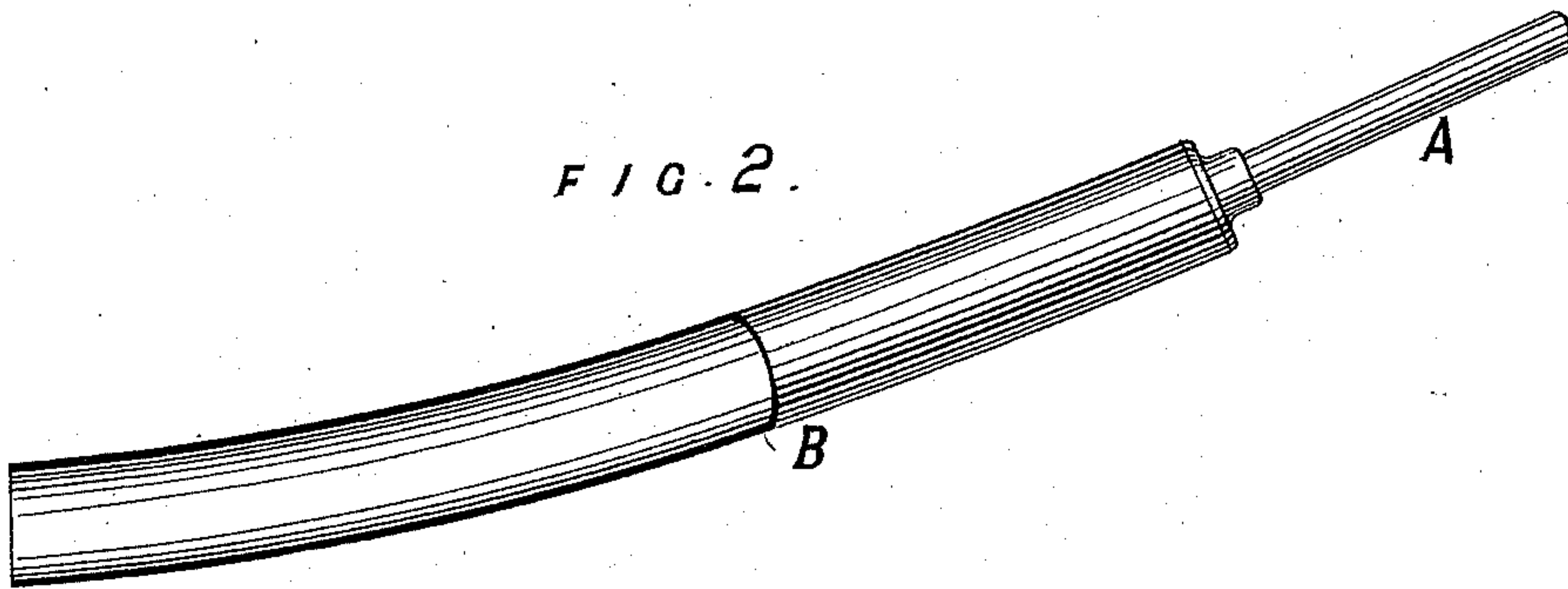
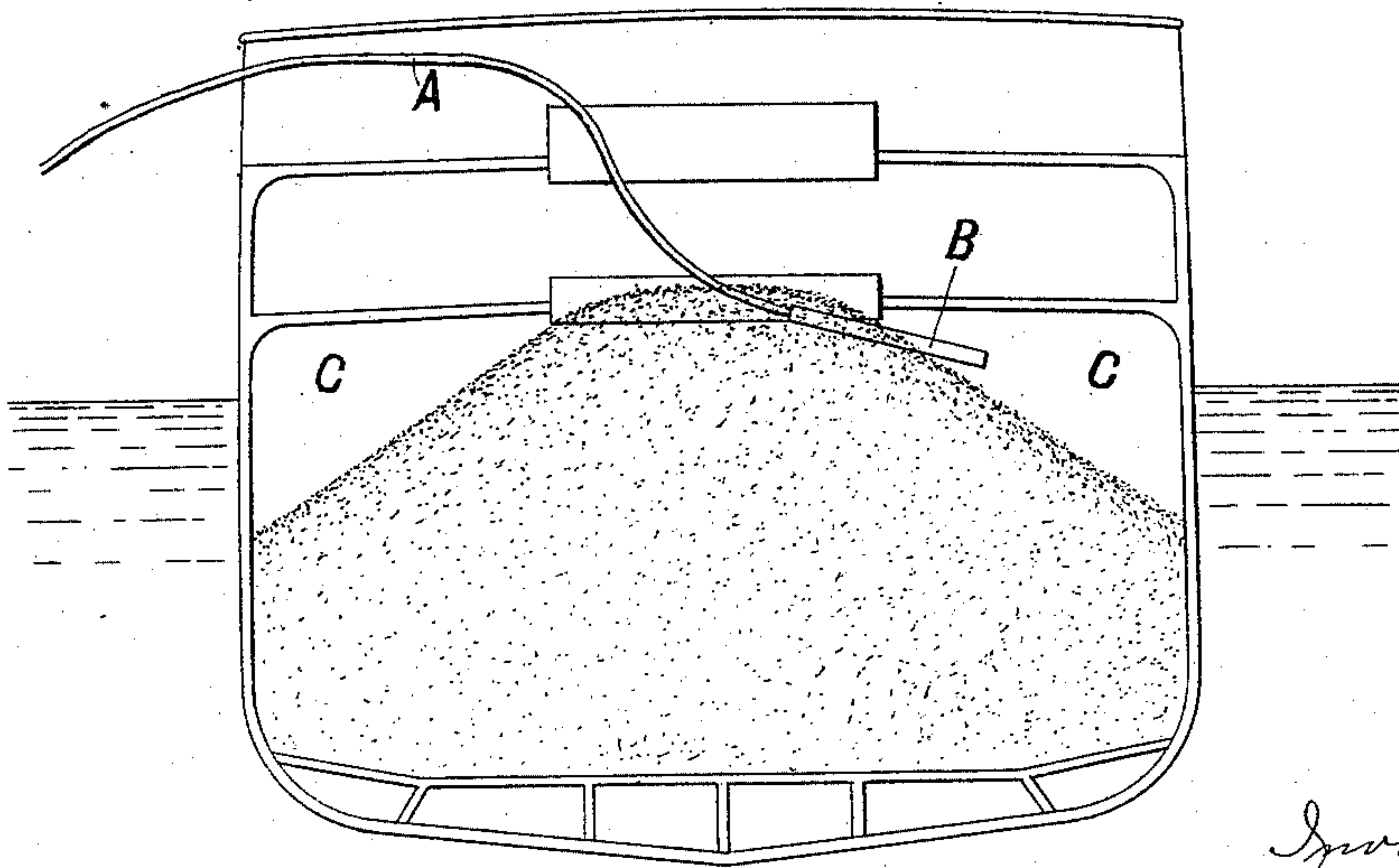


