Dec. 10, 1946. J. B. CONTNER 2,412,252

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Original Filed June 21, 1941 8 Sheets-Sheet 1

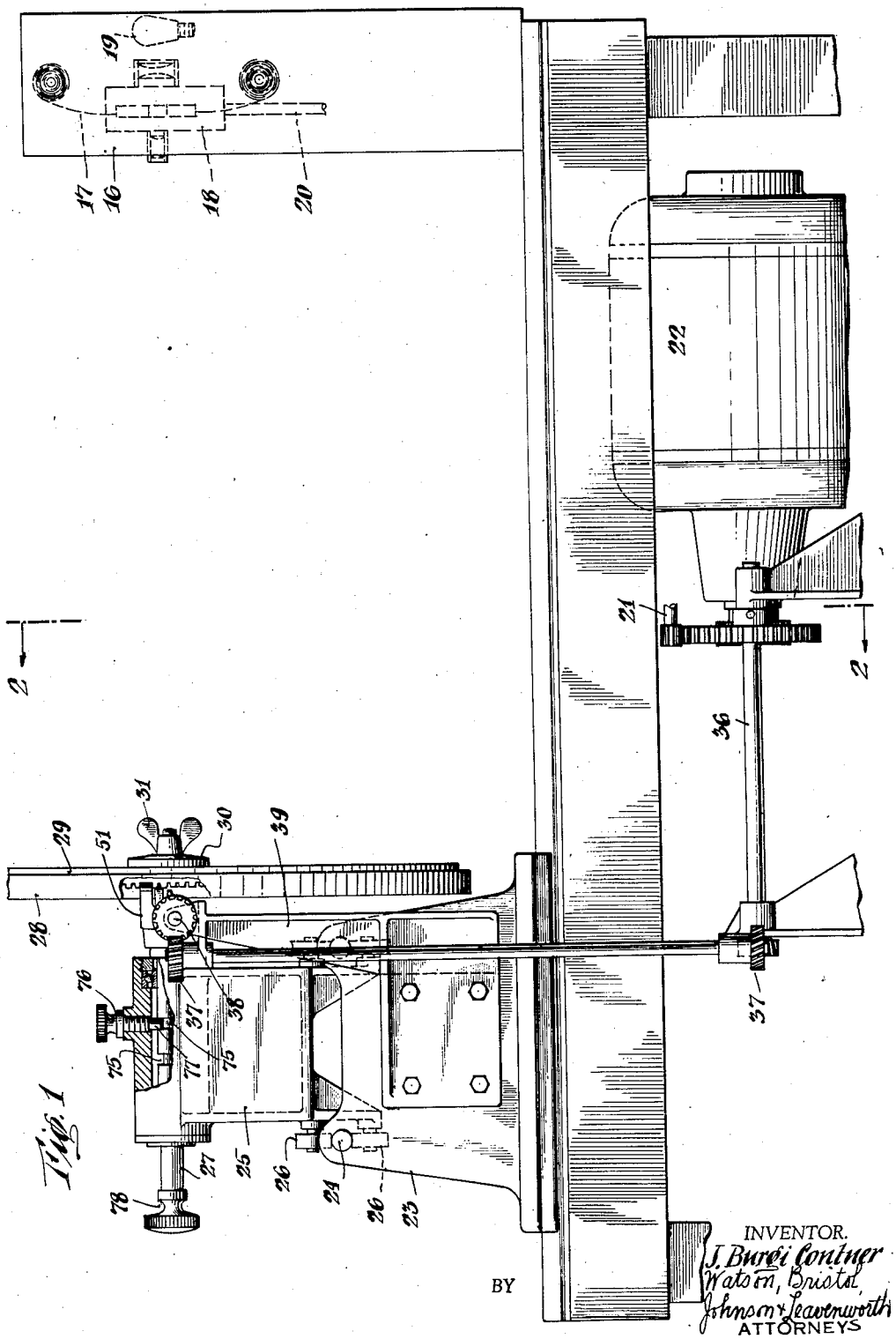


Fig. 1

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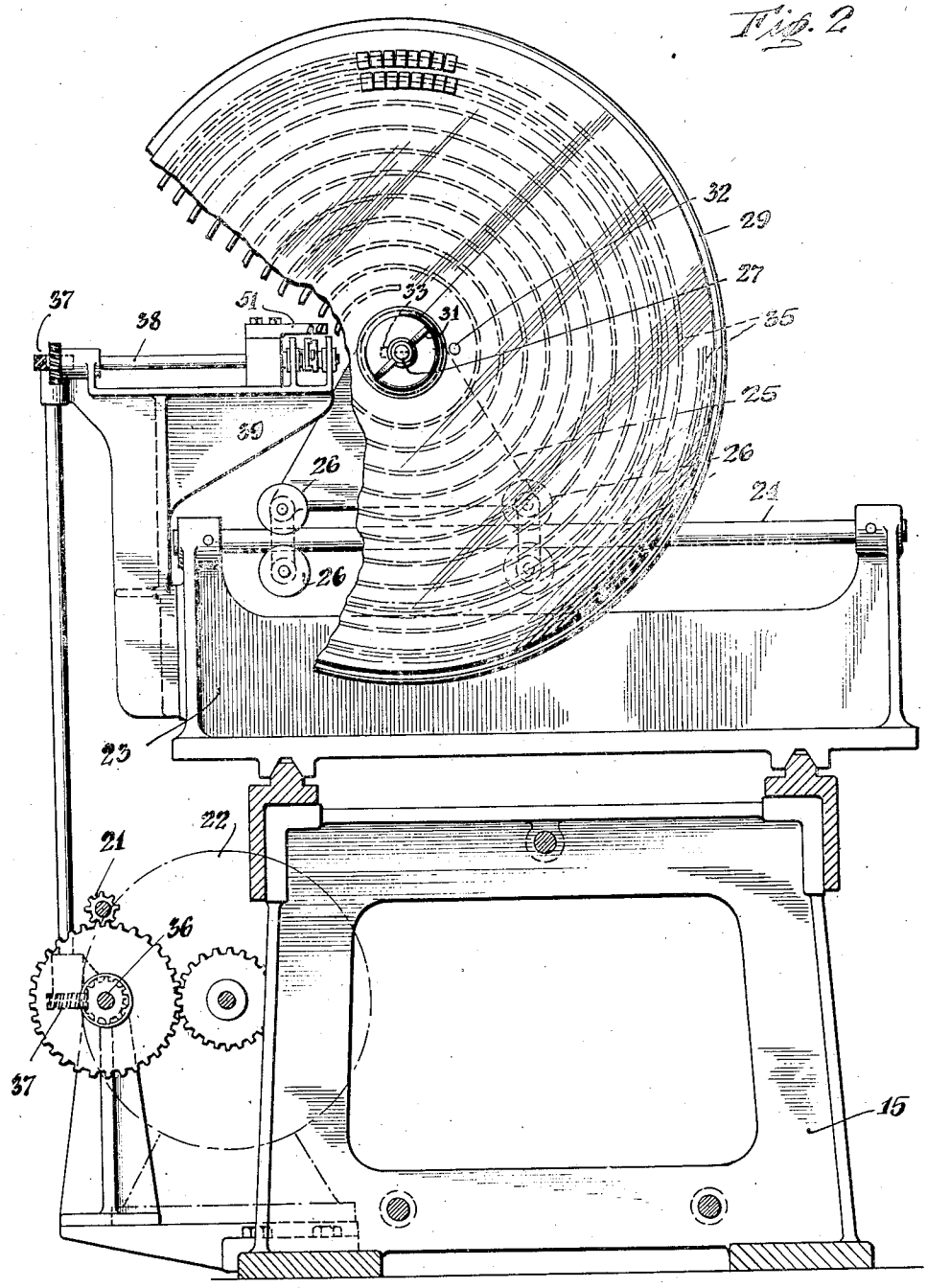
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Fig. 2



