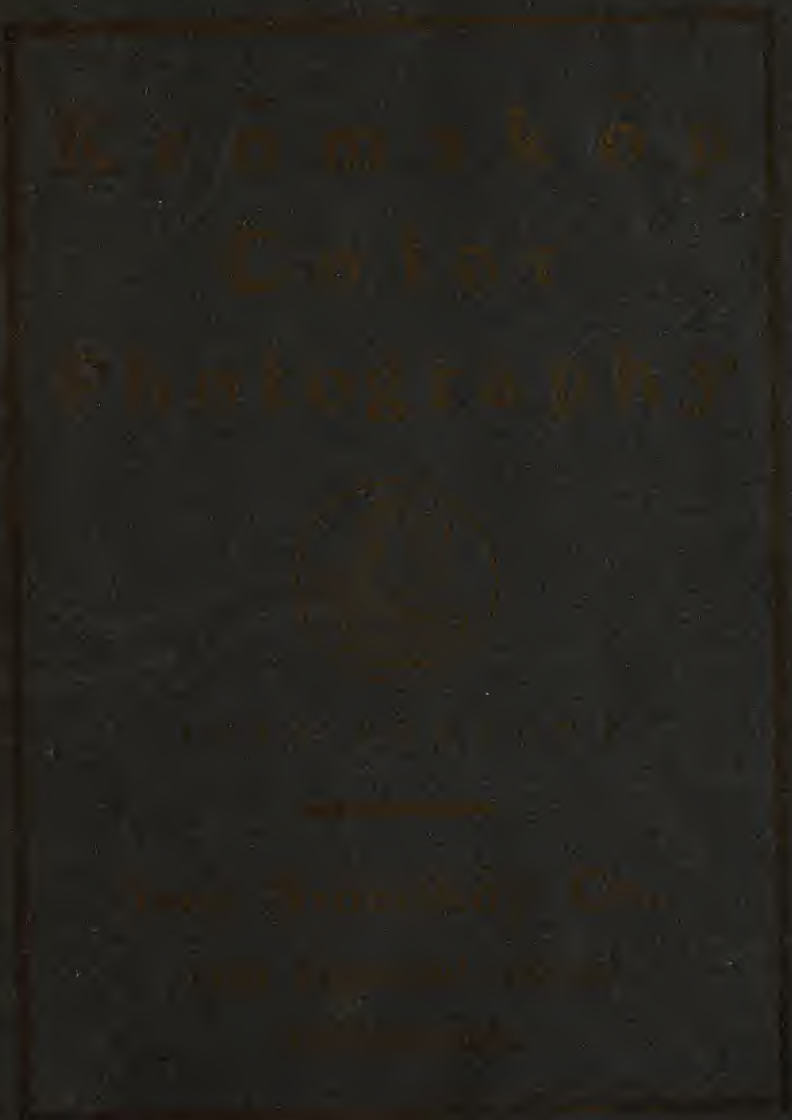
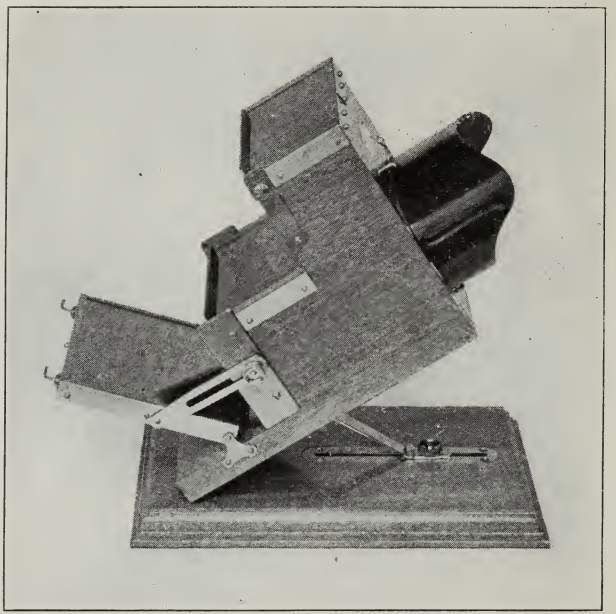




THE KRŌMSKŌP.

Color Photography

THE discovery of photography naturally set the problem of reproducing the colors as well as the forms of objects, and at first it did not seem a difficult one, because the colors seemed to be in the light, and why should not light lend itself as a brush to paint color, as already it had lent itself to paint light and shade? In 1839, when the first enthusiasm had been awakened by the discovery of photography, Isidore Niepce, the partner of Daguerre, assured a French nobleman that in a short time he would be able to reproduce his image as he himself saw it in a mirror; but this prophecy was not fulfilled, and while photography made great advances in every other direction, passing from wonder to wonder, the problem of automatically reproducing the colors of nature remained practically unsolved for half a century.

The efforts of the early seekers for a process of color photography are fairly comparable with the efforts of the ancient alchemists to find a means of transmuting

the baser metals into gold; they were sustained by a hope which had no basis in physical science, and no real progress was made until the laws of physics were appealed to, and invention stepped in to utilize facts and discoveries which could have had no bearing upon the original methods of research.

As long ago as in 1861, an eminent English scientist, Prof. James Clerk-Maxwell, laid the foundation of modern color photography, by suggesting an entirely new line of experiment, based upon demonstrable facts and principles. Prof. Young, at the beginning of the century, had promulgated the theory that there are three fundamental color sensations, red, green, and blue or violet. Prof. Helmholtz, half a century later, revived and ably supported this theory. Prof. Clerk-Maxwell carried the demonstration further, and then said, in effect, why not make three photographs to represent the three fundamental colors, and then optically blend them to obtain a photographic image showing the colors as well as the forms of objects? But Prof. Clerk-Maxwell's suggestion was forgotten. A similar suggestion was again made by another Englishman, Henry Collin, and by an Austrian, Baron Rausonnet, in 1865, and was again forgotten. The same principle was finally patented, with many ingenious elaborations, by Ducos du Hauron, a Frenchman, in 1868, and earnest efforts were made to reduce it to practice, and thus to realize a practical solution of the

problem of color photography. A most important step had certainly been taken, but success did not follow as anticipated; something was lacking or wrong, and after another twenty years, successful color photography still seemed to be, to quote from a German writer, "as far away as the stars in the skies."

The final solution of the problem along these lines is claimed by Frederic E. Ives, who by the application of a new and definite principle of color selection, in 1888, and by the subsequent invention of adequate devices for carrying out the process in a simple manner, has realized a perfectly successful and practical means for reproducing the colors of nature in a photographic image, so perfect that it fulfills the condition specified by Niepce, of appearing like a reflection of the object itself in a mirror.

While Mr. Ives has accomplished this by his Krōmskōp system, the same principle has been less perfectly developed as a means of making color prints, and alleged new processes of this kind are now quite frequently announced, and named for those who work them; but in reality none of them are new in essential particulars, and all are subject (in this country) to Mr. Ives' patent on the negative process. Besides these printing processes, there are the so-called Joly or McDonough process, and Prof. Wood's process, in some respects quite different, but which are also dependent for success upon the principle of color selection discovered by

Mr. Ives. The only modern process of "color photography" which does not come into this category, is that of Prof. Lippmann, which is based upon a totally different principle, but which is only of scientific interest, because commercially impracticable. Besides these genuine methods of color photography, there are processes, such as the so-called "Photochrom," which although advertised as "color photography," have no claim whatever to the title.

THE KRŌMSKŌP SYSTEM

HAS the important advantage over all other methods that it yields by far the most perfect results, and by simple and reliable means. It is the only perfect solution of the problem of recording and reproducing the colors of nature.

Krōmskōp is phonetic spelling for an abbreviation of "photochromoscope," meaning "to see photographs in colors." It is pronounced chrome-scope.

