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DRAWINGS ATTACHED

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(54) APPARATUS FOR MAGNETICALLY TREATING SEEDS

(71) I, RAYMOND DEVON AMBURN, a citizen of the United States of America, of 11420 Canal Road, Utica, Michigan, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for magnetically treating seeds, and more particularly to moving seeds through a magnetic field in such a manner as to insure their controlled exposure to different areas of flux density of the field.

In agriculture it is desirable not only to increase the yield of crops per acre of land planted but also to improve the percentage of seeds of a particular group that will germinate. It is also very desirable particularly in geographical areas where the growing season is rather short, to accelerate the germination speed of a particular group of seeds so as to maximize the time period in which the germinated seed can mature. The problem of acreage yield is particularly important in under-developed countries, in which modern agricultural techniques have not yet come into wide usage, and in which therefore a serious food problem exists for the population of such countries.

Chemical fertilizers have been provided for many years to increase the acreage yield of a particular crop. In addition, certain chemical fertilizers can accelerate the growing of a particular crop so as to utilize to the fullest possible extent the length of the growing season. Chemical fertilizers, however, ordinarily do not increase the germination speed of a seed nor do these fertilizers increase the germination rate, basically because chemical fertilizers act on a plant after the seed has germinated. In addition, the use of a chemical fertilizer involves considerable expense in purchasing it, storing it, and in the need for equipment to distribute it over a given acreage. Moreover, chemical fertilizers tend to cause air and stream pollution. These obvious shortcomings

of chemical fertilizers have been apparent to agricultural developers for many years and other methods of increasing the agricultural output of acreage have been investigated and developed. For example, it is well known that treating seeds with various types of electrical or magnetic fields, high-frequency waves, light or radioactive-type rays can increase germination rate and speed of seeds. The precise reason for the gain in germination rate and speed is somewhat obscured by many theories on the subject, but it is clear that some type of excitation takes place within the seed which causes a remarkable change in its normal characteristics as well as inducing seeds that normally would not germinate to germinate at the same rate as the other treated seeds.

In certain foreign countries considerable literature has been published on methods of and apparatus for the treatment of seeds. However, the treatment of seeds by the use of the afore-mentioned fields, waves or rays has not been widely adapted, mainly because the apparatus and processes for carrying out the seed treatment have been deficient in many respects. Although the treatment of seeds by the afore-mentioned methods has been carried out with a high degree of success on a laboratory basis, practical means for their implementation, both from the standpoint of mechanics and from the standpoint of economy, have not been developed. Thus, the reason for the lack of their widespread application for the purpose of expediting seed growth becomes obvious.

Certain prior art devices describe apparatus for automatically moving seeds in great numbers through a magnetic field. This apparatus comprises conveyors or gravity feed devices and also calls for the source of the fields, waves or rays to be moved relatively to stationary seeds. Such apparatus is not at all acceptable both because of its high cost, at least in some instances, and because the seeds cannot be properly treated either due to the fact that the time required for subjecting the seeds to the fields and so on is too extended or the intensity of the fields, rays or waves

