Sept. 21, 1965 P. M. FIELD ETAL 3,207,029

MANUALLY ADJUSTABLE OVERHEAD PROJECTOR MOUNTED ON A DESK

Filed Oct. 19, 1961 5 Sheets-Sheet 1

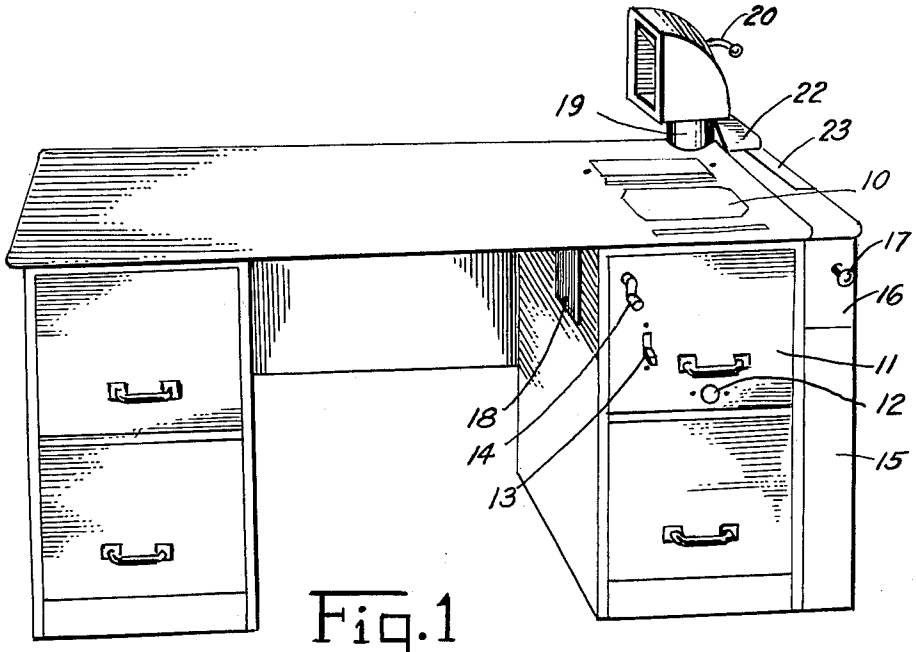

Fig.1

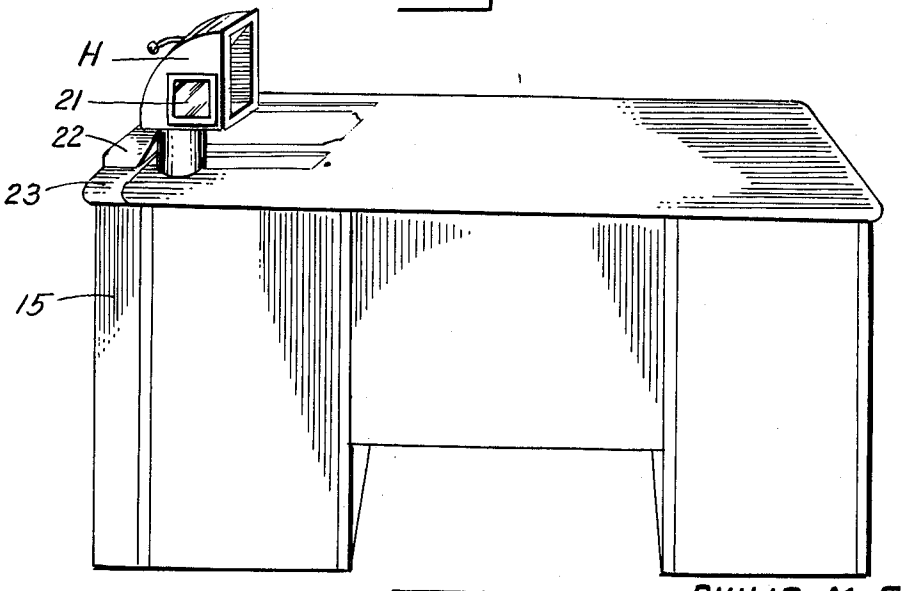

Fig.2

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MANUALLY