FIG. 3.



Witnesses:
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UNITED STATES PATENT OFFICE.

FREDERIC ELIOT DUCKHAM, OF LONDON, ENGLAND.

PNEUMATIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 533,281, dated January 29, 1895.

Application filed January 25, 1894. Serial No. 497,992. (No model.)

To all whom it may concern:

Be it known that I, FREDERIC ELIOT DUCKHAM, civil engineer, of Millwall Docks, London, England, have invented new and useful
5 Improvements in Pneumatic Apparatus for Conveying and Depositing Grain, &c., (for which I have filed an application for patent in Great Britain, No. 198 of 1894, dated January 3, 1894, a certified copy of which is herewith filed, and desire to avail myself of the
10 benefit of the convention of the International Union for the Protection of Industrial Property and final protocol mentioned and defined in the proclamation of the President of the
15 United States of date June 11, 1887,) of which the following is a full, clear, and exact description.

My invention relates to pneumatic apparatus for conveying and depositing grain and
20 other granular or pulverulent matters by a current of air under pressure and consists in an improvement in the discharge nozzle of the conveying pipe by which the grain or other matters conveyed by the air current are
25 deposited.

The improvement has for its object to enable the grain or other matter to be deposited by the air current in small or confined spaces left vacant after the greater part of a vessel's
30 hold, or a storage bin in a granary, is filled, such for example as the corners immediately beneath the deck of the vessel, or the ceiling of the bin, into which the grain, &c., fed in from above cannot flow by gravity by reason
35 of the fact that the surface of the mass of grain already filled into the hold or bin lies at the natural angle of repose and meets the deck or ceiling above. Such spaces have heretofore only been able to be filled by the operation of trimming by hand labor, which it is
40 the object of my invention to avoid.

