You'll soon see top television shows on the huge screens of movie theaters —new types of equipment will do it.

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Drawings by Lester Fagans and Walter Popp

TELEVISION is coming to your neighborhood theater. Soon, say experts, movie houses will be dishing up special television entertainment instead of second-rate second features. You then will be able to relax in a comfortable seat and enjoy championship boxing bouts, World Series baseball, bowl football games, and important news events as well as if you were right on the spot. And many of these special TV theater shows will not be flashing on the screens of home receivers.

Most important of the factors bringing television to the movie houses is new equipment able to project bright, movielike television images on a full-size theater screen. But basic dollars-and-cents business is involved, too. Theater owners have their eyes on audience-pulling television features, while sports promoters see the possibility of $10,000,000 box-office gates in television rights leased to theaters. A championship prize fight, they point out, could be staged in a small studio instead of a big arena and be viewed by millions of fight fans—at 85 cents or $1.10 each—all over the country.

The same reasoning applies to the big commercially sponsored TV shows—the sponsors want bigger audiences; the movie men want those audience-pulling shows in their theaters.

When television pictures do reach your local theater—successful demonstrations already have been made in several major cities—they will get there via one of five different types of video projectors now being groomed for the job. The basic systems are shown on the following pages.

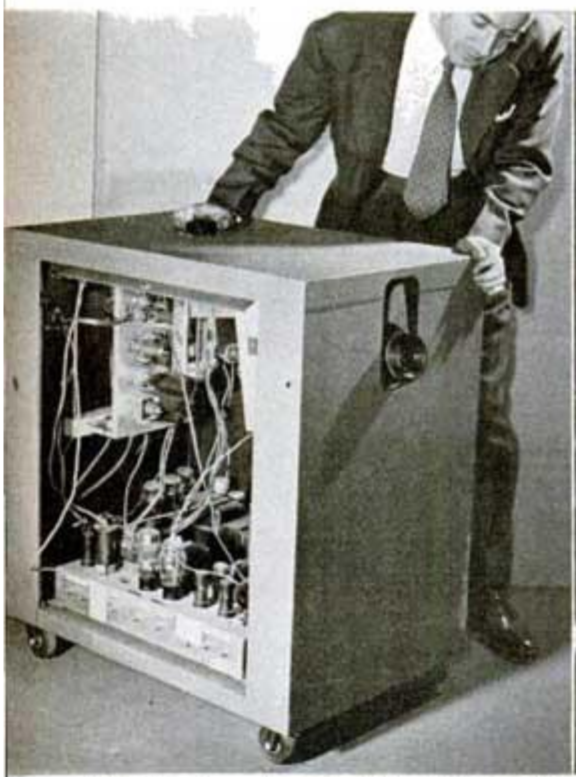
REFRACTIVE & REFLECTIVE PROJECTION

THE refractive and reflective methods of TV theater projection resemble the basic methods used in the familiar projection-type home receivers—they project the images formed on a cathode-ray tube directly onto a remote screen.

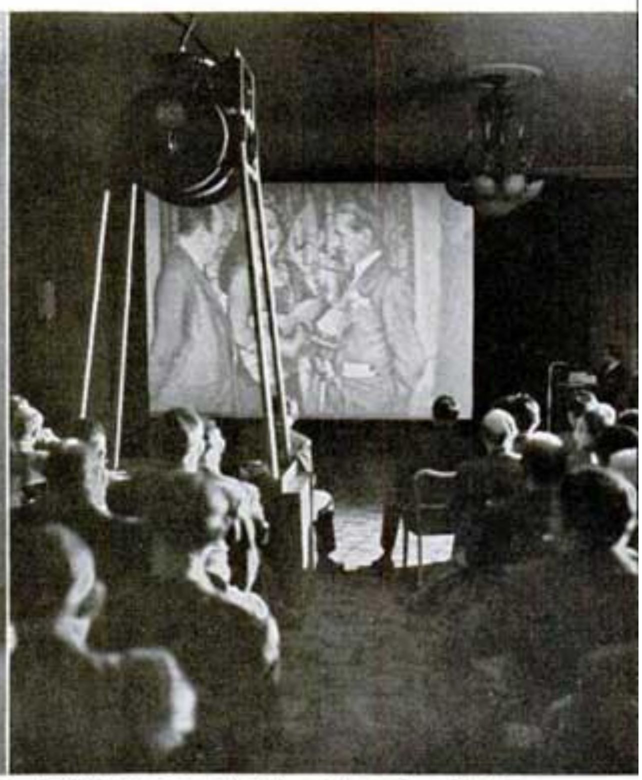
In the refractive system, a projection lens, placed directly in front of a high-voltage picture tube capable of producing brilliant images, throws the images on the screen. It is very similar to motion-picture or lantern-slide projection, with the cathode-ray tube simply replacing the film in the projector.

