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United States Patent: X-Ray Grain Inspection Apparatus

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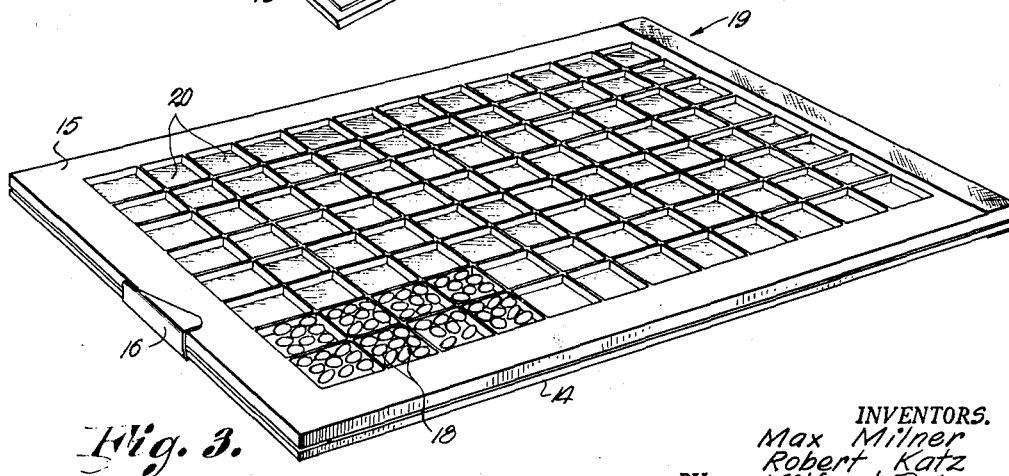
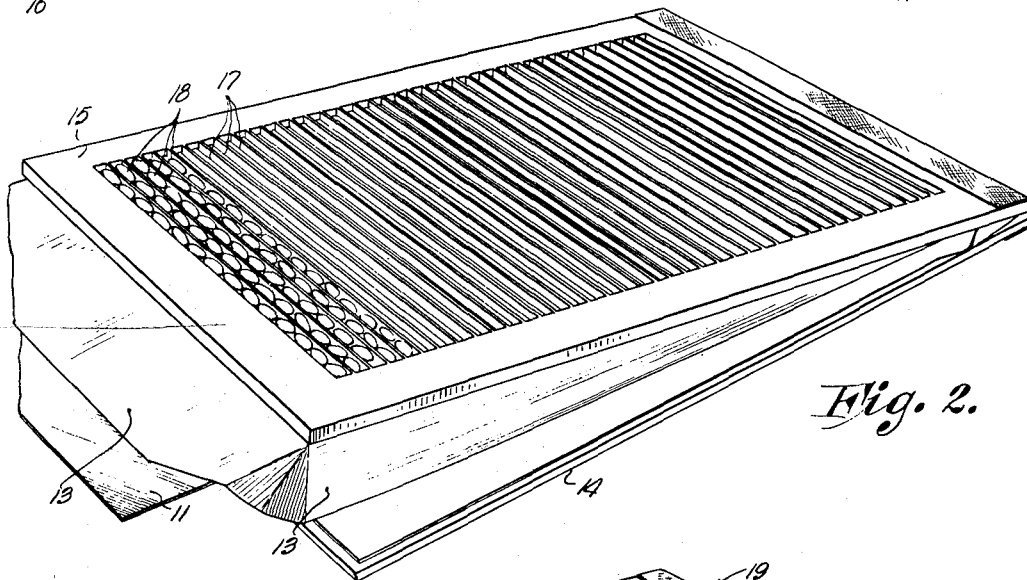
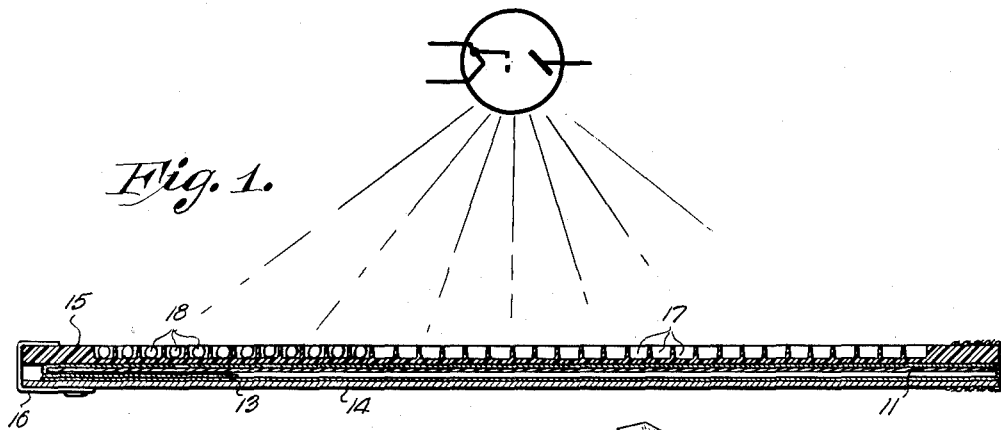
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R. KATZ ET AL

2,737,594

X-RAY GRAIN INSPECTION APPARATUS

Filed May 25, 1953



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2,737,594

X-RAY GRAIN INSPECTION APPARATUS

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Application May 25, 1953, Serial No. 356,956

2 Claims. (Cl. 250—53)

This invention relates to an improved apparatus for use in the X-ray inspection of samples of grain or seeds to determine internal insect infestation and other internal physical anomalies. It particularly relates to a novel film cassette and sample holder which helps to produce a clear radiograph of the sample which is held in an orderly alignment, thereby permitting rapid visual inspection and analysis.