ADJUSTABLE OVERHEAD PROJECTOR MOUNTED ON A DESK

Filed Oct. 19, 1961 5 Sheets-Sheet 2

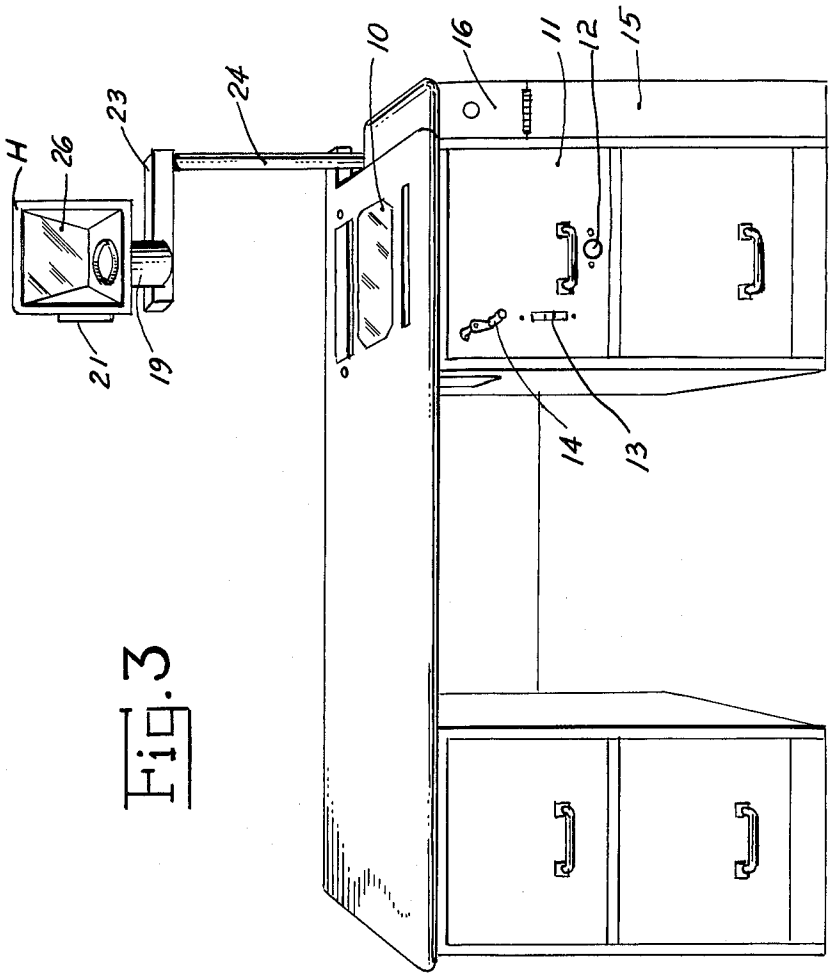

Fig. 3

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MANUALLY ADJUSTABLE OVERHEAD PROJECTOR MOUNTED ON A DESK

Filed Oct. 19, 1961 5 Sheets-Sheet 3

