G. BETTINI.

MOTION PICTURE TRANSPOSING APPARATUS.

APPLICATION FILED NOV. 16, 1916.

1,298,282.

Patented Mar. 25, 1919.

4 SHEETS—SHEET 1.

Fig. 1.

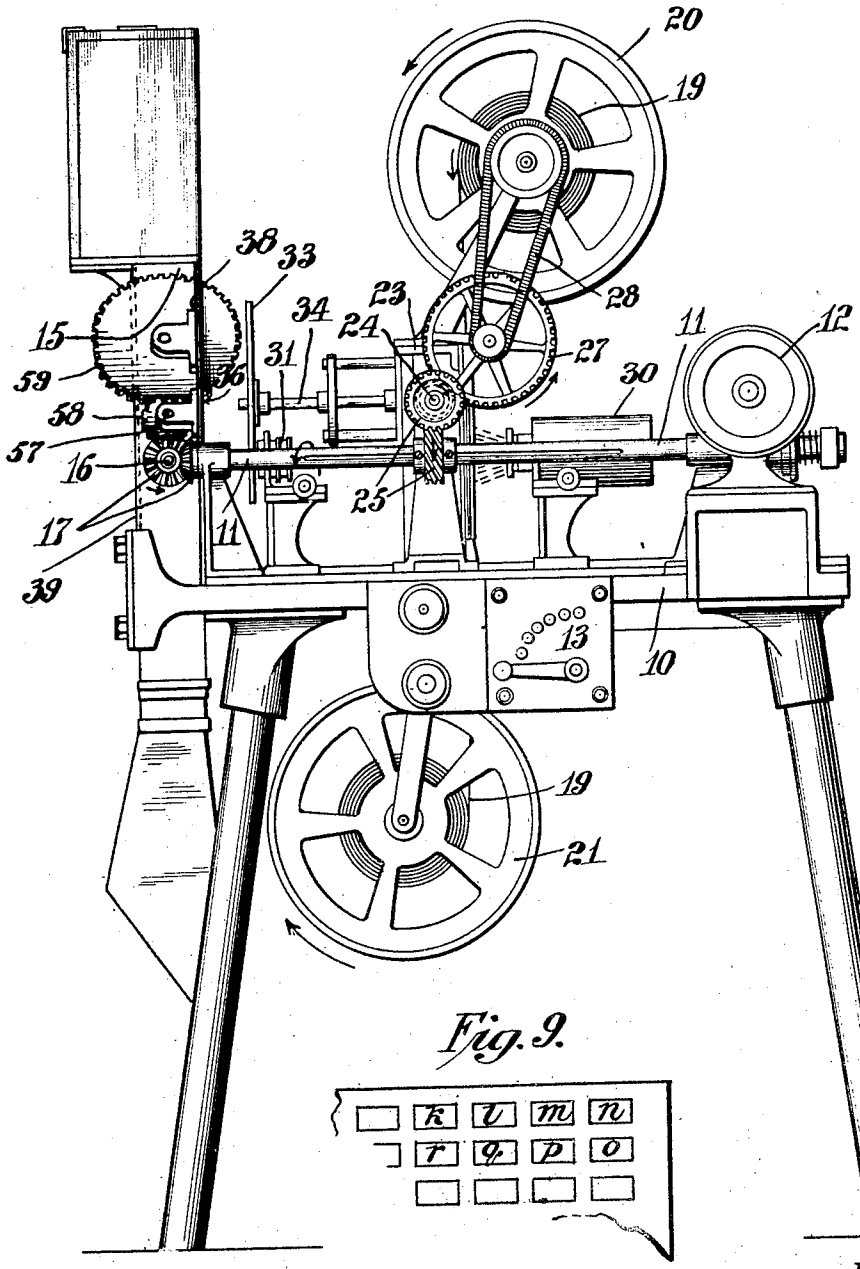

Fig. 9.

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4 SHEETS—SHEET 2.

