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L. CAPATOSTO
HOUSING AND MANIPULATING APPARATUS
FOR LIGHT MODIFYING ELEMENTS

2,822,729

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2 Sheets-Sheet 1

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FIG. 1

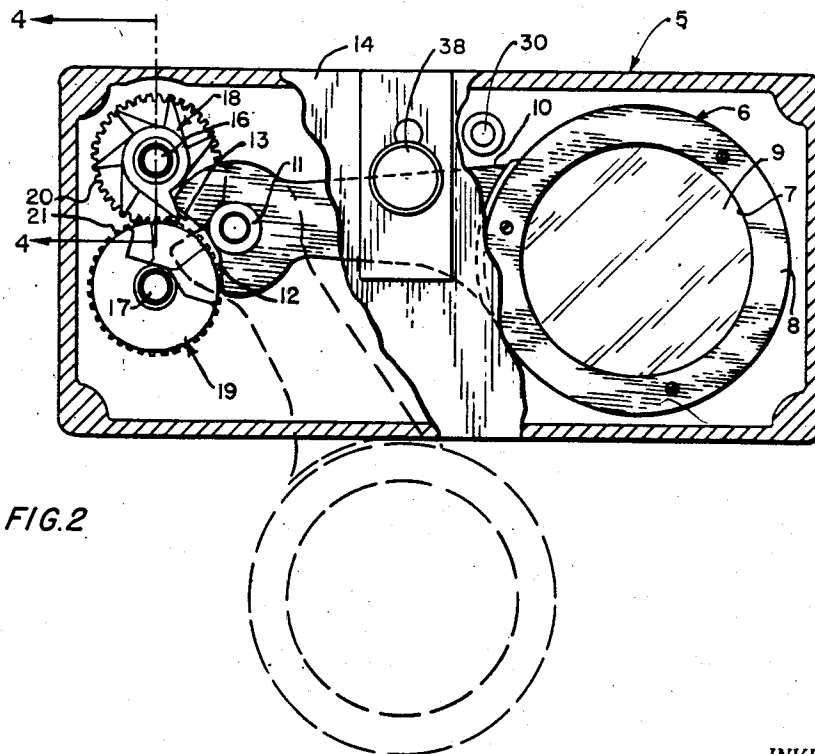
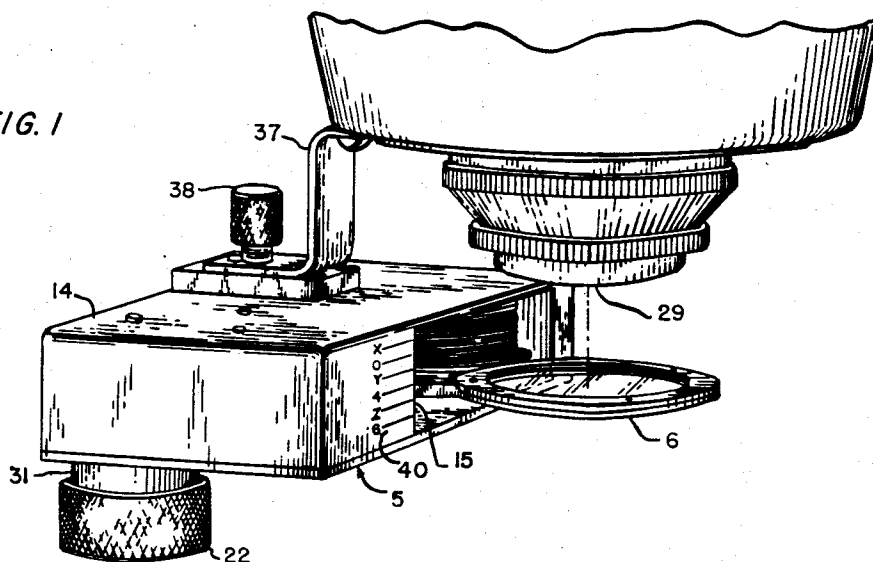


