Aug. 16, 1949. V. E. PRATT ET AL 2,478,980

PHOTOGRAPHIC PROJECTING, ENLARGING, COPYING, AND CONTACT PRINTING DEVICE

Filed July 29, 1944

3 Sheets-Sheet 1

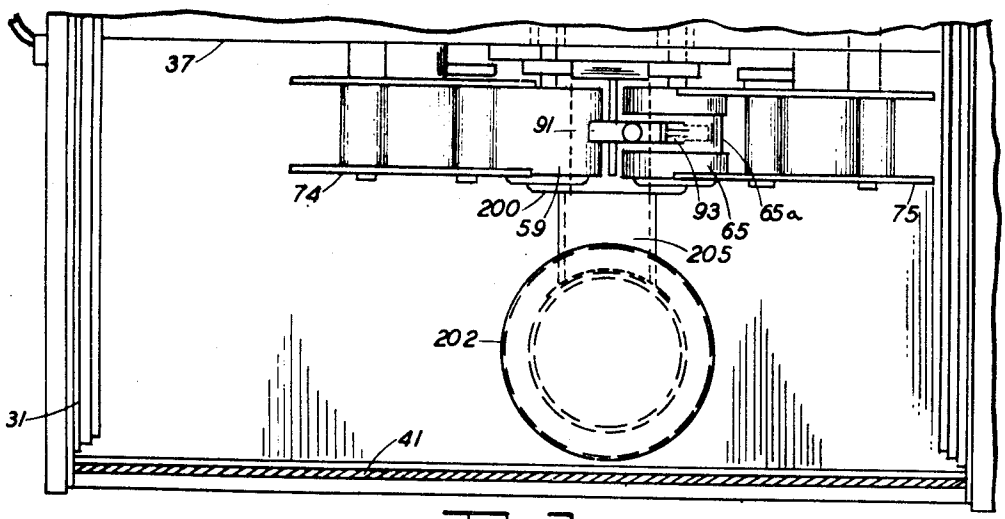

