

this army. Its members are public enemies, but not those of any foreign power. It is the army of crime.

But the laws of science do provide weapons for the hands of the officers of justice. The place of science in crime suppression was told at the opening ceremony by L. C. Schilder, personal representative of J. Edgar Hoover, Director of the Federal Bureau of Investigation, U. S. Department of Justice.

The science of dactylography—known to everyone as fingerprinting—affords a possibility of establishing identity for the protection of the innocent and conviction of the guilty. But more than that, it enables justice officials to follow the career of the criminal from place to place and crime to crime. Each day some 4,000 fingerprints come pouring in to the Department of Justice in Washington from 9,000 agencies in all parts of the world. These do not age; they remain always perfect identification of the individual. For fingerprints are changeless from about two months before the individual comes into the world until after he has left it.

The microscope in the crime detection laboratory, through the study of hair, bits of clothing, even dust, makes possible feats of detection that would have been considered miraculous a generation ago.

The science of chemistry lends aid in the analysis of blood, in cases of poisoning and in many other ways.

Photography, especially photomicrography, X-ray photography, and photography by ultraviolet light, provides society with another weapon.

Psychology and education of the public to a greater appreciation of the use of science and the problems of the police have yet to play their part, and the most important part in crime prevention, Mr. Schilder indicated. It is in this connection that the new exhibit was arranged by the Institute with the cooperation of law-enforcing agencies.

"Before the growing menace of murder, kidnaping, fraud, and violence can be stamped out in America, the minds of young boys and girls must be brought to an appreciation of the values of peace and security and honest dealing," he said. "Somehow the ideals of men and women must be raised to higher standards."

So now at the Franklin Institute, exhibit cases of guns, bullet-proof vests and shields, and the death mask of an arch-criminal who died of violence, offer for the first time publicly their mute but dramatic testimony of the need for a new psychological influence in the nation.

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metals by the action of light (photo-electric effect).

### Quicker Response

The new tube, Mr. Farnsworth indicated, should be of great advantage in television transmission because of its quicker response and amplification. He also predicted that it would have considerable influence in the design of future radio transmitters, mentioning, especially, transmitting sets for aircraft where the question of weight and simplicity is of the highest importance.

The revolutionary part of this tube is that it operates without a hot filament, whereas in the standard type of present day radio tubes amplification is secured by the boiling off of electrons from the hot cathodes. This new tube operates by recruiting electrons from a cold surface. Because there is no heating of elements required, there is little loss of efficiency. Radio transmitters thus may be built with fewer tubes, operating at a much higher efficiency.

### Quart-Size

In the I. R. E. demonstration one thousand watts of power were drawn from a tube about the size of a quart container. Because of its very high efficiency in the ultra-high frequency, the tube will materially decrease the cost of equipment for broadcasting stations using the ultra-high frequencies. This is particularly true of television.

Mr. Farnsworth pointed out that this decrease in the cost of transmitters for television would undoubtedly have some effect in overcoming the reluctance of broadcast station owners in the launching of television stations.

Probably the most interesting feature to the radio engineer is that in some of the designs of Farnsworth tubes, no filament, or heated cathode, of any type is used or needed. The great advantage of this can be seen when it is remembered that the life of ordinary tubes now in use ends when the filament burns out. Therefore, if these filamentless Farnsworth Multipactor tubes are operated within their ratings, there appears to be no good reason why they should not last indefinitely.

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There are more acres of tree land on American farms than acres of any other crop.

Removing very small impurities in common metals may so alter their properties that the pure metal is like a new product, not merely an improved one.

RADIO

## Radio Tube Without Filament Aid to Radio and Television

**A** NEW type radio tube without a filament and having potentialities in the development of television and the design of light-weight radio transmitters for aircraft was shown for the first time publicly before the meeting of the Institute of Radio Engineers by Philo T. Farnsworth, Philadelphia radio and television engineer.

The new radio tube is of the cold-cathode type and is known as the Multipactor. The operation of the tube, said Mr. Farnsworth, is based upon the harnessing of so-called secondary electrons which are emitted by certain metals when bombarded by other electrons inside the tube.

High amplification is achieved because a single free electron inside the tube liberates a million electrons from the cold cathode surfaces when it strikes. And it does this in a millionth of a sec-

ond. Inside the tube the million freed electrons in turn strike the metal surfaces and liberate a million times a million other electrons from the cathode.

Enormous currents are thus quickly built up inside the tube which, if left uncontrolled, would release enough electrons to be equivalent to all the electric current consumed by all the electrical apparatus in the world.

While this great current gain is theoretically possible it is, of course, never achieved in practice, for the tube would naturally quickly have its parts fused together.

The free electrons of the tube which start the bombardment and the subsequent amplification gains in current, said Mr. Farnsworth, are normally present in the tube because of the action of natural radioactivity or cosmic rays, or because the electrons are released from