The reflective system, on the other hand, makes use of a spherical mirror and a ringlike corrective lens to magnify and project the tube's image. Originally developed as an astronomical telescope—and now widely used in that science—it is usually called the Schmidt system after its astronomer-inventor. Basically, the design of a reflective projector resembles that of an old-fashioned "magic lantern," with the brilliantly glowing picture tube taking the place of the illuminated post card, and with a spherical magnifying mirror replacing the flat reflecting surface. The ringlike lens corrects for the spherical distortion introduced by the mirror. The picture tube faces away from the screen in the Schmidt system, its image being picked up by the spherical mirror and projected forward to the screen through the correcting lens that circles the tube's neck.

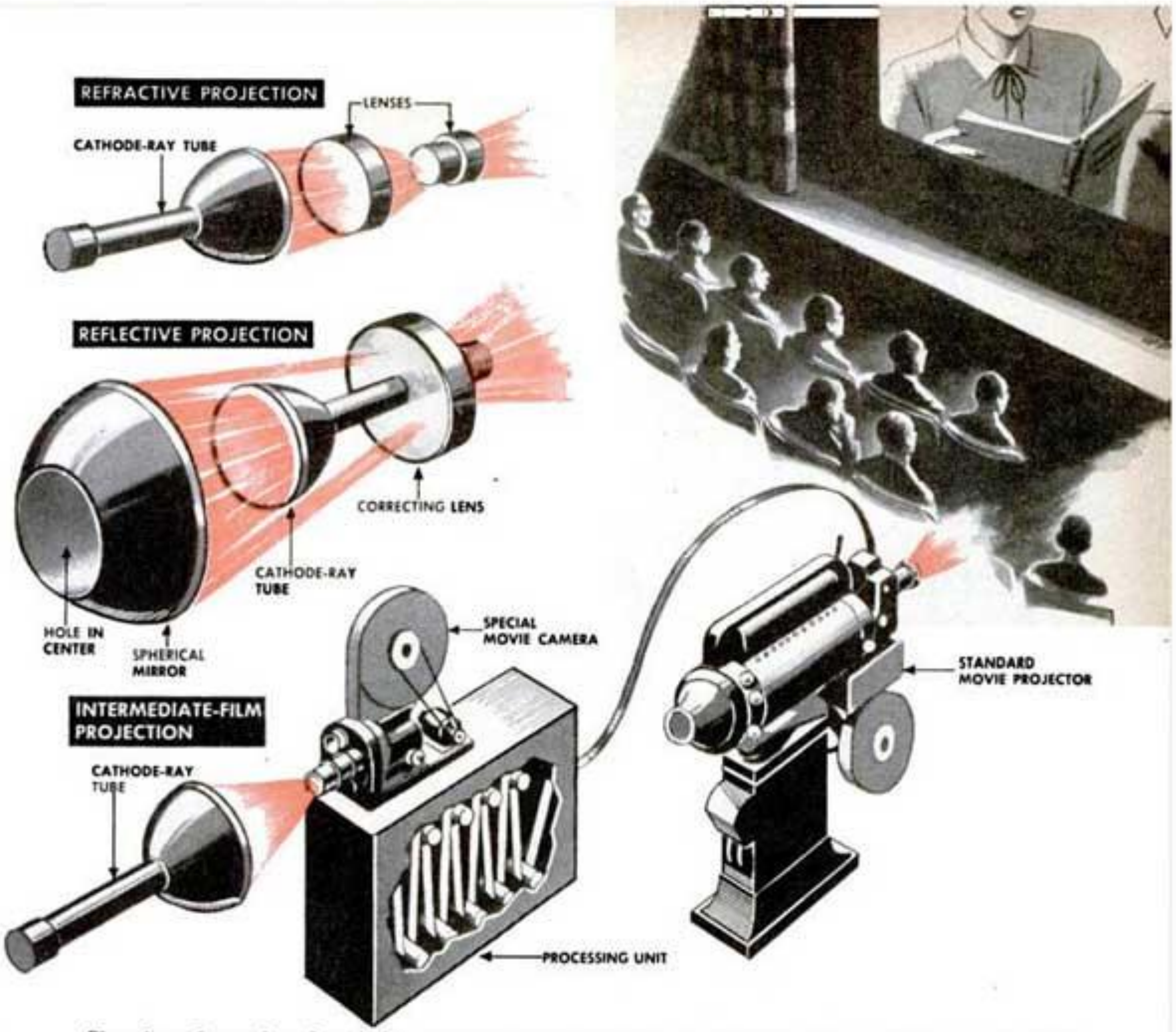
In both the refractive (lenses) and reflective (mirror and lens) systems of projection the brightness of the final picture on the screen depends entirely on the brilliance of the image formed on the cathode-ray tube. For this reason, extremely high voltages must be used to produce a cathode-ray beam powerful enough to get the maximum light output from the tube's fluorescent screen. Voltages as high as 80,000 often are necessary. However, the tubes can be small in size, frequently having pictures hardly larger than a postage stamp.