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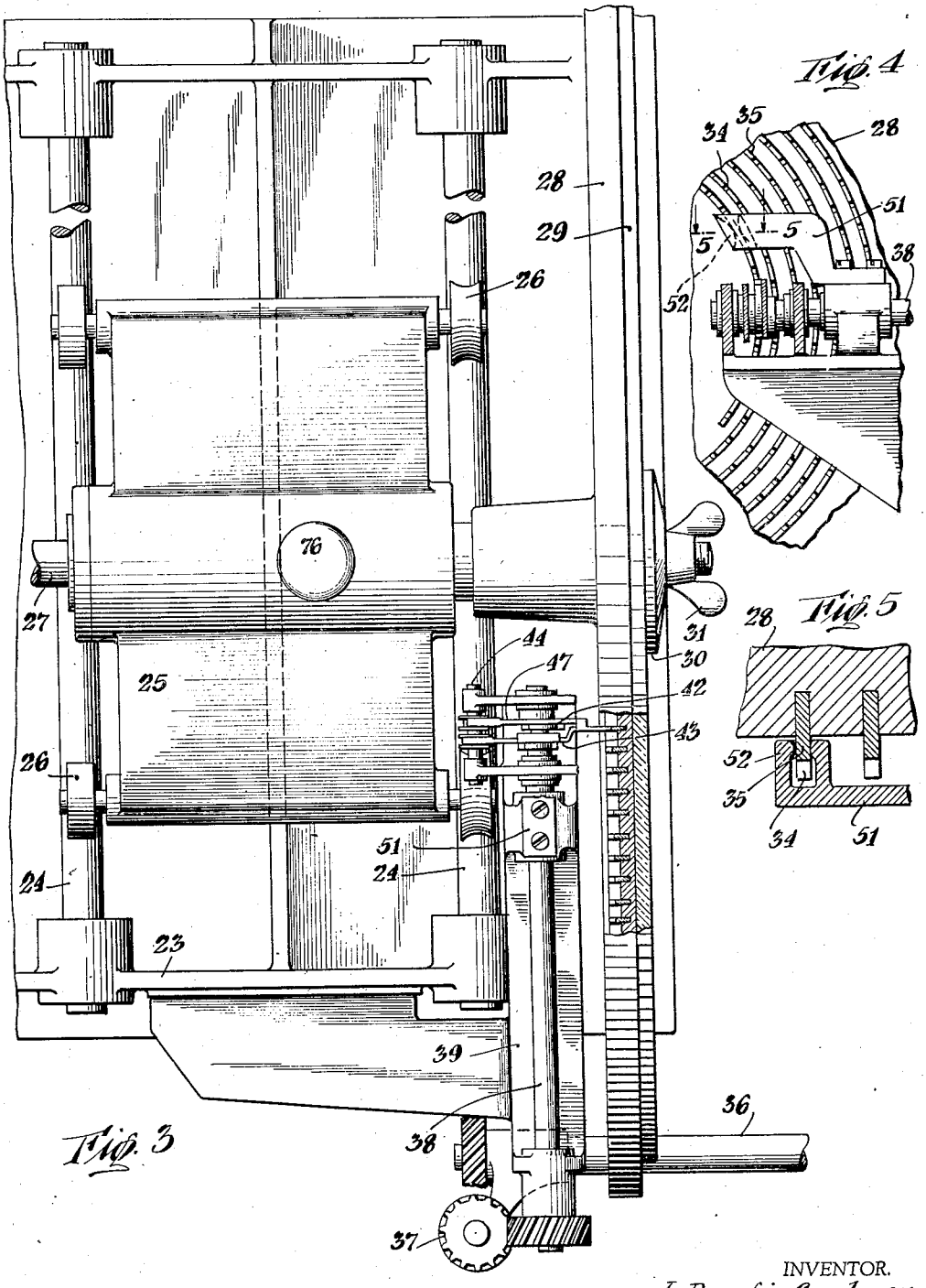


