S P E C I F I C A T I O N

of

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for

IMPROVEMENTS IN METHOD AND APPARATUS FOR DETERMINING THE GERMINATING VALUE OF SEED

(Pat. Appld. For)

CEL/JJM/A.

The present invention relates to the testing of seed to determine the germinative value thereof, and has for an object to provide a method or process, and an apparatus by the use of which the method or process may be conveniently practiced, for ascertaining in a relatively short period of time the condition of seed for growing.

The value of tests is widely recognized, and is strongly endorsed by the United States Department of Agriculture which has issued several publications on germination of seed among which might be mentioned a special Farmers' Bulletin No. 253 dealing solely with the germination of seed corn. The bulletin describes in detail the value of these tests and also sets forth what has heretofore been known as the simplest method of conducting the tests. It will be noted particularly that the tests require on an average of five days for determining by actual growth the germinative values of the selected seed.

Considerable objection has been raised by farmers against this present known method, and the tests are generally ignored on account of the time necessary to carry out the tests, the cost of apparatus often employed, and the space required for conducting the tests and for maintaining the grown bulk in proper and segregated condition during the germination of the selected seed.

One of the principal objects of the present invention is to provide a method by which the germinative values of the seed may be determined in a few minutes, and by the use of simple utensils or economical apparatus available in even remote rural sections of the country. The present process eliminates the necessity for the extreme care and attention required in the actual germination of the seed.

Another object of the present invention is to provide simple, compact and inexpensive apparatus which may be used in carrying out the said method quickly, conveniently and without complex manipulation of parts of the apparatus.

It is well known that seed is useless or becomes defective under various conditions, chiefly among which may be mentioned the immaturity of the seed in whole or in part; fermentation in whole or in part either while the grain is drying on the plant or after stored under unfavorable conditions; the action of frost; and rancid condition resulting from storing for a considerable length of time. These defects very seldom can be determined by the naked eye, or by supposed quick tests, such as splitting the seed and the like. These defects decrease, or entirely destroy the germinative power of the seed, and accounts for the weak growth of many of the plants in the field.

The present novel method or process is based upon certain actions and re-actions which take place in the seed when subjected to various chemical solutions or electrolytic process or other means for quickly augmenting the decomposition

defective parts of the seed and for acting to a considerable lesser degree upon the sould portions of the seed. The decomposed portions of the seed are discolored by re-action to a greater extent than are the sould portions of the seed, and hense any defective parts of the seed are developed or accentuated to the eye by the relatively dark or light discoloration of the seed.

While the method or process of this invention may be carried out for the determining of the germinative values of various seeds, the following disclosure of the invention will deal by way of example, with the treatment of seed corn. It is also understood that various kinds of devices and apparatus may be used in practicing this method or process, and that for the purpose of description the present preferred and comparatively simple form of apparatus is referred to and described, and illustrated in the accompanying drawing, wherein:

Figure 1 is a perspective view of an apparatus by means of which the present method of testing seed may be conducted.

Figure 2 is a fragmentary enlarged section taken through the seed holder, and

Figures 3 to 10 are enlarged views in elevation of corn seed, showing various defects therein as brought out by the darkened portions illustrated, in the present method.

In practicing the present method by use of the device illustrated in the accompanying drawing, a certain number of seed 10 is selected from each ear of corn to be tested, usually six in number from different portions of the ear in a manner recommended in the aforesaid Bulletin No. 253 of the Department of Agriculture, and the seed are placed in suitable spaced apart relation upon an absorbent flexible pad 11. The upper surface of the pad is divided into a number of squares or segregated portions divided by longitudinal and transverse indicating lines 12 which may be demarkations, scores, or the like in the upper face of the pad 11. The groups of seed 10 selected from each ear are placed in the separate spaced on the upper face of the pad and are pressed in the pad for maintaining the seed from displacement. In placing the seed it is preferred to dispose three seeds with the heart or germ side uppermost and three seeds with the germ side lowermost.