Most direct way to project television on a big screen is with a lens in front of the cathode-ray tube. A typical refractive projector is the U. S. Television model that is shown above.



Reflective, or Schmidt, system of projecting television uses mirror and lens to get big image. Latest RCA model (above) can fill a 15- by 20-ft. screen, may be available late this year.



Sketches above show basic elements of projection systems that have seen actual use in the U.S.

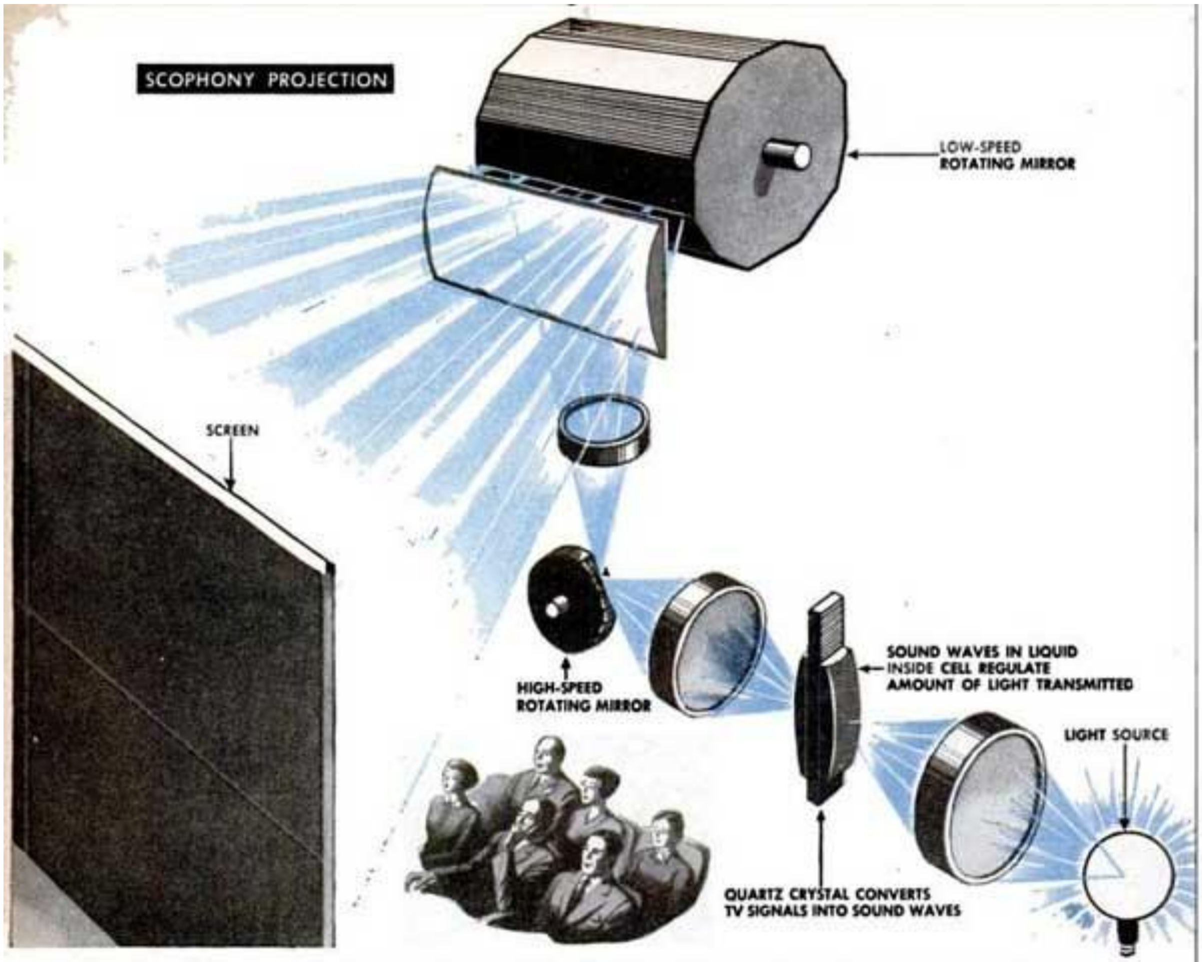
INTERMEDIATE-FILM PROJECTION

SINCE cathode-ray tubes can provide only a limited amount of light for projection, some engineers favor a theater-television system in which the final brilliance obtained on the screen comes not from a picture tube, but from some outside source—an incandescent lamp or a carbon arc.

One such system is the intermediate-film method of projection, which has been successfully demonstrated at New York's Paramount Theater. This is a continuous, three-step process making use of a direct-view television receiver, a special sound-on-film motion-picture camera, a high-speed film processing unit, and a regulation movie-theater projector. The TV images, displayed in this case on the tube's screen as negative images, are photographed continuously on positive film by the camera, which has been altered to compensate for the difference between the 24 exposures per second used in making movies and the 30 images per second used in television.

As the film is exposed, it enters an automatic, high-speed, high-temperature film processor, where it is developed, fixed, and dried. From the processor it is fed directly to the motion-picture projector. Elapsed time from TV image on the receiver to projected image in the theater—56 seconds!

A number of companies, including the Radio Corporation of America, Eastman Kodak, and others, are experimenting with the intermediate-film process. Among the improvements being tested are magnetic sound recording and a more precise shutter and film-moving system that will give smoother motion.



Scophony® has no cathode-ray tube, uses liquid light valve, rotating mirrors to create image.