The Krōmskōp is an instrument which accomplishes for light and color what the Phonograph accomplishes for sound and the Kinetoscope for motion. It does not produce fixed colored photographs, but it is a veritable realization of color photography to the extent of bringing before the eyes, *by a simple and practical process*, a photographic image in the natural colors which

is far more perfect and realistic than any colored picture on paper could possibly be, because it is perfectly free from surface texture and reflections, and is seen without distracting surroundings, and in solid relief, exactly as the object itself is seen by the eyes.

The Krōmskōp system of color photography is based upon the fact that all the varied hues in nature are physiologically equivalent to mixtures of three simple spectrum colors, red, green, and blue-violet. The Krōmskōp photograph consists of three stereoscopic pairs of images, similar in appearance to ordinary uncolored lantern slides, but which, by differences in their light and shade, represent the distribution of proportions of the respective "primary" colors in the object photographed. The Krōmskōp photograph is therefore, although not a color photograph, *a color record*, just as the cylinder of the phonograph, although not a cylinder of sound, contains a record of sounds, and the kinetoscope ribbon, although not an animated photograph, contains a record of motion. The phonograph cylinder must be placed in the phonograph before it can be made to reproduce the sounds recorded; the kinetoscope ribbon must pass through the kinetoscope in order to visually reproduce the moving scene; and the Kromogram must be placed in the Krōmskōp in order to visually reproduce the object photographed, which it does so perfectly, that all suggestion of photography vanishes, and the

object itself, be it fruit, flowers, portrait, landscape, or work of art, seems to stand before the eyes again, with every quality of color, texture, sheen, translucency, atmosphere, solidity.

Is this color photography? Many people, who looked to see this problem solved in quite another way, object to calling anything a color photograph which has not been colored in its substance, by the direct action of light in the camera. Such a photograph would be described with scientific accuracy as a "photograph in natural colors," even though the colors bore no resemblance to those of the object photographed. There are processes which produce actual pigment colors by the action of colored light in the sensitive film, but although the colors produced are natural in the sense of being produced by nature (the scientist's definition), they are not natural in the sense of being like the colors of the object photographed (the popular definition). The Krōmskōp system reproduces perfectly to the eye the actual colors of the objects photographed, a distinction which should entitle this method *above all others* to be designated as "color photography," and it is now so designated by the highest authorities in photographic science.

"Seeing is believing." No amount of testimony quite prepares one for the vivid realism which characterizes the Krōmskōp reproductions. Judgment should be suspended until the results have been seen and

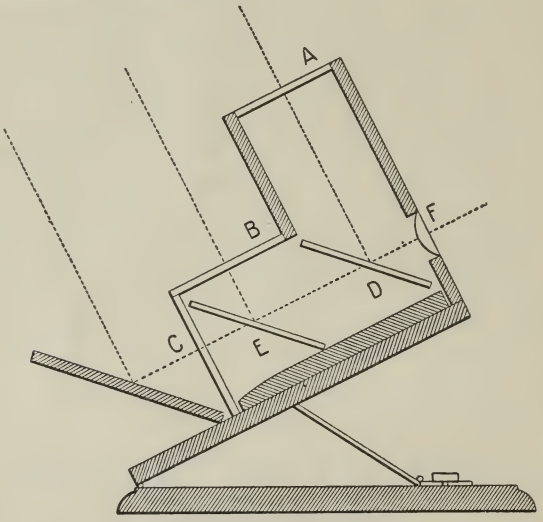
studied. An eminent scientist, when he first saw the results, said, "I knew that Mr. Ives was quite right in his theories, but I never dreamed that their practical application would result in such startlingly realistic reproductions." At every scientific soirée where the Krōmskōp has been shown in England, it has been the most popular exhibit. The president of the Royal Society tendered his special thanks and congratulations to Mr. Ives personally. At the Annual Conversazione of the Midland Institute, where nine instruments were shown three afternoons and evenings, at eleven o'clock on the third night a line of people, extending through three rooms were waiting their turn to see the Krōmskōp pictures. At a congress of German scientists at Dusseldorf, where every method of so-called color photography was exhibited, the Krōmskōp system was the only one that received special newspaper notice, and the German exhibitors sent a long congratulatory telegram to Mr. Ives. Letters of congratulation have been received from eminent scientists, and honorary medals awarded by scientific societies at home and abroad.

CONSTRUCTION AND OPERATION OF THE KRŌMSKŌP

The Krōmskōp consists of a mahogany case with colored glasses upon the outside and transparent reflectors inside, so arranged as to blend into one the three photographs which constitute the Kromogram, or *color*

record, in such a manner as to *reconstitute the scene before the eyes.*

It is used like a stereoscope, with photographs on glass, which are perfectly permanent, and can either be selected from our own extensive catalogue of subjects, or made with the Krōmskōp Cameras by professional and amateur photographers, without special knowledge or experience.



Its construction will be readily comprehended by studying the sectional plan on page 8. *A*, *B* and *C* are red, blue, and green glasses, against which the corresponding images of the color record are placed when the instrument is in use. *D* and *E* are

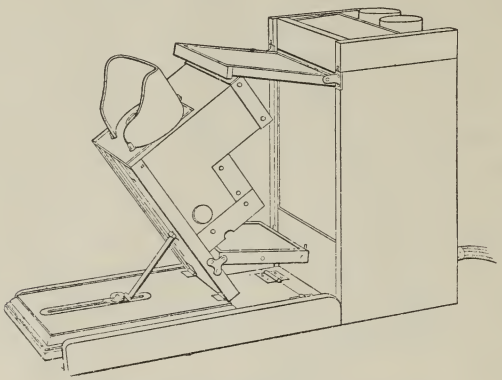
transparent reflectors of colored glass. *F* represents the eye lenses for magnifying the image. Beyond *C* is a reflector for illuminating the images at *C*—those at *A* and *B* being illuminated by direct light from above.

The operation of the Krōmskōp is as follows :—The green images are seen directly, in their position at *C*, through the transparent glasses *D* and *E*. The blue images are seen by reflection from the surface of the glass *E*, which makes them appear to occupy the same position, and in fact to become part of the images at *C*. In the same way the red images are seen by reflection from the surface of the glass *D*, and also appear to form part of the images at *C*. And finally, the eye-lenses at *F* not only magnify, but cause the eyes to blend the two images which constitute the complete stereoscopic pair, as in the ordinary stereoscope. The result is a single image, in solid relief, and in the natural colors.

When there is no Kromogram in the instrument, the mixture of the three pure colors produces white. Shading either of the glasses produces color, and it is the function of the Kromogram, by the varying density of its images, to make such a mixture of the pure colors as will reproduce all the infinite variety of light and shade and color of the objects photographed.

The Krōmskōp negative is usually made on a single photographic plate, at one exposure in a special camera,

by which the records of color are obtained automatically and accurately. The positive record is made by contact printing from the negative, in the usual way; the glass plate is then cut in three and mounted on the special hinged frame, designed to bring the respective pairs of images readily into position in the Krōmskop. The Kromogram, thus formed, can be changed with great facility and quickly folded up for putting away.

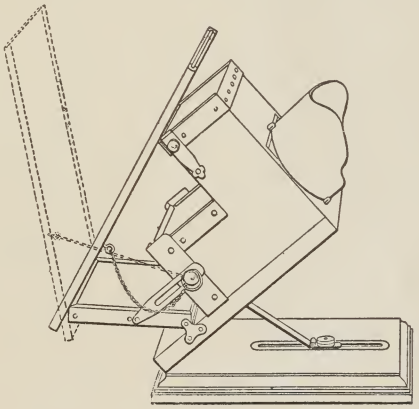


Krōmskōp and Night Illuminator.

In the daytime, the Krōmskōp is used in front of a window, and illuminated by the light of the sky. At night, and where light from the sky is not available, it is necessary to use the "Krōmskōp Night Illuminator," by means of which the light of two Welsbach gas burners or an acetylene flame is suitably distributed for this purpose.

A very convenient electric light illuminator has also been devised.

