PHYSICS

X-Rays in the Grocery Business

From Its Task of Diagnosing and Healing Human Ills, This Powerful Tool Turns to Job of Inspecting Foods

By DR. FRANK THONE

X-RAYS were practically monopolized by the medical profession, when they first appeared above the horizon of science, some forty years ago. Their delicate surgical fingers probed for embedded bullets, traced the outlines of broken bones, showed the dentist where the bad tooth was. They turned their arrows of beneficent destruction on cancer growths.

A little later, having scored their success in surgery, they turned to engineering. Industrial plants all over the world know their activities in finding hidden flaws in the heart of solid metal castings and forgings. They search out forgotten wiring and plumbing in old buildings. They show positions of moving parts within complex mechanisms.

Now X-rays are going into the grocery business. They are concerning themselves with such everyday dinner-table matters as potatoes and meat and apples and oranges, and candy for the kids. They are becoming the shopper's friends, and the grocer's friends, too.

Judgments of quality applied to fruits and vegetables by the average competent housewife necessarily depend in the main upon surface qualities. She can tell a lot about a tomato or a cantaloup by looking at it, feeling it, smelling it. She can glance at the blossom end of an apple and make a pretty shrewd guess as to the likelihood of finding a worm (or half a worm) inside.

Invisible Ills

But there are some faults to which the flesh of even the most appetizing vegetables and fruits is heir that no human eyes, however expert, can detect. Who has not bought a juicy-looking, perfect-skinned orange, only to find it "wooden" inside? Or some nice big potatoes for baking, that had nasty, black-lined hollow hearts when they came to the table?

Blame for such faults, calamitous though they are when you have company and want everything to come off just right, cannot be fixed on the grocer, or on the wholesaler, or on the grower. They don't want to sell you such faulty produce, because they want to keep on enjoying your business. They'd be just as glad as yourself for some dependable way of shunting such undesirable specimens off the road to market.

X-rays are used in the inspection of fruit, vegetables, and other foods very much as light has been used in the candling of eggs for many years. The egg candler has a special lamp (it used to be a candle) with an oval opening in one side of its solid metal chimney. He fits the eggs into this opening. If the light shines through with a nice, even glow, a little darker near the center where the yolk is, he knows the egg is good. If there are spots or mottlings, it is tossed into the can of "spots and rots."

But ordinary light, no matter how intense, will not serve for the "candling" of such opaque things as potatoes, grapefruit, and apples. Prof. R. B. Harvey, of the University of Minnesota, trying for some way of seeing to the heart of this marketing riddle, bethought him of the X-ray tube and the fluoroscope.

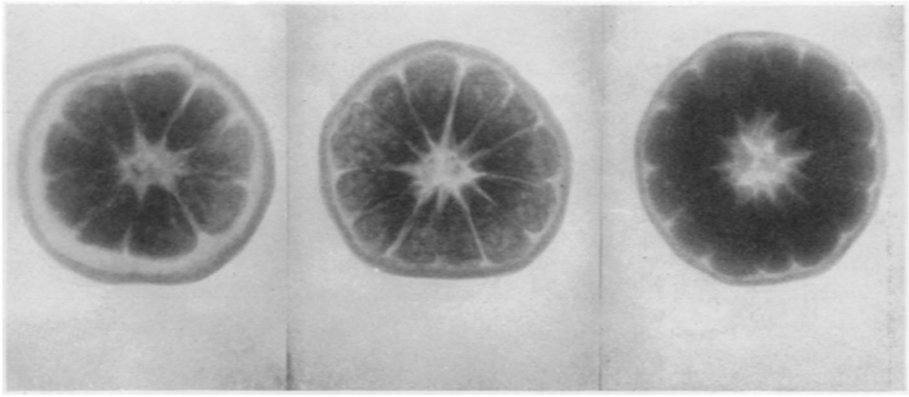
If you have ever had a really serious siege of indigestion, or something else wrong with your internal arrangements, you will remember how the doctor first fed you something with bismuth in it, and then pushed you up against a screen with an X-ray tube in operation on the other side of you. He could see a silhouette picture of your insides on this screen, which was coated with a substance that glows when X-rays strike it. This arrangement is called a fluoroscope. Maybe the doctor held up a mirror, so that you could conduct a survey of your own Department of the Interior.

The fluoroscope is used not only in medicine but also in the industrial applications of X-rays, where visual inspection is wanted, rather than a photographic record. Why not, Prof. Harvey asked himself, use it on potatoes as well as on those who eat them? So he tried it, and it worked.