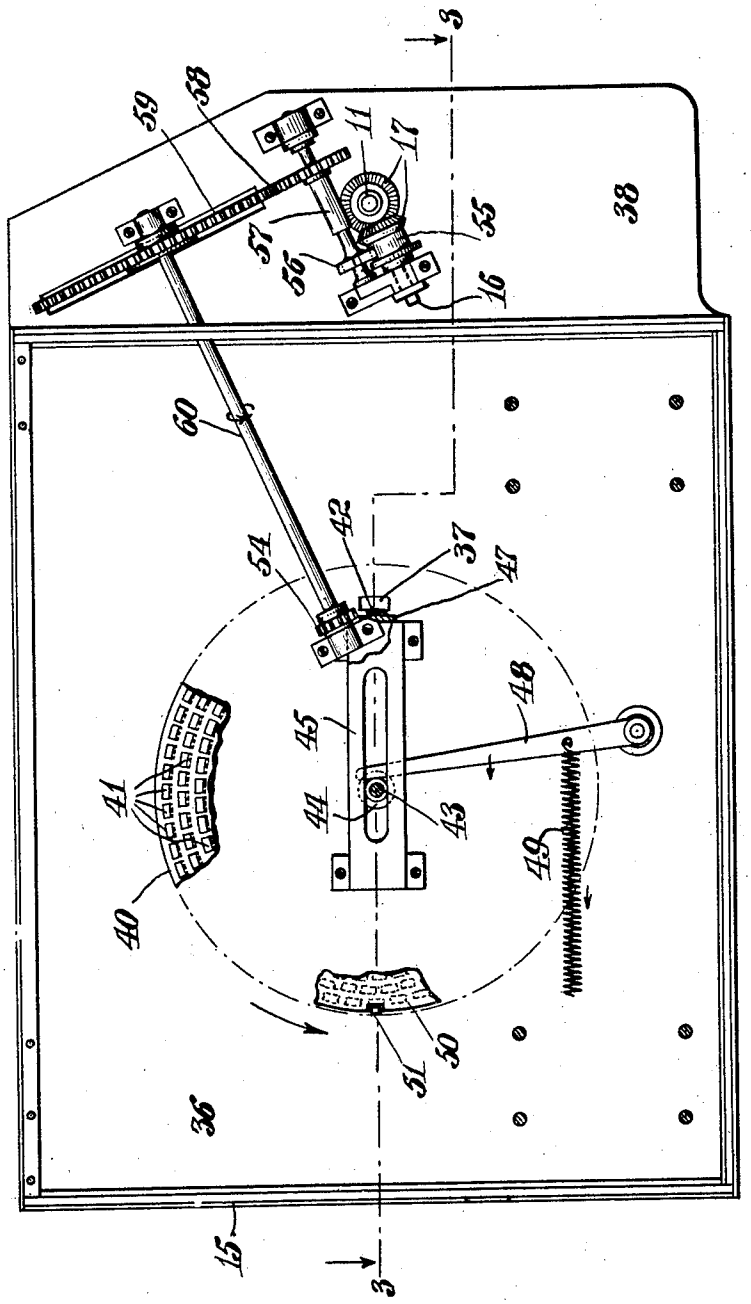

Fig. 2.

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4 SHEETS—SHEET 3.

Fig. 6.

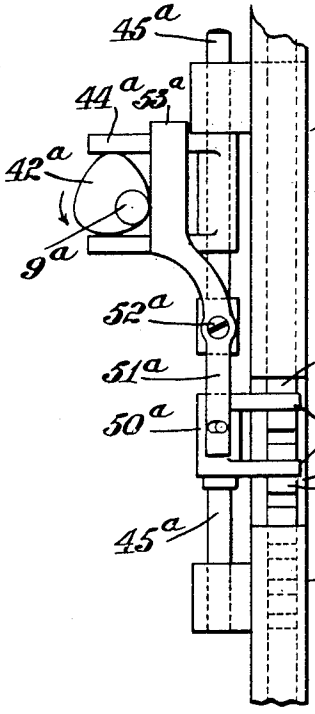


Fig. 7.

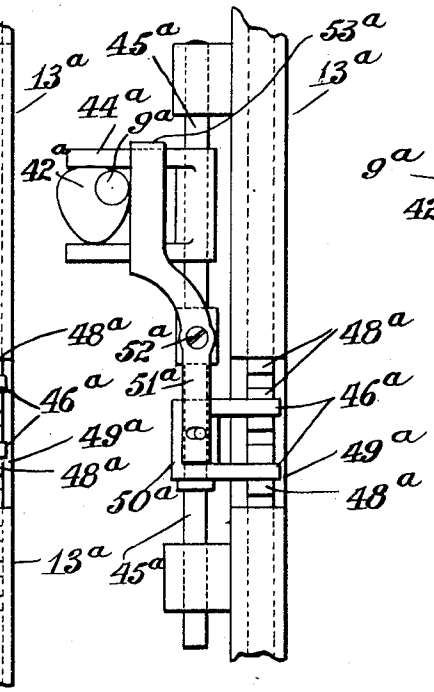


Fig. 8.

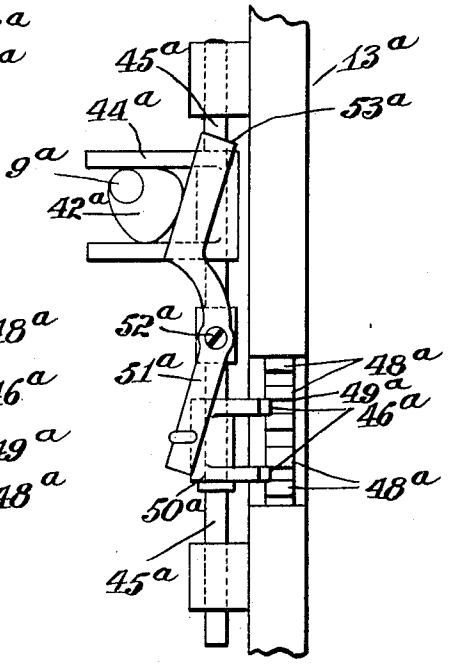
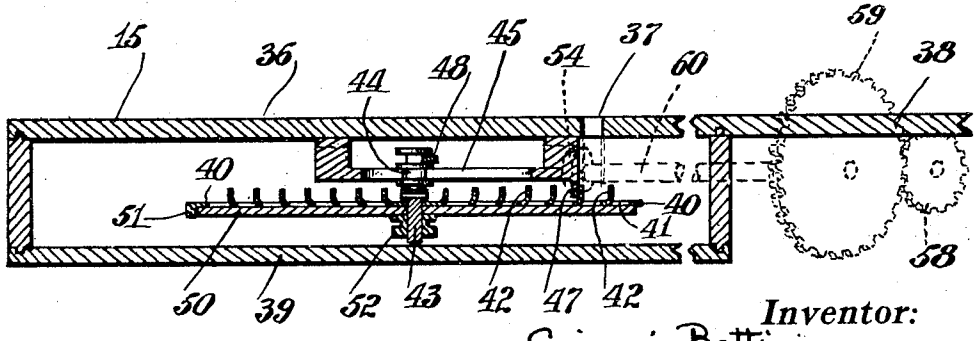


