

THE PATHÉ KINEMATOGRAPH COLOUR PROCESS.

M. RUOT AND L. DIDIÉE.

Meeting arranged by the Kinematograph Group, held at 35, Russell Square, W.C. 1, on Tuesday, December 2nd, 1924, the President (Mr. J. Dudley Johnston) in the Chair.

FROM the moment that moving pictures came into being, black-and-white scenes were improved by means of tinting. The next step was the complete reproduction of Nature's colouring, and this was actually obtained by hand-colouring the films. The colours obtained at first were not always the true shades of natural colours, but each object was coloured in a different tint. Every one remembers the success met by the first films showing green trees, blue sky, and people dressed in various colours; and what a degree of popularity they achieved! It may be said that this was a long time ago, yet the present-day coloured films do not seem to be a great departure from the original ones.

We propose to-night, in explaining the methods of Pathécolour, to show how the first colourers of film—true miniature artists—are now a thing of the past.

Mechanical aid has not entirely replaced these people, but it has made their work easily reproduceable.

We shall only speak of the method of colouring by stencil—a process which has been used for a long time in the colouring of post cards long before anyone thought of using it in relation to kinematography. One image can be coloured with a brush, but if we had many copies to colour, each of these images would have to be coloured with the same amount of care and precision, however tedious the work might be. On the contrary, if we have to colour part of scenery—trees in green, for instance—we can colour a great number of pictures fairly speedily by the application of a thin layer of colour through a hole made in a stencil, masking out everything else with the exception of the portions to be coloured in green. Evidently, we shall only be able to lay a flat tint within the exact limits of the designed contours, but this tint, when applied to a photograph, is modified by combining with the various thicknesses of silver which constitute the image. On the picture, therefore, not only one shade of green appears, but a wide range of tints between green and black or, rather, correctly, between green and the various greys.

When we add that this same experiment may be reproduced with any other colour on any part of the picture, it will be realized how it is possible to obtain a vast number of varying tints.

This bringing into play of the range of tints between a definite colour and the blacks of the image only constitutes the elementary rudiments of the process. If, instead of placing our colour over a black-and-white print, we place it over a copy toned in any of the tints that can be obtained, the results are more varied still.

To begin with, a specimen or master-copy is made of each picture. Obviously, each colour used in the specimen will mean at least one stencil. The number of colours used by the painter greatly influences the cost of the finished film, and the art of the director is to apply all his skill in obtaining his effects with the minimum number of colours. To sum up, the responsibility lies with the painter who colours the first film as to how many tints shall be used in the entire process. In the majority of cases six are sufficient. We shall therefore need six separate stencils, through which are applied the six corresponding colours.

A stencil, as is well known, is made from an ordinary positive print, on which we have to cut most patiently image after image, the contour of the surface to be coloured in one tint, green—for instance. A second film, identical with the first, will have to be used in a similar way, so that we may cut on the surface openings

through which we shall colour all the portions requiring to be coloured in pink, and so on, in the same way, for six stencils, each to be used for the placing of one colour.

Every one of the stencils comprises, when finished, a set of small holes, distributed here and there all over the surface of the image, according to the position of either the actors or the setting which we want to colour in a certain tint, and the position of these holes moves at the same time as the actors move across the scene.

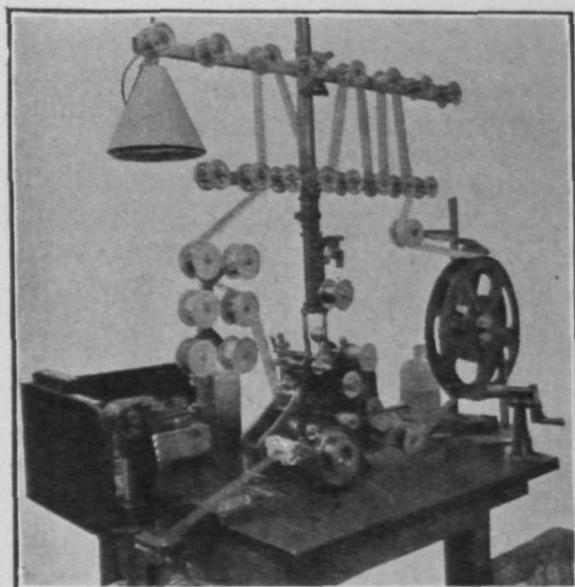
These six stencils will then have to be degelatinized, as it is through the clear celluloid that we shall have to place our colour on the positive prints needed for exhibition.