The Minnesota scientist reported his results before meetings of his colleagues as a job of research in straight science. But he was quite aware of its practical possibilities. Manufacturers of machinery for food handling and inspection have taken over the job of commercial

LOOKS INSIDE

Four young women using the same X-ray machine to separate "sheep" from "goats" in a citrus packing plant in California. A flick of the finger on the lever makes judgment effective. The "saved" fruit starts for market on the conveyor in the foreground; back of it, a smaller conveyor hustles the "lost" away to its doom.



WHAT IT SEES

These are X-ray photographs of tangerines: left, puffy; center, flesh granulated; right, normal.

distribution, and the machines are coming into use in a number of food industries.

There are differences in operation, according to the type of product being inspected, but fundamentally the machines are very much alike. At the heart of the apparatus is the X-ray tube. On either side is a slowly moving conveyor belt, carrying the fruits or vegetables. Above them are the inspectors, usually two on each side. Between inspectors and conveyor belts are the screens of the fluoroscope.

The inspectors, usually girls, alertly watch the procession of transparent shadows as they travel along the screens. So long as their appearance signals "normal" the girls make no move. But when a shadow shows up that shouts, "I'm a bad one," an operator flicks a lever with her finger. Out goes the imperfect specimen through a chute in the bottom, either onto the wasteheap or into such by-product uses as the particular industry may afford. The good ones stay on the conveyor belts and go their undisturbed way to market.

Danger in Use

Wherever X-rays are used, danger from continued exposure must be guarded against. The food-inspection machines are well insulated with plates of lead, which adequately protect the workers.

The machines have high capacity. The Food Machinery Corporation, of Riverside, Calif., state that one of their citrus inspection units is capable of handling, in an hour, from 100 to 150 field boxes of oranges, 70 to 90 boxes of lemons, 150 to 200 boxes of grapefruit, or 80 to 120 boxes of tangerines. Use of the machine has resulted in saving of as much as 30 per cent of batches of suspected fruit, cast out as bad by earlier inspection methods but proved to be good by careful check-up.

Injuries that cause internal defects in fruits and vegetables without marring their outward appearance come from a number of causes, usually not from insect infestation or plant disease caused by bacteria or fungi.

Too Rigid Growth

Hollow heart of potatoes, for example, seems to be due merely to too-rapid growth. Ordinarily it is found only in big tubers that have grown under unusually favorable conditions of moisture and warmth. They grow so fast around the outside that they literally split themselves inside. Their skins remain smooth and unbroken, and nobody can suspect their inner flaw. There is nothing unwholesome about their flesh, but of course they are not good for any kind of whole cooking.

Big grapefruit sometimes show an analogous defect. Their segments will be separated from each other, or pulled loose from the central solid column. But with citrus fruits in general, concealed inner defects more often arise from other causes. When a sudden freeze hits the orchards, it may only partly kill the fruits. Some of the juices ooze out from the killed cells and subsequently disappear from the fruits, leaving them loose and puffy, with a disagreeable dryness about their pulps. The X-ray fruit analyzer can spot this condition every time, whether it affects the whole fruit or only one side of it.

Perhaps the most serious, at least the most frequent, of concealed internal defects in apples is a browning of the flesh, that usually occurs in a ring, following the small fibrous strands that stand outside the core. It seems to be due to some upset in the apple's own physiology, rather than to any germ or virus infection. This condition also the X-ray analyzer can detect.

X-rays can be used to good effect for the inspection of processed as well as fresh food products. In some of the modern types of packed hams, for example, the bone is broken for greater compactness. This is all right if the break is a clean one, as it usually is, but if a chip or splinter of bone breaks loose and becomes embedded in the flesh the consequences are apt to be unpleasant. X-rays can pick out such compound fractures in packing, and eliminate them from the marketed products.

Shot Found

It might not be a bad idea for hunters to run their ducks and rabbits over an X-ray meat inspector, so they would know where to expect leaden shotgun pellets. That would be a much more agreeable way of locating them than to find them suddenly with their teeth!

Akin to those unexpected duck-shot are the annoying white pebbles, just about the size and shape of the kernels, that somehow get into the best-regulated of salted peanuts. Or the accidental pins, small screws, or other bits of metal that may become embedded in candy bars, or lost in the fluffy interior of boxes of breakfast cereal. The X-rays can find these where other methods of inspection fail.

