

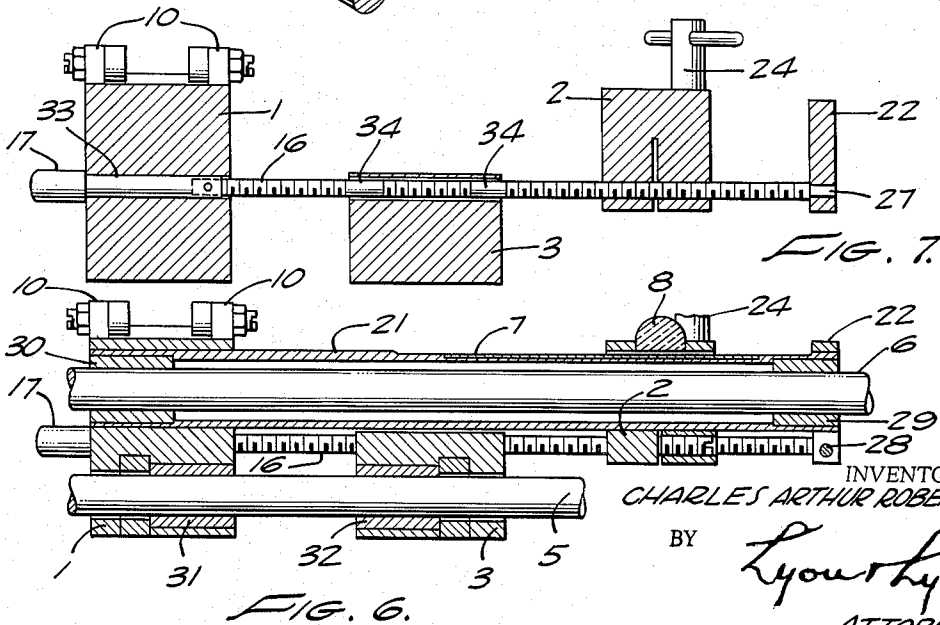
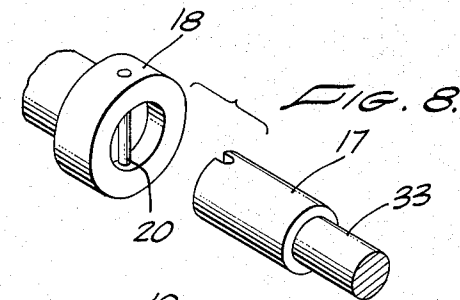
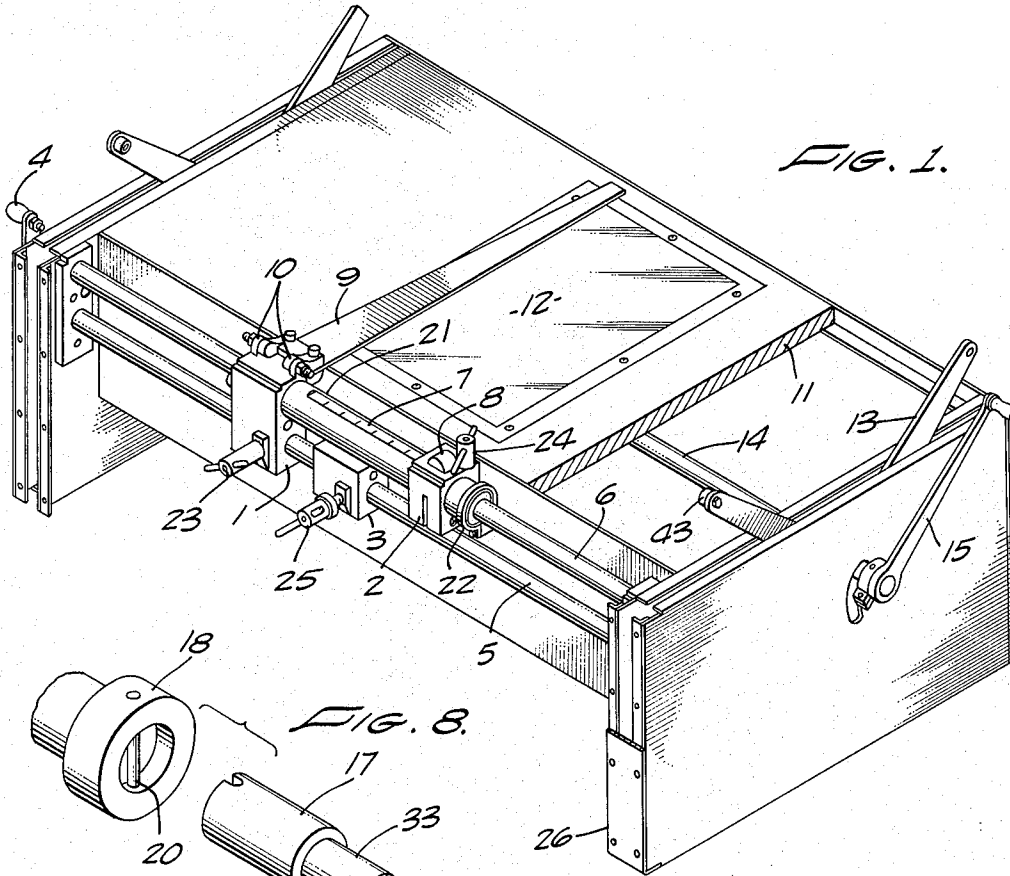
March 22, 1966

