ers have endeavored to solve this problem of "seeing over a wire," as it is commonly referred to, and one of the best methods tried in a laboratory, on a crude scale, is that of making use of a large number of selenium cells.

However, there are several drawbacks to this solution of the problem, some of them being enumerated below.

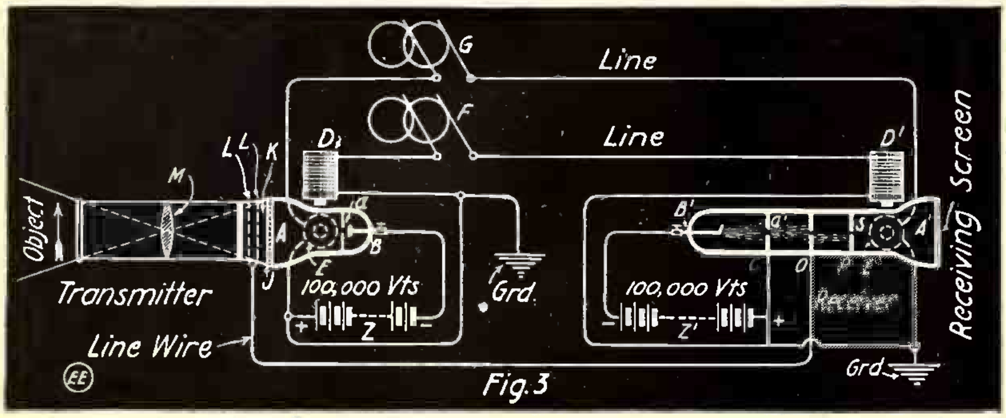

Fig. 3. Diagram of Proposed "Television" Scheme.

Selenium cells manifest a quality known as "time lag" in their electrical operation or action, and this means that it is difficult to build any such apparatus, as we now have under consideration, to act in an anywhere near perfect manner, when the selenium cells will show varying degrees of "time lag," or, in other words, when they tend to be sluggish in their action of changing from high to low resistance, etc. This lag is small, of course, and it must be understood that in considering the basis of this whole process that with the dot formation, even though made up of a vast number of small lamps, compactly grouped at the receiver end of the line, that the changes in the lamps' intensity, which is of course primarily dependent upon the action of the selenium cells on the transmitter, must be quite rapid, and this may be more readily understood when it is known that in the ordinary motion picture, with which we are all familiar, there

Fig. 3A. This Picture Is Made of Many Small Dots, Although You Wouldn't Think so. Note Marked Eye in Fig. 3B.

are from 16 to 20 different pictures projected on the screen per second. This has been found to give us a fairly steady picture owing to the "lag" of the human eye in perceiving an object in motion. That is to say, the eye does not loose its impression simultaneously, but the object's impression on the retina of the eye remains for a fraction of a second, and this explains how motion pictures are made possible by the present methods in vogue.

It has been estimated by a well-known English authority and scientist, who has worked along the line of Television, that if the selenium cell process was to be used to give good close-grained results on a surface only two inches square, there would be required 150,000 wires, 150,000 selenium cells, 150,000 lamps. While even to obtain an effect no better than that used in the coarsest process blocks, as used by ordinary daily newspapers, there would be required at least one-tenth that number of selenium cells, lamps and wires.

Working on this basis, but reducing the number of cells, etc., to be used, to a figure of 90,000, this scientist calculated that the cost for a 100-mile transmission circuit, including apparatus at both ends, would amount to the staggering sum of $6,250,000. This considers simply a monochrome reproduction in black and white only of the view or object over the circuit. If the apparatus in question should have to be triplicated, so as to give a colored picture, by the well-known three-color process, then the cost would naturally rise to three times the amount stated.

From this figure it is to be seen that evidently such a solution of the problem is far beyond us and not capable of industrial or practical applications, in the strict sense of the word.