Fig 2

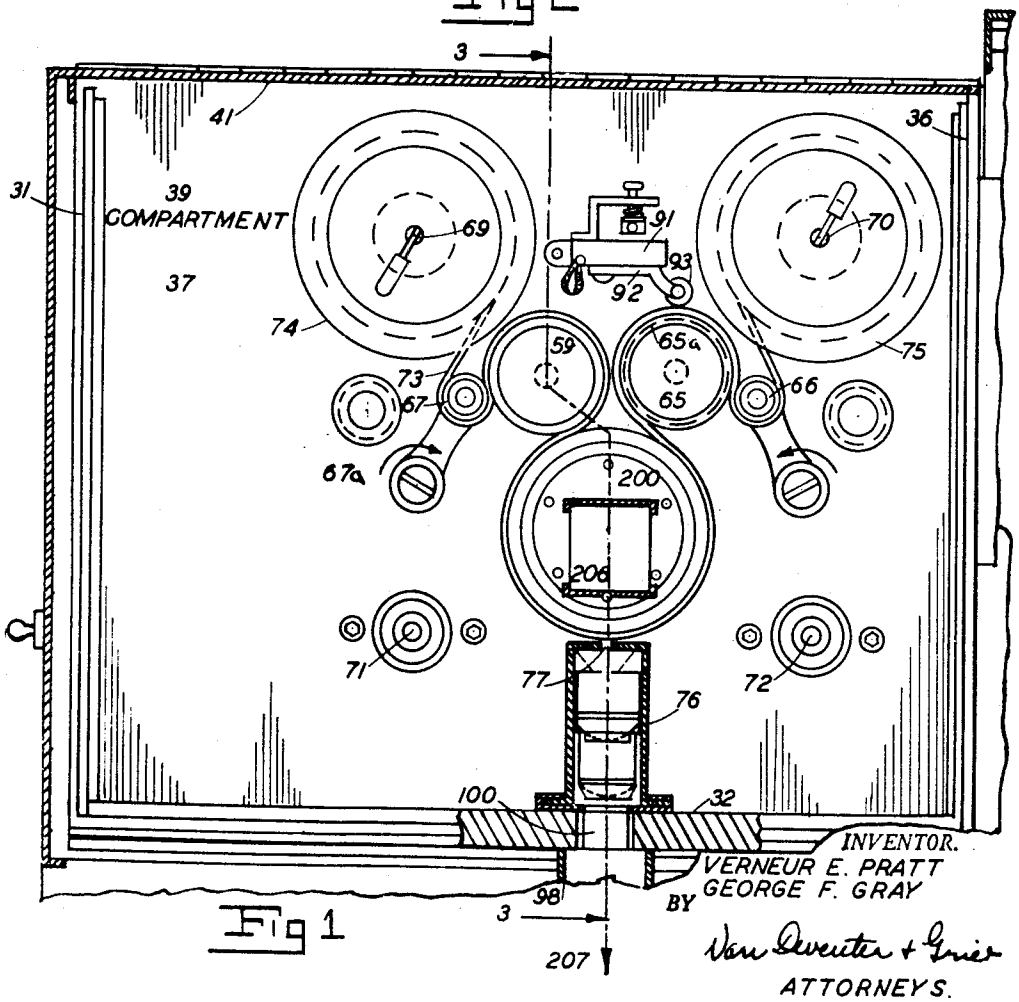

Fig 1

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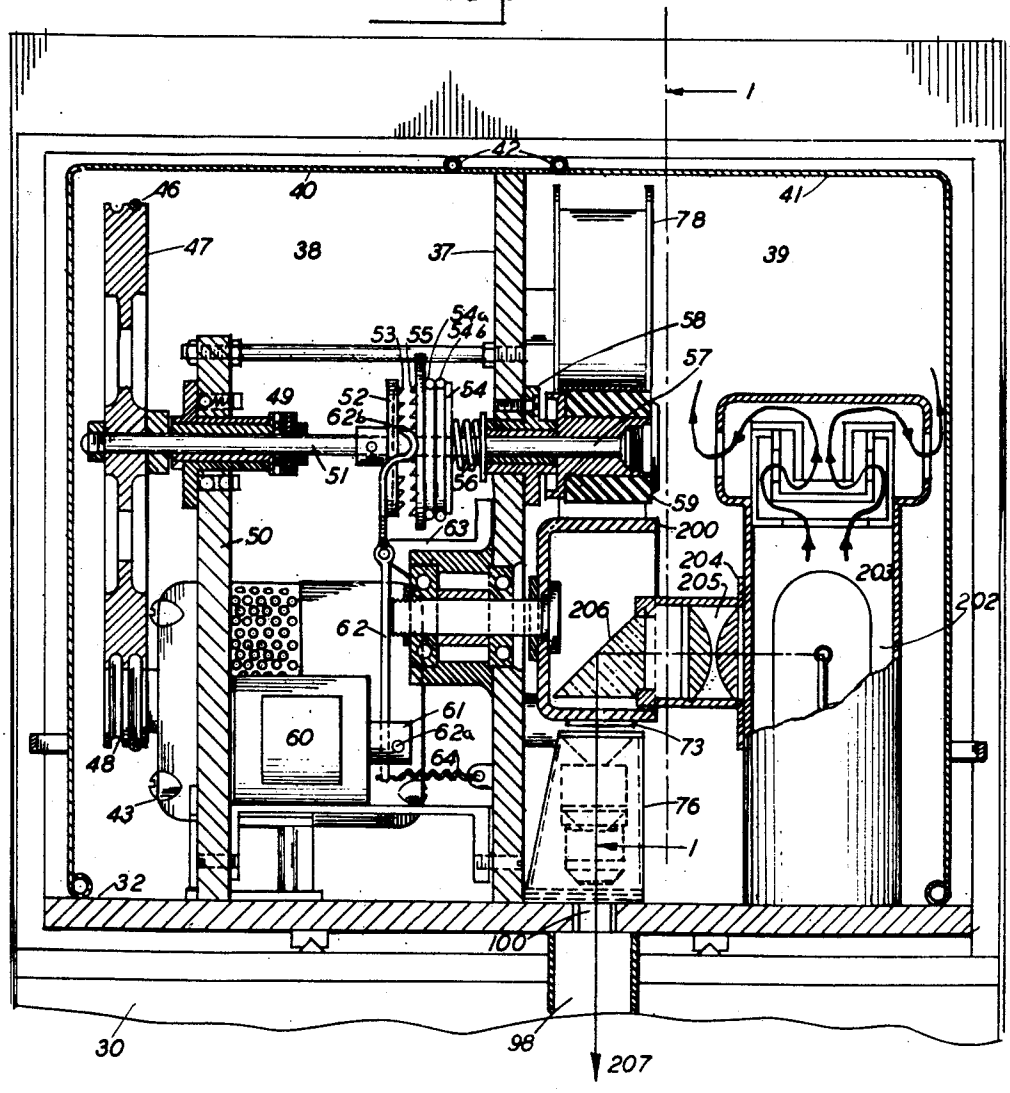
Fig. 3