Your petitioners have developed techniques by which the presence and degree of insect infestation of grain or seed is determined by X-ray radiography of grain or seed samples. In applying these techniques the equipment consists of an X-ray machine, an X-ray film in a light-tight container or film "cassette" and a tray or sample holder which holds the grain sample. Because of the difference in X-ray absorption between an infested portion and an uninfested portion of a kernel of grain, it is possible to differentiate between infested and uninfested grain on the finished radiograph.

An important problem is that of surveying the finished radiograph for the number of defective kernels. When radiographing a sample of grain prepared by scattering the kernels over the surface of the film with random orientation and with no special grouping, the resulting film is difficult to analyze, since the eye cannot systematically organize the picture into an orderly sample.

An object of this invention is to provide a sample holder upon which the individual kernels of the sample are easily and quickly oriented as a single layer, one kernel in thickness, and so arranged as to permit rapid inspection and detection of defective kernels.

To minimize penumbral effects it has been found desirable to have the specimen or sample as close as possible to the film. Therefore, another object is to provide a sample holder which is an integral part of the film cassette, thereby placing the sample in close proximity to the film and producing a clear picture.

It is apparent that if the grain sample and holder are placed between the source of X-ray and the X-ray film, the holder must be of a material which is relatively transparent to soft X-rays. Ideally, the sample holder should have greater X-ray transparency than the sample to be X-rayed, thereby producing a dark background for the developed film.

The face of the cassette which also comprises the sample holder or alignment tray therefore must be light-tight, geometrically thin and have great X-ray transparency.

In the drawings:

Figure 1 is a diagrammatic illustration in section of the essential elements of an X-ray grain testing apparatus according to the invention showing the relation between the various elements of the apparatus.

Figure 2 is a perspective view of a combination cassette-sample holder according to the invention.

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Figure 3 is a perspective view of a cassette-sample holder in which the sample holder is of a modified type.

Referring to the drawings, X-ray film 11 is contained in light-tight cassette 12 which has flaps 13, rear face 14, front face 15 and latch 16. Flaps 13 and rear face 14 may typically be constructed of stiff opaque paper.

Front face 15, which also acts as a sample holder, is made of a thin, colored or black sheet of paper or plastic or other material of low atomic number and contains a series of parallel, grain-holding grooves 17. Grooves 17 have a depth approximately that of one kernel of grain 18.

As shown in the drawings, sample holder 15 is formed of solid construction. An alternative construction can be made by fabrication by folding or stamping from a thin sheet.

To prepare a sample of grain for testing, the X-ray technician places a small quantity of grain on the grooved surface of sample holder face 15, then scrapes a straight edge or similar device across the face, causing a single layer of kernels 18 to settle into the grooves 17 and removing the surplus. Because grooves 17 are approximately the depth of a single kernel, the sample retained in the grooves will be one kernel thick.

The combination film cassette-sample holder containing the X-ray film and holding a sample of grain is then exposed to the X-ray beam.

It will be seen that the method permits rapid preparation and testing of samples, which is important when time is a factor, as for example, at harvest time when vast quantities of grain are in transit from farm to market.

Upon inspection of the exposed X-ray photograph, the grain will appear in orderly parallel lines and the number of infested kernels can be counted with ease and accuracy, since the eye of the inspector can follow the pattern of the grooves, and the danger of erroneous or duplicative counting is minimized.

A modified form 19 of the sample holder, according to the invention is shown in Figure 3. Here the grooves 17 have been eliminated and are replaced by a series of uniform, rectangular recesses, or pockets 20 which are in symmetrical arrangement. Each of the recesses 20 has a uniform depth approximating that of one kernel of grain. The preparation of samples in this case is identical with the procedure used with the holder 15 shown in Figure 2.

It will be apparent that identical recesses of still other shapes might be used and are encompassed in the scope of the invention.

From experimentation it has been learned that the recognition and counting of defective kernels is most efficient if the recesses 20 are of a size to hold from about 6 to about 10 kernels, the eye of the trained inspector being able to scan this quantity most readily.

The modified type of sample holder 19 has an advantage over the holder 15 of Figure 2 in that it can accommodate grains of somewhat varying sizes, whereas in holder 15 the size of grooves 17 must be varied for use with grains of varying sizes.

It is apparent that many modifications may be made in the sample holder without departing from the spirit of the invention.

It is further apparent that the apparatus is adapted for X-ray inspection of any other small granular objects, as well as seeds or grain.

Having thus described the invention, we claim:

1. In an X-ray granule inspection apparatus, in combination, a film cassette and a sample holder, said sample holder forming one face of said cassette, and being provided with a plurality of granule holding recesses, each

of said recesses having a depth approximately that of one granule of said sample.

2. In an X-ray grain inspection apparatus, in combination, a film cassette and a sample holder, said sample holder forming one face of said cassette, being formed of a thin, homogeneous material having high X-ray transparency, and being provided with a plurality of grain holding recesses, each of said recesses having a depth approximately that of a kernel of said grain.

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