Fig. 3

Fig. 4

Fig. 5

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Fig. 6

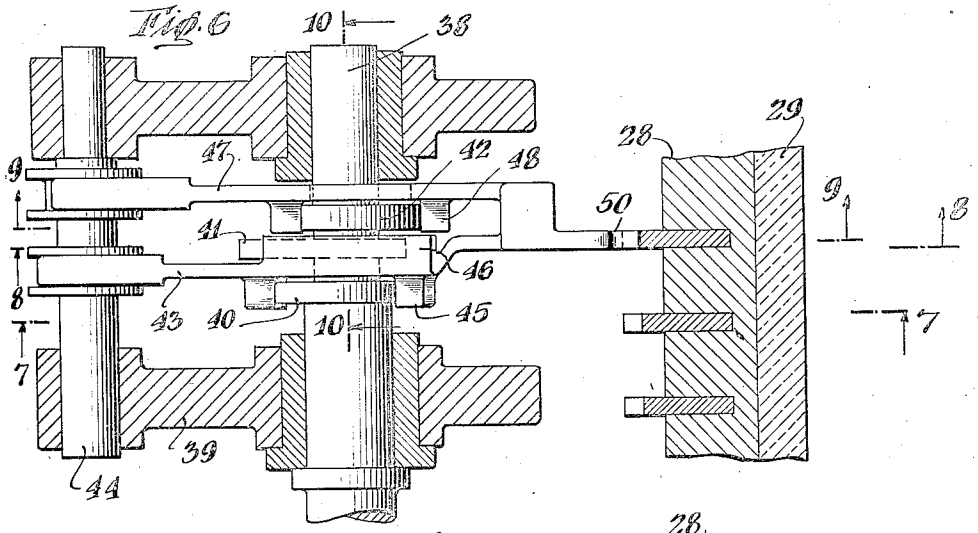


Fig. 7

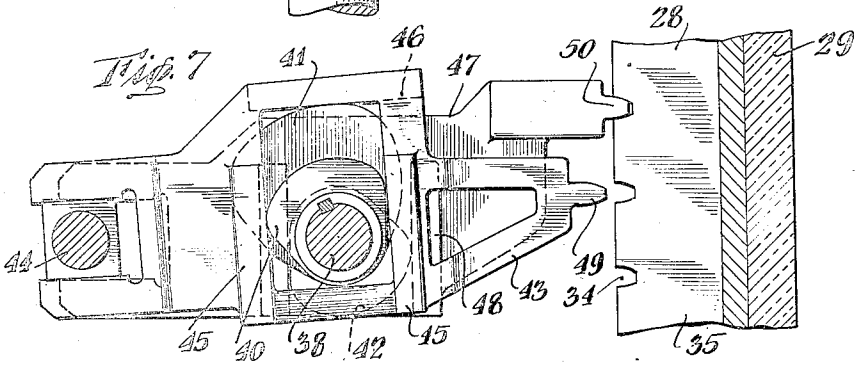


Fig. 8

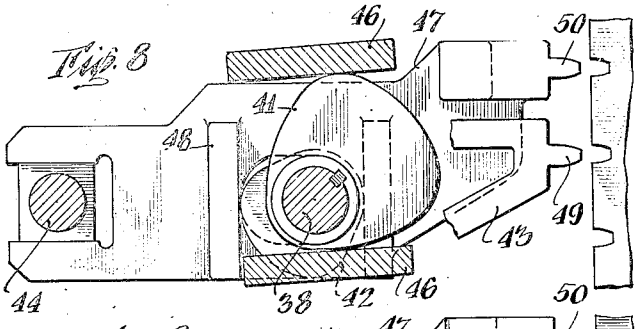


Fig. 10

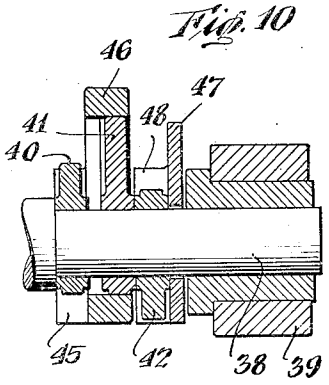
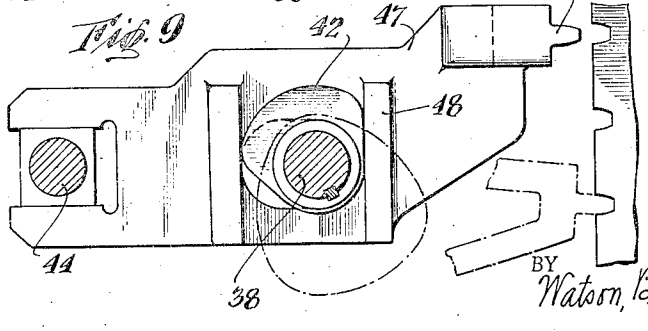


Fig. 9



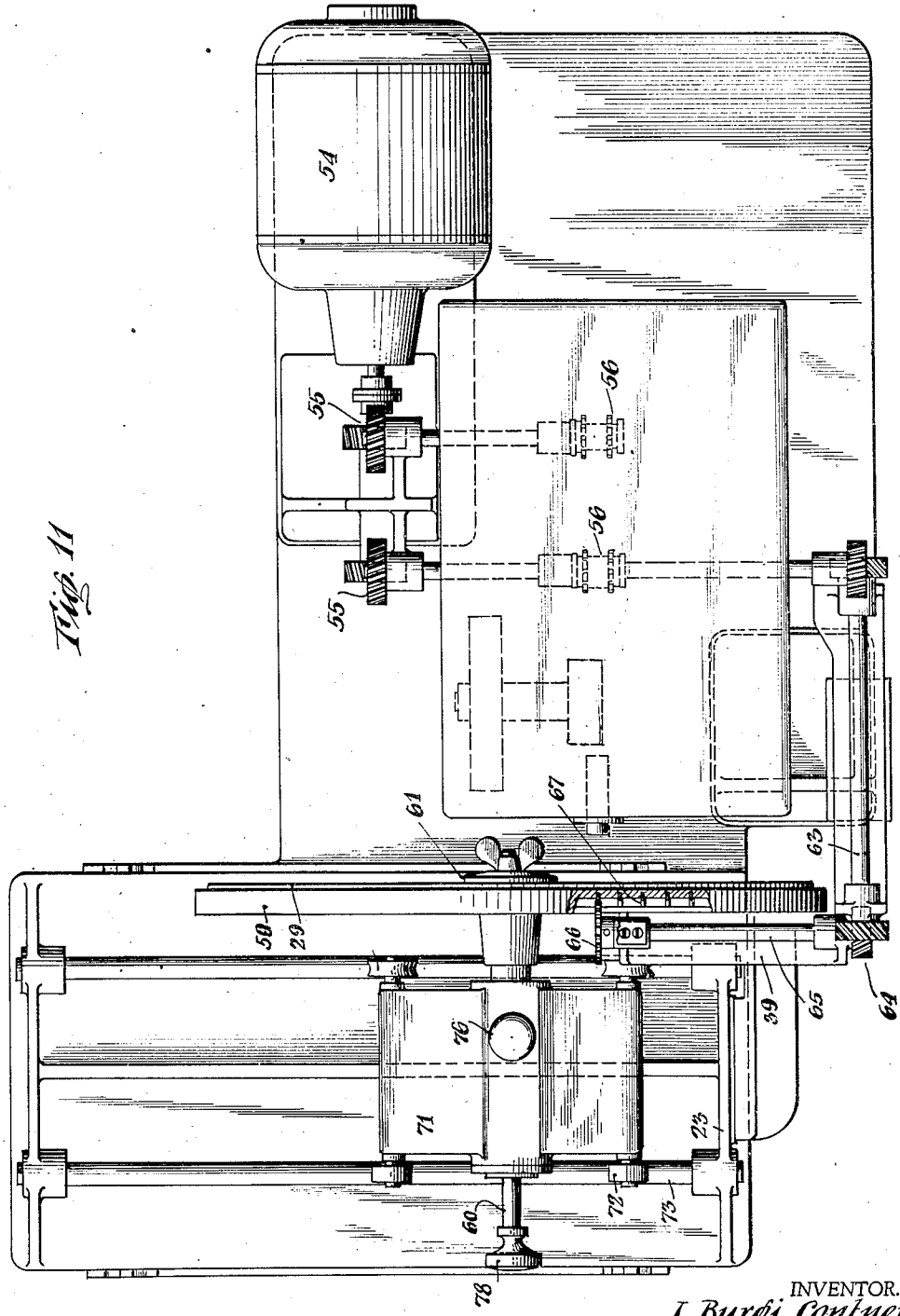
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Fig. 11



