

PATENT SPECIFICATION



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434,719

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PROVISIONAL SPECIFICATION

Production of Cinematographic Effects in Colour and Means Therefor

We, ALBERT GEORGE HILLMAN, British Subject, GEORGE HARMER JOHNSON, British Subject, and COLOURGRAVURE LIMITED, a British Company, all of
5 Victoria House, Vernon Place, Southampton Row, London, W.C.1, do hereby declare the nature of the invention to be as follows:—

The present invention relates to the
10 production of cinematographic effects in colour and means therefor, and particularly relates to obtaining such effects by optical synthesis or the so-called additive method in which consecutive colour record
15 pictures are simultaneously superposed on the screen, the red picture through a red filter and the green picture through a green filter in the case of a two colour additive process and with the addition of
20 a blue picture through a blue filter in the case of a three colour process.

The present invention is particularly applicable to the method described in our
25 co-pending application No. 2049/1933 (Serial No. 414,059) filed 21st January 1933, according to which negatives of records of two colour sensations alternating with each other are photographed by
30 apparatus which may be generally of the usual character for taking cinematographic pictures, but red and green colour filters are employed which are brought
35 into position so that a pair of records of two colour sensations one after the other along the film is simultaneously taken from the same aspect through such colour
40 filters, the arrangement of the optical system and the colour filters being such that during the next exposure period following a shift period in which the film
45 has been advanced an amount corresponding to a single picture pull, that picture of the pair which is the following picture in the direction of motion of the film through the gate, is again exposed with the same aspect through a like colour filter to that through it was first exposed.

Each colour sensation record is therefore
50 formed by a double exposure from the same aspect, but constitutes a composite photograph as regards motion analysis, and each pair of successive colour sensation records is the result of

simultaneous exposures from the same
55 aspect recording the same motion phase and periodic exposures from the same aspect but recording such slight different motion phase, but only by half exposure, that in general for normal or slow motion
60 has little or no subversive effect in colour fringing on projection of the positive film made from such negative film on the sheet.

A substantial shortening of the time
65 interval between the successive exposures of any one picture may be realised, other conditions being the same, by so arranging the taking system, as in our prior application aforesaid, that that picture of
70 any one of the recurring series which is exposed for the first time is shuttered after the companion picture exposed with it, and is re-exposed before the next following picture receives its first
75 exposure.

The realisation of this result may be
enhanced by shortening the cover sections of the shutter and accelerating the shift
mechanism.

It has been found however that when
80 photographing rapidly moving objects or when rapidly changing the aspect of view by quick movement of the camera, and in particular in studio or indoor work, the difference in the motion phase which
85 occurs between the two exposures of a given picture becomes pronounced, and sharply defined duplication or distortion effects are exhibited in the doubly exposed picture which militate against
90 good reproduction on the screen.

The particular shutter and filter
system according to our aforesaid application conduces to reduce to a minimum
95 the time interval between successive exposures, so that the difference between successive stages of motion as exhibited by each picture is made as small as possible.

The present invention aims to diminish
100 the objectionable effects above mentioned, and to this end broadly consists in giving each picture of recurring series of pictures taken from the same aspect, successive exposures of varying degree so
105 that each picture instead of being pro-

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duced by successive exposures of equal amount, will be formed at what may be termed full and partial exposures from the same aspect of view.

5 Such a method of differential exposure may be attained by providing a shutter with a plurality of apertures of which the one through which the partial exposure is made is smaller than that through
10 which the full exposure is made, although not increasing the virtual length of the full cover sections of the shutter.

The invention may be advantageously carried into effect by employing the
15 rotary shutter and oscillating filter system according to our previous application above referred to, and in such application of the invention, the desired effect can be realised by providing one of the shutter
20 openings with one or more partial shuttering or obscuring members which are integral or travel with the shutter and move across the gate so the exposures made through that opening are less sharp
25 than the exposures made through the other opening owing to the partial screening effect thus set up.

The shapes of the obscuring member or members may vary widely, and yet allow
30 for substantially even light transmission to the exposed picture areas.

According to one form of the invention, using a shutter of the form described and illustrated in our aforesaid prior applica-
35 tion, one or more radial shuttering arms intrude into one of the shutter openings. For example two approximately radial arms may be used dividing the shutter opening into three gaps, or three approxi-
40 mately radial arms dividing the shutter opening into four gaps, and preferably these arms are of such form as to be capable of fully or nearly fully covering one of the gate windows and to leave gaps
45 which are capable of fully or nearly fully exposing one window. Each picture is thus given a relatively long exposure by the main shutter opening and a succession of short exposures by the divided
50 shutter opening.