C. A. ROBERTSON
STEP AND REPEAT PRINTER

3,241,472

Filed Aug. 30, 1962

3 Sheets-Sheet 1



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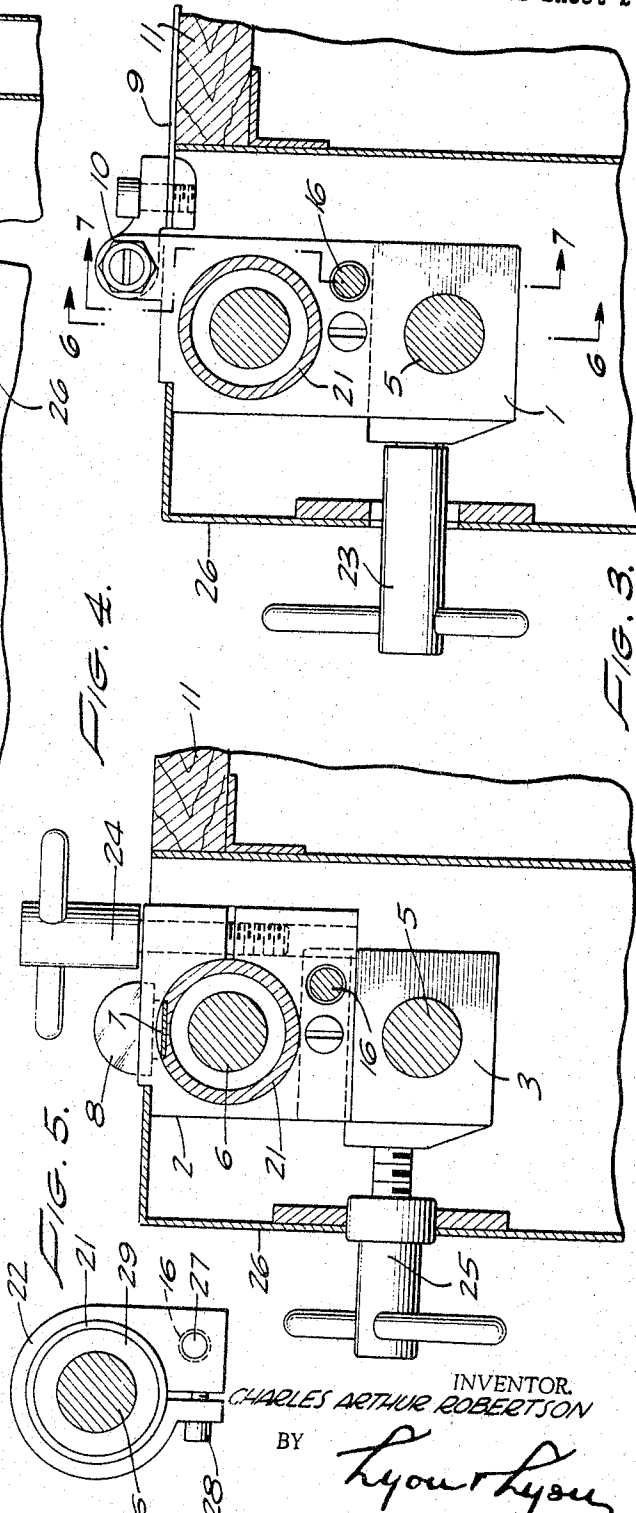