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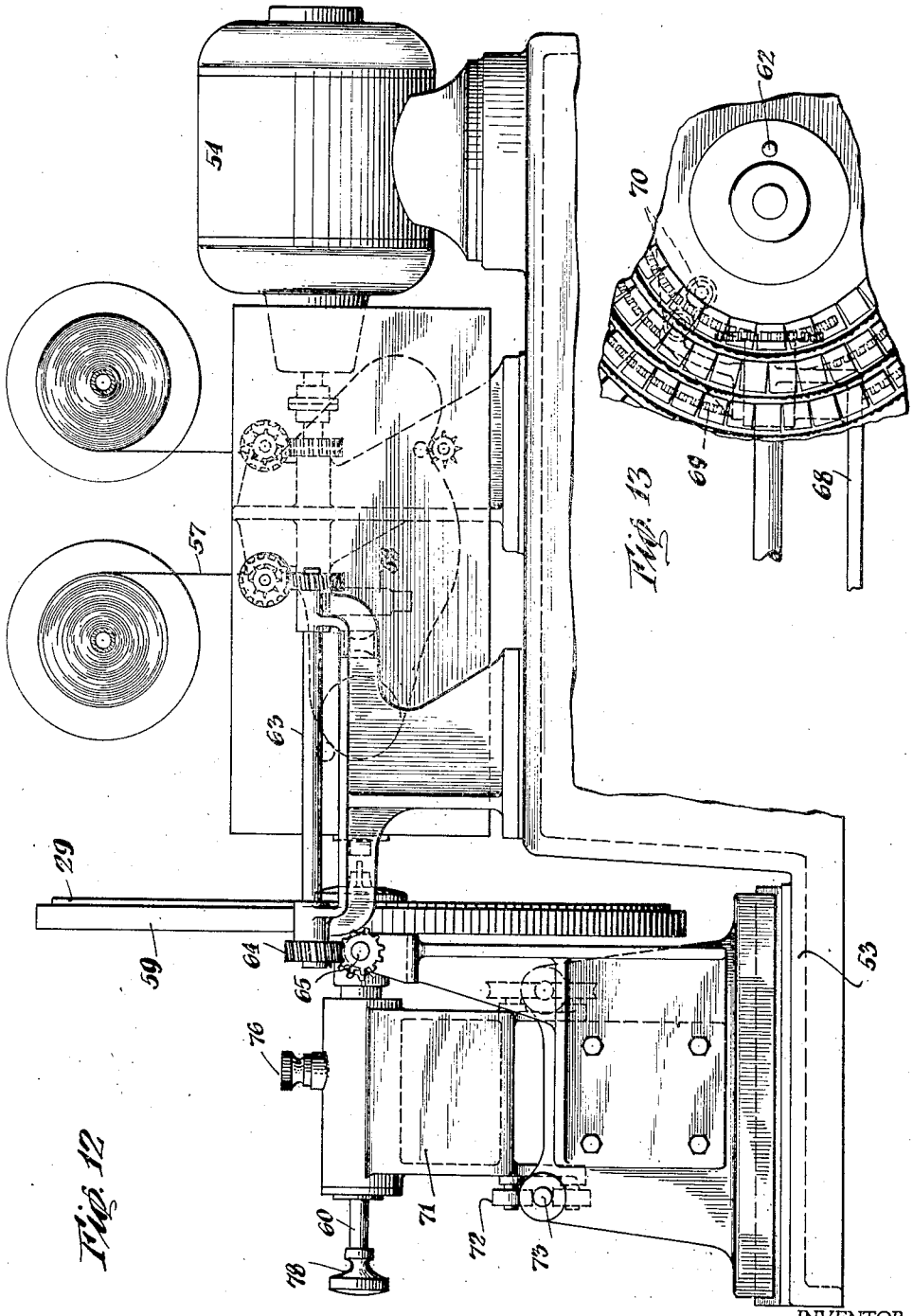