In another form the shutter opening

through which the lesser exposure is made, is in the form of a curved, spiral- or helical-like slot, so formed as first to expose the bottom corner of the lower
55 window, then to uncover both windows at one side and gradually to pass across both windows, finishing at the opposite side of both windows to that first uncovered. The slot may progressively increase in width
60 from the leading edge.

Or the normal shutter opening may be divided by one or more approximately radial partitions and provided with approximately concentric shuttering
65 bands in such a way that slots are formed on one side of the radial partition which lie at distances radially from the centre of the shutter corresponding to the posi-
70 tions of the bands between the slots on the other side of the partition.

Or slots may be formed like a stencilled Vee with the remote ends of the limbs of the Vee opening at the periphery of the shutter. Two or more such Vee slots
75 may be used.

Or a combination of any of the above forms of partial shuttering may be used.

Any of the above forms will conduce to the picture areas being evenly exposed.
80

A camera substantially as above described will produce an alternating monochrome rendering of colour selec-
85 tions on standard film from which a direct positive can be printed in the usual manner.

The partial shuttering or obscuring member or members may also be used in conjunction with the shutter in the pro-
90 jector.

The filters used and the general construction of the camera and projector, and the manner in which the pictures are identified, may be in accordance with those described in our co-pending appli-
95 cation above referred to.

Dated this 8th day of December, 1933.
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Patent Agents for the Applicants.

COMPLETE SPECIFICATION

Production of Cinematographic Effects in Colour and Means Therefor

We, ALBERT GEORGE HILLMAN, British Subject, GEORGE HARMER JOHNSON, British Subject, and COLOURGRAVURE
100 LIMITED, a British Company, all of Victoria House, Vernon Place, Southampton Row, London, W.C.1, do hereby declare the nature of this invention and

in what manner the same is to be per-
formed, to be particularly described and
105 ascertained in and by the following statement:—

This invention relates to a method of producing negative bands containing a single series of colour constituent images
110

(hereinafter referred to as negatives) which are suitable for producing corresponding positive constituents which may be projected on the screen simultaneously and so give pictures in substantially natural colours by optical synthesis.

The present invention is particularly applicable for producing negative bands by a method which is generally similar to that described in the specification of our prior patent application No. 414,065 dated 21st January 1933 according to which process (when the two colour system is used) each negative (except the extreme negatives of the band) is exposed twice, once to the same beam as the preceding negative, and once to the same beam as the succeeding negative, alternate negatives being exposed through red colour filters and the intervening negatives through green colour filters, the two exposures of each negative being through a filter or filters of the same colour and suitable means being provided for dividing the beam at each exposure. Each negative therefore constitutes a composite photograph as regards motion analysis and it is found that when photographing objects in slow or normal motion there is little or no colour fringing on projection of the positive film made from such negative film on the screen.

It has been found, however, that when photographing rapidly moving objects or when rapidly changing the aspect of view by quick movement of the camera, and particularly when the movement is near the camera, as often occurs particularly in studio or indoor work, the difference in the motion phase which occurs between the two exposures of a given negative may become so pronounced that on projecting the positives obtained from the negative band on to the screen, objectionable colour fringing results.

The object of the present invention is to diminish this objectionable effect by providing that one of the exposures to which each negative is subjected (either that with the preceding negative or that with the following negative) shall be of greater effect than the other exposure. Such exposures are hereinafter referred to as the main and the partial exposure. The difference in the effect of the exposures may be produced by a variation in the effective shutter aperture, either to reduce the quantity of light passed by it at any instant or to reduce the time of exposure, or by any other suitable method which varies the effect of the beam on the film, e.g. obscuring filters or the like might be used for the partial exposures, though we prefer the methods hereinafter more particularly described.

Each of the exposures may be continuous or broken up into a number of separate exposures.

Each picture will thus be formed by what may be termed full and partial exposures and from the negative film made according to our process a monotone positive transparency can be made by any usual or convenient method. In projecting such film each positive (except the extreme positives) is projected twice, once with the preceding and once with the succeeding positive, appropriate colour filters being interposed at each projection, and the usual single picture pull in the projector can be maintained.

It is found that on projecting on the screen positive films produced by this method, a blurring or smudging is produced where rapid movement has been recorded which renders the colour fringing less apparent.