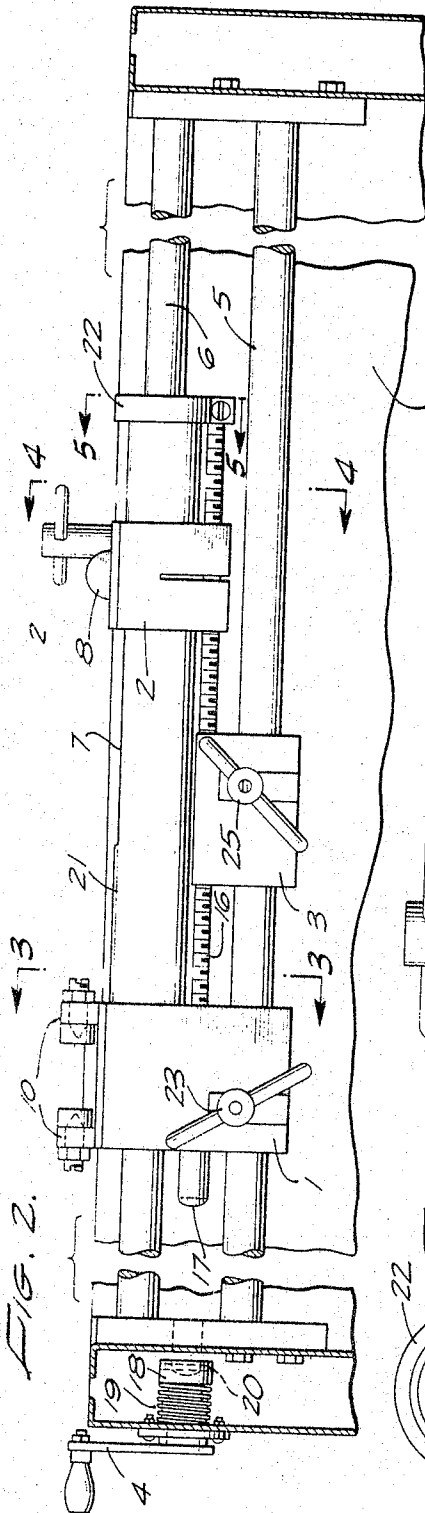
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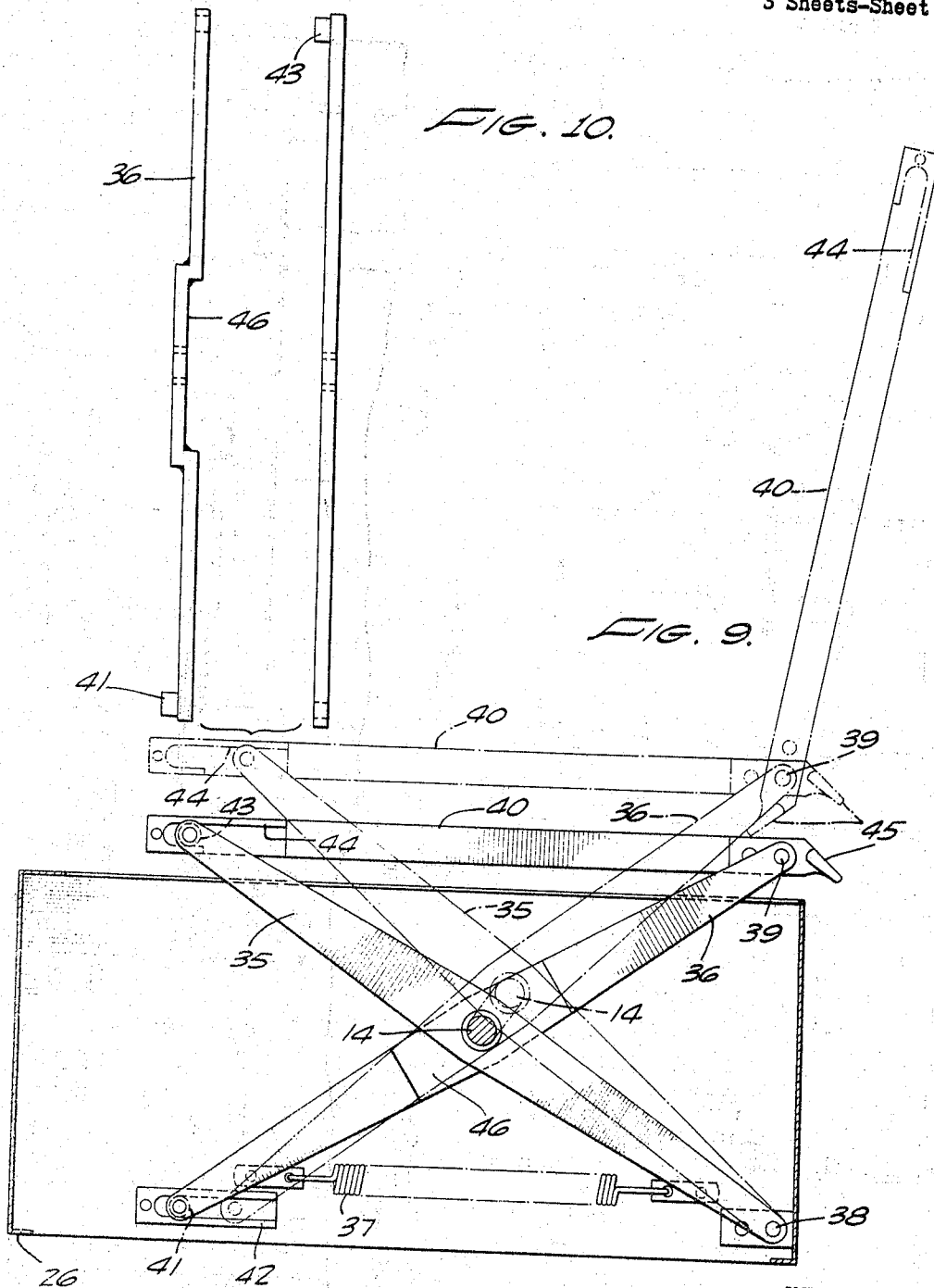
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3 Sheets-Sheet 3