Fig. 12

Fig. 13

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Fig. 14

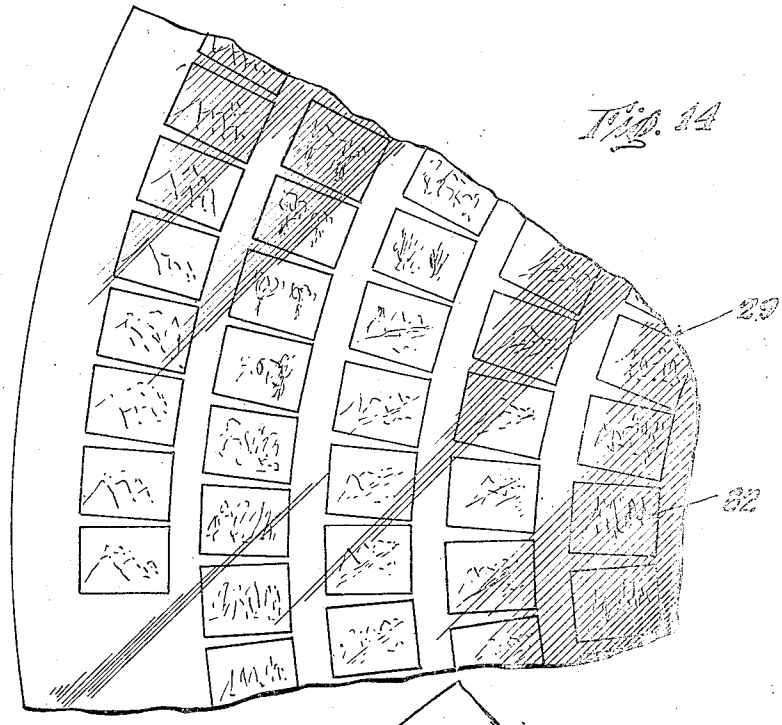
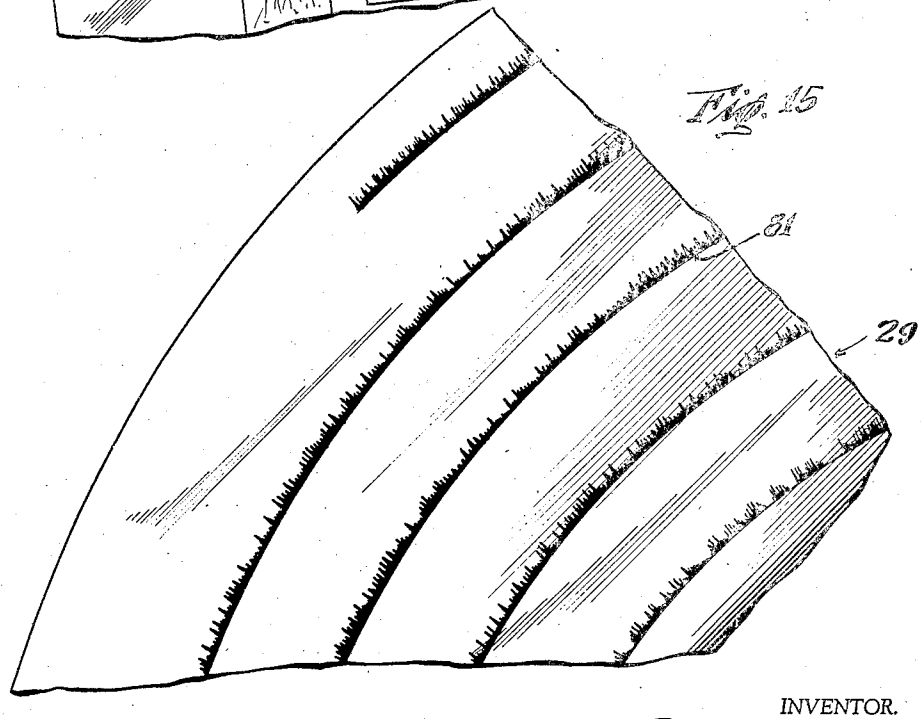


Fig. 15



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Fig. 16

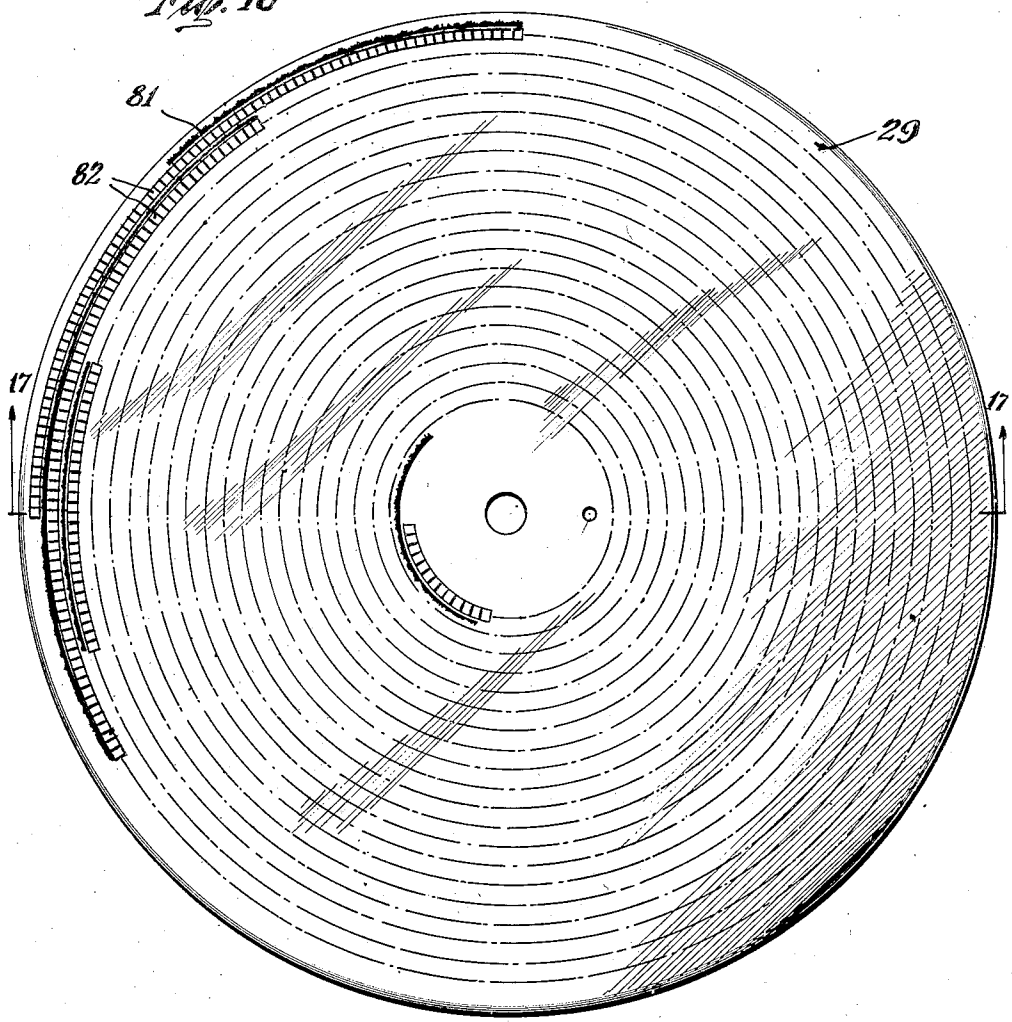
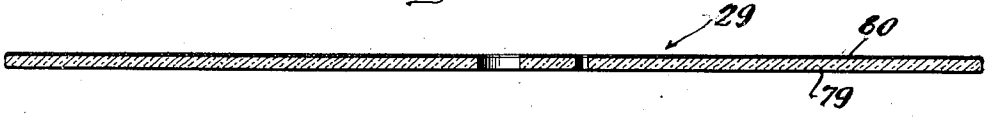


Fig. 17



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UNITED STATES PATENT OFFICE

2,412,252

PRINTING APPARATUS

J. Burgi Contner, New York, N. Y., assignor to Great American Industries, Inc., Meriden, Conn., a corporation of Delaware

Continuation of application Serial No. 399,069, June 21, 1941. This application March 27, 1944, Serial No. 528,274

1 Claim. (Cl. 88—24)

1

This invention relates to a structurally and functionally improved printing apparatus. In its more specific aspects, the invention contemplates a mechanism for the production of a record embodying functionally and structurally improved characteristics, said record being of primary utility when employed in association with automatic motion picture projecting and sound reproducing apparatus.