The invention may be advantageously carried into effect by means of a camera according to our prior patent application No. 414,059 and in such application of the invention, the desired effect can be realised by providing one of the shutter apertures, or using in conjunction therewith, an opaque portion or portions which decreases the area of such aperture with respect to the aperture through which the main exposure is made, without however necessarily decreasing its full angular range, as, for example, by providing narrow slots or the like in lieu of the usual aperture or by dividing the latter by means of one or more partial shuttering or obscuring members, which is or are integral or travel with the shutter, and move across the gate so that the exposures made through the slot or divided aperture are substantially less clear than the exposures made through the main aperture.

This may be done, for example, by making the aperture through which the partial exposure is made a continuous or discontinuous arcuate or sinuous or like narrow slot, or by introducing radial or circumferential or other opaque portions into a shutter aperture which is otherwise like the main shutter aperture. But the desired result can be achieved in many and various ways.

The four different forms of shutter shown in Figs. 1, 2, 3 and 4 of the accompanying drawings are given by way of example. Fig. 5 shows diagrammatically an optical system and Fig. 6 one form of filter system, which correspond with the systems shown in my prior patents aforesaid. Fig. 7 shows the image arrangement along the film.

In each of the first six views, 1, 2 130

indicate the windows through which two picture areas on the film may be exposed to the same beam A (see Fig. 5) appropriately divided by a perforated mirror 3 so that one part of the beam passes through the mirror and a lens 4 to the picture area exposed in the top window and the other part is reflected by a second mirror 5 through a lens 6 to the picture area exposed in the lower window.

A film shift mechanism is employed to shift the film down one picture area at each cover period, so that the area which has been exposed in the upper window is again exposed in the lower window, the filters being moved during the cover period so that the second exposure of each negative is made through a colour filter which is the same as or similar to that through which the first exposure was made.

As will be seen the arrangement of the colour filters 11, 12 (12¹) shown in Fig. 6 fulfils this requirement since if the exposure through the first window 1 is made through the red filter 11, the simultaneous exposure through the second window will be made through the green filter 12 and, after the shift period is completed, the second exposure in the second window 2, which will be of the red record, will be made through the red filter 11, the first window 1 now being used for photographing a green record, through the green filter 12¹.

This filter shift is synchronised with the picture timing of the camera, and for compactness it is convenient to employ an oscillating sector 15 carrying three filters arranged one after the other over substantially the same arc, the middle filter 11 being red and the outside filters 12, 12¹ being green.

As shewn the oscillating motion is imparted to the filter sector 15 by a crank pin drive 16 from the spindle 17 of the shutter 7 revolving at half the normal speed, which in an ordinary black and white camera is one revolution for one picture shift. This oscillating sector 15 is pivotally anchored at one end 18, remote from the filters, to the camera framework, and the crank pin drive 16 is preferably transmitted to such oscillating sector 15 through the medium of a sleeve 19 slidably mounted on a rod 19^a by which the sector 15 is pivotally mounted. Other appropriate methods of shutter control may, however, be used.

In each of the examples illustrated, the shutter 7 is provided with two apertures 20 and 21, the aperture 20 being that through which a full or master exposure of each picture area is made and the aperture 21 the one in which the partial

exposure of each picture area is effected.

In Fig. 1 is shewn an arcuate slot 22, eccentrically struck with reference to the centre of the shutter, through which the partial exposure is made. This slot is so arranged as first to expose the bottom outer corner of the lower window, then to uncover both windows at one side, viz., that remote from the shutter axis, and progressively to pass across both windows, finishing at the opposite side of both windows to that first uncovered. The slot may progressively increase in width from the leading edge 23.

In Fig. 2, which shows the form which is at present preferred, a discontinuous sinuous slot 24 is used which has a double diagonal sweep across the windows first from the lower outer corner and then from the lower inner corner of the bottom window.

In Fig. 3 an aperture corresponding with the full aperture is broken up by radial shuttering bands or arms 25. Two such arms are shown dividing the aperture into three parts, but a greater or lesser number can be provided. A convenient arrangement is that shown in which the arms and the gaps are each of such a size as to be capable of fully, or nearly fully covering, or exposing, respectively one window. Each picture area is thus given a succession of short exposures.

The main exposure aperture may also be divided into two or more parts, although of course due regard must be had to ensuring that this exposure shall be of greater effect than the partial exposure.