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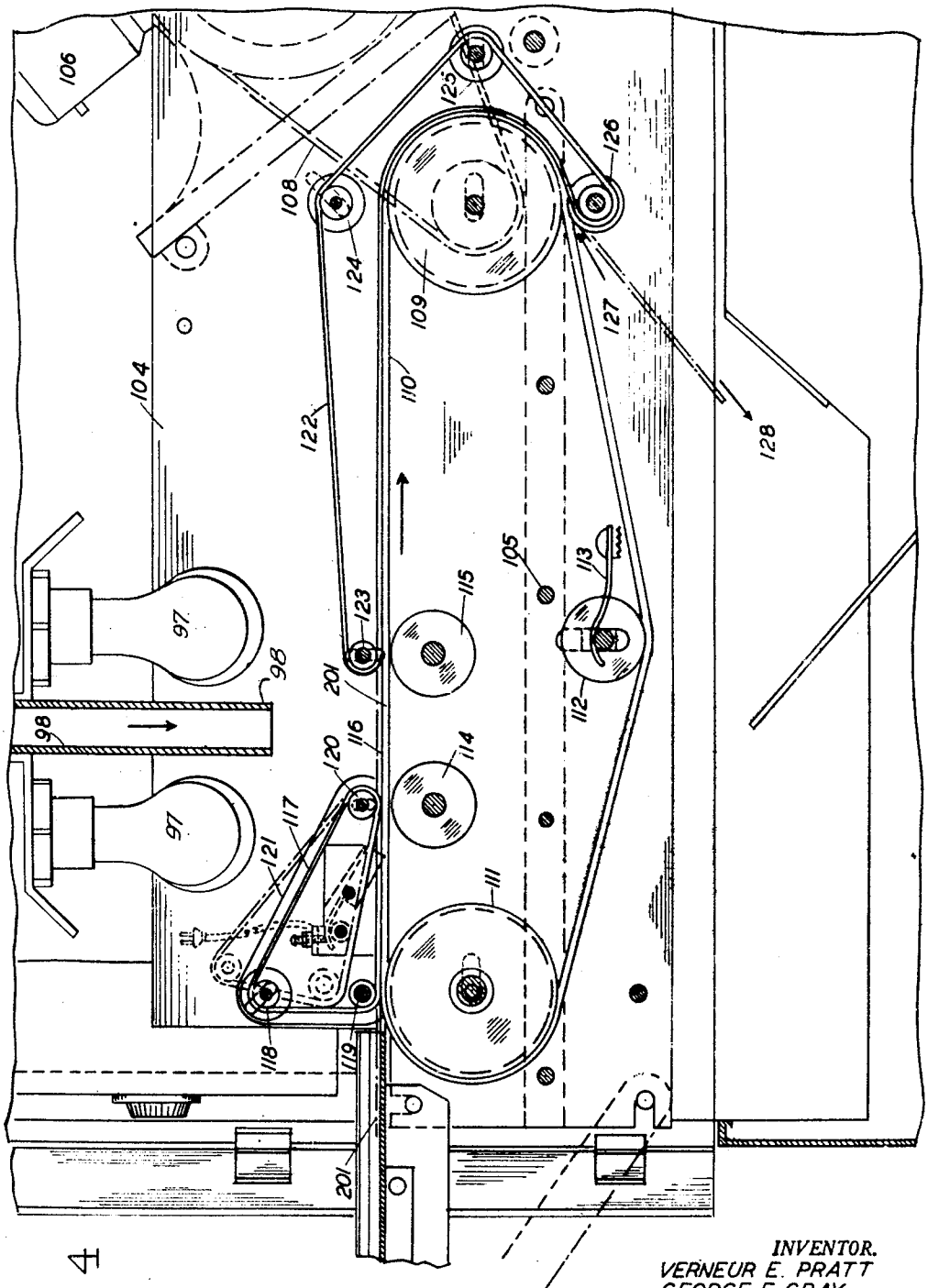