It is an object of the invention to provide a record which will be free from any inherent distortion and which may moreover, be handled without danger of injury; such record incorporating a series of successive photographic images which may be projected by a suitable light source to reproduce upon a screen or similar surface, a motion picture. Moreover by the present invention, a novel record will be produced which will also incorporate a sound reproducing feature such that while the photographic images are being projected, related sounds or sound effects may be reproduced by an apparatus associated with or forming a part of the visual projecting or reproducing mechanism.

A still further object is that of furnishing an apparatus of novel construction for printing composite sound and picture records; such apparatus being capable of use by persons having no especial skill and being virtually automatic in operation.

This application is a continuation of my presently co-pending application entitled "Printing method, apparatus and product," filed June 21, 1941, Serial No. 399,069.

With these and other objects in mind, reference is had to the attached sheets of drawings illustrating one practical embodiment of the invention and in which:

Fig. 1 is a somewhat diagrammatic side view showing a set-up of apparatus by means of which one step of the printing method may be practiced;

Fig. 2 is a transverse sectional view taken along the lines 2—2 and in the direction of the arrows as indicated in Fig. 1;

Fig. 3 is a somewhat enlarged plan view of one portion of the apparatus as shown in Figs. 1 and 2 and with certain of the parts broken away to disclose underlying construction;

Fig. 4 is a fragmentary rear view of part of the mechanism as illustrated especially in Fig. 3;

Fig. 5 is a transverse sectional view taken along the lines 5—5 and in the direction of the arrows as indicated in Fig. 4;

Fig. 6 is a sectional plan view showing in enlarged scale certain details of the feed mechanism;

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Figs. 7, 8 and 9 are transverse sectional views taken respectively along the lines 7—7, 8—8, and 9—9 and in the direction of the arrows as indicated in Fig. 6;

Fig. 10 is a longitudinal sectional view taken along the lines 10—10 and in the direction of the arrows as also indicated in Fig. 6;

Fig. 11 shows a lay-out of apparatus embodying the improved construction of the present invention and by means of which, a further step in the method of printing may be practised;

Fig. 12 is a side elevation of the mechanism as shown in Fig. 11;

Fig. 13 is a fragmentary face view of certain of the parts as shown in Fig. 12 and also illustrating the finished product which results from the use of a mechanism constructed in accordance with the teachings of the present invention and the practice of the method also herein taught;

Fig. 14 is a fragmentary face view of a portion of the record;

Fig. 15 is a similar view of a portion of a different record;

Fig. 16 is a face view of a complete record embodying photographic frames and a correlated sound track; and

Fig. 17 is a transverse sectional view taken along the lines 17—17 and in the direction of the arrows as indicated in Fig. 16.

It is primarily intended by means of the present invention to produce a photographic record such as may be employed in connection with a more or less automatic type of motion picture projector and sound reproducer as disclosed in my heretofore filed application, Serial Number 396,621, dated June 4, 1941, now Patent No. 2,346,472, issued April 11, 1944. As such, the record will include a body or base of transparent material (for example, a synthetic plastic) which presents upon its face a photographic emulsion embodying a series of frames or pictures to be projected by a motion picture apparatus; such frames being arranged in spiral form upon the body. The latter may conveniently be a disc. Also appearing on one of the faces of this body is a "sound track." While the latter may take numerous different forms, it conveniently should embrace a ribbon or band photographically impressed upon the plate and primarily intended for cooperation with a light sensitive or photoelectric cell and an amplifying apparatus, such

that sounds are reproduced as the record traverses the sound track.

It is also preferred that this sound track be arranged in spiral form upon the disc with its convolutions intervening the convolutions of the frames to be projected. As will be apparent from a reading of the following specification, the present apparatus and method permits of the production of a product which may vary in many respects from the particular construction just defined. Likewise, while it is preferred that the frames be primarily printed or provided on the disc and that only thereafter the sound track be provided, a reverse procedure might be followed. Accordingly, the following description is to be taken in an illustrative rather than in a limiting sense.

Thus, referring primarily to Figs. 1 and 2, the numeral 15 indicates a base or support. Disposed adjacent one end of the latter is a projection apparatus generally indicated at 16 and through which a film 17 is fed, by means of an intermittent mechanism enclosed within a housing 18. A light source 19 may serve to project the successive frames of the film 17 as the latter is shifted by means of the mechanism within the housing.

Such mechanism may conveniently be driven by means of a shaft 20 which has connection with a drive 21 coupled to a motor 22. The latter may be supported by the base 15. As will be seen from the foregoing, this mechanism is more or less conventional and may follow one of numerous different forms, all of which have been found to be satisfactory in connection with printing an exposure technique.

Adjacent the opposite end of the base or support 15, a frame 23 may be disposed. This frame mounts rail portions 24 extending transversely of the base and a carriage 25 is supported upon these rails. Such support should preferably be by means of anti-friction bearings (not shown) so that only minimum effort is necessary to cause the carriage to traverse the rails. As illustrated, the carriage may be supported on rollers 26 which extend both above as well as below the rails, thus assuring against any movement of the carriage upwardly or downwardly with respect to the rail portions.

The carriage 25 mounts a shaft 27. Again this mounting is preferably effected by furnishing anti-friction elements or bearings which will assure that only minimum power requirements will be necessary to effect rotation of the shaft. The end of the shaft extending towards the projector assembly may mount a plate 28. This plate serves as a support for the record disc or body 29. A detachment of one or both the plate and disc from the shaft may be permitted by employing a bearing member 30 beyond the record and which, by means of a readily detachable nut 31 or its equivalent, normally maintains the record against displacement with respect to the plate and also secures the latter against detachment from the shaft 27. Finally, with reference to this structure, it is to be observed that the plate 28 may carry a positioning pin 32 which extends through a corresponding aperture in the record 29 to assure that the parts assume a definite and predetermined relationship with respect to each other and that no relative movement of these parts may thereafter occur. Likewise as indicated in Fig. 2, the shaft 27 may be formed with a key 33 to enter a corresponding key-way provided as part of the plate 28, and to always assure a predetermined relationship of this plate with respect to the shaft.