The normal shutter aperture may also be divided by one or more approximately radial partitions 26 (see Fig. 4) and provided with approximately concentric shuttering bands 27 in such a way that concentric slots 27^a are formed on one side of the radial partition, which slots lie at radial distances from the centre of the shutter corresponding to the positions of the bands 28 between the concentric slots 27^b on the other side of the partition. Or slots 29 may be formed like a stencilled Vee (see Fig. 4) with the remote ends of the limbs of the Vee opening at the periphery of the shutter. Two or more such Vee slots may be used. The concentric slots and the Vee slots may be used in combination, as shown, or alone.

Combinations of other forms of slotting and/or partitioning may be used.

All the above forms are designed to cause the picture areas to be substantially uniformly illuminated.

For the reasons set forth in our prior patent application No. 414,065 it is very advantageous to mount the shutter so that

it will cover the individual picture areas successively in such manner that the second (or subsequent) exposure of a negative begins before the first exposure of the following negative. This can be effected by mounting the shutters shown in the drawings to rotate in an anticlockwise direction, i.e., so that the edges of the shutter apertures are moving at the moment when they effect the exposure, in a direction contrary to that in which the band moves through the camera.

It is also preferred to reduce the cover period as far as possible by employing any suitable accelerated film shift mechanism.

To obtain the best results the aperture through which the partial exposure is made should be so arranged as not to have the effect of increasing the angle subtended by the cover sectors of the shutter.

Fig. 7 shows the manner in which the negatives appear on the band. If the first two picture areas on the band A, B are exposed through the shutter aperture 20, full or "master" images $M^1 M^1$ will be produced thereon from the same beam. Area B will be subsequently exposed, after the film has been shifted down one picture area, with the area C through the obturated shutter aperture 21, so that areas B and C will receive partial exposures $S^1 S^1$ from the same beam. C and D will subsequently receive master exposures $M^2 M^2$ and D and E partial exposures $S^2 S^2$ and so on along the length of the film.

Where there is little or no movement in the scene, the images will be emphasized by the double exposure but where rapid movement has been recorded, then when two positives are projected which have been subjected to the same master exposure, the difference produced by the separate partial exposures has little or no effect on the image produced on the screen, but when two positives are projected which have been subjected to different master exposures and are alike only in respect of the partial exposures, the composite image shows a certain amount of confusion. The result is that the moving object becomes somewhat blurred on the screen and fringing of the colours becomes less apparent.

A camera substantially as above described will produce, as in the case of the camera described in our said patent applications aforesaid an alternating monochrome rendering of colour selections on standard film, from which a direct positive can be printed in the usual manner. Standard width film and standard picture pull can be used in the camera as well as in the projector.

The partial shuttering or obscuring

member or members may also be used in conjunction with the shutter in the projector.

The negative film and the filters used and the general construction of the camera and projector, and the manner in which the pictures are identified, may be in accordance with those described in our prior patents above referred to, although in general a somewhat wider aperture of the optical system will be used.

Although we have described our invention as applied in a process in which the negatives are exposed to the same beam appropriately divided, it is also applicable to processes in which two lenses are employed so that the negatives are exposed to different beams, though for the reasons given in our said prior specifications we consider such processes undesirable on account of the objectionable parallax effects.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Process for the production on a negative band of colour constituent images (negatives) forming one continuous series, which consists in producing each negative (other than the extreme negatives of the band) as the result of two exposures through the same or similar colour filters, comprising a main exposure together with the preceding or following negative, and a partial exposure (with the following or preceding negative) which produces a substantially less effect than the main exposure.

2. Process for the production on a negative band of colour constituent images (negatives) forming one continuous series, which consists in producing each negative (other than the extreme negatives of the band) as the result of two exposures through the same or similar colour filters comprising a main exposure to the same beam (appropriately divided) as the preceding or following negative and a partial exposure to the same beam (appropriately divided) as the following or preceding negative which produces a substantially less effect than the main exposure.

3. Process according to claims 1 or 2, in which such lessened effect is produced by a diminution of the time of exposure.

4. Process according to claims 1 or 2, in which such lessened effect is produced by a diminution of the light strength of the beam.