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3,241,472

STEP AND REPEAT PRINTER

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13 Claims. (Cl. 95—73)

The present invention relates to a device for producing a photographic film or print containing multiple images from a single original film or print image. This is accomplished by repeatedly exposing the same image on a strip of film, the film being moved after each exposure in order that unexposed film will be used for each successive exposure. The present invention also relates to a novel light source for printing or producing photographic film and to a novel arrangement for raising and lowering the lid on a printing device.

One of the principal difficulties experienced by prior workers in their attempts to devise a satisfactory step and repeat printer has been that of combining accurate and consistent stepping with simplicity of structure and operation. Thus, in those cases where great accuracy has been required, the step and repeat printers of the prior art have been relatively complicated and have often been undesirably sensitive to the minor vibrations that are an inevitable part of the operation of such devices. The present invention obviates these difficulties.

Another desirable feature of printing devices not found in the great majority of prior art devices is uniformity of light emitted by the light source. This has been, of course, because the great majority of prior art devices use point or linear light sources. One of the advantages of the present invention is that the area light source used permits substantially uniform lighting, as well as having an exceptionally long life and substantially no tendency to generate heat.

Still another difficulty found in many prior art printing devices is the tendency of the lid of the printing device to move the film when the lid is being removed from contact with the film. This is because many of the prior art printing devices have lids which have a lateral, as well as vertical, component of motion. This sliding motion relative to the film often causes discrepancies even in those devices which have accurate stepping assemblies. The device of the present invention substantially prevents such discrepancies from occurring.

One of the principal objects of the present invention is to provide a step and repeat printer which is both simple in construction and capable of accurate and consistent stepping.

Another object of the present invention is to provide a step and repeat printer which has a uniform light source, which light source generates substantially no heat and has exceptionally long life.

A further object of the present invention is to provide a step and repeat printer which has a lid raising mechanism which substantially prevents movement of the film when the lid is raised.

Other objects and advantages of this invention, it is believed, will be readily apparent from the following detailed description of the preferred embodiments thereof when read in connection with the accompanying drawings.

In the drawings:

FIGURE 1 illustrates the step and repeat printer of the invention pictorially.

FIGURE 2 is a front view of the step and repeat mechanism of the present invention.

FIGURE 3 is a transverse cross-section of a portion of the step and repeat mechanism.