Some workers in this field have also devised or advocated at different times very clever and ingenious methods, which seem quite good theoretically, for using a less number of selenium cells, lamps, etc., but to gain the same effect as if a large number of cells were used, by suitably moving a beam of light over the various cells successively at very high speed, and some similar arrangement being used at the *lamp* end of the circuit, where the picture is to be reproduced. This would act upon the principle of the retina retention of impression, as previously mentioned, and such ideas are based upon the theory that with proper apparatus, which unhappily is nearly impossible to construct from a mechanical standpoint, that each cell could be used for a fraction of a second.

One of the latest and most promising (theoretical) systems of Television—the *Telephot*—or the instrument for "seeing over a wire," makes use of a stream of cathode rays, which can be deflected and changed in their direction of production very rapidly, and moreover, these rays possess an infinitesimal amount of momentum or mass. This method has been brought forth by an Englishman, Mr. A. A. Campbell-Swinton, president of the Röentgen Ray Society, of London.

The apparatus based on his descriptions and ideas are shown in the illustration at Figs. 1 and 2. In this picture detailed apparatus only is shown for transmitting pictures one way, or, in this case, from right to left; the detailed receiving apparatus being then at the left of the picture and the transmitting apparatus with high frequency A. C. generators, etc., being shown at the right. Both transmitting and receiving tube openings are shown, however. It is evident that one can easily, and without any awkward motions, glance slightly upward to view the reproduced face in the smaller upper screen, which is shown placed at a small angle. A dictagraph or super-sensitive telephone transmitter is probably best for such instruments and is observed under the *television screens*. Six wires are required to transmit pictures both ways.

We may now briefly consider the operation of this apparatus advocated by Mr. Campbell-Swinton, and which has been favorably received by the scientific world, *although as yet not practically demonstrated*. The schematic diagram, Fig. 3, will help the reader to understand the diagnosis of its operation. Three line wires are necessary between the apparatus, as observed from the illustrations at Figs. 1 and 3. At the *transmitter* end of the line there is used a focusing lens barrel "X." The object whose reproduction is to be electrically transmitted over the line is arranged at the tube opening, as at "N." A Crooke's vacuum tube is used at "A" and at "B" is the cathode electrode of the tube, from which the cathode rays are shot forth at an incredible velocity and which have

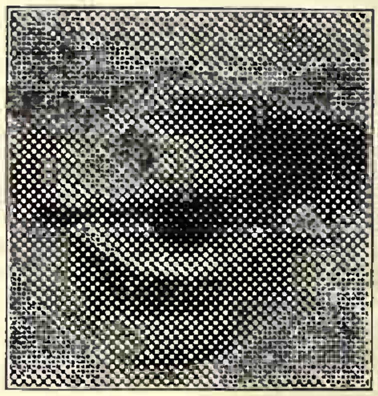

Fig. 3B. Hold This 18 Inches From You and the Effect Will Be Seen to Give the Facial Features Noted Inside the Marked Square on the Face at Fig. 3A.

practically no mass or momentum. An anode "C" of circular form is placed in the tube, which has at its center a small aperture or opening "a." Through this opening a small stream of cathode rays may pass; these rays being produced by a high potential *continuous current* from a source "Z," giving in the neighborhood of, say, 100,000 volts. Placed at right angles about the tube "A" are two electro-magnets "D" and "E," and these are energized by alternating currents from the A. C. generators or dynamos "G" and "F." These magnets allow of readily controlling or deflecting the cathode rays stream in a vertical and horizontal direction, respectively.

At "J" in the transmitter tube is placed a special screen, the whole surface of which is searched out by the stream of cathode rays, every tenth of a second, under the combined action of the A. C. electro-magnets "D" and "E." It should be mentioned here that the dynamos "G" and "F" produce *widely different* frequencies of alternating current; one of them producing, say, 1,000 complete positive and negative alternations per second, and the other 10 such complete alternations per second. The special screen "J" is proposed to be a gas-

(*Continued on page* 172.)