5. Process according to any preceding claim, in which the partial exposure is divided into two or more parts.

6. Process according to any preceding claim, in which the master exposure is divided into two or more parts.
7. Process according to any preceding claim, in which the period from the beginning to the end of the partial exposure is substantially equal to the similar period for the main exposure.
8. A camera for carrying out the process according to claim 1 or 2, comprising a rotary shutter having a main exposure aperture and a continuous or sub-divided partial exposure aperture having substantially the same angular range as the main aperture but considerably less aperture area than such main aperture.
9. A camera as in claim 8, in which the partial exposure aperture is formed by an eccentrically disposed arcuate slot substantially as described.
10. A camera as in claim 9, in which the slot increases in width from a minimum at one end to a maximum at the other.
11. A camera as in claim 10, in which the partial exposure aperture is formed by a slot of contrary curvature substantially as described.
12. A camera as in any preceding claim 8 to 11, in which a discontinuous slot is used for the partial exposure aperture.
13. A camera as in claim 8, in which the partial exposure aperture is divided by one or more radial, or approximately radial, obturating members.
14. A camera as in claim 13, in which the radial members and the exposure openings are each formed so as to be capable of fully or nearly fully covering or exposing respectively one picture area.
15. A camera as in claim 8, in which the partial exposure aperture is divided by staggered concentric opaque bands.
16. A camera as in claim 8 or 15, in which the partial exposure aperture comprises solely or additionally one or more Vee apertures.
17. A camera for producing bands of colour constituent negatives comprising a beam-dividing device for exposing two or more negatives to the same beam, a filter changing system, a shutter, an accelerated film shift mechanism to move the film by a single picture pull at each shift, said shutter comprising a main exposure shutter aperture and a partial exposure shutter aperture and being mounted to rotate so that the edges of the apertures are moving at the moment when they effect the exposures, in a direction contrary to that in which the band moves through the camera, so that the re-exposure of each negative commences before the exposure of the succeeding negative.
18. A process for producing negative bands substantially as herein described.
19. A camera for producing negative bands substantially as herein described or illustrated.
20. A negative band of colour constituent images produced by the process claimed in any claim 1 to 5.
21. A positive band of colour constituent images produced from a negative band as in claim 20.
- Dated this 29th day of November, 1934.
 HYDE & HEIDE,
 2, Broad Street Buildings,
 Liverpool Street, London, E.C.2,
 Patent Agents for the Applicants.

Fig. 1.

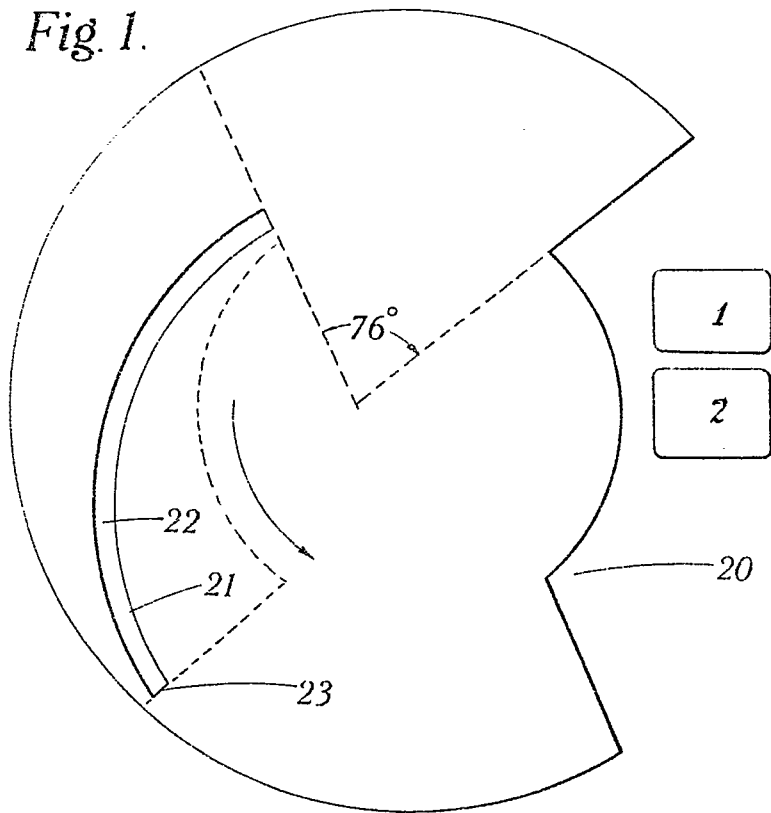
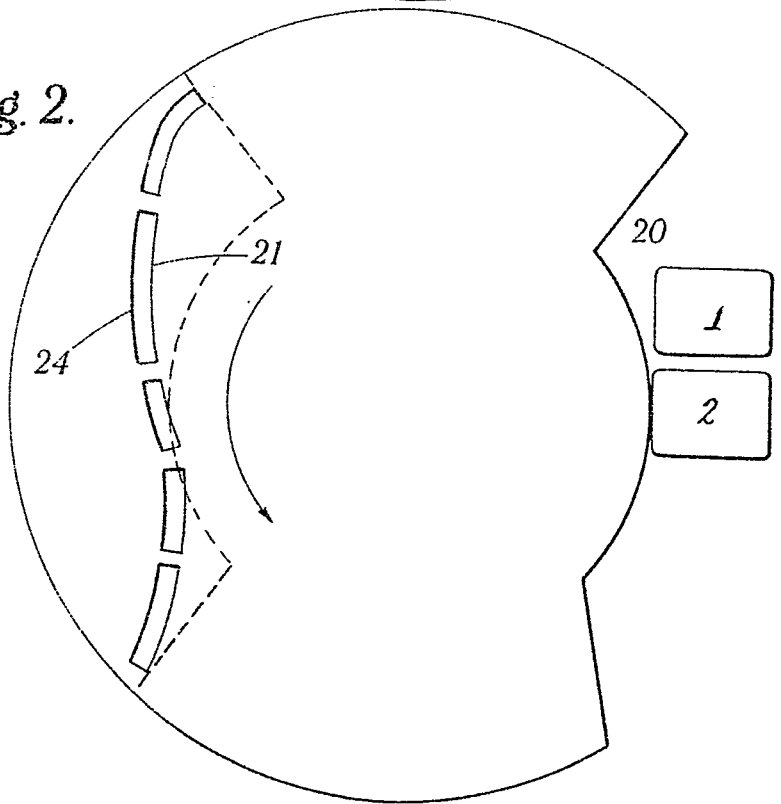