FIGURE 4 is a cross-section of another portion of the step and repeat mechanism.

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FIGURE 5 is a partial end view of the step and repeat mechanism.

FIGURE 6 is a longitudinal cross-section of a portion of the step and repeat mechanism.

FIGURE 7 is a partial longitudinal cross-section of the step and repeat mechanism.

FIGURE 8 is an exploded view of the portions of the device of the present invention which may be engaged to set the stepping mechanism.

FIGURE 9 is an end view of the lid raising mechanism of the present invention.

FIGURE 10 illustrates, in side view, the arms of the lid raising mechanism.

Briefly, the present invention comprises a step and repeat printer having a step and repeat mechanism comprising a pair of slide rods, three adjustable sliding elements, a disengageable setting mechanism for one of the slide elements and locking means for each of the slide elements. The present invention also includes an electroluminescent light source and a scissor-jack mechanism for raising and lowering the lid of the step and repeat printer.

Referring now to the drawings, FIGURE 1 illustrates the significant elements of the present invention in pictorial view. As illustrated in this figure, the step and repeat mechanism comprises line-up bar lock 1, step lock 2, step slide 3 and step set handle 4. These elements are slidably mounted on rods 5 and 6. Also mounted on rod 6 is scale 7. A magnifier 8 is mounted on step lock 2. Line up bar 9 is pivotally mounted on hinges 10 which are mounted on line up bar lock 1.

Adjacent to the step and repeat mechanism is mounting surface 11 which supports light source 12. The lid raising mechanism indicated generally by numeral 13 is mounted on axle 14 which is located beneath mounting surface 11. Also mounted on axle 14 is control handle 15, which functions to raise and lower the lid (not shown).

The step and repeat mechanism is shown in somewhat more detail in FIGURE 2. In this figure, step set screw 16 and the grooved member 17 mounted at the end thereof are illustrated. Grooved member 17 is adapted to engage pin 20 which is mounted in collar 18. Spring 19 is held under compression by collar 18.

Scale 7 (not shown) is mounted in tube 21. Tube 21 is integrally mounted between line-up bar lock 1 and collar 22. Step lock 2 is slidably mounted on tube 21. Step lock 2 is threadedly mounted on screw 16, while step slide 3 and line-up bar lock 1 are not threadedly engaged by screw 16. Screw 16 is, however, free to rotate within members 1 and 3 and collar 22. Members 1, 2, and 3 are provided with locking members 23, 24 and 25, respectively.

FIGURE 3 is a transverse cross-section taken on line 3—3 of FIGURE 2, while FIGURE 4 is a transverse cross-section taken on line 4—4 of FIGURE 2. These figures illustrate the same elements as those illustrated in FIGURES 1 and 2, with the addition that outer casing 26 is illustrated.

FIGURE 5 is an end view, taken on line 5—5 of FIGURE 2, of collar 22. As shown in this figure, collar 22 is a resilient member which is compressed by screw 28 against washer 29, tube 21 and rod 6.

FIGURE 6 is a longitudinal cross-section taken on line 6—6 of FIGURE 3. This figure illustrates essentially the same elements as those illustrated in FIGURE 2 with the addition of collars 30, 31 and 32. These collars serve as bearing means and are slidably mounted on the rods which they surround.

FIGURE 7 is a longitudinal cross-section taken on line 7—7 of FIGURE 3. This figure illustrates in detail the relation of screw 16 to the remaining elements of the step mechanism. As shown in this figure, screw 16 is

attached to element 17 through cylindrical member 33, with cylindrical element 33 free to rotate within line-up bar lock 1. Step slide 3 is provided with collars 34 which do not threadedly engage screw 16 and permit step slide 3 to slide freely on screw 16.

FIGURE 8 illustrates in detail the relation of grooved element 17, collar 18 and pin 20.

FIGURE 9 illustrates the lid raising mechanism indicated generally by numeral 13 in FIGURE 1. This mechanism comprises arms 35 and 36 which are mounted on axle 14. Arm 35 is rigidly mounted on axle 14 while arm 36 is mounted such that it is free to rotate. Arm 35 is also pivotally mounted on pin 38 while arm 36 is also pivotally mounted on pin 39 which is attached to lid 40. Arms 35 and 36 are also connected by extension spring 37. Arms 35 and 36 are provided with rollers 41 and 43 which are adapted to ride in grooves 42 and 44, respectively. Lid 40 is provided with stop member 45.