The Krōmskōp can be converted, in a moment, into an ordinary stereoscope, for viewing specially mounted glass stereograms. Moving objects, which cannot be photographed as Kromograms, may, therefore, be photographed by "snap-shot," and viewed stereoptically in the same instrument, and more perfectly than the ordinary paper stereograms. It is also possible, and most interesting and instructive, to show the regular Kromograms both with and without color.



Krōmskōp and Daylight Diffuser.

THE USES OF THE KRŌMSKŌP

[EXTRACT FROM A LECTURE BY MR. IVES AT THE SOCIETY OF ARTS, LONDON.]

Even those who have seen and recognized the beauty and perfection of the Krōmskōp reproductions often

ask—and it is perfectly reasonable that they should ask—"What useful purposes will this invention serve?" This question always reminds me of the story of Faraday, who, when asked what was the use of a certain new discovery, retorted by asking "What is the use of a new-born baby?" I can, however, suggest a few important applications for the Krōmskōp, artistic, industrial, and educational. In the first place, the works of the old masters can be reproduced by the instrument with every touch and tone of color depicted as in the original masterpiece. The color records, occupying little space, can be stored in a small cabinet, or readily sent from place to place for purposes of reference or exchange, affording to the artist opportunities to study at his leisure, and in the quiet of his own studio, the technique of the acknowledged masters of his profession, although the original paintings may not be accessible to him. Decorative work of all kinds can be as faithfully reproduced for the use and study of designers—tapestried hangings, mural paintings, stained glass windows, furniture, pottery, enamels, etc. Landscapes from all parts of the world, and rare and valuable objects of scientific interest can also be included in the cabinet of color records. It will even aid in medical diagnosis by acquainting the practitioner with the actual appearance of skin diseases, and their changes from day to day under various conditions which he has not met with in his own prac-

tice ; I shall not be at all surprised if its value to the science and practice of medicine shall prove to be incomparably greater than that of the so-called "new photography" with the Röntgen rays. It will even prove of considerable value, especially in that country of great distances, America, to many commercial travellers, enabling them readily to show to their customers the exact appearance, in color, of objects of merchandise which are too large or too valuable to be economically carried about as samples. It will also probably become an adjunct to every school and college in the world, not only as an illustration of applied science and a graphic demonstration of the principles of color vision, but because it will afford, by means of color records of rare natural history objects and peculiar cabinet specimens, a virtual extension of the school's collection which may add enormously to its educational value. Its application to portraiture is too obvious to call for comment. Still other useful applications have already been suggested, and new ones doubtless will be, as it becomes better known.

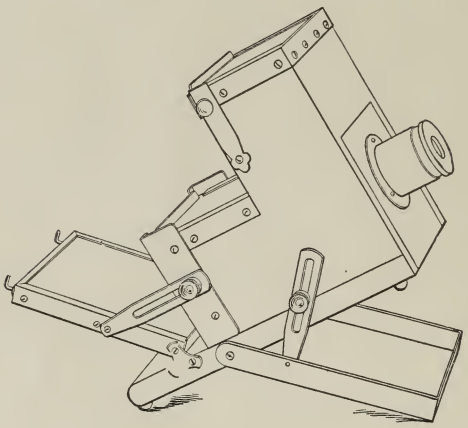
THE JUNIOR KRŌMSKŌP

Is a monocular (non-stereoscopic) instrument, with a focussing eye-piece, the Kromogram consisting of three images only.

Both the instrument and the Kromogram are cheaper

than the other form, but give equally perfect reproductions of the colors.

The Junior Krōmskōp will sometimes be preferred, —by artists, who are accustomed to see everything

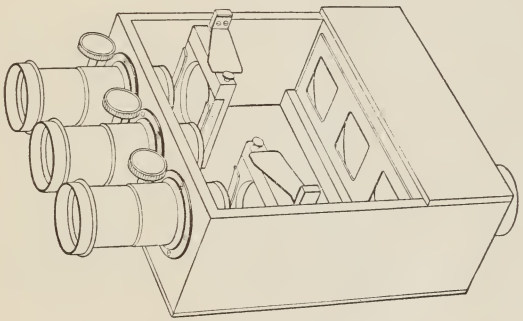


Junior Krōmskōp.

mentally as a picture instead of a solid object; by amateur photographers who wish with the least trouble and expense to make their own Kromograms, and by anybody to whom the difference in cost is of importance.

THE LANTERN KRŌMSKŌP

Is an attachment which can be used on the front of any ordinary lime light or electric light lantern. The pictures are the same as those of the Stereo. and Junior Krōmskōps, but specially mounted on a wooden frame. With the lime-light, good results are obtained up to four feet square, and with the electric light up to six



Lantern Krōmskōp.

feet. This attachment is admirably adapted for scientific demonstration of the principles of color photography, and for exhibitions of color pictures to small audiences.

A special form of this instrument, called the "Science Lantern Krōmskōp," shows a circular disk, the elements of which may be separated upon the screen, to show the analysis of color, and the process and effect

of superposing the three images. This is effected by the movement of a lever acting upon the two outer objectives and the mirrors which throw the light through them; this demonstration is not only interesting and instructive, but really spectacular, and this form of the instrument is specially recommended for school and college demonstrations. It has already been adopted as a standard demonstration apparatus in the physical department of leading universities.

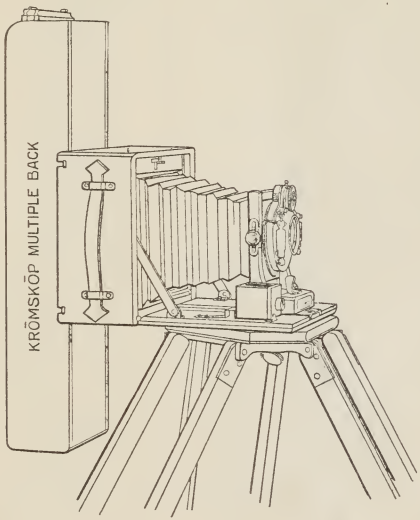
For general lantern exhibition purposes, permanent color print lantern slides are made from Krōmskōp process negatives, and such slides may be used interchangeably with ordinary lantern slides, and projected to any size. This process yields results which cannot be rivalled at any cost by hand coloring. The commercial production of such permanent print natural color lantern slides will be made a part of this business.

THE KRŌMSKŌP CAMERAS

The simplest device for making negatives of Krōmskōp pictures is in the form of a sliding color-screen and plate-holder attachment for an ordinary camera, called a Krōmskōp Multiple Back. With this attachment, the three images constituting the negative color record are made by successive exposures on a single sensitive plate, and it is a reliable method of obtaining the most perfect results when the light is perfectly

steady, as in uninterrupted sunlight. In a changeable light, the correct ratio of exposure is not easily insured, and it is not recommended to use it under such unsuitable conditions.

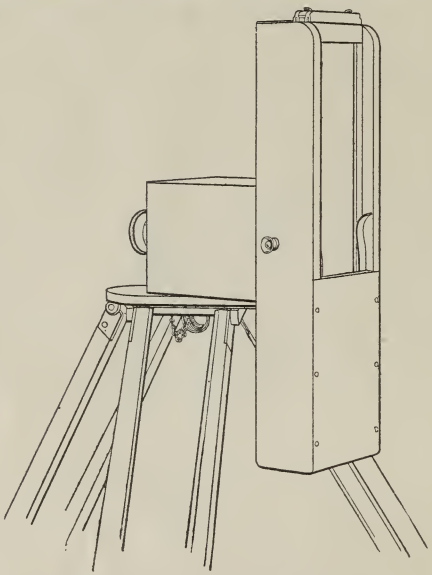
The Krōmskōp Multiple Back employs rectangular plates 2½ x 8 inches in size, and makes pictures for the



Junior and Lantern Krōmskops. If attached perpendicularly to a front-focussing camera, as shown in the illustration, it makes negatives from which Kromograms suitable for showing in the Stereo. Krōmskōp can be made by double printing, but which will not show true stereoscopic relief.