Fig. 2.



[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 3.

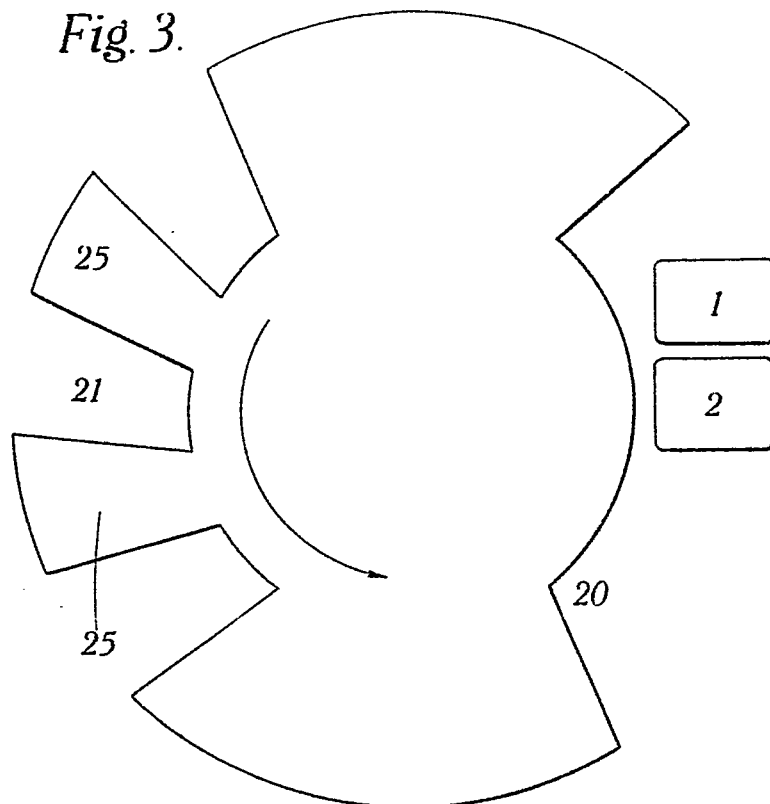
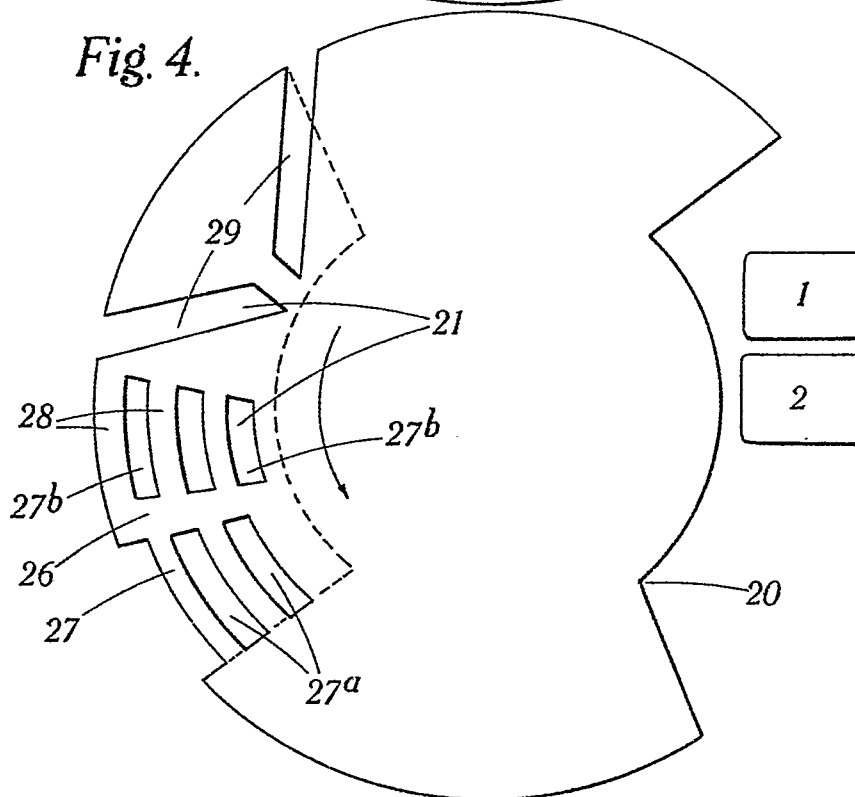