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- too low. In addition, the specific types of apparatus shown in the prior art are adapted to treat either only a particular type of seed or, at best, seeds which are very similar in nature and which therefore require similar treatment.
- 5 As a result, different types of apparatus must be provided to treat a variety of seeds or complex adjustments must be carried out to accommodate different types of seeds.
- 10 A further shortcoming of the prior art devices is that when it becomes necessary to change the type of treatment, completely different apparatus must be provided due to the different nature of the treatment means used, that is to say electrical or magnetic fields, high-frequency waves, etc. In addition, very sophisticated sources for producing the fields, waves and rays have been provided in the prior art to treat seeds moving along a conveyor.
- 15 Seeds are normally so small that sometimes they adhere to one another and tend to form piles and so the outer portions of the piles will create sufficient impedance to lessen the effect of their treatment within the pile. Therefore, the prior devices have very largely been found unsatisfactory.
- The present invention aims at overcoming or at least minimizing, the disadvantages of the prior art devices and processes. Accordingly, from its widest aspect the invention is directed to apparatus for magnetically treating seeds, comprising:
- (a) a tubular conduit of non-magnetic material
- 35 (b) a magnet mounted on the conduit between the ends thereof for providing a magnetic field extending through the conduit
- (c) conveying means of non-magnetic material disposed within the conduit and arranged to convey seeds from an inlet at one end portion of the conduit in an oblique path through the magnetic field to an outlet at the opposite end portion of the conduit,
- 40 the arrangement being such that in operation when seeds have been charged into the conduit the conveying means will cause each seed to roll and tumble and to be oriented while passing through the magnetic field in a plurality of positions relative thereto.
- 50 From a somewhat narrower aspect the invention is directed to apparatus for magnetically treating seeds, comprising:
- (a) a tubular conduit of non-magnetic material
- 55 (b) a magnet mounted on the conduit between the ends thereof for providing a magnetic field extending through the conduit
- (c) an auger rotatably mounted on and coaxial with the conduit and arranged to convey seeds from an inlet at one end portion of the conduit through the magnetic field to an outlet at the opposite end portion thereof,
- 60 the arrangement being such that in operation when seeds have been charged into the conduit rotation of the auger will cause each seed to roll and tumble and to be oriented while passing through the magnetic field in a plurality of positions relative thereto.
- Preferably, the conduit including the auger are mounted in an inclined position such that the conduit outlet is disposed above the inlet so that seeds to be treated may be gravity-fed into the conduit, be conveyed therethrough by the auger and discharged therefrom again by gravity.
- 75 It is also preferable if the auger is made of a non-magnetic material.
- In order to make the invention more easily understood, one embodiment thereof will now be described in more detail with reference to the accompanying drawing showing diagrammatically apparatus according to the present invention including a seed container and a seed collector.
- 85 Referring to the drawing, a container, or hopper, 10 is the depository for seeds to be treated, the seeds being gravity fed towards an outlet 12 thereof. A slide valve, or any similar device, 14 is mounted on a tubular conduit 22 to adjust the cross-sectional area of a conduit inlet 16 and thus to control the amount of seeds entering the inlet. The conduit 22 forms part of a seed-conveying arrangement generally designated by the numeral 18.
- 90 An auger 20 is rotatably mounted in and coaxial with the conduit 22 and is adapted to carry seeds from the inlet 16 to an outlet 24, the seeds discharged through the outlet 24 dropping into a collector 26, which can take any form such as a barrel, bag, etc. The auger 20 is journaled at 28 and 30, which are end closures of the tubular conduit 22 and is driven by a simple gear arrangement 32 and 34 which is powered by a motor 36.
- 95 A magnet 38 may be a permanent magnet but in the embodiment shown is an electromagnet disposed around the conduit 22 so that the magnetic field produced by the magnet passes through the conduit 22. It should be understood that the latter is composed of a material having a low impedance so as to interrupt in only a slight manner the flux density paths of the magnet 38. The tubular conduit 22 in the embodiment illustrated consists of a plastics material but any material offering low field impedance is satisfactory. The conduit 22 is inclined upwardly with respect to its inlet so that seeds entering the inlet 16 from the hopper 10 are driven upwardly in the conduit 22 in an oblique path. Thus, individual seeds will be disposed on flutes of the auger 20, will be rolled and tumbled and will take a path through the magnetic field that will expose several surfaces of each seed to different areas of flux density of the field so that proper treatment for that particular type of seed can be provided. The time period during which each seed is disposed within the field, or any portion of the field, can be controlled by either regulating the speed of the
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auger 20 or by increasing or decreasing the number of flutes of the auger so that a given seed will rotate and change its position a desired number of times while disposed within the field.

5 It will be appreciated that the operation of apparatus according to the invention is very simple in that seeds are stored in the hopper 10 and their flow into the conduit 22 is regulated by opening or closing the slide valve 14. When the seeds drop into the conduit through the inlet 16 and the auger 20 rotates, it will then move the seeds upwardly through the magnetic field within the conduit 22 in the area of the electromagnet 38. After passing through the field, the treated seeds are discharged from outlet 24, again by gravity in the simplest form, and collected in the collector 26, which is replaced when filled.

20 The flux density of the magnetic field set up by the magnet 38 varies from one portion to another and in certain instances it may be desirable to expose a seed a longer or shorter period of time, and it is likewise desirable in certain installations to vary the flux density with respect to the exposure of each seed so as to gain beneficial results. The variation of the density can easily be provided by a rheostat or other control means. The unique arrangement of an auger and a tubular conduit containing the seeds brings about this result.