Perfect results have been obtained in landscapes, flowers, natural history, medical subjects, and even portraits, by amateur photographers who have used these attachments in England.

The Krōmskōp Multiple Back is also supplied, if

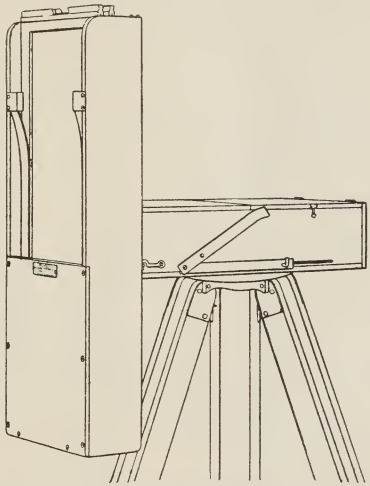


[Multiple Back Box Camera.]

desired, with a fixed box front and single achromatic lens in focussing mount, forming a complete and efficient though simple camera for color photography, at a low price.

Positives made by contact printing from Multiple

Back negatives appear reversed right to left in the Krōmskōp. This can be avoided by sending the negatives to us to have the Kromograms made, or, a reversing prism or mirror can be adapted to the lens at a moderate cost.

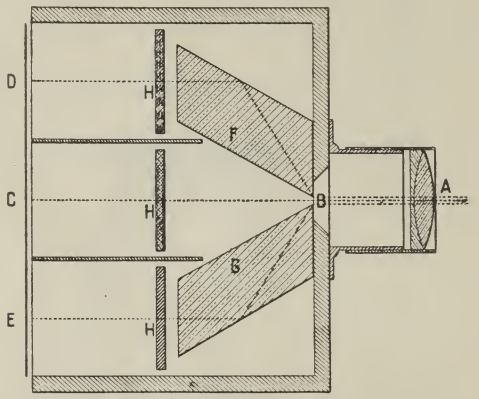


[Stereoscopic Multiple Back Camera.]

This camera is also made stereoscopic, with rack and pinion focussing, and inverting prisms in front of the lenses, so that positives made by contact printing are ready for cutting into three and mounting directly upon the Kromogram frames.

THE KRŌMSKŌP VIEW CAMERA

Is a triumph of optical science, containing, in addition to the essential parts of an ordinary camera, nothing more than two prisms and three color screens. With this simple device, Krōmskōp Color Photography is reduced to "one plate, one exposure." The construction is shown in the above diagram, in which a single achromatic lens, A, focussing by slip tube, in front of a diaphragm B, focusses an image at C ; but in



order to divide the light and form the other images at D and E, the prisms F and G are so placed that their inner front edges partly cover the square diaphragm aperture, which then appears like three juxtaposed slits, giving three practically identical points of view. The light passing into the prisms is twice reflected,

producing unreversed images at D and E, which owing to the greater distance from B to D and E than from B to C, would be of larger size than the middle image, and much out of focus, but for the fact that the greater refractive index of the glass as compared with air extends the focal point, so that the images are exactly equal except for the differences of light and shade introduced by the selective screens.

This camera permits exposures as short as five or ten seconds in bright sunlight. Stereoscopic records can readily be made by exposing two plates, with a lateral movement of the camera between the exposures.

The view camera is practically fixed focus for landscape and architectural photography, but may be focussed by slip tube for objects as near as 15 feet. It is not adapted for photographing quite small, near objects, such as bric-a-brac, flower and fruit pieces, etc.

The Krōmskōp photographic process is patented and the ownership of Krōmskōp Multiple Backs or Cameras carries with it a license to make pictures for private use and exhibition, *but not for sale*, unless by special arrangement.

ORTHOCHROMATIC COLOR SCREENS.

Both the bichromate cell and the sealed color screen were invented by Mr. Frederic E. Ives—the first in 1878, and the second in 1885. For 15 years Mr. Ives has used in his own work, and made for his

friends, sealed color screens adapted to give precise "orthochromatic" effects, and some of the earliest made of these screens are still in use and highly prized by their possessors. In an orthochromatic photography competition in England, some years ago, the prize was awarded for negatives made with an Ives' color screen (made by Mr. Ives himself), and within one year more than five hundred such color screens, adapted to a different plate, have been sold by an English dry-plate manufacturer at a far higher price than has ever been asked for optically-worked yellow glasses.

Unlike yellow glasses, and most of the sealed screens now on the market, these screens absorb the ultra-violet light perfectly; unlike colored gelatine and celluloid diaphragm screens, they are at the same time optically perfect, permanent and not easily damaged; unlike the bichromate cell, they require no attention except to keep the surface clean. They will also give some orthochromatic effect even on ordinary plates. The colors used are permanent and their absorption progressive from the violet end of the spectrum.

Skillful operators having been instructed in the making of these screens, they can now be supplied suited to any plate and any purpose. They are made only in squares, best adapted for attachment to the inside of the camera lens board, but capable also of being fitted over the front of the lens, by means of a special adapter.

OPINIONS OF SCIENTIFIC AND PHOTOGRAPHIC EXPERTS IN ENGLAND

Sir William Abney, F.R.S., Head of the Science Department at South Kensington Museum, and author of several well-known works on photography and color science: "It is the acme of perfection. . . . Mr. Ives is a competent experimenter and deep thinker, and has practically applied scientific theory." . . . "Mr. Ives, . . . the pioneer in the application of exact science to Color Photography." . . "Mr. Ives, attains in his Krōmskōp an exquisite degree of perfection."

Prof. Silvanus Thompson, in "The Saturday Review." —"A more satisfactory solution of the photographic registration and reproduction of color is afforded by the chromoscope of Mr. Ives. . . . Ives' success in this optical combination has been nothing short of marvellous."

Rev. F. C. Lambert (Journal of the Camera Club)—Mr. Ives has brought before the Club a perfect realization of the dream of every human being—the reproduction of the lovely hues of nature. He seemed almost to have accomplished the impossible—to have put his foot on the end of the rainbow, and to have caught up the colors of the goddess Iris."

Lionel Clark, Esq., at the Society of Arts, said (Journal of the Society): "Most of them were accustomed to seeing stereoscopic slides, but interesting and curious as the result was, he thought the effect on the mind always was that you were

looking at a little clay model—whether it were a basket of fruit or a statue, it was not the real thing. The total absence of all color, the mere yellow or brownish-purple of the print, gave the effect of a model, though it was perfect in relief and detail. But in this case you saw the same model endowed with the colors of Nature, and it then ceased to look like a model, and you thought you were looking at the real thing. Some of Mr. Ives' slides which he had seen were the most realistic things in the world—you could not really tell whether you were looking at the real thing or at an image of it."

EDITOR OF THE "Photographic News."—"It must be admitted that Mr. Ives has given us the means of viewing an object reproduced by photography as it has never been seen before—that is, solid as in the stereoscope, and at the same time instinct with life and color."

EDITOR OF THE "British Journal of Photography."—"It is but the merest truth to say that the 'Krōmskōp,' as an instrument, appears to be perfect in its simplicity, and that the color reproductions it exhibits have a flawlessness and fidelity little short of marvellous. . . . Causes wonder and delight, not only to the layman, but to those who have given color photography long attention. . . . We had opportunities for observing that the Prince [of Wales] was deeply interested in the projection of color, his chief encomiums being reserved for the Ives process."

EDITOR OF THE "Amateur Photographer."—It is hard to estimate the amount of praise that is due to Mr. Ives for the manner in which he has followed up his original ideas, with a tenacity which is little short of marvellous, until he has brought them to this conclusion, which is as near to absolute perfection in a process of this kind as can well be imagined." . . . .

"Mr. Ives' 'Krōmskōp' gives the finest results. The scale of coloring is far truer, as comparison between the object and its reproduction abundantly testifies."