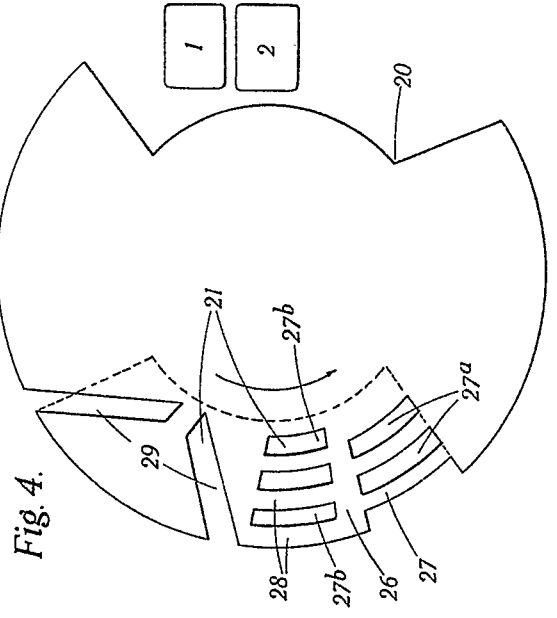
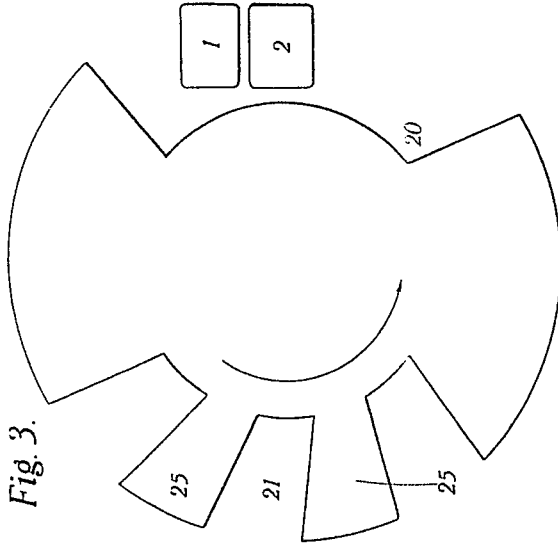
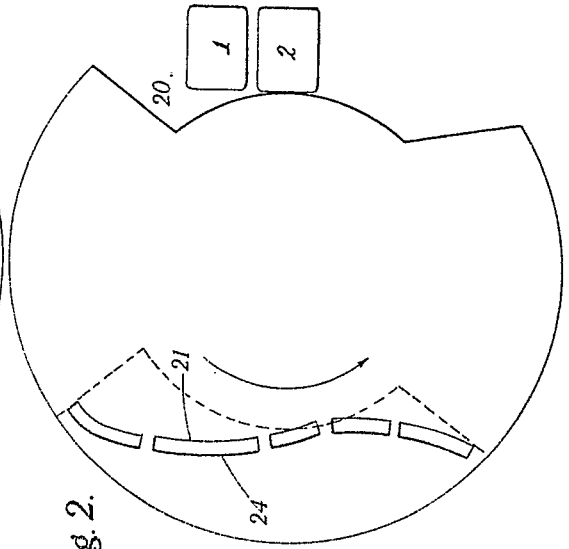
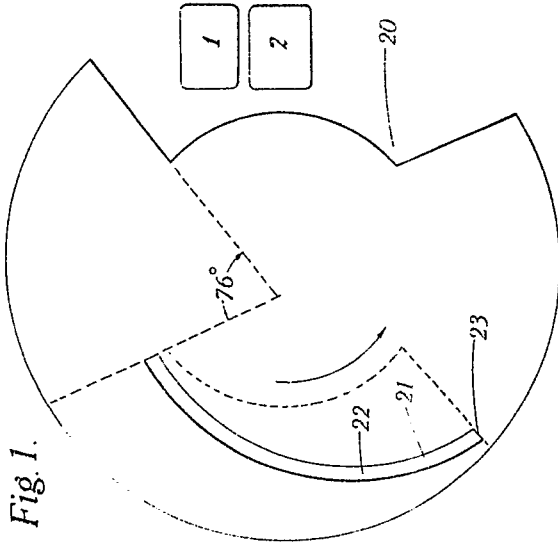