The absolute necessity there is for the stencils to be most accurately matched between them need hardly be emphasized, not only as regards perforations, but also as far as the contours of the various images are concerned. We also have to get perfect registration between each of the stencils and the positive print to be coloured.

In the earlier days it was soon noticed that, however perfect the machinery used in placing the colour, the ordinary means of printing films were not sufficiently accurate to allow the reproduction of coloured copies free from fringing. The play that always exists in an ordinary printing machine was a great handicap. For this reason we have had to design a special printing machine, which we might call the "Super-Printer." The negative film and the positive stock are not only driven by intermittent movement, but they are also, whilst passing through the gate, laterally registered.

We have to print through our "Super-Printer" a number of positive copies representing both the prints for exhibition and those which will be needed for the making of the stencils. Once printed, all the positive films are developed in the normal way. They must then be examined most carefully by hand, and again on the screen.

Stencil cutting has a history of its own. As far as we are concerned, we began by cutting stencils by hand, using a needle fitted on a special guiding arm, but it was soon found out that cutting by means of a sharp edge was an improvement. Two processes began to be used; one by which the cutting was done on the film itself, and the other process by following the image thrown, enlarged, on a ground glass.



STENCIL CUTTER.

With every one of these systems we were still cutting the film by simple hand pressure. Real progress was made when it became possible to animate the needle with rapid and alternating movement. Pathé Cinema, for this purpose, designed their famous stencil-cutting machine, which in the course of years they have kept on improving. The cutting needle vibrates in a continuous vertical movement. Here is, very roughly, how this movement is obtained: We have an electro-magnet fixed in a vertical position; this is magnetized by alternating current. A small armature of soft iron is allowed

to pivot in a horizontal plane, the pivot centre being in the axis of symmetry formed by the two bobbins of the electro-magnet. The alternating current

causes the armature to oscillate in a horizontal plane. Oscillations keep on all the time that the alternating current is passing through the bobbins, as the armature is placed in such a way that whilst moving in a horizontal plane it can never enter into contact with the poles of the magnet. Once having obtained horizontal oscillations, nothing is easier than to pass to vertical oscillations, as required for our purpose. One end of the soft iron armature carries a small rod terminated by a steel ball, moving in a socket of the same metal. There is also fitted at the other end of the rod another ball similarly moving in another socket; this second socket is part of a lever. The lever and socket are fitted inside runners allowing movement in a vertical direction only, and exactly in the vertical plane of the line of the poles. That is to say, the centre of the unit, the rod being rigid, each time that the armature passes under the line of the poles it brings the lever to the utmost of its downward movement. On the contrary, each time that the armature is on either side of the line of the poles the lever will be raised until it reaches its utmost upwards movement, and at the same time the armature will have reached its extreme horizontal swing.

The lever commands directly the cutting needle or the cutting edge, as the case may be. This lever and the cutting needle are components of the outside frame of the unit; the electro-magnet and the armature form part of the inside frame of the unit. As the inside frame can slide vertically within the outside frame, and the only connection between the two frames being the rigid rod, by moving the electro-magnet component up or down the length of travel of the needle varies at will.

As regards cutting stencils, this is obtained by combining the vibration of the needle with the moving of the said needle on the surface of the film; this displacement of the needle on the surface is the only movement which is really done by the hand of the worker.

The lighting of the cutting machine has always proved a delicate question. We must use a light which will not prove harmful to the eyes. For a long time the cutting machines of the direct type, that is to say, machines where the hand directly drives the needle, were worked in daylight with the help of a reflecting mirror. The system had a drawback, as we were obliged to alter the mirror attachment at night and artificial light had to be used.

As working in daylight gave better results, and was appreciated by the workers, we fitted our cutting machines with a special lighting system approaching as much as possible to daylight by using a special blue screen.

For either kind of machine the cutting stencil is done image by image. Of the two systems of cutting, either direct or by enlargement, one can hardly decide which is the better, and both systems are now being used with equal success.

We hope we have made it quite clear that in the direct cutting all that is required of the worker is to follow exactly the contours of the section of the image to be cut on the film itself or on the enlargement. The instrument with which the worker follows the contours is very like the ordinary pen-holder, and the mere passing of the point of the holder over the contour of the picture creates contact and causes the vibration of the electro-magnet.

The stencil-cutting machine on the enlargement system was in the earlier stages a very complicated proposition. As a rule, the worker followed the image thrown on the ground glass, this image being projected from a copy different from the one being cut, yet identical in every image, so as to ensure accuracy of the cutting.