EDITOR OF "Photography."—"The perfect *furore* of applause that greeted Mr. Ives' colored pictures was well deserved. . . . He has obtained a far nearer approach to perfection than has to our knowledge fallen to the lot of any other man who has experimented in color photography." . . . "The voice of the colors is bound up in the black and white transparencies, and the speech comes to the picture in the right value and force, as do sounds from the cylinder of the phonograph where they are stored." . . . "An instrument capable of bringing before the eyes, in all their original brilliance of color, an Immaculate Conception of Murillo, a mosaic from Pompeii, or a beautiful scene in a London park." . . . "The fidelity of color and consequent illusion is something which has to be seen to be believed." . . . "The lecturer [Captain Abney, at the Royal Institution] pointed out that it is to Mr. Ives that we practically owe the present effective results. His ingenuity, patience, perseverance and scientific knowledge had given us a triumph in the form of the photochromoscope."

FROM REPORT OF MR. IVES' LECTURE AT THE CAMERA CLUB, in Journal of the Camera Club.—"The President [Captain Abney] concluded by moving a very hearty vote of thanks to Mr. Ives. . . . The vote of thanks was carried amid loud and continued cheering, and one of the largest audiences ever assembled in the Camera Club proceeded to inspect the photochromoscopes. . . . Members were occupied until a late hour in looking at the beautiful color and stereoscopic effects."

MR. VAN DER WEYDE, the fashionable London portrait photographer, in the "Daily Mail," September 21, 1898.—"Mr.

Ives' process is the most perfect and most beautiful yet attained. . . . The picture is astonishingly beautiful and true to Nature."

H. C. MARILLIER, ESQ., in the "Pall Mall Gazette," of the same date.—"The first and best known process of reproducing colors is that of Mr. Ives. . . . A simpler but less effective method . . . invented by Dr. Joly. Both Ives' and Joly's plates are suitable for throwing on a screen with a lantern, the enlargement of the scored lines being, however, a marked drawback in the latter case."

PHOTOGRAPHY IN COLORS. From the London "Daily News."—"Photography in colors no longer means the photograph printed in colors, nor yet the 'colored photograph,' both of which terms are apt to be associated in the artistic mind with some rather painful as well as endurable experiments. As we speak of it to-day, it means the practical results of a truly important invention completed after many years of persevering efforts by Mr. Frederic Ives, who has just read, at the galleries of the Fine Art Society an explanatory paper with accompanying illustrations, and is now giving the public an opportunity of judging for themselves as to the interest of his discoveries. The invention is the Krōmskōp for the reproduction, in the absolute colors of nature, of all objects photographed with a specially designed camera, and moreover, by a permanent process, so that the traveller and student will be able to store up not only impressions of beautiful or otherwise interesting things, but the actual presentment of them with the appearance of color and texture added to form.

The system will be equally available for perpetuating living originals; so that we shall be able to carry in a box a few inches square, not only records in facsimile of treasures of art,

but the figures of our friends, their surroundings, and anything else that it may be desirable to store up for affectionate remembrance. With the Krōmskōp at this point of accomplishment, then bid farewell to the minor poet ; his lady-love will no longer live in dreams, for he will preserve in a box the very sheen of her hair, just as in the present exhibition may be seen the gloss on the butterfly's wing, the bloom on the petal of a flower, the very tone of old ivory and inlaid pearl from the cabinet of the collector. The mere craving for a method of photography in natural colors is nearly as old as that pioneer of the camera's image, the Daguerreotype, which most of us revere for the sake of the ancestors that have been handed down through it. . . . The camera makes the negative images which constitute the color record on a single sensitive plate, at one exposure ; and a contact positive from this, when cut in three and mounted on a folding cardboard frame, is dropped into the Krōmskōp, which, as well as the camera, is stereoscopic, When viewed through this instrument it is no exaggeration to say that the object looks quite real."

EXTRACTS FROM AMERICAN TECHNICAL JOURNALS.

Dr. John Nicholl, in *Outing :*

"I have followed the Krōmskōp from its inception, and written of it many times, but never saw it until a few weeks ago, and then I found it the old, old story, 'the half not been told.' No description can convey anything like a true idea of the beauty or perfection of the, what seems to be, almost created colors. Three photographs, differing nothing apparently from ordinary lantern slides, are laid on the steps of the instrument, so simply that a child may do it, and instantly they are clothed in all the glowing colors of nature."

From the *American Journal of Photography:*

"The fact that most people have looked for a process of color photography which would decorate our walls and illustrate our books and periodicals has, no doubt, tended to disparage in the public mind the importance of methods of color photography which do not achieve this particular result. This is so far true that knowledge of the fact that there exists a means by which colors are perfectly reproduced to the eye by purely photographic and optical means spreads very slowly. It must certainly be a subject for congratulation that records and reproductions of the natural colors can now actually be obtained by a simple and reliable method, which is very little if any more difficult in practice, and involves no more operations than stereoscopic photography.

"By the Krōmskōp system of Mr. Ives, landscapes, works of art, natural history and medical subjects, and many other things, are reproduced as a matter of every-day practice, with all their visible qualities of form, color and texture, and without the defect of surface reflections or mechanical structure; and by no other means has this been accomplished, all allied methods showing either imperfect color reproduction or mechanical breaking up into lines, or both."

From the *American Amateur Photographer:*

"Krōmskōp, not a very melodious title, means 'seeing color,' and surely never was instrument more worthy of its name. Three stereoscopic positives strung together as a ladder, differing apparently only in size, (being a little smaller) from ordinary stereoscopic transparencies, and each apparently alike, are simply laid on the steps of the instrument, when lo, the landscape, or whatever the subject may be, is seen in all the glory of the colors of nature, and that in her most brilliant effects. The change from one subject to another is but the work of two

or three seconds, and so perfectly is everything arranged that should there be, for any cause, a want of coincidence or coalesence or proper blending, a touch of one of two screws will at once secure perfect alignment.

"In the instrument on our table, there are at this moment six apparently similar 2 x 1⅞ transparencies of a wonderfully beautiful landscape, including distant mountains, a middle distance of pastoral beauty, and a foreground of foliage and water, with two steamboats on its surface, altogether making, in their uncolored state, a charming photograph, and one that to the untrained eye looks as if the whole six were exactly alike. Lay them on the steps of the Krōmskōp, however, and—well, one thinks he will never care to look at an uncolored photograph again. It is simply indescribably beautiful.

"* * * * If all could see it as we see it now, there are few families that could afford its very reasonable price that would not at once include it among their household gods."

From *The Camera:*

"The Krōmskōp system of color photography undoubtedly yields the only photographic reproductions in the natural colors which quite satisfy the eye, the images being true in color, and entirely free from 'lines' or other structure."

From *The Professional and Amateur Photographer:*

"So much has been said in recent years about processes of color photography, and so much of it has related to methods which produce crude and imperfect (when not positively offensive) results, that the great majority of people, blinded and mislead by so much chaff, are not yet aware of the fact that the perfect reproduction of the colors of nature in structureless photographic images is an accomplished fact. It is true that such a result has not been achieved in the form of prints upon paper; but with a camera as simple in operation as any other,

and a viewing device which is used like a stereoscope, nature and art are reproduced to the eye as if seen in a mirror. So much has been accomplished by the 'Krōmskōp' system of Mr. Frederic Ives."

From *Anthony's Photographic Bulletin:*

"The 'Krōmskōp' system of Mr. Frederic Ives is now coming to the front, and enjoys the distinction of being the first method by which photographic color reproductions have been obtained which are so perfect as to deceive the eye of the uninitiated, many of whom have suspected a trick when shown the reproductions of objects in the stereoscopic Krōmskōp."