Now with a view to providing means which will assure a rotation of the shaft 27, as well as a shifting of the carriage 25 with respect to the rails 24, attention is primarily directed to Figs. 4 to 10. As is apparent in these views, the plate 28 has associated with its rear face a drive rack comprising a series of spirally extending notches 34 which intervene teeth forming a part of a spirally extending rib 35 affixed to or associated with the rear face of the plate 28. These notches provide shoulders for engagement by intermittent feeder and locking means and are spaced a distance equivalent to one frame. However, it is obvious that the notches might be spaced a lesser distance by retiming the mechanism and also, that these notches instead of being formed in a rib might be otherwise developed as part of the plate 28. Extending from the motor 22 is a drive shaft 36 which by means of gearing 37 may transmit motion to a shaft 38 supported by a bracket portion 39 forming a part of the mounting 23. The shaft may operate an intermittent feeding and locking mechanism for the plate 28; the details of this mechanism are shown in Figs. 6 to 10.

In these views, the numerals 40, 41 and 42 indicate three cams affixed to shaft 38. A follower 43 has its inner end rockingly supported by a block on a shaft 44. This follower is provided with vertically extending rail portions 45 for cooperation with the cam 40 and horizontally extending rail portions 46 (as viewed in the present layout) which cooperate with the cam 41 to constitute a structure similar to a swinging-block linkage as shown. A follower 47 is also supported by a block on shaft 44 and extends adjacent the follower 43. Vertical rail portions 48 are associated with this follower and cooperate with cam 42 to provide a reciprocating structure with substantially all up and down or swinging movement restricted by the sides of an elongated slot 47*a* formed in follower 47 through which projects shaft 38 as shown in Figs. 6 and 9.

It follows that with the shaft 38 rotating, cams 40 and 41 will cooperate with the respective rail portions 45 and 46 of the follower 43 to shift the latter vertically and to also project and retract such follower along an axis substantially perpendicular to such shifting movement. The follower 47 will simply be projected inwardly and outwardly due to the drive provided by the cam 42.

The forward end of follower 43 terminates in a feeder tooth 49 which pursuant to the operation of cams 40 and 41, enters a notch 34, moves downwardly equal to the distance between successive notches to effect an angular rotation of plate 28 and record disc equal to the height of one picture frame, and disengages in position for cooperation with the succeeding notch 34.

The follower 47 terminates in a detent 50, illustratively a tooth, which cooperates with a preceding notch 34. Instead of a tooth 50, the detent could obviously comprise a braking surface which would engage with a surface of the rib 35 or a surface of the plate 28.

With the parts properly timed, they will function in the manner shown in Figs. 7, 8 and 9. In the first of these, the tooth 50 of follower 47 is extended into one of the notches 34. This tooth being merely capable of inward and outward movement (i. e. movements towards and away from the plate 28), it will accordingly simply function as a locking tooth. In other words, it

will prevent movement of the plate **28** as well as the disc **29** coupled therewith. With the parts in this position, the tooth **49** begins to project incident to the cam **40**. Just prior to such projection, tooth **50** will be retracted and the parts will accordingly assume the position shown in Fig. 8. Under continued movement of the shaft **38**, tooth **49** will enter the notch **34** adjacent thereto and thereupon cam **41** will cause the follower **43** to be shifted downwardly to correspondingly move the plate **28** and disc **29** a distance equal to the spacing of corresponding frame portions. This movement will continue until the parts have reached the position shown in Fig. 9. At that point and due to the cam **40**, the tooth **49** will begin to retract from the notch. Simultaneously, tooth **50** will begin its projecting movement towards the plate **28**. It follows that it will enter the adjacent notch **34**, so as to lock the plate against further movement as the follower **43** shifts to a position at which tooth **49** is wholly retracted and begins its upward movement to again establish the relationship of the parts, as shown in Fig. 7.

As a consequence, plate **28** and disc **29** will be fed intermittently. The amount of such feeding will correspond precisely to the relationship to be imparted to the photographic frames to appear on plate **29**. Now with the projector operating in synchronism with the plate feed and lock, it is obvious that the successive frames on the film **17**, will be projected by the light source onto the sensitized surface of the plate **29**. In such projection, the resultant frames may be larger than the frames appearing on the film **17**, they may be equally sized, or they may obviously be smaller. In any event, however, according to the spacing which is to be imparted to the frames and which will in turn depend upon the size of the latter, the feeding mechanism associated with the plate **28** will intermittently rotate the latter, so that successive portions of the disc **29** will be caused to define the field of projection developed by the light source **19** and film **17**.

The projection apparatus is so synchronized that rotation of the plate **28** and disc **29** occurs between the projection of successive photographic frames by the projector; the plate and disc are held against movement during the instant of projection.

Now with a view to having this series of frames upon the record or disc, define a spiral path, the carriage **25** must be shifted along the rails **24**. Of course, the projection source might be shifted sidewise, while the disc is simply rotated. However, in view of the mechanical difficulties in achieving such a result, it is preferred that the structure presently illustrated be resorted to and in which the projection axis remain fixed. Attention being directed to Figs. 4 and 5, it will be noted that a bracket portion **51** may be mounted on the bracket **39** adjacent the shaft **38** as shown. This bracket portion may conveniently carry contact shoes or riders **52**, which bear against opposite faces of the rib **35**. Thus, it is obvious that as shaft **38** rotates to intermittently rotate plate **28** and record **29**, it will also cause a sidewise shifting of these units, together with shaft **27** to correspondingly move carriage **25** with respect to the mounting **23**. Consequently, the series of exposed frames will be arranged in the form of a spiral upon the record **29**. This spiral series of frames will extend from any point desirably spaced from the edge of the disc to a point adjacent the center of the same. After this operation has been completed, the nut **31** or equivalent securing structure may be loosened. If desired, the plate **28** also may be dismounted from the shaft **27**. It is preferred however, that instead of dismounting the plate **28**, the parts be brought to the position shown in Fig. 8 or else by means of any suitable mechanism, these parts may be brought to positions at which they will completely clear one another. In such positions, it is apparent that plate **28**, may together with the carriage **25**, be shifted to a position at which it might again receive a record to be exposed. Thereafter, the operation of the parts as afore described might again be re-established.

One form of mechanism which may be employed has been shown in Fig. 1 in which it will be seen that the shaft **27** is provided with a knob **78** by means of which it may be manipulated. This shaft is also formed with grooves **75**. Projectable into these grooves is the end **77** of a retaining member **76**. Obviously, with the parts in the position shown, no longitudinal shifting of shaft **27** may occur. However, by simply loosening member **76**, the plate **28** may be shifted by correspondingly moving the shaft **27** in a manner such, that the driving mechanism will clear the rear face of the plate.