Fig 4

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UNITED STATES PATENT OFFICE

2,478,980

PHOTOGRAPHIC PROJECTING, ENLARGING, COPYING, AND CONTACT PRINTING DEVICE

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Application July 29, 1944, Serial No. 547,131

7 Claims. (Cl. 88—24)

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This invention relates to combination photographic projector, enlarger, flow camera and contact printer and more particularly to modifications in the combined camera and printer described in the co-pending application for U. S. Letters Patent Serial Number 507,939, filed October 28, 1943, now U. S. Patent No. 2,435,099, dated January 27, 1948, of which the instant application is a continuation in part.

The objects of the invention are:

To provide means where the aforesaid camera-printer can be used as a flow enlarger;

To provide means where the aforesaid camera-printer can be used as a projector or flow printer;

To provide an improved device of the character described in which a transparent drum supports a film as it passes across the field of view of a lens;

Other objects and advantages will be more fully apparent from the following specification, wherein is described a device of the type described in the aforesaid co-pending application to which has been added the necessary parts to enable enlarging and projecting to be accomplished.

In the accompanying drawings:

Figure 1 is a vertical longitudinal view on the line 1—1 of Figure 3 and partly in section of a device of the character described embodying the invention;

Figure 2 is a top view partly in section of the device shown in Figure 1;

Figure 3 is a transverse sectional view on the line 3—3 of Figure 1 and partly in section of the device shown in Figure 1; and

Figure 4 is a vertical longitudinal view of a feeding mechanism that may be used with the apparatus shown in Figures 1 to 3 inclusive.

Referring to Figure 1, the enlarger or projector unit has a suitable framework including the front 31, the base 32, a rear plate 36, and suitable connecting members forming a frame. The front, base, and their connecting members (not shown) are secured together in any suitable manner to form a unit structure.

Referring to Figure 3, a longitudinal vertical mounting plate 37 extends from the front 31 to the rear plate 36 and may be secured to these plates and to the base 32. This plate divides the unit into two compartments indicated at 38, 39 in Figure 3. The compartment 38 contains the driving and clutch control mechanism for operating the camera, and compartment 39 contains the film reels, drive and guide rollers, film drums and lens mounting. Covers 40, 41 are hinged at 42 to the mounting plate 37 (or attached to the unit

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in any suitable manner) and extend over and close the compartments 38, 39 as shown in Figure 3, and these covers can be made sufficiently close fitting to prevent the entrance of light to either or both the compartments 38, 39.

The driving mechanism for the projector comprises a suitable motor 43 mounted on bracket 44, secured to plate 37 or base 32. This motor may have a built-in gear reducer if desired. Such a gear reducer usually employs worms and can be made free from back lash. The motor is preferably a synchronous motor.