From *The Photo-Era:*

"The honor of applying color photography successfully for the first time to the illustration of a scientific expedition belongs to Prof. H. J. Mackinder, of the University of Oxford. In a recent report to the Royal Geographical Society of London, he showed a number of pictures of Mount Kenia, in Africa, which rises 17,000 feet above the sea level, directly under the equator. The pictures were taken by the Ives' process, and show vivid effects of colors in tropical skies, vegetation and waters. The ordinary photograph gives no idea of the color of the ground, which is uniformly reddish; but Prof. Mackinder's picture showed the red tint of the earth as well as the black bodies of the dwarf bushes, their brown tops, and the light blue sky and white clouds above them. All who have seen them were deeply impressed with the process that could produce such remarkable results."

From *Wilson's Photographic Magazine.*

"The Krōmskōp system alone has produced a structureless image in colors so perfect as to be comparable with a mirrored reflection of the object itself, and although restricted in its ap-

plication by the necessity for employing a device like the sterescope to see the pictures, its success and importance within the limits of its application will be a revelation to the world. The results are, in fact, better than they could be on glass or paper, because the color records are permanent and unchangeable, and the reproductions are seen without surface reflections or distracting surroundings.

"Mr. Frederick Ives has now been working uninterruptedly upon the system for many years, and by a process of evolution from complex to simple means and devices, marked by the issue of many patents, has at last made it possible to reproduce nature to the eye by means of a simple camera and a simple viewing instrument."

From *The Photo-Miniature:*

"Despite the attractiveness of flower and tree photographs in monochrome, it goes without saying that the capabilities of photography in this direction would be enormously enhanced if the colors, as well as the form, texture and gradation of light and shade, could be reproduced as the eye sees them. The mere tinting of monochrome photographs will never satisfy the eye, even for decorative purposes, because the peculiar delicacy, richness and translucency of flower coloring are utterly lost in the underlying monochrome. . . . . The Krōmskōp system does not produce color prints, it being necessary to blend the color elements by optical means; but with this limitation, it yields results which seem almost mirrored reflections of the objects themselves, and undoubtedly represent the highest achievement in photographic reproduction."

From *The Photographic Times,* N. Y.

"The pursuit of color photography in the popular sense, has proved ever to be the pursuit of an *ignis fatuus.* There

appears to be even less hope to-day than there was half a century ago that any chemical compound may ever be found which shall be converted by the action of colored light into correspondingly colored pigments, and all real progress has been made along other lines. * * * The only practical realization of the reproduction of colors of nature by photographic means is a composite process based upon the trichromatic theory of color vision. * * * Mr. Ives * * * has realized by far the most perfect results that have ever been attained, so perfect in fact, that the reproductions presented in his "Krōmskōp" appear like mirrored reflections of the objects themselves. * * * The results are unique, in that they are both true as to color, and without "lines" or other mechanical structure. * * * It is an achievment the practical importance of which can hardly be estimated. Already the Krōmskōp system is coming into practical use in the fields of art, medicine, and commerce, and amateur photographers are taking it up with enthusiasm."

From *The Florists' Exchange,* N. Y.

"The Ives Krōmskōp Company show color photography to perfection. This exhibit should be inspected by every visitor to the Convention. and its value noted as a practical demonstration of the color value of plants."

From *Popular Science.*

"This process, in addition to its value of photography pure and simple, will be of great practical utility in the reproduction in exact versimile of great masterpieces of art, decorative work of all sorts, including tapestry, stained glass windows, and rare and valuable objects of scientific interest."

From *The House Furnisher,* New York.

"Moses, Swann & McLewee use a Krōmskōp in selling their new line of lamps. This new 'machine,' aided by slides, shows

the lamps in their original colors. The device knocks out the color printer and is a great expense saver."

COLOR PHOTOGRAPHY IN MEDICINE.—*From "The Philadelphia Medical Journal."*—On Wednesday evening Mr. Frederic E. Ives demonstrated his Krōmskōp to the members of the College of Physicians, of Philadelphia. We give in another column a brief description of his invention as outlined in his lecture, and desire now to add our cordial appreciation of its value in medicine and surgery. From the description and cuts given it will be seen that the method of taking the photographs insures absolute perfection of relief or stereoscopic effect, when the three photographs are fused to unity, and that in making the fusion the Krōmskōp also adds every tint and color of the original. Mr. Ives showed a number of pictures of diseased persons and tissues (ulcers, a jaundiced individual, etc.), which were of most astonishing lifelikeness and accuracy. In the preservation of the records of disease the invention will undoubtedly prove of inestimable use to surgeons and specialists, and one forsees many ways in which lecturers and teachers will find the invention of manifold and excellent service.

A DEMONSTRATION OF COLOR PHOTOGRAPHY at the College of Physicians, of Philadelphia, by Mr. Frederic E. Ives, took place on Wednesday evening, November 1st. In introducing the inventor the Vice-President, Dr. W. W. Keen, called attention to the value of this method of photography as applied to several departments of medicine, especially in pathology, surgery, internal medicine and dermatology. The difficulty of reproducing by drawings the exact pathologic appearances, for example, of pneumonia, apoplexy of the brain, infarct in the kidney, cancer of the liver, etc., is very great, but a good photograph by this method would give a far better and more accurate idea of the appearance to the student. The tints are exactly

reproduced, so that whether it is employed in teaching or in demonstration of specimens in connection with a paper before a society, it would be invaluable. The same would apply to surgery, as, for example, the appearance of an ulcer, of an ulcerated carcinoma of the breast, of a cystitis, or the varying appearances on section of carcinoma and sarcoma.

In medicine, he was a little uncertain whether the instrument was delicate enough to show the taches rouges of typhoid, though it would probably show the petechial spots of purpura and possibly of typhus. Jaundice could be well shown, the appearance of the vaccine vesicle, the differentiation between smallpox and chickenpox would be facilitated very much by such photographs. In dermatology it goes without saying that all the affections of the skin in which color enters could be well reproduced. It would be well if our hospitals especially would furnish themselves with outfits for the purpose of taking such photographs.

SAMPLE EXTRACTS FROM LETTERS FROM PURCHASERS OF KRŌMSKŌPS

(These and other letters from purchasers may be seen at our office)

"The Krōmskōp came this morning in perfect condition. I had no difficulty with it, and got the first Kromogram into perfect register and illumination in thirty seconds. * * * I am perfectly delighted with it."

"The Krōmskōp and Multiple Back are entirely satisfactory in every particular. I had little or no trouble with the use of either. * * * What a wonderful instrument it is, and how much it will add to the sum of human happiness!"

"The Krōmskōp outfit arrived O. K. * * * I did not find a moment until yesterday, 'Christmas,' and I assure you the Krōmskōp is the best Christmas present I could wish for."

"The Krōmskōp arrived in good shape, and will be of great assistance in entertaining our friends. Your invention is the most beautiful of scientific marvels, and I must send you my heartiest congratulations."

"I had no trouble whatever in adjusting and getting wonderful results with the Junior Krōmskōp."

"The most wonderful thing I ever looked at."

"I think the Krōmskōp the most beautiful and the most perfect method of representing the colors of nature."

From the purchaser of the first new "Krōmskōp View Camera":

"The view camera came safely, was carefully cleaned, and Saturday afternoon I started out to test its merits and to discover its defects. Before starting I used two plates, 'getting its range' in regard to timing. There was quite a fresh breeze, and I certainly realized one advantage over the Multiple Back at the start. Between four and six o'clock I secured two perfect negatives. I call them perfect because the positives from both give pictures that are true in color and tone. The last one, taken at six o'clock, was a surprise. I hardly expected to succeed with it. The light was soft and the shadows long, just the lighting I love in a picture, but so hard to secure in a regular photograph. In this Kromogram the illumination is perfectly rendered as seen by the eye, not a shadow is slighted, not a particle of black; it is truth itself. The colors are not lost in the shadows, as I have been led to expect, but are as true as those in the sun."

"What I have seen of the Krōmskōp has convinced me of its *extraordinary possibilities.*"

"No trouble at all in getting the Krōmskōp into adjustment, and the results are a delight."