Hard foreign objects may cause mischief long before they get between our unwary teeth. A stray stone or piece of metal can become the traditional monkey-wrench in the works if it goes into the hopper of a coffee-grinder or a spice-mill. A method that can watch whole batches of food materials during processing can often make substantial savings in time and in expensive parts that might otherwise need replacement.

The whole possible gamut of uses of X-ray inspection in food handling and processing has by no means been realized. For instance, corn canneries might very well put an X-ray food analyzer between their delivery chutes and the husking machines, so that wormy or smutty ears could be eliminated at the very outset of the process, or at least detoured to a second processing line, where the defective parts of the ears could be cut away before they are mingled with the sound ones.

In pea and bean canneries one of the principal sources of trouble are little round white pebbles (*Turn to Page 61*)

From Page 59

that get through sieves because they are so nearly like the vegetables with which they are mixed. X-rays would help to eliminate these jawbreakers.

X-rays might possibly be used also on the finished packages, cans, and bottles, to hunt down defective seals, bad corks, and other leaks that might admit contamination or lose contents. Sometimes, too, after long storage, certain types of internal spoilage occur; X-rays might be used for re-inspecting such material before shipping, to eliminate packages that were good to begin with but have gone bad while waiting to move.

Science News Letter, July 23, 1938

POPULATION

Oldest American Cities Are on the Pacific Coast

RESIDENTS of St. Augustine, Fla., may be surprised to hear it, but Long Beach, Calif., has just been pronounced an oldest city—the oldest, in fact, of America's large cities, with San Diego running a close second.

These two are the oldest, from the standpoint not of date of settlement, however, but of age of their residents. Metropolitan Life Insurance Company statisticians are the authorities for the new oldest city titles. They report that almost one-tenth — 9.2 per cent. — of Long Beach's population is over 65 years old. In San Diego the proportion of residents over 65 years is 9.1 per cent.

Spokane, Wash., is third in order of age of its inhabitants, and, in fact, all the Pacific Coast cities have pretty old populations. The reason, of course, is not hard to find. An equable climate and facilities for rest and recreation for which these cities are distinguished attract old people who have retired and are able to live on their income or savings. For the same reason, the highly industrialized city of Gary, Ind., is the youngest of all the nation's cities of over 100,000 population. Only 1.7 per cent. of its inhabitants are over 65 years old.

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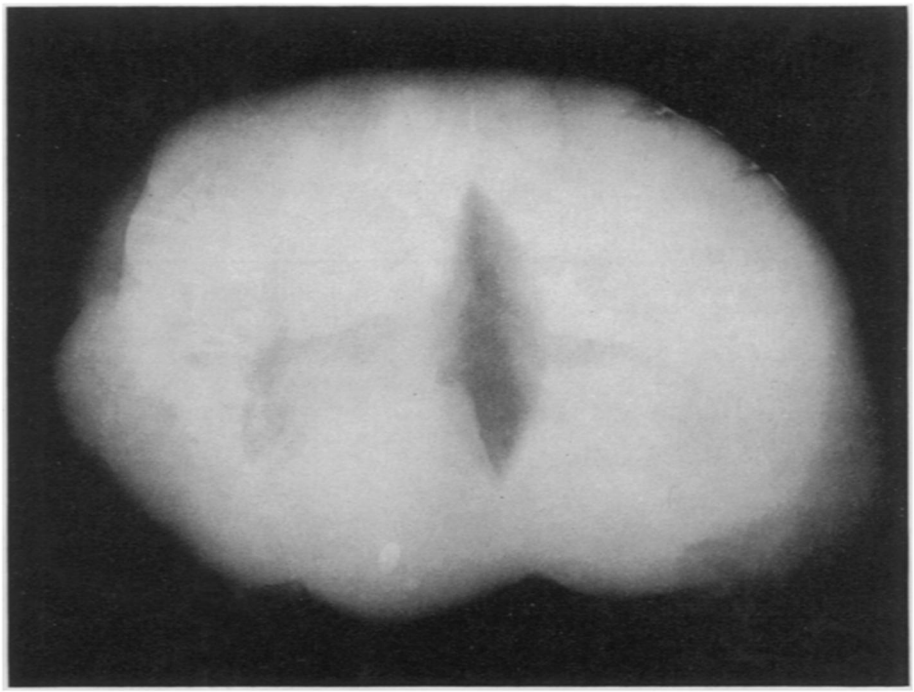
Princeton University has acquired a rare Moslem medical book written in the tenth century and carried off from the Near East by Crusaders.



FALSE HEART

The eye of the X-ray said: "This potato is hollow-hearted, unfit for baking."