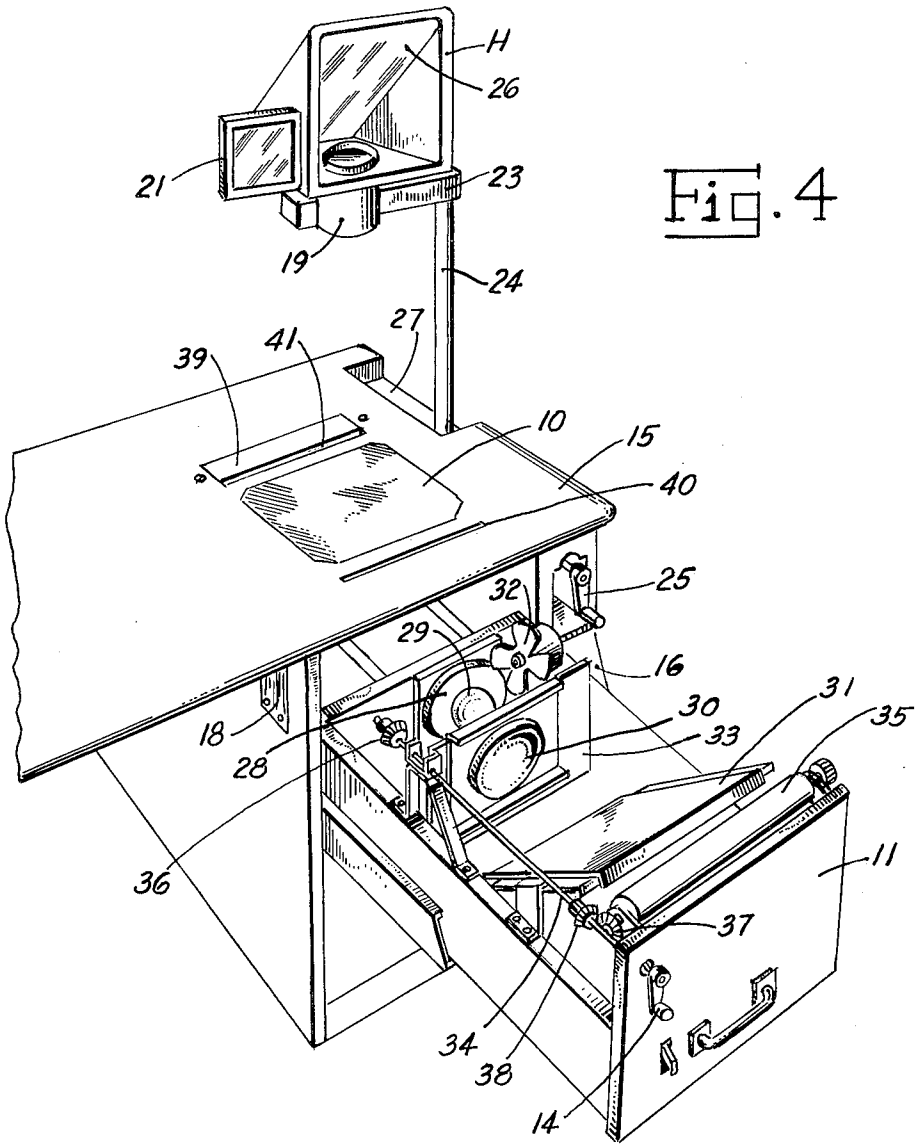

Fig. 4

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MANUALLY ADJUSTABLE OVERHEAD PROJECTOR MOUNTED ON A DESK

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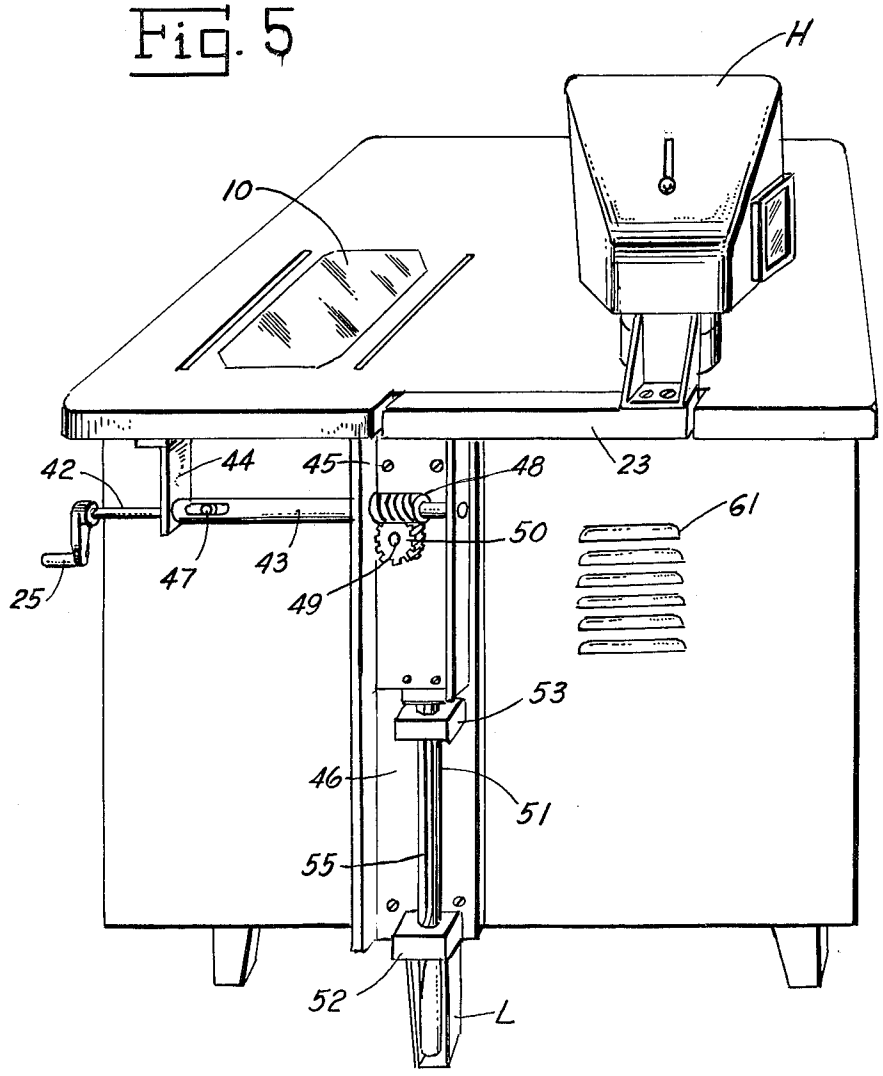
Fig. 5