The motor is provided with a driving pulley 48 over which the belt 46 passes to the driven pulley 47 on shaft 51 supported in bearing 49 in the bracket 50 secured to the base 32 and plate 37 as shown in Figure 3.

Shaft 51 has secured to its inner end, the driving member 52 of a clutch having a plurality of teeth 53 on its engaging face. The laterally movable driven member 54 of the clutch also has teeth 55 on its engaging face and is urged to the left, Figure 3, by a compressed spring 56 carried on a shaft 57, the clutch end of which is splined to slidably support the member 54 to be rotatably driven thereby.

The clutch construction here shown is merely by way of illustration, and any suitable clutching mechanism may be employed.

The shaft 57 extends through the plate 37 and is supported in a suitable bearing 58 therein and carries on its outer end in the compartment 39, the film drive roller 59.

A suitable electrically operated clutch operating device such as the solenoid 60 has a plunger core 61 having a pin 62^a engaging the arm 62 supported on the bracket 63 mounted on plate 37. This arm has a forked end 62^b which rests on the outer flange of the driven member 54 of the clutch which is thereby held out of engagement (against the urge of spring 56) with the driven member 52 when the core 61 of the solenoid is in the position shown in Figure 3, the solenoid being energized. The arm 62 is connected at its lower end to the tension spring 64 so that when the clutch members 52, 54 are brought into engagement by spring 56, which occurs when the solenoid is de-energized, the core 61 via pin 62^a is pulled outwardly by arm 62 and spring 64 so as to be in position for re-operation. The belts 54^a, 54^b drive the usual take-up pulleys on the film take-up reels (not shown).

The mechanism in compartment 39 as shown in Figure 1 comprises the film drive roller 59 and a plurality of film guide rollers 65, 66, 67, and the

transparent film drum 200 which is rotated by the film engaging the circumferential rim thereof. These guide rollers and the drum are mounted on stub shafts extending from the plate 37, the rollers 65, 66, 67 and drum 200 being freely rotatable.

Film reel supports 69, 70, 71, 72 are provided for the reception of the usual film reels 74, 75, and the film 73 to be projected may be taken from reel 74, passed over the guide roller 67, which has a spring (not shown) urging it in the direction of the arrow 67a around drive roller 59, drum 200, roller 65, roller 66 (which is spring-pressed like 67) and finally wound up on reel 75. The latter reel may, by its supporting shaft 70 or in any other suitable manner, be driven in the usual manner to take up film as it is unwound from reel 74.

The mechanism just described is merely illustrative; any suitable mechanism may be employed to unwind the film continuously past the lens.

The lens tube 76 is slidably mounted on the base 32 so as to be easily removable from the compartment 39 and contains a suitable lens adapted to project an image on the film 73 where same passes a slot 77 in the upper end of the lens tube downwardly through the opening 100 and tunnel 98.

The light tunnel, as shown, is positioned above the sheet 201 of sensitized paper, or forming a screen, and the rectangular tunnel extends across said sheet the full width of the platen. For example, if the machine is designed to handle paper 8½ inches wide, the tunnel will extend across the 8½ inch dimension.

The upper end of the tunnel 988 terminates directly below the lens tube 76 as shown in Figure 1 so that the image produced by this will cover the surface 116 of the sheet 201. An aperture 100 is provided in the base 32 of the unit to permit light to pass therethrough.

To provide illumination for the film, a suitable lamp house 202 may be mounted on the base 32 in any suitable manner as shown in Figure 3 and contains the lamp 203. The lamp house has a tubular lens mounting 204 in which is mounted the usual condensing lens system 205. Secured to and supported by the lens mounting 204 is a prism, or other suitable device, 206, located within the drum 200 at least the rim of which is transparent. This drum is of accurate diameter to support the film 73 as the drum revolves.