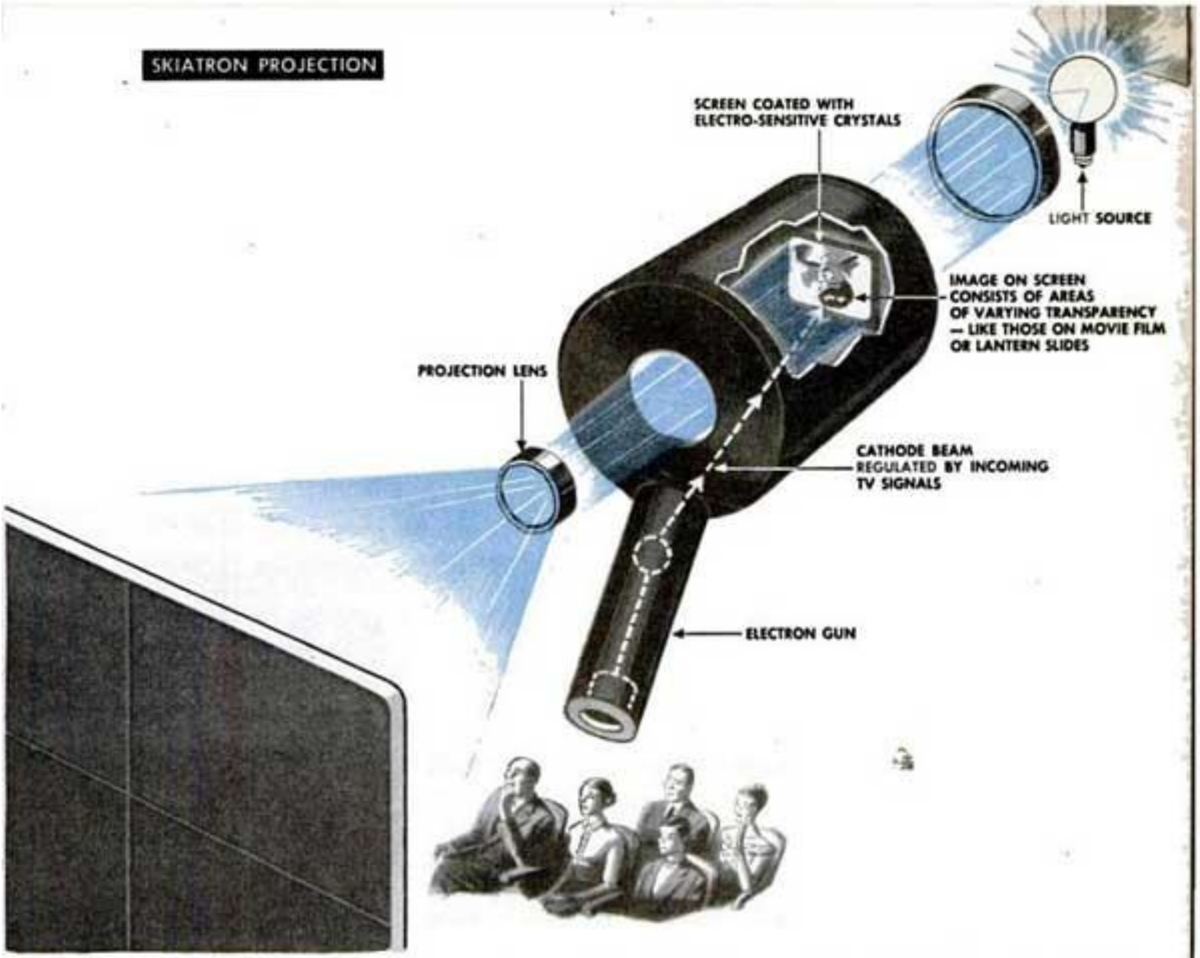
SCOPHONY PROJECTION

Most revolutionary of the TV projection systems is Scophony®. It has no cathode-ray tube at all, but uses a light valve, rotating mirrors, and an arc or incandescent lamp to turn the television signals into screen images.

Two things are needed to make a television image in any system: spots of light of the proper brightness, and a way to scan, or place those spots in the correct positions to form the picture. In ordinary electronic television, the spots are created by varying the strength of a cathode-ray beam in accordance with the incoming signal, and the spots are placed by moving the beam. In Scophony, the spots are made by varying the strength of a light beam with the valve—a sort of continuously changing filter—and placed by reflecting them from the mirrors.

The light valve is a liquid-filled cell containing a quartz crystal. The crystal is connected to the incoming television signals, converting them into high-frequency sound waves. The varying sound waves change the liquid's index of refraction—the amount it will bend a beam of light passing through it. Thus the signals control the amount a light beam will be bent passing through the cell, and therefore the amount of light that will pass *directly* through it. This makes the spots of light of the proper brightness.

To place these spots in their right positions, Scophony has two motor-driven, many-sided, mirrored drums—one to scan from side to side, the other up and down. A small, high-speed scanning drum picks up the light spots from the valve and reflects them, one by one, to form a single horizontal line on one of the mirrored faces of a low-speed scanning drum. The low-speed drum, with the aid of a lens, projects each line, one below the other, onto the screen to form the completed image.