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MANUALLY ADJUSTABLE OVERHEAD PROJECTOR MOUNTED ON A DESK

Filed Oct. 19, 1961 5 Sheets-Sheet 5

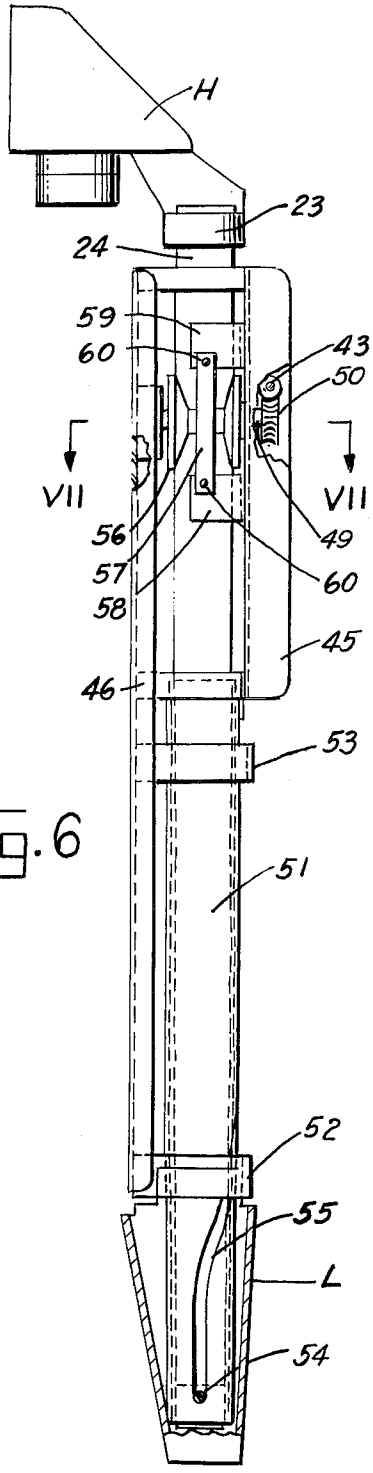

Fig. 6

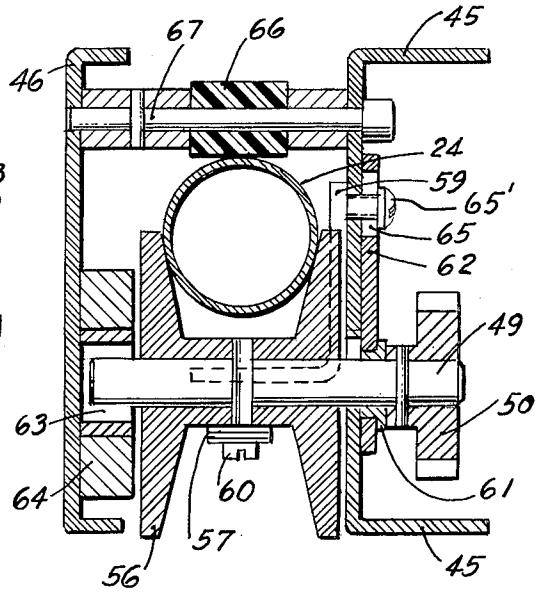

Fig. 7

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&
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United States Patent Office 3,207,029 Patented Sept. 21, 1965

3,207,029

MANUALLY ADJUSTABLE OVERHEAD PROJECTOR MOUNTED ON A DESK

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Filed Oct. 19, 1961, Ser. No. 146,198
12 Claims. (Cl. 88—24)

This invention relates to overhead projectors and more particularly to apparatus of this type incorporated in a desk.