Another system is to throw on a ground glass the enlarged image passing under the cutting needle by means of prisms. In both systems the movement is transmitted by a pantograph actuating the guiding point and the cutting needle operating the film.

The system mostly used is a machine in which the "guide film" is thrown

on the ground glass by a special optical system. It is, of course, essential that the "guide film" thrown on the ground glass be exactly similar in every way—perforations, width, etc.—to the film being cut. It is necessary, before the cutting operation begins, to have a special examination of the film made to ensure that the perforations of the image of the two films tally to perfection.

In all the above types of machine the cutting of the stencil is done image after image, the films being made to move one picture at the time, at the will of the worker, who can move both films at the same time by one turn of the handle commanding both films.

Although we now think that cutting stencils is an easy operation, that is not exactly the case, and it is likely that any one who was to try his hand at this game of patience would find results far from satisfactory. To become a skilled cutter weeks and weeks of learning are necessary. Even a skilled worker cannot cut more than three feet of stencils per hour.

When direct cutting is undertaken the guiding point has to be passed over a very minute image; care must be taken not to get away from the line designed by the painter, and steadiness of hand and good sight is necessary to arrive at this accuracy of cutting. All these qualifications make selection of the cutting staff a difficult question, and there are many rejections amongst the persons who would like to be employed in the department.

If, for some reason or other, the section to be detached holds on to the body of the stencil, the worker has to complete the cutting by means of a sharp cutting point. This operation is, so to speak, the touching-up of the stencil.

If an opportunity were presented to go through the Pathécolour Department, workers would still be found in the cutting room cutting by hand, the earlier and more ancient system still being favoured when we have to cut large surfaces presenting bold and regular contour. Of course, for this special operation the most skilled of our workers are required; the work is done on a ground-glass table fitted on an inclined plane, something similar to the photographer's retouching desk. The greatest care has to be taken, as a slip of the knife might ruin the whole section of the stencils.

It can be realized at this stage what a lacy effect each stencil presents. We have pictures where the same colour has to be distributed into a great number of small spaces. In other cases, on the contrary, we sometimes have to cover in one colour only a large portion of the image. We find that portions of such a large size reduce greatly the strength of the stencil, and to avoid the same getting damaged we then have to space our holes every other picture.

The stencil is now a very costly possession, and has next to be cleaned of the gelatine remaining on the support. This has to be done with great care, and friction of any sort avoided which would be likely to scratch the celluloid. Special care must also be taken so that no alterations in the pitch of perforations or dimension of the film occurs, as it is essential that both perforations and image of the stencil should exactly coincide with the film to be coloured films, of course, not having to undergo the various washing and drying operations to which a stencil is subjected. Degelatinization is best obtained by using a suitable solution of hypochlorite.

The stencil is now made and ready for use. We have next to apply the colour on the copies required for exploitation. Formerly this operation was done with a flat brush, but improved methods allow us to-day to do this more speedily.

The stencil and the film are made to travel together and to come into very close contact over a drum; at the moment that the stencil and the film are passing over the drum and held taut the colour is applied through the stencil holes on to the film.

The machine consists of a drum of large diameter, fitted with teeth, the

width of which can be automatically set. This setting allows us to obtain perfect register between the films to be coloured and the stencils.

The film and the stencil travel together in the same direction, whilst in the opposite direction an endless velvet ribbon moves, fed with liquid colour by means of a rotating brush, this brush picking up the coloured solution from a small endless metal ribbon. The metal ribbon dips into a small trough containing the colouring solution, and its speed can so be altered as to pick up the exact quantity of colouring matter required for the film; this varies greatly, according to the size of the surface to be coloured.

The reel to be coloured is made up of all the positive sections that have to undergo the processes, all these being printed on the continuous system and on the same reel of positive stock.

The stencil is placed on the machine in a continuous loop, so that after passing over the drum it goes back to the top rollers, the number of which varies with the length of the stencil.

The finished film falls into a basket or is passed through a drying cabinet in order to hasten the drying operation.