Skiatron system, used in wartime radar, employs special cathode-ray tube to make pictures.

SKIATRON PROJECTION

STILL in the laboratory stage of development, the skiatron system of TV projection promises one of the simplest methods of putting bright images on a big screen. It uses an independent light source, but with an all-electronic image-forming device, thus eliminating the difficulties usually involved in mechanical scanning.

The heart of the system is a new kind of cathode-ray tube—the skiatron tube—that has a screen of electro-sensitive crystals (such as potassium chloride) rather than the fluorescent screen found on ordinary cathode-ray tubes. These electro-sensitive crystals act just the opposite way fluorescent screens do. Instead of glowing when struck by a beam of electrons, they darken—and darken in direct relation to the strength of the electron beam hitting them.

Placed in a television-receiver circuit, the skiatron tube produces "shadowgraphs," or lantern-slide-like transparencies, rather than brilliantly glowing pictures. By arranging the tube's components at a 45° angle, rather than in a straight line as in the normal cathode-ray tube, the concentrated beam from a powerful light source can be used to project the tube's filmlike images onto a large screen. The skiatron projection system, in effect, makes it possible to employ the normal movie-projection technique used in the intermediate-film method—without the intermediate film! By using three-tube arrangements with filters, skiatron could also project color television.

The skiatron tube, still under development for television, saw war use in projecting radar images aboard battleships. One difficulty, which was unimportant in radar but must be corrected for television, is the relatively long persistence of the shadow image it produces. END

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