Apparatus according to the invention is self-contained and relatively compact so that it can be transported with ease and is also economical to manufacture. The motor 36, shown driving the auger, can take any form such as electric motor, hydraulic motor, pneumatic motor, etc. and preferably the auger 20 would be made of a plastics material so as to minimize its impedance to the magnetic field, although this is not an absolute requirement due to the varied exposure of a seed to the field as it spirals upwardly. The apparatus due to its compactness can either be moved from place to place or due to its economical design many such devices can be provided at different locations. In under-developed countries, for example, where the seed must be locally treated due to the treated seed's relatively short shelf life, such apparatus can economically be provided near the site of the seeds planting.

Another advantage of the auger 20 is that since it moves the seeds along an inclined path, piling of seeds passing through the magnetic field is prevented because the seeds tend to spread out on the flutes of the auger due to centrifugal force and, therefore, there is very little unwanted shielding encountered due to piles of seeds going through the field. It is also within the scope of the present invention to provide vibrating means to the conduit, or the auger, so that seeds which would normally stick together due to moisture and such like will be separated and again the flow through the magnetic field will be relatively even. Like-

wise, a vibrator can be applied to the hopper 10 to break up the seeds and flow control means can be disposed in the way of baffles and such like within the hopper 10 to distribute the seeds fed into the inlet 16 more evenly. Most desirably, a single line of seeds is formed on the outer periphery of each flute of the auger so that no shielding of seeds takes place and each seed receives the same amount and intensity of treatment. This is extremely difficult, as a practical matter, so the foregoing recited methods of evening the flow of seeds through the magnetic field are set forth to show ways of assisting this levelling of the seeds. Thus, it will be evident that apparatus according to the invention is extremely versatile and will be very efficient in its operation in moving seeds in a controlled manner through a magnetic field.

WHAT I CLAIM IS:—

1. Apparatus for magnetically treating seeds, comprising:

(a) a tubular conduit of non-magnetic material

(b) a magnet mounted on the conduit between the ends thereof for providing a magnetic field extending through the conduit

(c) an auger rotatably mounted on and coaxial with the conduit and arranged to convey seeds from an inlet at one end portion of the conduit through the magnetic field to an outlet at the opposite end portion thereof, the arrangement being such that in operation when seeds have been charged into the conduit rotation of the auger will cause each seed to roll and tumble and to be oriented while passing through the magnetic field in a plurality of positions relative thereto.

2. Apparatus as claimed in Claim 1, wherein the magnet is mounted on the conduit spaced from the inlet and the outlet.

3. Apparatus as claimed in Claim 1 or Claim 2, wherein the magnet is an electromagnet and comprises a coil winding wrapped around the conduit and extending along a portion of the axial length thereof.

4. Apparatus as claimed in any of the preceding claims, including a motor for driving the auger and power transmission means therebetween.

5. Apparatus as claimed in Claim 4, wherein the motor is mounted on the conduit.

6. Apparatus as claimed in any of the preceding claims, wherein the conduit consists of a plastics material.

7. Apparatus as claimed in any of the preceding claims, wherein the conduit is mounted in an inclined position with the outlet elevated with respect to the inlet.

8. Apparatus as claimed in any of the preceding claims, wherein a slide valve is mounted on the conduit adjacent its inlet for adjusting the cross-sectional area thereof.

9. Apparatus as claimed in any of the pre-

ceding claims, wherein the auger is made of a non-magnetic material.

10. Apparatus for magnetically treating seeds, comprising:

5 (a) a tubular conduit of non-magnetic material

(b) a magnet mounted on the conduit between the ends thereof for providing a magnetic field extending through the conduit

10 (c) conveying means of non-magnetic material disposed within the conduit and arranged to convey seeds from an inlet at one end portion of the conduit in an oblique path through the magnetic field to an outlet at the opposite  
15 end portion of the conduit,

the arrangement being such that in operation when seeds have been charged into the conduit the conveying means will cause each seed to roll and tumble and to be oriented while passing through the magnetic field in a plurality of positions relative thereto. 20

11. Apparatus for magnetically treating seeds constructed, arranged and adapted to operate substantially as herein described with reference to the accompanying drawings. 25

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