"Your Kromogram No. 144, Canal Scene, near Bristol, Pa., is very real, and the lighting is soft, full of actual sunshine, with no trace of glare from the water; it can be looked at with the eyes wide open. That picture calls forth exclamations of delight every time it is shown, and from artists, too."

"Now, having got used to the beauty of the instrument, I do not like to be without it a moment,—for my friends and myself."

"The Krōmskōp was duly received and I had no difficulty in learning to use it; it is *the marvel* of everyone who sees it."

"The difficulties attending the use of the Science Lantern Krōmskōp prove to be trivial. Squarely faced, they have in my experience, vanished. The results obtained yesterday in my lecture were satisfactory to me, and were pronounced by others to be '*exquisite.*' Make the bill out to the College but send it to me."

"I have been your faithful admirer for years, and now I am enjoying your Krōmskōp more and more."

"I am perfectly satisfied with the Jr. Krōmskōp and await the return of Spring with some impatience, as I shall fit myself out with one of your cameras, and put all of the many gems of scenery in this locality on records in *color, instead of monotonous black and white.*

"I am going at your color photography with heart and soul. I don't think there is a man living that is more enthusiastic than I am about your invention."

"On opening the instrument, the right D mirror was found to have jumped out of place, but was replaced with a touch, *everything is so beautifully simple.*"

"After seeing that picture to-day, which you took of my garden, I am so delighted with the result that I want to have one of your Krōmskōps just as soon as you can possibly give me one; for to preserve that picture as you have taken it would make me want one of the instruments *at any price at all.*"

"I am now making very good Kromograms. If people would consider the labor and the patience that must have been required in perfecting the Krōmskōp, the care and skill demanded in its making, I think they would realize that a wonderful optical

instrument, such as it certainly is, could not in reason, be sold at the price of a toy. I am more than satisfied indeed, with the knowledge gained by possession and use, of its capability of giving pure and unalloyed pleasure, of which we do not tire, and friends ask for again and again. I should hesitate to say what would be sufficient inducement to relinquish its altogether delightful companionship. *Nothing purchasable is better worth its price than the Krōmskōp.* Few would deny this, I think, if the Kromogram they saw were the portrait of a friend."

——

"A friend who was quite indifferent at first and said he had seen photographs in natural colors before, and did not think much of them, finally consented to let me show him the Krōmskōp, and *he became more enthusiastic than I was.* Get me a man to help me with my regular work and I'll keep you busy selling Krōmskōps."

——

"I have been interesting scientific people in your Camera and I predict a great future for you."

——

"I was very much surprised and delighted with the Krōmskōp, as were all who have seen it."

——

One person remarked that "the reason it did not seem so wonderful, was because *everything seemed so perfectly natural that he imagined he was looking at the things themselves.*"

——

"I have reached my last dozen plates; that may mean with your 'View' Camera, twelve good negatives, for *I have not lost a plate since I began to use it.*"

"As of course we greatly prefer to show the best results of your marvelous process, will you kindly exchange the Jr. Krōmskōp, we bought for our College, for the Stereo. form, we paying the difference in price."

"In your Kromogram of 'Rhododendrons,'—they are so exquisitely beautiful that I cannot get them out of my mind. Truly, the Krōmskōp must be *seen* to be believed."

"If you have a large collection of dermatological and pathological specimens, there will be no Medical College or City Board of Health, no matter how small, that *can afford to be without* a Krōmskōp and a large collection of specimens, because a good collection of skin disease atlases will cost $200 or more, and a good collection of Parisian wax works will cost $2,500 or more, and *neither are as good as good Kromograms.*"

LETTER FROM SIR WILLIAM HERSCHEL TO MR. IVES

LAWN-UPTON, LITTLEMORE, May 10, 1898.

MY DEAR SIR :

I have long been at the point of sending you the enclosed prints from the first "negative" on glass, but always wished to bring it to town personally. I have failed again this week, and must be content to trust the post. I cannot, in this way, however, express to you the gratitude which I myself, and all to whom I have had the privilege of showing your exquisite results, have felt every time we use the instrument and its marvellous pictures.

The faint black image of the 40-foot telescope, at one end of a series, and your stereoscopic color pictures at the other end, are things which it is worth while to have lived to see in one lifetime. Sir John would have given all he had of eyesight, I do believe, to have seen the latest triumphs of photography.

Yours very faithfully,

F. E. IVES, ESQ. W. J. HERSCHEL.

LETTER FROM PROFESSOR WALTER KÖNIG TO MR. IVES

PHYSICAL SOCIETY, FRANKFURT A. MAIN,

May 19, 1898.

MUCH RESPECTED SIR :

You have had the great kindness to send me through Herr Strauss, your Projection Chromoscope, to exhibit before the Physical Society. I have made frequent use of the apparatus. I have demonstrated to many people, and every time the most lively interest has been excited. I inform you of this in congratulating you on your beautiful and highly instructive invention, and add thereto my grateful thanks that you should have given me the opportunity of being the first to make these splendid demonstrations in Germany.

At the beginning of October will take place in the Physical Society at Frankfurt, a meeting of teachers of High Schools from all parts of Germany. On this occasion I should like to exhibit the apparatus. I am venturing to inquire whether I may keep it so long, or could the Society purchase the apparatus?

I also take the liberty to ask whether you do not feel inclined to exhibit the apparatus at Dusseldorf in September, at the meeting of German scientists, or to allow it to be exhibited. This would be an excellent opportunity to make the invention known in Germany. Perhaps you will be disposed to act on this suggestion.

With high esteem,

PROFESSOR WALTER KÖNIG.

The following letter speaks for itself :

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., MAY 10, 1900.

FREDERIC E. IVES, ESQ.,
1324 Chestnut St., Phila., Pa.

Sir :—The Patent Office is preparing an exhibit for the Pan-American Exposition to be opened at Buffalo, about April 1st, 1901, and since it is desirable to convey to the public the importance of our patent system, the latest advances in the arts and sciences should be illustrated.

The importance of Color Photography is recognized, and I write to enquire if you will furnish an exhibit illustrating the principles involved in your system.

Should you be willing to oblige the office in this respect, such exhibit will be accepted with the understanding of course, that it will be preserved intact, and will be returned to you if desired, in good condition, after the exposition shall have closed.

Very respectfully,
C. H. DUELL, Commissioner.

Our system was *the only one on Color Photography* shown in the Government Building—U. S. Patent Office Department,—at this Exposition.

IVES KRŌMSKŌP COMPANY,

1324 CHESTNUT STREET,
PHILADELPHIA.

KRŌMSKŌP PRICE LIST

The Stereoscopic Krōmskōp, in polished mahogany with lacquered brass fittings, adjustable light diffuser, and eight Kromograms..... $50 00

Stereoscopic Kromograms, List A, each..... 1 00

" " " " per dozen..... 10 00

" " " B, each..... 1 50

" " " " per dozen..... 15 00

The Junior Krōmskōp, monocular, in polished mahogany, with adjustable light diffuser and four Kromograms 25 00

Junior Kromograms, List A, each..... 75

" " " " per dozen..... 7 50

" " " B, each..... 1 00

" " " " per dozen..... 10 00

Stereo. Krōmskōp Night Illuminator, in polished mahogany, with two incandescent gas burners and nickel reflector, including two *special white* mantles..... 12 00

The same, with acetylene gas burner instead of Welsbach burner..... 11 00

Junior Krōmskōp Night Illuminator, polished mahogany, with one incandescent gas burner and nickel reflector, including one *special white* mantle..... 10 00

The same, with acetylene gas burner instead of Welsbach burner..... 9 50

Krōmskōp Carrying Case..... 2 50

Junior Krōmskōp Carrying Case..... 2 25

The Lantern Krōmskōp, with six slides..... 65 00

The Science Lantern Krōmskōp, permitting of separating the colored images upon the screen, thereby showing the physiological analysis of color (now in use in the physical lecture rooms of leading colleges), with six slides..... 80 00