FIG. 2

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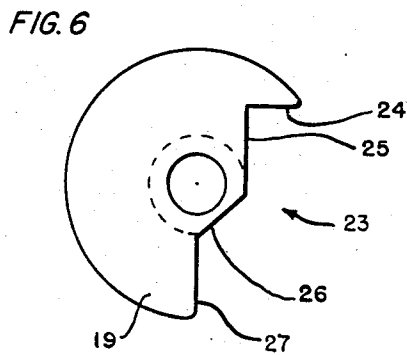
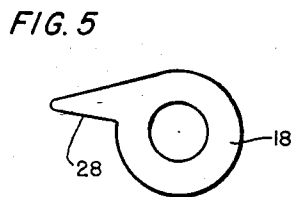
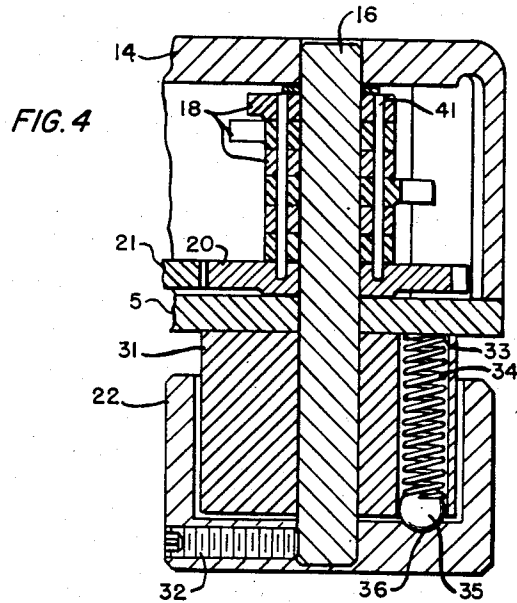
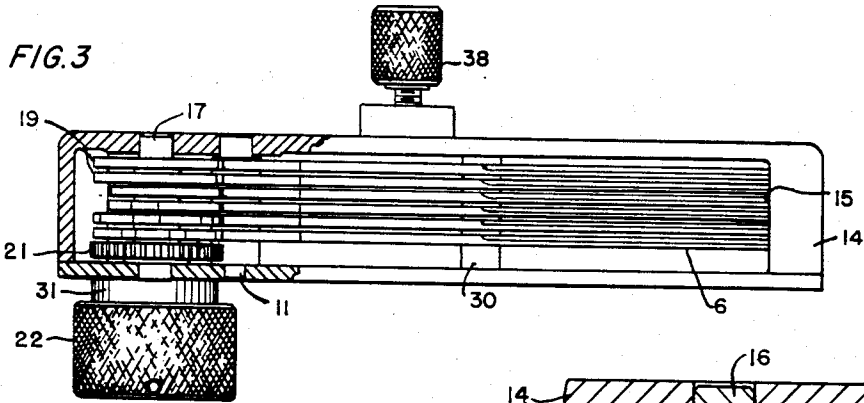
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2 Claims. (Cl. 88—111)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes without the payment of any royalty thereon.

This invention relates to a combination protecting inclosure and manipulator device for a plurality of light controlling screens or the like.

The invention provides complete protection for the filters or screens when not in use and incorporates an efficient selective manipulating means for removing the desired filter from its protecting case and positioning it in operating position. The manipulating means also functions to replace the filter in its case and to sequentially remove and replace all of the filter units.

The device may briefly be described as follows. A protecting casing is provided to contain a plurality of filter or masking units or the like for use in various optical devices. Each of the units is arranged to move smoothly into and out of the casing.

The complete device is light and compact having provision for securing it in operating position on the apparatus with which it is used, such as a photographic enlarger.

A mechanism is provided for moving a selected one of the filter units or a sequence thereof out of the casing into operative position and then back into the casing by means of the simple turning of a knob. The knob is secured to a shaft having a number of cams thereon corresponding to or not less than the number of filter units. These cams engage follower surfaces of the filter holder units to swing them about a pivot into operating position. The cam assembly has a gear thereon meshing with another gear upon another shaft which carries a plurality of retracting cams which act upon another follower surface upon the filter holders to move them back into their casing.

The cams may be relatively angularly positioned on their shafts to provide direct sequential selection of filters or they may have any desired arrangement.

It is a primary object of the invention to provide protection and ready accessibility for a plurality of interchangeable light controlling accessories or the like for optical apparatus.

A further object of the invention is to provide a protecting holder for the accessories which is mounted directly upon the apparatus with which it is to be used.

A still further object of the invention is to provide means for quickly and accurately manipulating the accessories from storage position to operating position one at a time or if desired in prearranged sequence.

Other objects and features of the invention will more fully appear from the following description and will be particularly pointed out in the claims.

To present a better understanding of the invention a specific embodiment thereof will be described and illustrated in the accompanying drawings in which Fig. 1 is a general view of the device in perspective; Fig. 2 is a top plan view with portions of its casing broken away; Fig. 3 is a front elevation of the device partly in cross-

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section; Fig. 4 is a vertical cross-section on line 4—4 Fig. 2; Figs. 5 and 6 are detail views illustrating the shape of the cams used in the device.

The invention greatly increases the efficiency of operation of optical apparatus wherein light modifying members such as filters, masks and the like are to be inserted in a beam of light or interchanged from one to another in the beam. It very often is required that a substantial number of filters of varying values must be interchanged.

The conventional method has been, prior to the invention, to provide some sort of a holding device at the operating position of the filters and to manually and individually insert and remove the required filter in the holding device.