Fig. 3.



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4 SHEETS—SHEET 4.

Fig. 5.

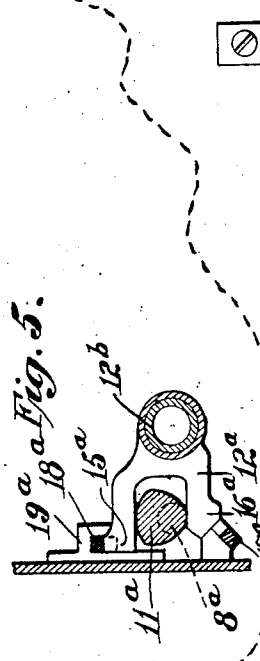

Fig. 4.

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UNITED STATES PATENT OFFICE.

GIANNI BETTINI, OF PARIS, FRANCE.

MOTION-PICTURE-TRANSPOSING APPARATUS.

1,298,282. Specification of Letters Patent. Patented Mar. 25, 1919.

Application filed November 16, 1916. Serial No. 131,680.

To all whom it may concern:

Be it known that I, GIANNI BETTINI, a subject of the King of Italy, residing at Paris, France, have invented certain new and useful Improvements in Motion-Picture-Transposing Apparatus, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to motion picture transposing apparatus, that is to say, to an apparatus for converting a series of motion pictures from one form or arrangement to another. More particularly, the invention is directed to the transposition of a series of motion pictures arranged, as usual, in a single row or strip into a different form of record, for example, one having a circular or spiral or a parallel-row arrangement of pictures. The usual strip record may be a negative, and may be used for printing or producing positives of the spiral or other forms mentioned, and obviously the operation may be reversed, namely, by transposing the spiral or other form of special record into the usual or strip form.

The general objects of the present invention are to afford a transposing apparatus of superior efficiency in operation, simplicity, strength and durability in construction, free from vibration and other factors of uncertainty, and such as will print the pictures in the exact positions requisite, and clear in outline and detail. Other and more particular objects and advantages pertaining to the invention will be elucidated in the hereinafter following description.

To the attainment of such objects and advantages, the present invention consists in the noval apparatuses, combinations, arrangements, devices, details and other features herein illustrated or described.

I will first describe two different embodiments of the principles of this invention, and will thereafter point out the features of novelty in the claims.

In the accompanying drawings, Figure 1 shows what may be considered a side elevation of a transposing apparatus embodying the present invention, the front of the machine being at the right, the rear at the left. The mechanisms seen in this view may be employed for the making of different forms of records, spiral, parallel-row, or other form.

Fig. 2 is a rear elevation, with certain parts omitted for clearness, of a plate shifting mechanism adapted to be used in cooperation with the mechanism of Fig. 1 for transposing the pictures of an ordinary strip record into a spiral arrangement. Fig. 3 is a section taken on the plane 3—3 of Fig. 2.

Fig. 4 is a front elevation with certain parts omitted for clearness, of a plate shifting mechanism adapted to coöperate with the mechanism of Fig. 1 for the production of records having parallel-row arrangement of pictures. Fig. 5 is a section taken on plane 5—5 of Fig. 4. Figs. 6, 7 and 8 are similar left hand elevations showing certain of the parts of Fig. 4 in three different positions. Fig. 9 indicates the form of record resulting from the employment of the apparatus shown in Figs. 1 and 4 to 8.

Referring first to the apparatus for producing records of spiral form, this being shown in Figs. 1, 2 and 3, the mechanism is shown as supported by a convenient table 10. Mounted in suitable bearings above the table, is a horizontal shaft 11 which drives or controls the various parts of the mechanism. As will be seen, this shaft serves to operate the devices which feed the negative strip record with a step by step motion, and also the devices which shift the circular sensitive receiving plate, and also operates the optical shutter which opens when the strip and plate are stationary, and closes during their shifting movements.

The drive shaft 11 may be turned in any desired manner, for example, by an electric motor 12, which may be controlled in speed by an electric controller 13. Manifestly the speed of the apparatus must be regulated so as to insure the proper exposure of the plate.