The light rays from the lamp will pass through the lens, or lenses 205, into prism 206, through the out-turned rim of drum 200, and through the film 73 supported thereon. The emergent beam from the film passes through slit 77 and through the lens in tube 76 and continues downward in the direction of the arrow 207, Figure 1.

The platen unit shown in Figure 4 is mounted immediately under the projector unit previously described. This unit has a framework similar to the camera unit. Side plates of the platen unit are shown at 104. These side plates are suitably spaced apart by tie rods 105, and between these side plates the platen mechanism is mounted.

The mechanism shown in Figure 3 forms a complete self-contained unit or sub-assembly which may be in the form of a drawer as more fully described in the aforesaid copending application and is, therefore, removable from its supporting framework or cabinet without disassembling the parts mounted therein. The mechanism shown in Figure 4 may also form a complete self-contained unit or sub-assembly which may be in the form of a drawer, as more fully described in the aforesaid copending application and is, therefore, removable from its supporting framework or cabinet without disassembling the parts mounted therein.

This mechanism comprises the driving motor 106 which through belt 108 drives the pulley 109, the shaft of which carries a plurality of suitable pulleys on which there are a plurality of endless belts 110 which pass over a pulley 111 at the outer end of the unit. Individual take-up pulleys 112 spring-pressed downward at 113 may be used to take up the slack in each belt 110 so as to keep it tight and flat across the guide rollers 114, 115 so that the upper surfaces of the belts below the field of view of the lens at the point 116 will form a rigid traveling support for the sheet 201 to receive the image from the film.

Lamps 97 are suitably supported above the platen mechanism to illuminate the space 116 below the light tunnel 98.

When the device is used as a flow camera, copy flowing across said space, due to the action of the platen mechanism previously described, will be illuminated by said lamps.

When the device is used as a contact printer, as previously described, and motor 106 is not in operation, and a piece of white paper or the like is laid on the platen mechanism to form a reflecting surface at 116, light from the lamps 97 wlil be reflected from said surface and up the light tunnel 98 and through the films on drum 200.

At the forward end of this unit there are a plurality of idler belts 117 passing over the pulleys 118, 119 and 120, the two forward pulleys 118, 119 are mounted in a sub-frame 121 which swings around the axis of the pulley 120 as shown in dotted lines, Figure 4. The belts 117 are in frictional contact with the belts 110 and are driven thereby so that a sheet or web of paper 201 fed into the front of the platen unit will be grasped by the belts 110 and 117 and carried across the space 116 below the light tunnel 98. As the sheet continues to travel to the right, Figure 11, it will be grasped by idler belts 122 carried by the pulleys 123, 124, 125 and 126. Belts 122 are in frictional contact with the belts 110 and the paper 201 will therefore be grasped by belts 110 and 122 and carried around the drive pulley 109 between the belts 110 and 122 and emerge at the point 127, and drop into the storage compartment 128 located below the unit. The paper may be wound on a spool.

The paper 201 may be any suitable type of photographic paper, or other material adapted to receive a photographic image and the emergent beam from tunnel 98 impinges upon this paper at 116.

The synchronizing of the film feed in the camera unit, and the feed for the paper 201 is not described in detail, as any suitable control mechanism such as that described in the aforesaid copending application may be used. Also, details of the construction of the mounting, framework and electrical connections are given in said copending application and are therefore not described here in detail, as these may be of any desired type.

The foregoing describes the device when used as a projector wherein an image on film 73 is projected downwardly to the platen at the point 116. If a sensitized medium, such as a sheet of photographic paper 201 is fed across the field of view

at 116, the image produced by the projector will be photographed thereon. The device when so used is a flow enlarger and projector, the paper 201 being in motion and the linear speed of same being in timed relation to the linear speed of the film 73.

If plain white paper is used at 201, the device becomes a projector, as the image then projected to the sheet can be seen by the observer. As it is not necessary for the sheet to move, motor 106 operating the platen mechanism can be stopped.