It is often desired to project material or images onto a screen or wall surface located behind a speaker. This type of projection apparatus, generally referred to as an overhead projector, is particularly useful in connection with lectures, sales promotion work, education, etc. Various types of overhead projectors are in existence and while these are of a portable design, they are, nevertheless, bulky, heavy and rather complex. Consequently, in a majority of applications, the device remains in a relatively fixed location within the room in which it is to be used. In the field of education, apparatus of this type which is provided with a table (or housing on wheels) occupies valuable space disproportionate with respect to the actual use of the apparatus. On the other hand, most of the presently available overhead projectors are designed for placement on a desk for operation thereof and since the device is bulky and heavy to handle, it is permitted to remain on the desk during periods of non-use, thereby distracting from the attention of the pupils, generally, and materially interfering with the normal use of the desk. It is believed these shortcomings of present projectors of this class have militated against their more general use in the classroom.

A device made in accordance with this invention is incorporated in a standard kneehole desk and includes means for quickly and conveniently placing the device in operating or non-operating condition. All optical components, except the projection head, are disposed in operative relationship within one of the desk drawers. When the device is not in use, the projection head is positioned at a corner of the desk so that its obstruction and interference with normal use of the desk is minimized. Upon rotation of a crank handle, the projector head simultaneously is raised and rotated into proper optical alignment over a transparent plate inserted into the desk top. The transparent plate constitutes a flush continuation of the desk top thereby providing a writing surface and a support for the material to be projected.

An object of this invention is the provision of an overhead projector having most of the optical components incorporated in a conventional desk in such manner as to be conveniently available for use when desired and imposing a minimum interference with the normal use of the desk when the device is not in use.

An object of this invention is the provision of an overhead projector where in the major portion of the components are disposed within a drawer of a conventional desk and can produce a vertical light beam which passes through a light permeable plate disposed flush with the top surface of the desk and into a projection head that is selectively positionable from a non-operating to an operating position relative to the light beam.

An object of this invention is the provision of projecting apparatus comprising a conventional desk having a transparent, flush plate closing an opening formed in the top of the desk and over a drawer, an optical system disposed within the drawer, means accessible externally of the desk for adjusting the optical system, a projection head normally positioned at a corner of the desk and manually-operable means for effecting movement of the projection head to operative position with respect to the optical system.

An object of this invention is the provision of an overhead projector incorporated into a conventional desk and including simple elevating means for simultaneously raising the projection head relative to the desk top and rotating the head from non-operative to operative position relative to a vertical light beam originating in a drawer of the desk and passing vertically through a transparent plate inserted into the desk top, and wherein the elevating means serve as a focusing device for the projection head.

These and other objects and advantages will become apparent from the following description when taken with the accompanying drawings, illustrating one embodiment of the invention. It will be understood, however, that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purpose to the claims appended hereto.

In the drawings wherein like reference characters denote like parts in the several views:

FIGURE 1 is a perspective view, showing the front of the desk with the projection head in the non-operative position;

FIGURE 2 is a similar view showing the back of the desk;

FIGURE 3 is similar to FIGURE 1 but showing the projection head in the operative position;

FIGURE 4 is a fragmentary view showing the desk drawer opened to expose the contained components;

FIGURE 5 is a side view of the desk with the housing cover removed to show the mechanism for movement of the projection head from non-operative to operative position;

FIGURE 6 is a side view of the mechanism removed from the desk and drawn to a larger scale; and

FIGURE 7 is a horizontal sectional view taken along the line VII—VII of FIGURE 6.