It is of course understood that the ears of corn from which seed to be actually tested, has been removed are placed in a predetermined place, preferably on a numbered rack so as to be able to identify the untreated seed with that being treated of any particular ear of corn, both before and after the test has been completed. Where seed other than that provided by nature with a suitable carried, such as the cob of corn, is to be tested a batch of seed, say from a single cantaloupe is dried and maintained in a single batch until after the test, a fee of the seed of the batch

being tested to determine the germination value of the said batch. Or the approximate germinative value of a mixed batch such as is sold at seed dealers, may be determined by selecting a number of seed from the mixed batch, but it is far better to follow out the procedure of maintaining the batches separate as above described in order to get the best results.

The pad 11 is preferably supported upon a base plate 13, which may be a sheet of tin, a board, or any suitable material for holding the pad flat and admitting manipulation of the seed holder. If desired, the base plate 13 may have blocks 14 on its under side near its corners for spacing the base plate from a flat supporting surface and for admitting access of the lifters beneath the base plate for raising the holder. A cover plate 15, preferably of glass, is placed over the seed which is fitted to the pad 11 for holding the seed firmly on the pad. The cover plate 15 is preferably of glass for the reason that the reaction or developing of the seed may be readily observed while practicing the method and without the necessity of frequently lifting the cover over the seed holder. The weight of the cover plate 15 is deemed sufficient for holding the seed 10 in place but means may be provided for clamping the parts together if desired, and submerging the device in the liquid without the hands coming in contact therewith.

The holder for the seed is adapted to be placed in a tray or pan 16 of greater dimensions than the holder so that the holder may be readily laid in the tray and lifted

out of the same. The tray 16 is of sufficient depth to contain a quantity of liquid sufficient to entirely cover the holder.

While various chemicals may be used for developing or re-acting upon the seed, for the purpose of this description reference will be had only to an easily and economically obtained substance for effecting the action and re-action. This substance, which may be obtained in all parts of the world, is lime, frequently found as calcium carbonate, Ca C O_3 and is most commonly placed upon the market as burnt lime. For using the burnt lime in this method, the lime is slacked, such as by adding one part of water and three parts of the lime, producing calcium hydroxide, Ca H2 O2.

The calcium hydroxide, which is produced in a fine white powder or flour of lime, is mixed to the proportion of five percent with water or with any other practical proportion, to obtain the required strength of lime solution for effecting the re-action in the grain. It is preferred to heat the water or solution say to a boiling point, before the introduction of the seed thereto, which will augment the process, and provide for development in a minute and a half more or less according to the temperature of the solution.

This solution is placed in the pan or tray 16, and when the seed is mounted in the holder, the holder is emersed in the solution and the re-action or development of the seed may be observed through the transparent top plate 15. It is desirable that during the process, the top plate 15 be lifted slightly one or more times over the grain to admit access of the solution freely about the grain. The absorbent pad 11.

is adapted to conduct the solution to the underside of the grain so that the solution has free action to all sides of the grain for simultaneously treating the same.

If desired, the pad 11 may be provided with data 17 contra-distinguishing the various compartments or sections of the pad 11 from one another and the facilitate the checking of the various selected seed with relation to the ears or cobs from which the same have been taken. Of course the designating indicia 17 may be arranged otherwise than is here disclosed.

When the grain is subjected to the action of the lime, the lime first attacks the skin of the grain and discolors it; in the case of corn turning the skin a light yellow Where the grain has become decomposed or otherwise injured, the skin opposite such portions of the grain is affected by the lime to a greater extent and is changed to a relatively dark yellowish brown color. This action takes place within from one to fifteen minutes or more when the water in the tray 16 is boiling, and a little care must be exercised in not over-developing the grain for the desired contrast in colors of the sound and unsound portions of the grain is reduced. While the solution, in such a short time, is not permitted to wholly disintegrate and remove the skin of the grain, it is found by actual experiment that the skin is so affected opposite the unsound portions of the grain, by such unsound portions, that the lime changes these portions of the skin to a darker color than the portions of the skin which are opposite the sound parts of the grain. By reason of this fact, the method may be conducted within a few

minutes time, although if desired the grain may be subjected to the solution for fifteen minutes or more in order to fully disintegrate and remove the skin and allow the solution to attack the vital nucleus and starch and glutten components of the grain. Under such conditions, the body of the grain is affected similarly to that of the skin, in other words the unsound portions of the grain are turned to a different color than are the sound portions.