FIGURE 10 illustrates arms 35 and 36 in greater detail. As clearly shown in this figure, arm 35 is planar while arm 36 is provided with recessed portion 46.

In order to put the step and repeat printer of the present invention into operation, the line-up bar lock 1, the step lock 2, and the step slide 3 are unlocked. The carriage comprising these elements is then moved along rods 5 and 6 to a position adjacent step set handle 4 such that grooved element 17 engages pin 20. Line-up bar lock 1 is then locked by turning locking member 23. Step set handle 4 is then rotated, which in turn causes screw 16 to rotate, thereby setting step lock 2 at the desired dimension as indicated on scale 7 which may be read through magnifier 8. Step lock 2 is then locked by turning locking element 24. At this stage of operation, the stepping mechanism is set to reproduce the desired dimension.

The next operation is that of positioning the film which is to be stepped. The film is first positioned in the center of light source 12. Line-up bar lock 1 is then unlocked and line-up bar 9 is moved to the film. The film is then lined up with line-up bar 9. The film is then taped down on the light source 12 with the emulsion dull side on the film up. The area of the light source on either side of the film is then masked off.

The unexposed film which is to be exposed is then attached to the step and repeat printer. In order to do this, the line-up bar lock 1 is first unlocked and line-up bar 9 is moved a short distance, on the order of $\frac{1}{2}$ inch, away from the edge of the film already attached to light source 12. The line-up bar lock 1 is then locked. A strip of unexposed film which is, of course, relatively long and slightly wider as compared to the film already attached to the light source area 12 is then selected. The narrow dimension of this film is then taped, or otherwise attached, to line-up bar 9 with the emulsion side down. The device is now ready to perform the actual stepping and printing.

Referring now to FIGURE 9, lid 40 is first lowered until it engages roller 43. Step slide 3 is then moved such that it is in abutting relation with line-up bar lock 1 and locked in this position. Lid 40 is then lowered to the printing position by turning control handle 15. Light source 12 is then illuminated by any conventional means, e.g., a switch, and illumination continued for the time necessary to expose the unexposed film. The illumination of the light source 12 is then terminated and the film is ready to be stepped.

In order to step the film, lid 40 is first raised by turning control handle 15, but the lid is not raised further. The line-up bar lock 1 is then unlocked and the line-up bar 9 is moved as far away from step slide 3 as is possible, i.e., until step slide 3 comes into abutting relation with step lock 2. This will, of course, move the unexposed film through the predetermined distance indicated on scale 7. The unexposed film is now in printing position. Lid 40 is then lowered and light source 12 is illuminated, thereby making a second exposure next to the

first exposure. This procedure may then be repeated until the desired number of prints have been obtained.

The operation of the lid raising mechanism indicated generally by numeral 13 in FIGURE 1 is best understood by reference to FIGURES 9 and 10. As previously described, arm 35 is rigidly attached to axle 14 whereas arm 36 is free to rotate on axle 14. Furthermore, arm 35 is planar while arm 36 is provided with recessed portion 46. The arms are assembled such that the concave portion of recess 46 is adjacent arm 35.

When the lid is to be raised, axle 14 is caused to move through an arc around pin 38 in a clockwise direction. This causes arm 35 to move in an upward direction and also permits spring 37, which is under tension when lid 40 is at its lowermost position, to cause roller 41 to move through groove 42. When roller 41 moves through groove 42, arm 36 pivots around axle 14 and pin 39. Roller 43 is likewise caused to move through groove 44. Thus, arms 35 and 36 are angularly displaced, but the only component of motion imparted to lid 40 is a vertical upward movement. Lid 40 may, of course, be further rotated about pin 39 such that stop member 45 is brought into contact with arm 36. This permits unrestricted access to the light source area. Obviously, the lid may be lowered merely by reversing the operations previously described.

One of the important features of this invention is the use of an electroluminescent light source. Any of the well known electroluminescent devices which are readily available may be used. For example, the device disclosed in U.S. Patent No. 2,894,854 could be used. For ordinary printing operations, it has been found that electroluminescent devices energized by one ampere at 110 volts, 60 cycles A.C. give satisfactory results. The uniformity of illumination possible with electroluminescent devices makes them distinctly superior to the conventional point or linear light sources. Furthermore, the electroluminescent devices have exceptionally long life and generate substantially no heat.