Fig. 4.





[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 6.

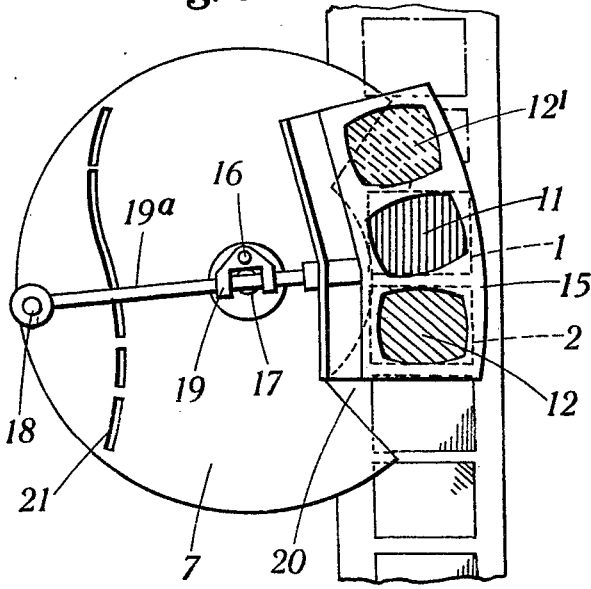


Fig. 5.

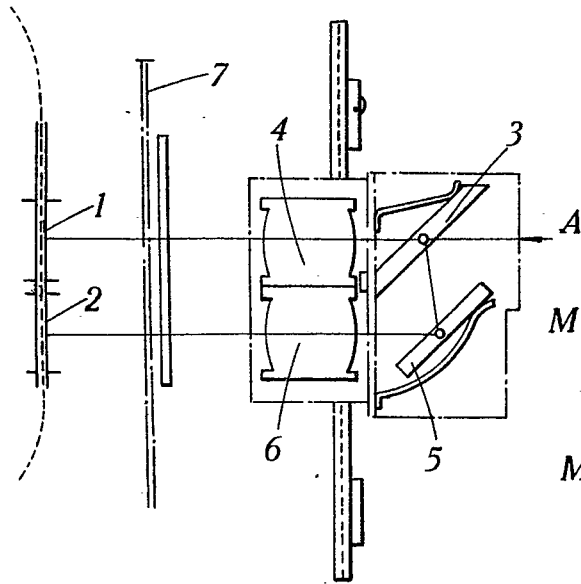
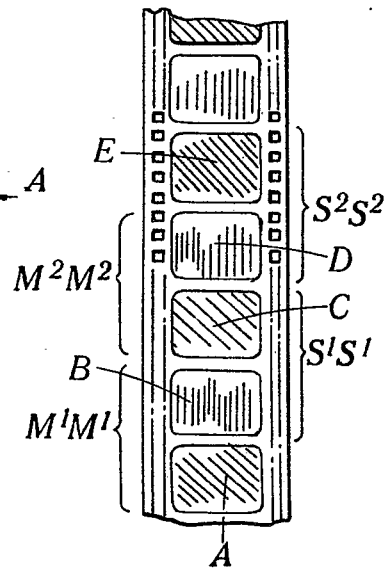


Fig. 7.



[This Drawing is a reproduction of the Original on a reduced scale.]