If it is desired to use the device as a flow camera to photograph images of copy, such as documents or the like, fed across the point or space 116 in the focal plane of the lens by the operation of the platen mechanism, unexposed film is used at 73 and lamp 203 is extinguished. The copy on the moving belts of the platen mechanism is illuminated in any suitable manner, such as by lamps 97, and an image of the copy is impressed on the film 73 as the film and copy are moved relative to each other, all as more fully described in the aforesaid copending application.

To use the device as a contact printer and produce prints directly from a film without enlargement, the camera is used as described in the aforesaid pending application. But, it is here briefly pointed out that the reel 74 carrying negative film 73 is placed on support 71; a roll of unexposed film is placed on support 69; films are wound over the guide rollers and around drum 200; the negative film being outside and the image surfaces of the films being in contact. Take up reels are placed on the supports 70 and 72 to receive the films.

The lens 76 is removed and as the films are slowly moved through the device by operation of the camera motor 43, light from the lamps 97 is reflected by a white sheet 201 placed on the platen mechanism at 116, the motor of the platen mechanism 105 being stopped. This reflected light passes up the tunnel 98 through the slit 77, through the negative film 73, and the film lying below it on the drum 200, thereby making a contact print on the last-mentioned film.

It will be observed from the foregoing that the present invention provides in a single apparatus or device:

(a) An enlarger capable of enlarging images on a film and photographing said enlarged images on a flow sheet of sensitized material.
(b) A projector whereby an image on a film is projected and enlarged on a screen for visual observation.
(c) A flow camera where images of moving copy are impressed on a moving film.
(d) A contact printer wherein an image on one film is printed on another film, said films being in contact and no lens being used.

This quadruple use of the device is largely made possible by the employment of the transparent drum 200 and its cooperative relationship with the film or films which it supports, the arrangement being such that a beam of light can be projected from the inside of the drum through a film supported thereon when the device is used as an enlarger, or a projector.

When used as a flow camera, or a contact continuous printer, the light beam is projected from outside the drum and through the film thereon.

Because of the necessity of reversing the path of the light in such a multi-use device, such structures have heretofore been complicated and required extensive and careful rearrangement

and relocation of the various parts such as the lamps, lenses, supports, etc., when converting the device from one use to another, which rearrangement is unnecessary with the instant invention.

What is claimed is:

1. In a multi-use device of the character described, a camera-projector unit including a framework having a vertical mounting plate extending longitudinally of the framework, a lens having its optical axis parallel to the plane of said plate, means carried on said plate for supporting and moving a film transverse the optical axis of said lens including a rotatably supported drum having a transparent arcuate rim portion adapted to be driven by a film engaging said rim, driving means extending through said plate for operating said film moving means, means for illuminating film carried on said drum comprising a light source mounted in said unit, means for projecting a beam of light through the arcuate rim of said drum and through film supported thereby and outwardly through said lens, a slit-forming member positioned in the optical path of said lens wherein said slit is parallel to the axis of the drum, a platen unit including a conveyor spaced apart from said first unit, the linear speed of said conveyor being synchronized with the movement of said drum, said conveyor being located subjacent said projector unit and adapted to position flat sheets in the field of view of said lens, said sheets being moved by said conveyor at a different linear speed from the speed of said drum and positioned to receive on their flat surfaces enlarged images projected thereto from film carried on said drum, and means for illuminating sheets carried by said conveyor to cause an image of same made by reflected light to impinge on film carried by said drum, said first means for illuminating film mounted in said camera-projector unit being extinguished the while.