This system presupposes that the operator will have conveniently at hand the required filter and that the visibility in the workroom is adequate to choose the correct one and to properly and quickly place the filter in its holder.

Obviously, the visibility in the room in which optical operations involving filters is being conducted is not high and many times it is very low. This is especially true in the darkroom wherein photographic operations are conducted. The difficulty of locating, identifying and inserting the correct filter impairs the efficiency of the whole operation. The present invention reduces selection and replacement of filters to the simple turning of a single knob.

By way of example, the present invention will be described in connection with a photographic enlarging apparatus. In such an apparatus it becomes necessary to insert light modifying partially transparent elements in the light beam of the apparatus. It may be desired to reduce the light intensity in which case one or more neutral density filters are used. In the printing of color elements such as transparencies or color prints it is many times necessary to use filters of various colors and density to exercise a desired control in the color balance of the final print. Color separation filters are also necessary in the making of separation negatives and in the making of prints on the variable gamma type of printing paper wherein filters are used to control the contrast of the prints.

In this type of apparatus, therefore, as well as in other optical devices it is for certain operations essential to use one or more filters or masks to control the light. The device of the invention may be constructed to contain any number of different filters or light modifying elements. As illustrated in the drawings the dust tight casing 5 is designed to hold six different filters. The filter material may be glass, sheet gelatin, sheet plastic or any appropriate substance. The filters, desirably, are held securely in holders 6 having apertures 7 slightly smaller than the filter. The filter is placed over the aperture and a clamping ring 8 is provided to secure the filter 9 in position.

The filter holders have a shank portion 10 in the outer end of which is an aperture within which is received a pivot pin 11. The outer extremity of the shank 10 beyond the aperture has formed thereon a pair of angularly disposed faces 12 and 13 which are engaged by cams to cause the filter to be respectively projected from and retracted into the casing 5 in a manner to be described.

Desirably, the casing has a removable cover portion 14 securely fastened to its main section. The holders 6 are arranged one above the other with their ends containing the filters situated at one end of the casing. The holders are pivotally supported upon the pivot pin 11 to freely swing into and out of the casing thru an opening 15 in the side thereof. Desirably, the holders 6 are spaced from each other slightly by spacing washers.

Special means are provided to move the filters in and

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out of the casing. The mechanism for manipulating the filters and their holders comprises a pair of parallel shafts 16 and 17 rotatably mounted in the casing 5 the shafts having respectively groups of cams 18 and 19 secured thereon. The shafts are connected by a pair of intermeshing gears 20 and 21 having a driving ratio of one to one. One of the shafts, for example the shaft 16, has an extension outside of the casing and has secured thereon a manually operable knob 22 by means of which the shafts 16 and 17 are rotated.

The structure of and the manner in which the cams 18 and 19 coact with the holders 6 will now be described. One group of cams are designed to eject the holders while the other group retracts them. In each case there are the same number of cams on the shafts as there are filters, each cam acting upon one only of the filters. The cams 18 on shaft 16 consist of a circular hub portion thru which the shaft extends and a substantially radially extending narrow tooth-like cam portion shown in Fig. 5. The cams are angularly spaced a convenient amount as for example 54° which leaves a space of 88° which may be the spacing between the number one cam and the last cam. Each cam is positioned axially along its shaft in position to coincide with the plane of the respective holder 6 it is to operate.

The cams upon the shaft 17 are arranged similarly to those on shaft 16, each cam being positioned in a plane coinciding with the plane of the holder it is to actuate. The cams 19 are also angularly spaced 54°. Each of the cams 19 have the shape shown in Fig. 6. They are made from a disc of metal having a cut out portion at 23 and of a thickness substantially the same as the shank 10 of the holders. The cut out portion is cut inward from its periphery along a line 24 diagonal to a tangent drawn at the periphery of the disc thus forming a hook-like portion 25. The line 24 meets a line 25 at substantially right angles thereto. The line 25 is parallel to and spaced outwardly from a radius of the cam. The cut out then follows generally the curvature of the hub portion 26 thereof and thence extends outward to the periphery along a radius 27 parallel to the line 25. All of the cams are alike and are spaced angularly about their axis of rotation the same as the cams 18. The exact shape of the cut out 23 is not critical and may have any form which will function in the manner set forth hereinafter.

The pivot pin 11 is so positioned that the faces 12 and 13 on the filter holders are situated in the position shown in Fig. 2 wherein the face 13 is adjacent to the face 28 of one of the cams 18 while the lobe of the end portion of the filter holder presenting the face 12 is entirely removed from the cutaway portion 23 of the corresponding retracting cam 19.