At the rear of the apparatus is shown a light-tight box 15. This may contain the sensitive plate of whatever form is used, and the mechanism for shifting it intermittently so that the plate may successively receive photographic impressions through an aperture in the front wall of the box. The mechanism within the box may comprise an outwardly extending operating shaft 16, geared to the drive shaft 11 by a pair of engaging bevel pinions 17. The details of the mechanism within the box 15 will be later described in connection with Figs. 2 and 3.

An ordinary negative strip 19 of motion picture film is shown as being run off from

a first reel 20, and coiled up upon a second reel 21. In passing from one reel to the other, the film strip passes through a box 23 containing any usual intermittent feed mechanism, such as the ordinary four-motion feed, which serves to move the film downwardly to the extent of one picture at a time, then holding it stationary for a brief period before again advancing it. This mechanism may be driven by an operating shaft 24, which is shown as connected to be driven by the drive shaft 11 by a pair of helical gears 25.

By the described arrangement, one rotation of the drive shaft 11 gives one rotation of the operating shaft 24, so as to advance the film to the extent of one picture, and in the same period the operating shaft 16 of the plate shifting mechanism is given one rotation, and, as will be seen, this causes the plate to advance to the extent of a single picture.

The usual auxiliary devices of film feeding mechanisms may be employed. For example, a gear 27 driven from the shaft 24 may operate a slip drive 28 to advance the reel 20; and the receiving reel 21 may have a resilient or other take-up device.

The optical parts of the apparatus include a lantern 30 directed toward the rear, and an objective 31 between the lantern and the box 15 containing the sensitive plate. The arrangement of lenses may be such as to conveniently reduce the size of pictures. A shutter 33 is shown between the objective and the box 15, this shutter being rotated by a shaft 34, which, in turn, is driven from the shaft 24. The traveling motion picture strip 19 and the rotating shutter are both arranged in the path of the light rays as described, with the result that whenever the shutter is open an exposure is produced and an image of one of the pictures on the film is projected on the sensitive plate within the box 15. Any suitable precautions may be adopted to protect the sensitive plate from undesired exposure to light.

When it is desired to make the spiral arrangement of record, the mechanism associated with the light tight box 15 may be as disclosed in Figs. 2 and 3. The spiral arrangement of the little windows seen in Fig. 2 sufficiently indicates the arrangement of the record intended to be produced.

The box 15 has a front wall 36 with an optical aperture 37 for admitting the rays of light to be focused into an image on the sensitive plate. The box also has an outwardly extending wall 38. The walls 36 and 38 support the mechanism to be described. The rear wall or cover 39 is removable and is substantially omitted from Fig. 2 to better disclose the interior.

The carrier disk 40, forming a permanent part of the mechanism is partly indicated in Fig. 2, its position being indicated by a broken circle. This disk is located between its actuating mechanism and the rear cover. The disk has a plurality of apertures or windows 41, each one of a substantially square form, and all the windows forming a series spirally arranged around the disk. The disk may be made of sheet metal and the windows formed by striking tongues 42 of metal forwardly therefrom, the tongues being left projecting forwardly for certain purposes.

The disk 40 is intended to rotate and for this purpose is mounted on an axle 43. The disk is also intended to have a horizontal feed to secure the spiral arrangement, and for this purpose the axle is mounted in a slide block 44, which may slide longitudinally in a slotted guide piece 45, mounted on the front wall 36.

The forwardly projecting tongues 42 of the disk 40 form a spiral series, and are sufficiently continuous to substantially form a flange which may be used for guiding purposes. The flange formed by the tongues 42 is adapted to coöperate with a fixed guide 47 projecting rearwardly from the right hand end of the guide piece 45, see Fig. 3. As each of the windows 41 comes into exposing position opposite the aperture 37, its struck out tongue portion slides over the fixed guide piece 47. In this way the disk is properly relatively positioned during its progress, and as the disk turns around and around, the spiral arrangement of the tongues causes it gradually to feed bodily toward the right in Figs. 2 and 3. It is shown as having been already fed partly toward the right. In order to hold the tongues 42 in contact with the guide piece 47, I have provided a resilient device tending to restrain the disk and hold it toward the left. This consists of a push bar 48 pivoted at its lower end, its upper end pressing against the axle 43 of the disk, and a spring 49 tending to pull the parts toward the left as shown.

It will be understood that the disk 40 is intended to carry at its rear face, a sensitive disk 50 which is to receive the pictures. There may be a notch-and-finger device 51 for properly relatively positioning the disks and a central locking nut 52 for securing them together.

If the disk 40 be now rotated toward the right, its spirally arranged tongues in cooperation with the guide 47, will automatically cause its gradual feed toward the right. It, therefore, only remains to describe the means for giving intermittent rotation to the disk. Its rotation should be stopped for a brief period while each successive window stands in line with the optical apparatus.