If in lifting the cover with care, any of the seed should float to the surface in the solution, it is evidence of lack of density and observation of missing seed from any section or compartment of the pad will indicate that the seed of the particular ear of corn or batch of seed related to it, should not be used as seed.

It is well known that a visual examination of grain before the test does not disclose the quality of the grain, except in some very accenuated instances, and therefore the great advantage and desirability of the present method may be appreciated for the only positive known means of determining the values of grain heretofore has been by germination of the grain, a long and tedious as well as expensive method, as above explained.

It is to be distinctly understood that this method is not limited to the use of lime as a reagent, reference to it being merely by way of example and because it may be readily obtained in any civilized parts of the world and is inexpensive. Neither is the method limited to the use of an alkali in the solution as a reagent. Various fluid reagents,

whether liquid or gaseous may be used which attacks the inferior parts or portions of the seed differently than the sound parts or portions of the seed, may be used. Decomposition may be augmented by electrolyses which will be found very useful where very large quantities of seed is to be tested and where speed is of great importance.

As illustrating the action and re-action of the substance upon the grain to show the defective or unsound parts thereof, reference is had to Figs. 3 to 10 inclusive, of the drawing. In Fig. 3, the tip or inner end of the grain 10 is unsound as is shown by the contrasting discoloration of the grain by re-action. In Fig. 4, the edges of the grain are unsound as shown by the relatively deep discoloration. In the latter case, the surrounding starchy substance is partly deteriorated and consequently if this seed by planted it will lack the full nourishment required. In the former instance, shown in Fig. 3, the inner end or what is commonly termed the "heart" of the corn is affected and experiments show that the germination of such seed results in a weak root growth.

In Fig. 5 is shown the discoloration of the heart 18 of the seed, showing that the seed possesses no germinative value and is dead. In Fig. 6 is shown a grain which is sound in the parts but which has developed a dark spot 19 near the top or outer end of the grain, showing a slight decomposition in the body or nourishing portion of the seed. This spot may occur in any other part of the grain, and

though it will germinate experience shows that no grain should be planted even if it shows the slightest trace of decomposition.

Fig. 7 shows the entire outer end or top of the seed affected by contact, as a rule with moisture. Fig. 8 shows the top and bottom of the seed 10 affected. Fig.9 shows a slight decomposition in the heart of the grain which is indicative of weak branch and upper stalk growth. Fig. 10 shows the manner in which a grain is affected when the heart thereof is entirely dead, as contra-distinguished from the showing in Fig. 5, which latter indication shows that the grain has been affected by frost.

There appear other seeds that do not show any spot as in Fig. 6, if the spot 19 were removed. Such spotless grains are from sound ears or batches which comprise the strong germinating seeds and are the only ones that should be planted.

This discoloration of the seed by this process remains practically fixed or readily discernable for a very great length of time. Therefor the discolored seed may be maintained as examples of inferior seed to stimulate care in raising, protecting, drying and storing of seed. The discolored seed in framed condition may be used at exhibitions, in conjunction with text, lectures, etc, to make known the various agents which have a deteriorating effect on the seed and point out the remedy.

The process may be likened to the development of a photographic negative in that the seed with little or no visual evidence of immaturity, it having been exposed to deterioating agents; or death by age, may be acted upon

by a reagent to develop such defects to be readily discernable just as lack of exposure under proper conditions, or lack of life so to speak, of the sensitized coating of the photographic plate due to age, is readily perceived by subjecting it to a reagent, such as the developing fluid.

I claim:

1. That method of determining the germinating value of seed, comprising subjecting selected seed to a reagent.

2. That method of determining the germinating value of seed, comprising subjecting selected seed to a reagent capable of changing the color of the seed differently as to its constituents.

3. That method of determining the germinating value of seed, comprising exposing selected seed to a chemical action for reaction to develop contrasting colors of the constituents, readily discernable to the naked eye.

4. That method of determining the germinating value of seed, comprising, subjecting selected seed to the action of a reagent for bringing out in contrasting colors sound and unsound portion of the seed.

5. That method of determining the germinating value of seed, comprising, subjecting selected seed to an alkali solution.

6. That method of determining the germinating value of seed, comprising, subjecting selected seed to a solution of alkali and water.

7. That method of determining the germinating value of seed, comprising, subjecting selected seed to a solution of alkali and boiled water.