The relative position of the parts above described exists when all of the filters are within the casing 5. Assuming it is desired to eject the topmost filter the knob 22 is rotated counterclockwise. The topmost of the cams 18 as viewed in Fig. 2 will then engage the face 13 of the top filter holder and cause it to swing its filter out of the casing and into operating position as shown in dotted lines Fig. 2. In the specific application of the invention described herein this extend position places the filter upon the axis of the lens 29 of an enlarging apparatus as shown in Fig. 1.

At this time it will be noted that the face 12 of the holder and the face 24 of the top cam 19 have moved substantially into contact since the shaft 17 is rotated clockwise by its gear 21. Also the cam 18 is about to clear the periphery of the portion of the filter holder presenting the face 13. Thus the topmost filter is placed in operating position. If desired this position may be accurately located by means of a click stop device to be described hereinafter.

If it is desired to replace the filter or to substitute another therefor, the knob 22 is again rotated counter-

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clockwise. When the face 24 engages the face 12 the filter and holder are swung back into the casing where it is stopped by a bumper 30 desirably having a rubber covering to absorb the shock of contact. At this time the second cam 18 from the top has arrived at a position ready to engage the face 12 of the second filter holder from the top so that further rotation of the knob will eject the second filter. By further rotation of the knob 22 the second filter will be retracted until it engages the bumper 30 when it is again within the protection of the casing 5.

By continued rotation of the knob 22 any one of the filters may be placed in operating position. An important feature of the invention in this connection is its use in the sequential operation of a series of filters such as in the case where three color filters are used in the making of separation negatives. In this operation the three filters are arranged sequentially within the casing and they are brought into operation by successive partial rotations of the knob. Under the dim light permissible or in total darkness manipulation of the filters becomes a simple, fast and accurate operation.

To further enhance the operation of the device, a click stop or other similar means is employed to indicate the completion of each filter positioning operation. To accomplish this result means are associated with the knob 22. The knob is hollowed out to present a cup shape which fits loosely over a boss 31 extending outward from the casing 5 and thru the center of which the shaft 16 extends. A set screw 32 secures the knob to the shaft. A hole 33 is formed near the periphery of the boss 31 within which is received a spring 34 which engages and urges a steel ball 35 into one of a plurality of depressions 36. The depressions are six in number corresponding to the six filter holders and are angularly spaced to correspond to the spacing of the cams. The position of the knob upon the shaft is adjusted so that the ball will enter the first depression when the number one filter is projected and will enter the other depressions successively as the other filters arrive at their operating positions. Thus the friction imposed by the spring and ball serves to guide the operator in accurately selecting and positioning any filter even in total darkness. By knowing the position of each filter in the casing from a given reference point, such as with respect to the topmost one, the operator may readily select any desired filter by rotating the knob thru the required number of ejecting cycles.

As shown in Fig. 1 the device is adapted to be secured to the apparatus with which it functions. Such attachment may be permanent or readily separable. As shown, a bracket 37 is fixed to the body of the enlarging apparatus the lower end of which is provided with an attaching thumbscrew 38. Desirably a thumb screw 38 has threaded engagement with and acts to clamp the casing 5 to the bracket. The parts are so arranged that when a filter has been ejected from the casing its center will be upon the optical axis of the lens 29.

As shown in Fig. 1 the front wall 40 of the casing may conveniently be used for inscribing the identification of each filter, the respective inscriptions being placed on the wall in line with the filter identified.

The cams may be secured in fixed angular relation and to their respective gears in any desired manner. One manner of accomplishing this end is shown in Fig. 4. In this construction a pair of locking pins 41 are driven thru drilled holes in each cam and in the associated gear.

What is claimed is:

1. A housing and manipulating device for a plurality of light controlling screens comprising a casing to inclose said screens, carriers to hold said screens pivoted about a common axis to swing into and out of said casing, a plurality of ejecting cams fixed to a shaft parallel to said axis, a corresponding plurality of retracting cams fixed to another parallel shaft, follower means on each

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carrier associated with corresponding ejecting and retracting cams to actuate the corresponding carrier out of and into said casing, successive cams on each shaft having their cam faces angularly spaced to act successively and independently upon said carriers and means for rotating the cam shafts simultaneously in opposite directions.

2. A housing and manipulating device for light controlling screens comprising a casing to inclose the screens having an opening to permit the screens to be moved out of the casing, a plurality of carriers for said screens 10 presenting cam follower surfaces, a pivot shaft in said casing upon which said carriers are independently pivoted in different planes, a pair of parallel cam shafts mounted in said casing parallel to said pivot shaft, a plurality of cams fixed together on each shaft equal in 15 number to the number of said carriers, the said cam follower surfaces on each carrier being disposed to engage the cam faces of a pair of cams oppositely disposed on

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said shafts, successive cams along said shafts having their cam faces disposed in angularly spaced positions to act successively and independently to move said carriers out of and into said casing and means for rotating the cams on each shaft simultaneously in opposite directions.

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