For this purpose, I have made use of the

same struck out tongues 42. These are adapted not only to form a spiral guide as explained, but are adapted to constitute a spiral series of teeth, by which the disk may be conveniently driven. For so engaging the teeth 42, there is shown a pinion 54 between the disk and the front wall of the box. The teeth of the disk and those of the pinion will, of course, be suitably shaped to cooperate with each other on this rotary shifting action. The pinion 54 may be driven from the drive shaft 11 of the machine by the following connections: The drive shaft 11, by a pair of bevel pinions 17, rotates the operating shaft 16. These parts are seen both in Figs. 1 and 2. An intermittent drive device 55, 56 may be of a usual type consisting of a drum 55 on the shaft 16, this drum having a single recess and a tooth therein, and a toothed wheel 56 on a parallel shaft 57. The drum as it turns, locks the device 56 until the single tooth of the drum comes into play to advance the device by one tooth, when the latter becomes again locked until another rotation has occurred.

The shaft 57 carries a pinion 58, engaging a gear 59 on a shaft 60, which extends toward the center of the box, and there carries the pinion 54 which directly engages the teeth 42 of the carrier disk.

As the parts are shown, one rotation of the shaft 11 or 16 sufficient to shift film strip 19 one picture causes a quarter rotation of the shaft 57, or one-twelfth rotation of the shaft 60. The pinion 54 having twelve teeth, the disk 40 is advanced to the extent of a single window or picture on each rotation of the main drive shaft 11. It follows that when the apparatus is in full operation, each picture on the strip film 19 is projected through one of the windows 41, and exposed on the sensitive plate 50 during a part of each rotation of the drive shaft but while the film strip and sensitive surface are momentarily stopped, following which the shutter 33 closes, and, while closed, both the spiral disk and the film strip shift to the extent of one picture, whereupon the succeeding picture is projected through the successive window of the disk; and so on to the end of the series.

The modified form of apparatus is for transposing a series of pictures from a strip or single line film into a record with an arrangement having a plurality of substantially straight, parallel rows of pictures. This modification is shown in Figs. 1 and 4 to 8 inclusive, Fig. 9 illustrating such a record.

The means for operating a negative film and the means extraneous to the casing in which the sensitive record sheet is to be arranged correspond substantially with the mechanism shown in Fig. 1, and partly in Fig. 2. In Fig. 1 there is the main drive shaft 11, which makes one rotation for the exposure of a picture, and the intermeshing bevel pinions 17, by which the drive shaft 11 rotates operating shaft 16, which extends into the casing for the sensitive surface or plate. In Fig. 4 and the following figures the light tight box 15 of Fig. 1 is omitted, except that there is shown in dotted lines a frame or support 15^{x} for the mechanism within the light tight box, which will have an aperture in its front wall for the admission of the optical image.

The rectangular sensitive plate, or plate having a rectangular sensitive field which may be converted into a record such as shown in Fig. 9, is supported by the apparatus of Fig. 4, etc., in any convenient manner upon a carrier 13^{a}.

It is intended that this carrier 13^{a}, which may be of any suitable construction, together with the sensitive plate, be given certain step by step motions vertically and laterally so as to successively bring different portions of the plate into exposing position. If desired the sensitive plate may be faced by an opaque member having apertures or windows corresponding in position with the images to be produced, but this is not essential. The mechanism of Fig. 4 etc., about to be described, is for the purpose of transmitting motion from the operating shaft 16^{a} to the carrier 13^{a} so as to intermittently advance the same, while other parts associated with said carrier are adapted to drop the sensitive plate to a lower level, said carrier with said plate then advancing reversely along the second row, and so on, until a record plate is produced, substantially as in Fig. 9. The step by step advance is indicated on said Fig. 9 by letters *l*, *m*, *n*, *o*, *p*, *q*, *r*.

Referring to Fig. 4 it will be seen that there is shown a pair of bevel pinions 17^{a}, corresponding with the bevel pinions 17 operated by the main drive shaft 11, as in the first form of the apparatus, and that one of these pinions is mounted upon a shaft 4^{a}. Said shaft 4^{a} carries a gear wheel 5^{a} which is in constant mesh with two similar wheels 6^{a} and 7^{a}, on which gear wheel 6^{a} is keyed to a horizontal shaft 8^{a} while the gear wheel 7^{a} is loosely mounted upon a shaft 9^{a}. A clutch 10^{a} is also mounted upon shaft 9^{a} whereby to clutch the gear wheel 7^{a} to said shaft. Shaft 8^{a} through intermediate and other mechanism, is adapted to impart a step by step shifting movement to the carrier 13^{a} and hence to the sensitive surface supported thereby, such shifting movements causing the plate to be shifted along the length of one row of picture receiving portions on the sensitive surface, while shaft 9^{a} and mechanism associated therewith shifts the surface from one row of picture receiving portions thereon to the next, as from *n* to *o*, Fig. 9.

The shaft 8^a is mounted in suitable bearings on the frame or support for the mechanism of Fig. 4, and is provided with a cam 11^a of suitable length, which cam is straddled by stirrup-like or double pawl 12^a, which is shown in Figs. 4 and 5. This stirrup-like double pawl can oscillate freely in a direction transverse of the cam shaft 8^a, it being mounted upon a sensitive plate carrier 13^a before referred to. Said carrier is mounted upon and guided in its movements by a pair of parallel guide bars 14^a, 14^a.