Special stand, hood and hand-feed electrical lamp or lime-light jet, to make the Lantern Krōmskōp complete in itself and independent of ordinary lantern,..... $20 00
Extra Slides for the Lantern Krōmskōp, each..... 1 00
" " " " " " brass bound,..... 1 50
Carrying Case for the Lantern Krōmskōp 2 50
Krōmskōp "Multiple Back," to attach to ordinary camera, for Krōmskōp color photography, with one 2½ x 8 in. (double) plate holder..... 25 00
Krōmskōp "Multiple Back," with box camera attachment and single achromatic lens in focussing tube, with one (double) plate holder, complete for making triple negatives..... 28 00
The same, with the addition of reversing mirror..... 30 00
Krōmskōp "Multiple Back," in combination with a 4 x 5 Cycle Folding Camera of our own selection, with R. R. lens, time and instantaneous shutter, plate holder, and case for camera, complete..... 35 00
Extra 2½ x 8 in. double plate holders, each..... 1 50
Stereoscopic Multiple Back Camera, complete, with inverting prisms, and one double plate holder 65 00
Extra 5 x 8 Plate Holders (double), each..... 1 50
Krōmskōp View Camera (*one plate, one exposure*)..... 75 00
Reversing Mirror. 2 50
Extra Plate Holders (double), each..... 1 50
[The Krōmskōp Multiple Backs and cameras are at present adapted only for use with Cadett Spectrum (London) plates, and must be used with the plates for which they have been adjusted. These plates will be supplied in the special sizes at maker's prices, plus cost of importation.]
Printing Frames, 2½ x 8, each..... 80
Deep Hard Rubber Developing trays for 2½ x 8 plates, each 75

Dark Room "Safe" Light, 6½ x 8½	$ 2 00
" " " " 8 x 10	2 50
Yellow orthochromatic sealed screens, light, medium or deep, (state requirements and plate used), 2 x 2 in., each	2 00
Set of three—light, medium and deep	5 00
Size 2½ x 2½ in., each	2 50
Set of three—light, medium and deep	6 00
Size 3 x 3 in., each	3 00
Set of three—light, medium and deep	7 50

KRŌMSKŌP CABINETS AND OTHER SPECIALTIES IN PREPARATION. KROMOGRAM LISTS PUBLISHED SEPARATELY.

SPECIAL PRICE LIST OF CADETT SPECTRUM PLATES, TRANSPARENCY PLATES, KROMOGRAM MOUNTS, AND OTHER MATERIALS FOR MAKING NEGATIVES AND KROMOGRAMS SENT ON APPLICATION.

ON THE COST OF KRŌMSKŌPS AND KRŌMSKŌP CAMERAS.

The first perfectly successful reproduction of colors on the trichromatic principle was accomplished by Mr. Ives after ten years of experiment, under conditions not commercially practicable. It required another ten years of experiment and invention, marked by the issue of many patents, to so simplify the method and devices as to make its operation practicable and perfect under the conditions of ordinary photographic practice. The evolution has been one from complexity to simplicity, both in operations and devices, and there can be no doubt that in the present Krōmskōp and Krōmskōp Cameras, the problem has been reduced absolutely to its simplest terms. Nothing simpler could possibly be made to answer without sacrificing some important feature of size, or quality, or practibility. Simple as these devices are, however, they have to be made with such special and perfect materials and adjusted with such skill and precision, that they are necessarily far more expensive than ordinary sterescopes and cameras, just as a Zeiss Planar lens, although containing no more glass and brass than a common magic lantern objective, is many times more costly. After considerable experience, leading to the adoption of more elaborate and precise mechanical and optical adjustments, the cost of manufacture has increased rather than diminished, and on the basis of the high standards finally adopted, the prices are as liberal as possible, and yield no greater profit to the manufacturers than are necessary in the interests of the purchasers themselves.

In some foreign countries where the system is not protected by patents, several attempts have been made to cheapen the instruments, but such experiments have invariably resulted disastrously and the only successful instruments in use to-day have been made according to the inventor's specifications, on the basis which has established the prices for the Ives Krōmskōp Company.

IVES' U. S. PATENTS RELATING TO COLOR PHOTOGRAPHY.

July	22,	1890,	No.	432,530
May	17,	1892,	"	475,084
December	18,	1894,	"	531,040
September	24,	1895,	"	546,889
April	4,	1899,	"	622,480
September	5,	1899,	"	632,573
October	17,	1899,	"	635,253
May	1,	1900,	"	648,748
August	14,	1900,	"	655,712
October	23,	1900,	"	660,442
January	22,	1901,	"	666,423
January	22,	1901,	"	666,424
February	26,	1901,	"	668,989

Other Patents Applied for.

NOTE.—In view of the announcements of alleged new or improved or simplified photochromoscopic apparatus which now frequently appear in foreign periodicals and are reproduced in this country, it should be stated that the first practically successful instruments of this character were made and patented by Mr. Ives, who has also made and patented the simplest and the most efficient devices for this purpose, and that the Ives' patents cover essential details of every fully operative device that has been announced in any country. *We caution against infringements.*

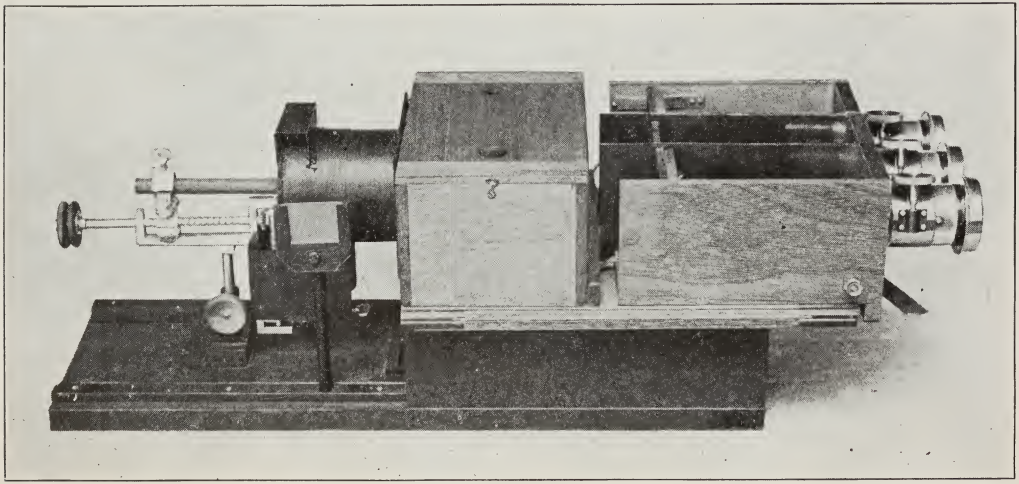
MEDALS HAVE BEEN AWARDED BY THE FOLLOWING SCIENTIFIC SOCIETIES:

The Franklin Institute, Phila.—The Elliott Cresson Gold Medal.
The Photographic Society of Philadelphia.—A Special Gold Medal.
The Society of Arts, London.—The Society's Silver Medal.
The Scottish Society of Arts, Edinburgh.—The Keith Prize and Medal.
The Photographic Society of Vienna.—The Gold Medal.

Owing to the newness of everything relating to successful color photography, we are frequently asked to send our apparatus "on approval." As we have known of instances where this privilege has been abused, —orders being given to secure the Kromskop merely to gratify curiosity and entertain friends, and then return —we have made it a rule to ship the Kromskop, and everything relating to the system, to *bona-fide purchasers only;* but we *guarantee* all apparatus and supplies to be as represented.

FIFTH EDITION.

PRESS OF THE LEEDS & BIDDLE CO.
1019-21 MARKET STREET
PHILADELPHIA
1901



SCIENCE LANTERN KRŌMSKŌP,

With Special Base and Electric Lamp. Price, complete, $100.00.