It will be obvious to those skilled in the art that the step and repeat printer of the present invention has many uses and is adaptable to almost any multiple printing operation. Furthermore, it will be obvious to those skilled in the art that the cumulative effect of the many novel and inventive features of the present invention produces an unexpectedly superior product.

Still further, it will be readily apparent to those skilled in the art that the present invention may be modified in various ways without departing from the scope thereof. For example, the underside of lid 40 may be provided with a foam rubber or other resilient coating to prevent the lid from damaging the film or light source.

Having fully described the present invention, it is to be understood that it is not to be limited to the details thereof, but is of the full scope of the appended claims.

I claim:

1. A step and repeat printer comprising an electroluminescent light source mounted in a planar work surface; a stepping mechanism mounted next to one edge of said work surface, said stepping mechanism comprising a pair of parallel rods, a first member adapted to slide upon a first one of said rods, a second member adapted to slide upon said first rod, a tubular member rigidly connected to said first member and adapted to slide upon the second one of said rods, a third member adapted to slide upon said tubular member, said second member being mounted between said first member and said third member, said first, second and third members being so dimensioned that the range of movement of said second member is limited by said first member and said third member, a threaded member in threaded connection with said third member, said threaded member being adapted to rotate freely in said first and second members, a first engageable member attached to one end

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of said threaded member, a second engageable member, means for rotating said second engageable member and means for locking said first, second, and third members; a lid; and means for raising and lowering said lid, said raising and lowering means comprising an axle, a first arm and a second arm mounted on said axle, said first arm being rigidly mounted and said second arm being free to rotate, one end of said first arm slidably engaging said lid and one end of said second arm pivotally engaging said lid, the other end of said first arm being pivotally mounted and the other end of said second arm being slidably mounted, a spring connecting said other ends of said first arm and said second arm, and means for causing said axle to move through an arc, said arc having its center at the pivotal mounting of said first arm.

2. The printer of claim 1 wherein said tubular member is provided with a scale.

3. The printer of claim 2 wherein said third member is provided with a magnifying means.

4. The printer of claim 1 wherein said first member is provided with a pivotally mounted bar.

5. The printer of claim 1 wherein said first end of said first arm and said other end of said second arm are provided with rollers.

6. The printer of claim 1 wherein said first engageable member comprises a grooved member and said second engageable member comprises a collar having a pin therein.

7. A stepping mechanism comprising a pair of parallel rods, a first member adapted to slide upon a first one of said rods, a second member adapted to slide upon said first rod, a tubular member rigidly connected to said first member and adapted to slide upon the second one of said rods, a third member adapted to slide upon said tubular member, said second member being mounted between said first member and said third member, said first, second and third members being so dimensioned that the range of movement of said second member is limited by said first member and said third member, a threaded member in threaded connection with said third member, said threaded member being adapted to rotate freely in said first and said second members, a first engageable member attached to one end of said threaded member, a second engageable member, means for rotating said second engageable member and means for locking said first, second, and third members.

8. The mechanism of claim 7 wherein said tubular member is provided with a scale.

9. The mechanism of claim 8 wherein said third member is provided with a magnifying means.

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10. The mechanism of claim 7 wherein said first member is provided with a pivotally mounted bar.

11. The mechanism of claim 7 wherein said first engageable member comprises a grooved member and said second engageable member comprises a collar having a pin therein.

12. A step and repeat printer comprising a light source mounted in a planar work surface; a stepping mechanism spaced from and mounted along one edge of said work surface, said stepping mechanism comprising a pair of parallel rods, a first member adapted to slide upon a first one of said rods, a second member adapted to slide upon said first rod, a tubular member rigidly connected to said first member and adapted to slide upon the second one of said rods, a third member adapted to slide upon said tubular member, said second member being mounted between said first member and said third member, said first, second and third members being so dimensioned that the range of movement of said second member is limited by said first member and said second member, a threaded member in threaded connection with said third member, said threaded member being adapted to rotate freely in said first and second members, an engageable member attached to one end of said threaded member, the other end of said threaded member being attached to said tubular member and means for locking said first, second and third members.

13. The step and repeat printer of claim 12 wherein said light source is an electroluminescent light source.

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EVON C. BLUNK, *Primary Examiner*.