One arm or pawl 16^a of the stirrup-like device 12^a is arranged in coöperative relation with a rack bar 17^a which is fixed rigidly to the supporting frame. Said pawl 16^a is of such thickness that it can, under the influence of the cam 11^a, enter and exactly fit in the notches of the rack bar 17^a, thereby rendering the stirrup device 12^a immovable laterally and locking the plate bearing carrier 13^a in the position as set by the said pawl 16^a. It will be understood that the distance between the teeth of the rack bar 17^a corresponds with the approximate length of each single picture area on the sensitive surface. The other pawl 15^a of the stirrup device 12^a is located in coöperative relation with the teeth of a rack bar 18^a, which is similar to the rack bar 17^a but is arranged so that it can be moved longitudinally. Rack bar 18^a is mounted in suitable supports, as 19^a, by which it is guided in its movements.

Rack bar 18^a is provided with a longitudinal extension 20^a, which terminates in a nose or lug 21^a, which engages in a peripheral groove 22^a of a cam 23^a, which is loosely mounted upon shaft 4^a. Cam 23^a can be rigidly connected with shaft 4^a by means of a suitable clutch 24^a which is controlled by a fork 25^a suitably pivoted to the frame of the apparatus, and provided with a pin 26^a which engages in a suitable slot or groove 26^b in a lever 27^a. Said lever is pivoted at 28^a to the frame of the apparatus, while its free end 29^a is suitably shaped so that it may be maintained by means of a spring 29^b in constant engagement with a cam 30^a. Cam 30^a turns on a suitable center support, together with a large gear wheel 31^a which is in constant mesh with a small pinion 32^a, which is keyed upon the shaft of a bevel pinion 33^a which is in mesh with a bevel pinion 34^a fixed on the shaft 8^a. It will be seen that the cam 30^a will be rotated by means of the shaft 8^a through the described intermediate gearing. Lever 27^c, before mentioned, is connected by means of a link 35^a with a detent lever 36^a, the end of which is adapted to enter suitable openings in one face of the grooved cam 23^a, for the purpose of locking said cam and concomitant parts in position.

Cam 30^c before mentioned is made rigid with a second cam 37^a, which is notched at 38^a at a point approximately opposite the high point of the cam 30^a. The free end 39^a of a lever 40^a travels upon the notched edge of the cam 37^a said lever being pivoted to the frame of the apparatus at 41^a, and suitably connected with the clutch 10^a which is arranged upon beforementioned shaft 9^a. Said clutch 10^a is pressed toward the gear wheel 7^a by means of its operating spring 43^a. Shaft 9^a is provided with a cam 42^a similar in conformation to the cam 11^a and is adapted to control the movement of the plate to receive photographic impressions to another row after said plate has received such impressions on a preceding row. The mechanism controlling this row to row movement is more particularly represented in Figs. 6, 7 and 8, which mechanism is hidden in Fig. 4, and includes a fork 44^a which is mounted upon a longitudinally shiftable stem or shaft 45^a arranged upon the shiftable carrier 13^a, said fork embracing the said cam 42^a. The shiftable stem or part 45^a is provided with fingers or pawls 46^a which are adapted to enter the spaces between teeth 48^a of a rack bar 49^a forming a part of the plate carrier frame. This rack bar 49^a is shiftable in a direction rectilinearly of the direction of movement of the carrier 13^a. The fingers or pawls 46^a are rigidly connected to a sleeve 50^a which is adapted to oscillate on the shiftable stem or part 45^a, and this sleeve is controlled by the lower end of a swinging lever 51^a which is pivoted to the stem 45^a at 52^a, the other end of this lever, when in the position of rest, touching the shaft 9^a—42^a in the position shown in Fig. 6.

The plate or sheet having the sensitive surface for receiving the images of the pictures on the film such as 19 of Fig. 1, is held in the carrier 13^a by means of suitable springs which are not shown, but may be of any suitable construction and arrangement to prevent any movement of the sensitive surface except the controlled movement.

The operation of this modified form of the invention for producing records somewhat similar to that shown in Fig. 9 is as follows:

The movement transmitted to the shaft 11 in turn transmits motion to the bevel pinions 17^a, causing the pinion on the shaft 4^a to rotate at the same speed as the gear wheel 25 which controls the film apparatus. The shaft 4^a transmits its motion to the gear wheel 5^a and from that to the gear wheels 6^a and 7^a; the gear wheel 7^a, occupying the position shown in Fig. 4, ordinarily turns loosely upon the shaft 9^a, owing to the clutch 10^a being removed therefrom, while the gear wheel 6^a imparts its rotating movement to the shaft 8^a which turns at the same speed as the gear wheel 25, Fig. 1.