8. That method of determining the germinating value of seed, comprising, subjecting selected seed to an alkali solution, and electrolytic action.

9. That method of determining the germination value of seed, comprising, subjecting selected seed to a solution of alkali and water, and electrolytic action.

10. That method of determining the germinating value of seed, comprising, subjecting selected seed to a solution of alkali and boiled water, and electrolytic action.

11. That method of determining the germinating value of seed, comprising, subjecting selected seed to a lime solution.

12. That method of determining the germinating value of seed, comprising, subjecting selected seed to a solution of lime and water.

13. That method of determining the germinating value of seed, comprising, subjecting selected seed to a solution of lime and boiling water.

14. That method of determining the germinating value of seed, comprising, subjecting selected seed to a chemical solution, and electrolytic action.

15. That method of determining the germinating value of seed, comprising, subjecting selected seed to a boiling chemical solution, and electrolytic action.

16. In apparatus of the character described, the combination of a base and a basecover therefor, adapted to confine seed therebetween.

17. In apparatus of the character described the combination of a base and a base transparent cover therefor, adapted to confine seed therebetween.

18. In apparatus of the character described the combination of a base, absorbent material thereon and a covering for said absorbent material spaced therefrom and adapted to confine seed therebetween.

19. In apparatus of the character described, the combination of a base, absorbent material thereon, and a transparent cover for said absorbent material spaced therefrom and adapted to confine seed therebetween.

20. In apparatus of the character described, the combination of a base and absorbent material thereon.

21. In apparatus of the character described, the combination of a base and absorbent material thereon, and delineations to define compartments.

22. In apparatus of the character described, the combination of a base an absorbent pad thereon, delineations to define compartments on said pad, and a cover for said absorbent pad spaced therefrom, and adapted to confine seeds therebetween.

23. In apparatus of the character described, the combination of a base, an absorbent pad thereon, delineations to define compartments on said pad, and a transparent cover for said absorbent pad spaced therefrom, and adapte to confine seeds therebetween.

24. Apparatus of the character described, comprising, in combination, a tray, and a carrier comprising a base and base cover therefor, adapted to confine seeds therebetween, and of a size to fit wholly within said tray when supporting the seeds.

25. Apparatus of the character described, comprising, in combination, a tray, and a carried comprising a base, absorbent material thereon, and a base cover therefor adapted to confine seeds therebetween, and of a size to fit wholly within said tray when supporting the seeds.

26. Apparatus of the characte r described, comprising a tray, adapted to hold liquid, and a carrier for the seeds of a size to fit wholly within said tray.

27. Apparatus of the character described, comprising a tray, adapted to hold liquid, and means

providing compartments in said tray, including a transparent cover for said compartment.

28. An apparatus of the character described, a carrier comprising a flat base and a base cover therefor adapted to confine seeds therebetween, and permitting ingress of liquid to the seeds from the sides of the carrier.

Fig. 1.