From the foregoing, it is apparent that a negative is produced (assuming the film **17** to be a positive) and which negative comprises a disc-like body free from distorting tendencies or characteristics, and upon the face of which, a series of succcessive photographic images are present. These images are arranged in spiral form extending conveniently from a point adjacent the periphery of the disc, to a point slightly spaced from the center thereof. Each of these frames or pictures is longitudinally spaced an equal distance from the other. Due to the spacing of the convolutions of the rib **35** or any equivalent feeding structure, the adjacent convolutions of the frames are displaced sidewise to an extent such, that adequate space intervenes to accommodate the sound-track. In this connection, it is to be borne in mind that it is preferred to arrange this sound-track so that it will be interposed between adjacent convolutions of frames.

Now with a view to providing an apparatus by means of which the sound-track will be applied or caused to be arranged on the face of the disc, attention is primarily invited to Figs. 11, 12 and 13. In these views, the numeral **53** indicates the base of a printing mechanism which may be motor driven as indicated at **54**. The motor by means of gearing **55** and sprockets **56**—or other equivalent feeding mechanism—serves to move a film **57** containing the sound track to be reproduced, past a projection field as defined by a lamp and lens assembly **58**. Such movement will be at a constant linear speed and the projected image will define the sound-track appearing upon the film **57**. The record **29** is supported upon a turntable or mounting disc **59** and the latter is mounted upon a shaft **60**. A clamping and wing-nut assembly **61** may retain the record against displacement with reference to the mounting disc **59** and the latter may also have a positioning pin **62** associated with it, so that the record disc may at all times be brought into predetermined relationship with respect to the mounting structure. Said predetermined relationship is such that the initial exposure of the record disc to the sound track projector is radially offset with respect to the photographic frames, whereupon a number of photographic frames may appear in

advance of the commencement of the sound track, as appears on the completed record shown in Fig. 16. Obviously, the sound track could lead the picture track, if desired. A drive 63 may extend beyond the film-strip moving mechanism and serve to rotate by means of gearing 64, a shaft 65. Affixed to the latter is a gear wheel 66, the teeth of which will mesh with notches or gear teeth 67 associated with or formed in the rear face of plate 59.

As shown especially in Fig. 13, shaft 65 may have support in a bracket 68 and the latter may be extended, as indicated at 69, to provide a pair of mountings disposed immediately beyond the gear 66. These mountings may support rollers 70 which are spaced a distance such, that they extend to either side of the rib or other structure which provides the teeth 67. It is obvious that if a different structure is employed, these rollers or their equivalents might suitably cooperate with such structure, to assure a sidewise movement of the disc as the latter is rotated.

In connection with such movement, it will be noted that shaft 60 is supported by a carriage 71 having rollers 72 which cooperate with rails 73 in a manner similar to the structure heretofore described in connection with Figs. 1 to 10 inclusive. This is again conceding that in the present unit of apparatus, it is preferred to have the light axis stationary and the record axis susceptible to sidewise displacement.

In any event it will be understood, that with an apparatus such as is shown in Figs. 11 to 13, the sound track appearing upon the film 57 or equivalent record will be photographically projected onto the face of the record 29. It will also be obvious that such sound-track will be interposed between the convolutions of the spirally arranged series of frames. Accordingly, in a projection apparatus employing a record corresponding to the record 29, it will be feasible to dispose the sound "pick-up" to one side of the projection axis of the optical system for the frames.

Also, as indicated in Figs. 11 and 12, a structure similar to that afore described in connection with Figs. 1 to 10 may be employed. In other words, the shaft 60 may be longitudinally shiftable by releasing a retaining member 76 and manipulating the knob 78. As a consequence of such shifting, the drive mechanism will be uncoupled and any desired position of the parts may be readily established.

From the foregoing, it will be appreciated that a negative record is produced by a method which includes an intermittent movement of the record to provide a successive series of spirally arranged frames upon the face of the same. Each of these frames will correspond precisely to the frame which is being projected from a film or other source in that the latter together with the record, will be in stationary condition during the instant of exposure. Also, a sound track is produced as part of the record and this track is also arranged in spiral form and preferably has its convolutions intervening the convolutions of the frames. Again it is obvious that the sound track will be faithfully reproduced due to the fact that the movements of the record and the film, or equivalent member presenting the sound track, are completely synchronized and the exposing light

source or ray is directed merely at one precise point of the disc. After the foregoing operation has been completed, it is of course obvious, that a "master" record is provided in the form of a negative. By disposing this record adjacent similar records and exposing the same to light, any number of positives may be produced by contact photographic printing. Each one of these positives may be subjected to rough handling without injury and may also be stored for long periods of time without any damage.

The record has been clearly shown in Figs. 14 to 17 inclusive. This record is generally indicated at 29 as in the preceding views. It includes a relatively rigid body 79 formed of any suitable and transparent material. A layer of light sensitive material 80 is applied to the face of body 79. Upon the completion of the steps of the method resulting in the photographic frame appearing upon the record, a body such as is shown in Fig. 14 results and in which the frames have been indicated at 82. Upon the completion of the steps involving the application of the sound-track, a record such as illustrated in Fig. 15 is presented. As will be seen, this record as well as the record as shown in Fig. 14 have their indicia appearing in the form of spiral convolutions; the sound-track having been indicated at 81 in the latter figure.

Where both the sound-track and the frames appear on the same disc—as is preferably the case—a complete record results as in Figs. 16 and 17. In these views, it will be observed that the convolutions of the sound-track and frame have been shown as intervening each other and with the initial convolutions having their entrance portions slightly displaced with respect to each other.

From the foregoing it will be appreciated that among others, the objects of the invention as specifically aforenoted are achieved. Obviously numerous changes in the steps of the method, the structure of the apparatus and the resultant product might be resorted to without departing from the spirit of the invention as defined by the claim.

I claim:

A printing apparatus including in combination guiding means, a carriage mounted for movement along said means, a transversely extending shaft rotatably supported by said carriage, a rigid plate secured to said shaft in advance of said carriage, a record, means for mounting said record in contact with the outer face of said plate and against movement with respect to the same, a light source, means to receive and shift in operative association with said source an image-carrying member and whereby a light image may be projected towards said record and plate, driving means extending spirally from the rear face of said plate and formed with a series of notches, means connected to said driving means and extendable into the notches defined by said rib to rotate said plate, and further guide means movable with respect to said carriage and engaging said rib whereby as said plate rotates said carriage shaft, plate and record will be shifted laterally.

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