Reference now is made to FIGURES 1 and 2 wherein there is shown a transparent plate **10** inserted into an opening formed in the top of the desk. The upper surface of the plate lies flush with that of the desk top. As will be described in detail below, the drawer **11**, at the right side of the desk kneehole, houses the components of the optical system with the exception of the projection head H which is here shown in the lowered, non-operative position. It will be noted that in this position, the projection head is disposed at a far corner of the desk resulting in a minimum interference with the normal use of the desk. The front wall of the drawer **11** includes an electrical connection socket **12** (by means of which the apparatus is connectable to a conventional 110 volt power source), an on-off line switch **13** and a rotatable handle **14**, the latter actuating a mechanism for advancing or rewinding a spool containing transparent paper, or the like, which passes over the projection stage (transparent plate **10**) and permits writing on the stage by means of a suitable wax pencil. A housing **15** covers the mechanism which functions to move the projection head from the illustrated, non-operative position to the operative position spaced over the plate **10**, such housing including a hinged cover plate **16** which normally covers the handle for operating the said mechanism. It may here be pointed out that the cover plate **16** is opened by pulling upon the attached knob **17**. Attention is directed to the vents **18** formed in an inner wall of the desk. The specific purpose and function of the parts briefly identified to this point will become clear as the description proceeds. At present, it is appropriate to point out that the projection head H includes a lens **19**, a handle **20** for adjustment of the angular position of the

internal mirror and a pivotally mounted external mirror **21** which may be swung outwardly from the illustrated position whereby the projected picture can be viewed by the operator without turning around. A bracket **22** secures the projection head to a generally rectangular arm **23**. This arm is attached to the mechanism for movement of the projection head to the operative position and lies flush with the desk top, as shown, when the projection head is in the illustrated non-operative position.

Reference is now made to FIGURES 3 and 4 wherein the projection head H is shown in the operative position. A comparison of FIGURES 1 and 3 will make apparent the fact that the movement of the projection head from the non-operative position (FIGURE 1) to the operative position (FIGURE 3) involves both a raising and a 90 degree rotation of the head. This is accomplished by means of a novel mechanism which includes the shaft **24** (to which the bracket **23** is rigidly secured) and which mechanism is effective upon rotation of the handle **25**, see FIGURE 4. The handle **25** is secured to a horizontal rod mounted for limited axial movement whereby the handle can be moved forwardly for rotation, as shown in FIGURE 4, or moved rearwardly to permit closure of the cover plate **16**. In any event, rotation of the handle **25**, in one direction, results in a simultaneous raising and counterclockwise rotation of the shaft **24** and the head H, whereas a rotation of the handle in the reverse direction results in a simultaneous lowering and clockwise rotation of the rod and head.

As shown in FIGURE 3, the apparatus is in condition for use, assuming the power cable is connected to the outlet plug **12** and the line switch **13** is actuated to closed position. A vertically directed, diverging beam of light passes through a Fresnel condenser, located beneath the transparent plate **10**, which converges the light so that it passes through the projection head lens **19**. A mirror **26**, within the head, directs the light toward the projection screen located behind the person sitting at the desk.

The fragmentary view of FIGURE 4 also shows the projection head H in the operative position. Here, the rear view mirror **21** has been swung into a position whereby a person sitting at the desk can see the picture which is projected on a suitable screen or on the wall in back of him. Also clearly shown in FIGURE 4 is the recess **27**, formed in the housing **15**, and which accommodates the arm **23** when the projector head is in the non-operative position, as shown in FIGURE 1. The desk drawer **11** is shown in the fully-opened position. This drawer houses the major components of the optical system, namely, a reflector **28**, a lamp **29**, a condensing lens **30** and the light-reflecting mirror **31**, the latter directing the light beam vertically through a Fresnel condensing lens (secured to the desk top and located in fixed position beneath the transparent plate **10**) and through the plate **10**, when the drawer is fully closed. An electric fan **32** directs a continuous air stream past the lamp and through the vents **18** for cooling purposes. Although not visible in FIGURE 4, air vents are also provided in the right end wall of the desk, such vents being located opposite to the vents **18** so that when the desk dawer is closed, there is a free flow of air through the vents upon rotation of the fan.