2. In a multi-use device of the character described, a camera-projector unit including a framework having a vertical mounting plate extending longitudinally of the framework, a lens having its optical axis parallel to the plane of said plate, means carried on said plate for supporting and moving a film transverse the optical axis of said lens including a rotatably supported drum having a transparent arcuate rim portion adapted to be driven by a film engaging said rim, driving means extending through said plate for operating said film moving means, a motor connected to said driving means secured to said unit and movable therewith, means for illuminating film carried on said drum comprising a light source mounted in said unit, means for projecting a beam of light through the arcuate rim of said drum and film supported thereby and outwardly through said lens, a slit-forming member positioned in the optical path of said lens wherein said slit is parallel to the axis of the drum, a platen unit including a conveyor spaced apart from said first unit, the linear speed of said conveyor being synchronized with the movement of said drum, said conveyor being located subjacent said projector unit and adapted to position flat sheets in the field of view of said lens, said sheets being moved by said conveyor at a different linear speed from the speed of said drum and positioned to receive on their flat surfaces enlarged images projected thereto from film carried on said drum, and means for illuminating sheets carried by said conveyor to cause an image of same made by reflected light to impinge on film carried by said

drum, said first means for illuminating film mounted in said camera projector unit being extinguished the while.

3. A device as claimed in claim 2 including a second motor for operating said conveyor, said second motor forming part of said platen unit.

4. A device as claimed in claim 2 including a main frame wherein said camera-projector unit is removably mounted in the upper part thereof and said platen unit is mounted in said main frame subjacent said camera-projector unit whereby flat sheets on said conveyor in said platen unit are positioned in the field of view of the lens of the camera projector unit.

5. In a multi-use device of the character described, a main framework, a camera-projector unit mounted in said framework and including a lens, means in said unit for supporting and moving a film transverse the axis of said lens including a rotatable supporting drum having a transparent arcuate rim portion having its surface perpendicular to the axis of said lens, the axes of said lens and drum intersecting, said drum adapted to be driven by a film engaging said arcuate rim, a slit-forming member positioned in the optical path of said lens, means in said unit for projecting a beam of light through the transparent rim of said drum and film carried thereon and to direct same through said lens, a conveyor adapted to support flat sheets mounted in said framework independently of said projector unit and adapted to place flat sheets in the front focal plane of said lens, and means for projecting light to sheets so placed.

6. In a combined photographic projector, enlarger, flow camera and contact printer, the combination of a main frame, a supporting structure mounted on said frame, a pair of reels mounted on said structure, a second pair of reels mounted on said structure, means for transferring film from one of said reels in each pair to the other reel of the pair at a predetermined linear speed, a hollow rotatable drum having a transparent rim forming an arcuate support in the paths of said films between reels of each pair and adapted to be driven by at least one of said films, a lens outside said drum and having its axis perpendicular to the axis of the drum and adapted to be focussed on the film supported thereon, a slit-forming member positioned in the optical path of said lens, a conveyor for positioning flat sheets in the front focal plane of said lens, said conveyor adapted when in motion to move said sheets transverse the optical axis of said lens at a fixed speed relative to the linear speed of film moved by said transferring means, means for illuminating sheets carried on said conveyor, means for illuminating film on said transparent rim, said two illuminating means being usable at will whereby when a single pair of said reels and one negative film is employed the device may be used as a projector-enlarger, or as a contact printer when both said pairs of reels are respectively supplied with a negative and an unexposed film, and as a camera when said first illuminating means is used to illuminate sheets on the conveyor and a single pair of reels is employed using unexposed film to receive images via light reflected from sheets on the conveyor.

7. In a combined photographic projector, enlarger, flow camera and contact printer, the combination of a supporting framework, a casing removably supported on said framework in the upper portion thereof, said casing having a vertical mounting plate extending longitudinally therein and dividing said casing into two compartments, said plate supporting the following instrumentalities in cooperative relationship in one of said compartments; to wit, film reels, means for moving film carried on said reels, a rotatable drum having a transparent rim for supporting said film in the back focus of a lens, a lens, a light source, means for directing a beam of light through said transparent rim and into said lens for projection outside said compartment; the other of said compartments containing a motor for driving said film moving means via a shaft extending through said mounting plate, a conveyor mounted subjacent said casing and adapted to position flat sheets in the front focal plane of said lens, and means for illuminating sheets on said conveyor whereby same may be photographed by reflected light via said lens and on to film carried by said drum, said first mentioned light source in said casing being extinguished the while.

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