Supposing that the frame 49ª with the rack teeth is positioned as indicated in Fig. 4, with the sensitive plate set thereon and held in the carrier 13ª, and that the shaft 8ª—11ª is rotated so as to impart an oscillating motion to the double pawl 15ª, 16ª. If the pawl 16ª has been moved by the cam 11ª so as to be engaged in one of the notches of the stationary rack bar 17ª, the result is that all the allied parts are held immovable during the momentary opening of the shutter device such as shown in Fig. 1, and a picture upon the film is then projected upon the sensitive plate. The cam shaft 8ª—11ª, continuing its rotation, brings the double pawl into the position indicated in Fig. 5, thus releasing the pawl 16ª from the rack bar 17ª and causing the other pawl 15ª to be engaged in one of the notches of the shiftable rack bar 18ª. Inasmuch as the lug 21ª of the rack 18ª is engaged in the cam groove 22ª, said rack bar will receive a reciprocating movement at each rotation of the cam wheel 23ª, the cam being so proportioned that it will shift the rack bar 18ª equal to the width of one image. The consequence is that the shiftable rack bar 18ª and its associated double pawl gives a lateral displacement to the sensitive plate equal to the width of one image, so as to shift the plate to the next position to receive a new image at the next picture receiving portion of the sensitive surface of the plate. A slight oscillation of the double pawl toward the stationary rack bar 17ª, brings the pawl 16ª into engagement with said rack bar 17ª, for the next impression on the sensitive surface, after which the other pawl 15ª of the stirrup device 12ª is brought into engagement with the next notch of the shiftable rack bar 18ª for another displacement of the carrier and sensitive plate, and so on. This operation is gone over fifteen times for a plate designed to receive sixteen rows of images. It is clear that during the described displacement of the plate in the direction of a row of image receiving portions of the sensitive surface, the cams 30ª and 37ª will simultaneously rotate by means of the shaft 8ª. The pinions 34ª and 33ª being in the ratio of 1 to 2, while the pinions 32ª and 31ª are in the ratio of 1 to 8, the result is that the cams 30ª, 37ª make one turn for sixteen turns of the shaft 4ª, which is operated by the main drive shaft, before described. The movable rack bar 18ª, therefore, gives fifteen step by step movements to the sensitive plate, and then, when the pawl 16ª of the stirrup device is in engagement with the last notch of the stationary rack bar 17ª, the high point of the cam 30ª acts to raise the end 29ª of the lever 27ª, while, on the other hand, the end 39ª of lever 40ª enters the notch 38ª of the cam 37ª, which notch is diametrically opposite the high point of cam 30ª. The lever 27ª, now being shifted toward the right by the action of the cam 30ª, disengages the clutch 24ª from the cam 23ª, thus leaving it loose upon the shaft 4ª, while the detent 36ª is moved by the action of the link 35ª so as to draw the operative end of the detent into engagement with one of the notches or openings, not shown, of the cam 23ª. The cam 23ª is thus locked, and the rack bar 18ª is held stationary.

Simultaneously with the operation of the lever 27ª and concomitant parts, the lever 40ª, which is pushed back by the spring 43ª, causes the clutch 10ª to become engaged with the gear wheel 7ª which is mounted loosely upon the shaft 9ª. As the gear wheel 7ª is now rigidly clutched to the shaft 9ª, a rotary motion is imparted to the gear wheel 7ª and shaft 9ª through the medium of the intermediate gear wheel 5ª. The cam 42ª is shown in its raised position in Fig. 6, but as soon as it begins to rotate by the action of its shaft 9ª it acts upon one of the projections 44ª so as to bring said projections 44ª into the position shown in Fig. 7, by causing the frame 49ª to shift a distance corresponding with the height of one image. At this moment the cam 42ª, continuing its rotation as shown in Fig. 8, bears upon the end 53ª of the lever 51ª, thereby moving it into the position shown in said figure. This causes a partial rotation of the sleeve 50ª and the oscillation of the fingers 46ª, which thereby become disengaged from the notches of the rack bar or carrier frame 49ª. The sensitive plate is then held immovable in the carrier 13ª by the beforementioned springs, and the cam 42ª, continuing its rotation, withdraws from the lever 51ª, which returns to the position shown in Fig. 6, while this cam, acting upon the upper branch of fork 44ª, carries the latter again into the position shown in Fig. 6. The cam having now made a complete turn, the fingers 46ª move back into the notches of the rack bar or frame 49ª, through the medium of suitable springs, not shown, and the cam 37ª having continued to rotate, again raises the end 39ª of the lever 40ª in order to bring back the clutch 10ª into the position shown in Fig. 4, so that the rotation of the cam 42ª is discontinued.

At the same time, the high point of the cam 30ª has passed the end 29ª of the lever 27ª and the latter is brought back to the left by the spring 29ᵇ, and the clutch 24ª is returned into locking engagement with the cam 23ª, thereby removing the detent 36ª from its interlock with the cam 23ª. The cam 23ª now commences to rotate again, thus imparting reciprocating movements to the rack bar 18ª, as before described. Owing to the conformation of the cam 11ª and to a peculiar arrangement of the control for the cam 23ª and of the gear wheels 5 and 6, the

pawl 15ª of the stirrup device 12ª is in engagement with the reciprocating rack bar 18ª when it reaches the end of its course to the left, whereas when it reaches the end of its course toward the right the pawl 16ª is in engagement with the fixed rack bar 17ª. As a consequence the first lateral step by step movement received by the sensitive plate, after its shift from one row of image receiving portions to the next row, will be imparted in the direction of the series of step by step movements which are to follow directly after this row to row shifting.