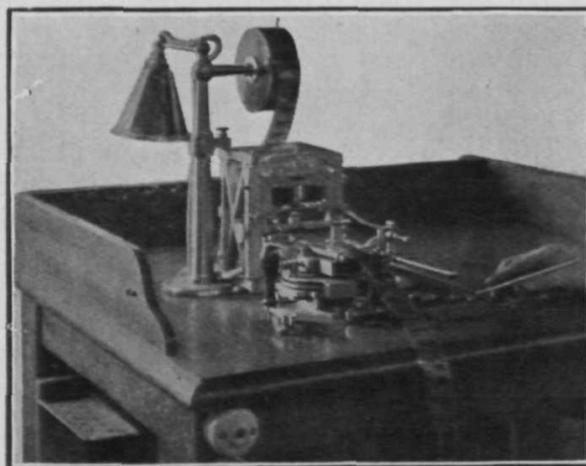
To allow the machine to work in a continuous manner it is necessary that the length of each section of the positive print to be coloured be exactly the same as that of the stencil, now joined in a loop. To arrive at this we have sometimes to use spacing in the stencil to make up for the leads that are always to be found on positive copies. These leads on the positive print repeat themselves in exactly the same length, as the positive copies have also been printed on the continuous machine, and from the very same negative from which the stencil was obtained.

The nature of the colouring solution applied by the velvet can easily be guessed. As the body to be coloured is gelatine, we have to get an aqueous solution. The strength of this solution varies according to the depth of tint we wish to obtain.

The colouring must be perfectly even, and as the solution is being applied by the velvet it will be readily realized that this velvet has a tendency to become poorer in solution on the very spaces covering the stencil holes, and richer everywhere else. It is, therefore, necessary to spread the solution in a more even manner, and to get this result the worker should continuously rub the top of the velvet whilst it is passing over the film. This spreading operation will be noticed when the film showing you the working of the machine is projected.

Having spoken of colouring matter, it is essential to add that these colours must be light-resisting and transparent. With colours specially tested and proven to have these qualities the worker can obtain all the desired tints. Deciding on tints is not always an easy task. We soon found that with a slight alteration in the lighting of the room trouble occurred in matching colours. For this reason we decided to instal a permanent system of lighting, which is also, as near as possible, that of daylight. To obtain this result, we had, as we did with the cutting machines, to use blue-tinted lamps.

There remains the registering. We have seen that for the colouring operations the width of the teeth is adjustable, the drum being made of two half-sections, each carrying a line of teeth. These two sections being adjustable, it will be realized



COLOURING MACHINE.

that the stencil and the positive print are always perfectly taut one over the other.

Lateral registering between the positive print to be coloured and the stencil openings will depend for mutual register on the perforations. This trouble is avoided, as we have already seen, by taking the precaution of printing from the same negative, not only the positive prints to be coloured, but also the films used as stencils.

The diameter of the drum has been carefully calculated, so that three full images are always resting on the face of the drum; thus each image is, therefore, coloured by several different sections of the velvet. In this way the tint is more regular.

It must not be concluded that colouring operations are always perfect and never need touching up. This we have sometimes to do. A worker is always liable to make a mistake, and we can usually save the film and avoid reprints by merely washing the colour off.

At this stage a film was projected showing all the stages of the colouring operation. This was followed by some specimen sections of films that were then being coloured at the Pathé works.

It only remains to add that this method of colouring—which you appreciate in England for the actual value of the work it represents—by stencil will always present the following interest. It can be applied to any film whatsoever without its having been prepared for that purpose. Given a good negative, the colouring operation can be performed on any film.

Whatever the simplifications and modifications that may be brought to bear on this process, it will always remain a curiosity, and we shall feel flattered to think that in retaining your attention all this time we have in some measure succeeded in interesting you in this unique process of Pathécolour.

VOTE OF THANKS.

Mr. BLOCH expressed the thanks of the Kinematograph Group in particular for the excellent way in which Messrs. Pathé had arranged the demonstration and the clear manner in which they had made an intricate and highly ingenious process palatable to the audience.

The PRESIDENT felt sure those present would wish to thank M. Ruot for the very lucid manner in which he had laid the subject before them and explained a very intricate mechanism.

The vote of thanks having been heartily accorded, M. Ruot briefly expressed his appreciation of the kind remarks that had been made.

THE PICTORIAL PHOTOGRAPHERS OF AMERICA.

THE Second International Salon of the Pictorial Photographers of America will be held at the galleries of the Art Centre, New York City, from May 15th to June 15th. The last day for receiving prints is April 18th. Prints should be forwarded at the earliest possible date, and the entry form, with the entry fee (one dollar), may be sent at any time in advance of the prints. Prints from foreign countries should be sent unmounted; they will be mounted by the Committee, if accepted. Not more than six prints may be submitted by any one exhibitor; they may be in any photographic medium, but must be entirely the work of the contributor. Coloured prints are ineligible. All communications (but not prints, which must be posted in accordance with the special instructions on the entry form) should be addressed to Mr. John H. Kiem, Chairman, Exhibition Committee, Art Centre, 65, East 56th Street, New York City, U.S.A.