In all previous attempts to deposit grain directly in such confined spaces it has been found that the velocity of the air current necessary for the conveyance of the grain through
45 the conveying pipe is so great on emerging from the discharge nozzle introduced into a confined space, such as above referred to, that the scour of the air current in escaping
50 from the said space and the rebound of the grain on striking the walls of said space, causes the grain to be carried away instead

of being deposited in the vacant space, so that for however long a time the jet of grain may be directed into the said space it could
55 not be filled up, and hence recourse has always been had to hand labor for trimming.

My invention consists in causing the velocity of the air jet to be so diminished before it emerges from the nozzle that while the rate at
60 which the grain, &c., is conveyed through the conveying pipe is not affected, the air on emerging from the nozzle escapes quietly without carrying the grain away with it, the grain being deposited in the confined space
65 until the latter is quite filled up. This I accomplish by providing the conveying pipe with a discharge nozzle or expansion chamber of greater sectional area than said pipe
70 so that the compressed air on entering the nozzle will expand and be correspondingly diminished in velocity, while the grain carried by it will retain by virtue of its inertia
75 a certain amount of acquired momentum so that its velocity although reduced will not be reduced to so great an extent as that of the
80 air, the result being that the particles of grain will become somewhat massed together and be less liable to be carried off by the escaping air.

Reference is to be had to the accompanying drawings, forming part of this specification, wherein—

Figures 1 and 2 show longitudinal sections of two slightly-modified forms of my improved
85 nozzle applied to a conveying pipe, and Fig. 3 is a cross section of a vessel being loaded, showing the spaces into which the grain, &c., cannot flow and into which it is conveyed and there deposited by means of my improved
90 nozzle.

A is the ordinary flexible conveying pipe through which the grain, &c., is conveyed by a current of air under pressure.

B is a nozzle or length of tube connected
95 to the end of pipe A and which forms an expansion chamber, said nozzle tube, or expansion chamber exceeding the pipe A in diameter in about the proportion of three to one while the length of this nozzle B is about equal
100 to ten times its own diameter. I have indicated these proportions as those found to answer best in actual practice but I do not limit myself absolutely thereto.

The nozzle or expansion chamber B may either be straight, as shown in Fig. 1, or be slightly curved, as shown in Fig. 2, so as to be more favorably directed into the space to be filled. In either case the grain projected through it from the pipe A tends to fall toward the lower side of the nozzle or expansion chamber and flow out therefrom in a compact stream at a reduced velocity while the air separated from it escapes quietly without disturbing the mass of grain already deposited.

C C are the vacant spaces beneath the deck of the ship at either side of the hatchway, for instance, into which the grain, &c., filled into the hatchway will not flow when the hold is nearly filled up, owing to the heaped-up surface of the mass sloping at the natural angle of repose meeting the coamings of the hatchway, which intercept the further flow of grain down the sloping surface, so that however much the mass may be heaped up in the hatchway, these spaces C will not be filled so long as the ship remains on an even keel.

I claim—

1. In pneumatic apparatus for conveying and depositing grain and other granular or pulverulent matters by a current of air under pressure, the combination, with the conveying pipe for said granular matters and air, of a terminal expansion nozzle of uniform diameter from end to end and of larger sectional area than said pipe, whereby the granular matters can be forced to a given point in a compact stream and the air required to force it thereto be dissipated before it reaches said point.

2. In pneumatic apparatus for conveying and depositing grain and other granular or pulverulent matters by a current of air under pressure, the combination with the conveying pipe for said granular matters and air, of a terminal expansion nozzle of larger sectional area than said pipe, said nozzle being curved and of uniform diameter from end to end, whereby the granular matters can be forced to a given point in a compact stream and the air required to force it thereto be dissipated before it reaches said point.

3. In pneumatic apparatus for conveying and depositing grain and other granular or pulverulent matters by a current of air under pressure, the combination, with the conveying pipe for said granular matters and air, of a terminal expansion chamber or discharge nozzle of a suddenly enlarged sectional area greater than said pipe said enlargement beginning near the junction with the pipe and continuing through the outlet whereby the granular matters become massed at a given point and form a compact stream outflowing at a diminished velocity while the air required to force it to that point passes off free of the grain, substantially as and for the purpose specified.

FREDERIC ELIOT DUCKHAM.

In presence of—

THOMAS LAKE,
17 Gracechurch Street, London, Notary's Clerk.

W. M. HARRIS,
17 Gracechurch Street, London, Notary Public.