It will be observed that, owing to the proportions of the several gears and pinions, the reciprocating rack bar 18ª is shifted for the distance of one tooth and, therefore, displaces the sensitive plate to the extent of one image or picture receiving portion for each turn of the drive shaft 11 shown in Fig. 1, and consequently for each image which is transferred from the film onto the sensitive surface.

The transmission of movement from the drive shaft to the pinions 17 or 17ª can be effected in such a way as to prevent transmission of the movement of the drive pinion of the pair 17 or 17ª to its shaft, if an abnormal strain be produced upon the latter due, for instance, to the presence of some foreign body in the gearing, to the defective position of the sensitive plate, or to any other cause so that the apparatus will come to a stop without becoming damaged.

It is possible to arrange for the transfer of a certain number only of the views from the film to the sensitive surface instead of all the views. This method of transferring is specially desirable in the case of a moving picture machine designed for use as a toy. It is obvious that the sensitive plates may be of any desired shape, and that the images which are to be photographed thereon can be disposed thereon in any way desired, the surface which is to receive the images preferably having its image receiving portions arranged to move in a direction across the direction of movement of the film which is being photographed. The operation of the apparatus may be effectuated by hand or by means of any suitable motor.

It is obvious that the invention is susceptible of modification other than the two forms of the apparatus herein shown and described and that parts may be omitted, parts added, and parts substituted without departing from the spirit and scope of the invention as covered by the appended claims.

What I claim is:

1. A motion picture transposing apparatus for photographically printing a series of images between a plate-like image member having a substantial number of successive transverse rows of images, and a second image member having a different arrangement, the same including in combination with the optical means and drive means, connections for advancing the second member relatively to the optical means and mechanism for carrying and moving the first member in synchronism with the second member, comprising clutch connections for shifting the image member transversely from image to image along each successive row, clutch connections for gradually advancing the member bodily longitudinally to bring row after row into optical position, and a controller acting at the end of each row to unclutch the first connections and clutch the second connections for the period of one shift.

2. A motion picture transposing apparatus for photographically printing a series of images between a plate-like image member having a substantial number of successive transverse rows of images, and a second image member having a different arrangement, the same including in combination with the optical means and drive means, connections for advancing the second member relatively to the optical means, and mechanism for carrying and moving the first member in synchronism with the second member, comprising clutch connections for shifting the image member transversely from image to image along each successive row, clutch connections for gradually advancing the member bodily longitudinally to bring row after row into optical position, a controller acting at the end of each row to unclutch the first connections and clutch the second connections for the period of one shift, and means to lock the first connections in position while unclutched.

3. A motion picture transposing apparatus for photographically printing a series of images between an image plate having a substantial number of successive transverse rows of images, and a second image member having a different arrangement, the same including in combination with the optical means and drive means, connections for advancing the second member relatively to the optical means, a movable carrier for the plate, connections for shifting the image plate carrier transversely, comprising a transversely vibratable rack, a pawl on the carrier and an elongated cam for intermittently engaging rack and pawl, and connections for gradually advancing the plate longitudinally to bring row after row into optical position, comprising a carriage, fingers or engagers on the carriage for engaging the plate edge and an elongated cam for vibrating the carriage and causing the fingers to engage and disengage the plate.

4. A motion picture transposing apparatus for photographically printing a series of images between an image plate having a substantial number of successive transverse

rows of images, and a second image member having a different arrangement, the same including in combination with the optical means and drive means, connections for advancing the second member relatively to the optical means, a movable carrier for the plate, connections for shifting the image plate carrier transversely, comprising a transversely vibratable rack, a pawl on the carrier and an elongated cam for intermittently engaging rack and pawl, means for continuously rotating the cam and means for vibrating the rack with interruption at the end of each picture row, and connections for gradually advancing the plate longitudinally to bring row after row into optical position, comprising a cam, a device for advancing the plate one row for each action of the cam, and means for causing the cam to act during the interruption of the pawl vibration at the end of each picture row.

5. A motion picture transposing apparatus for photographically printing a series of images between an image plate having a substantial number of successive transverse rows of images, and a second image member having a different arrangement, the same including in combination with the optical means and drive means, connections for advancing the second member relatively to the optical means, connections for shifting the plate transversely from image to image along each successive row, comprising a pair of opposed racks, a pawl connected to the plate, means to shift the pawl to alternately engage the racks, means for vibrating one rack to cause pawl and plate to shift image by image to the end of each row, and means for then so vibrating one rack as to cause the same to shift back along the next row, and connections for gradually advancing the plate longitudinally to bring row after row into optical position.

6. A motion picture transposing apparatus for photographically printing a series of images between an image plate having a substantial number of successive transverse rows of images, and a second image member having a different arrangement, the same including in combination with the optical and drive means, connections for advancing the second member relatively to the optical means, connections for shifting the plate transversely from image to image along each successive row, and connections for gradually advancing the plate longitudinally to bring row after row into optical position, comprising a clutch, means for closing the clutch for one action at the end of the row, a cam turned by the clutch, a plate engaging means or finger, and a device for disengaging the finger, all arranged so that the cam causes the finger to engage and advance the plate, disengage and return.

In testimony whereof, I have affixed my signature.

GIANNI BETTINI.