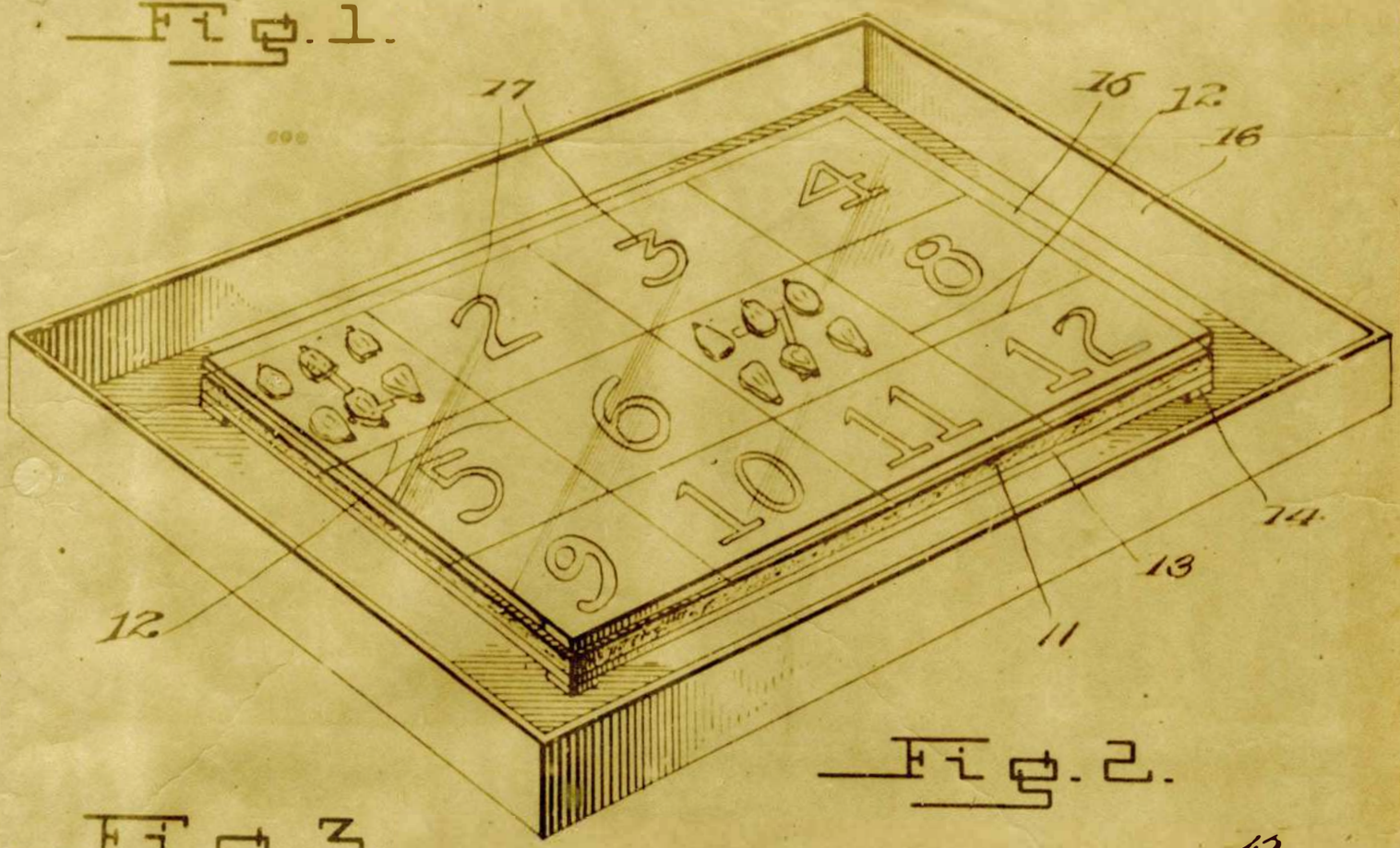


Fig. 2.

Fig. 3.

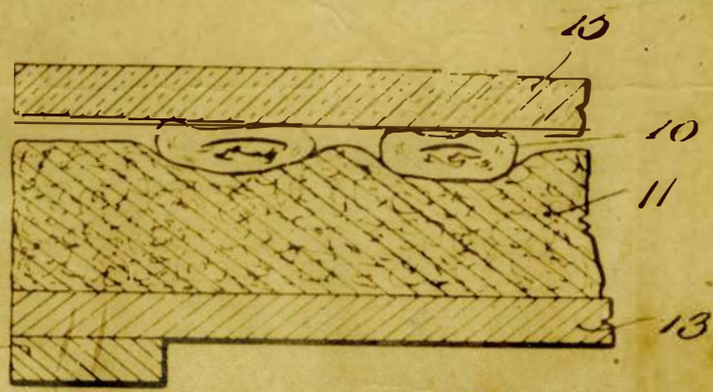
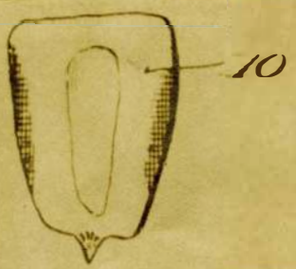


Fig. 4. Fig. 5. Fig. 6.

Fig. 7.



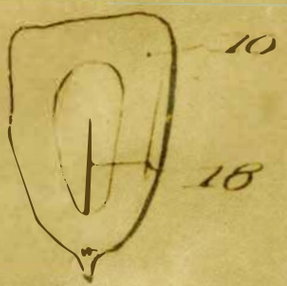


Fig. 8.

Fig. 9.

Fig. 10.

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