An end of the rod **34** passes through a clearance hole formed in the front wall of the drawer and has the crank **14** secured thereto. A supply roll **35**, of acetate or cellophane material, is rotatably mounted on a shaft and disposed within the drawer, said shaft having a bevel gear **37** secured thereto for selective meshing with a gear **38** that is secured to the rod **34**. Although not shown in the drawing, a take-up spool is disposed beneath the cover plate **39**. The take-up spool is rotatably mounted on a shaft carrying a bevel gear (similar to the bevel gear **37**) which meshes with a second bevel gear **36**, secured to the rod **34**, when the drawer is fully closed. The material from the supply roll **35** is threaded through a slot **40**, formed in a desk top, passes over the transparent plate **10** and to the take-up roll through the slot **41** formed between the cover plate **39** and the desk top. Thus, when the drawer is closed and the handle **14** is pushed against the drawer front, the bevel gear **36** engages the gear on the take-up roll shaft and rotation of the handle advances the transparent material from the supply roll **35** onto the take-up roll. On the other hand, when the handle is drawn away from the drawer front, the bevel gear **36** is disengaged from the take up roll and the gear **38** meshes with the gear **37** so that the material can be re-wound onto the supply roll **35**. Sketches, drawings, notations, etc., can be made upon that portion of the material overlying the transparent plate for simultaneous projection on the screen.

Reference is now made to FIGURE 5 wherein the housing cover has been removed to expose the mounting of the mechanism for movement of the projection head to the operative or non-operative position. The handle **25** is secured to an end of the rod **42**, which rod extends into an axial hole provided in the shaft **43**, the latter being rotatable within aligned bearing holes formed in the bracket **44** (secured to the desk) and the spaced, upturned sides of a U-shaped bracket **45** that is rigidly secured with respect to the mounting plate **46**, said mounting plate **46** being secured to the end wall of the desk by suitable means or bolts. The forward end of the shaft **43** is provided with a slot into which a pin **47** extends, the pin being force-fitted within a radial hole formed in the rod **42**, whereby the handle **25** can be pushed inwardly to permit closure of the cover plate **16**, see FIGURES 1 and 4. A worm gear **48**, secured to the shaft **43**, engages a gear **50**, which is secured to a shaft **49**. Also secured in fixed position relative to the mounting plate **46**, as by the horizontal brackets **52** and **53**, is a guide tube **51** having a helical slot **55** formed therein. The lower end of the guide tube **51** extends somewhat into a metal leg L, which is secured to the lower bracket **52** by suitable screws.

The construction and arrangement of the parts forming the mechanism will best be understood by reference to FIGURES 6 and 7. The rod **24**, which carries the platform **23** and the projection head H, is slidably disposed within the guide tube **51** having the helical slot **55** formed therein. It will be noted that the slot **55** has an upper, longitudinal portion extending substantially to the top of the guide tube and a lower, similar portion terminating a spaced distance from the bottom of the tube. Further, the upper and lower longitudinal portions of the helical slot are oriented at 90 angular degrees relative to each other. A pin **54**, provided with a screw slot, is threaded into the inner rod **24** and extends through the helical slot of the guide tube. As shown in FIGURE 6, the inner rod is in the fully lowered position wherein the pin **54** rests upon the wall of the helical slot. In this position of the rod **24**, the bar **23** lies flush with the desk top, see also FIGURE 5. When the rod **24** is raised, the travel of the pin **54** along the helical portion of the slot **55** produces a simultaneous rotation of the rod.

Vertical movement of the rod **24**, upon rotation of the shaft **43**, is effected by means of a flanged roller **56** that is pinned to the shaft **49** carrying the gear **50**. The inner surfaces of the flanges, of the roller **56**, are conical and are advanced against the rod **24** by a leaf spring **57** having ends secured to the spaced L-shaped brackets **58** and **59** by screws **60**, which brackets are secured to the base of the U-shaped bracket **45**.

As best shown in FIGURE 7, the shaft **49**, carrying the gear **50** and the flanged, friction drive roller **56**, is rotatable in a bearing **61** carried by a slide plate **62** and has an end which rides in a horizontal slot **63** formed in a shaft guide **64** that is fixed relative to the mounting plate **46**. The slide plate **62** is also provided with a horizontal slot **65** through which extends a screw **65'**

that is threaded into the base of the U-shaped bracket **45**. This arrangement permits movement of the drive roller **56** inwardly against the rod **24** under the biasing action of the leaf spring **57**. Positioned at the opposite side of the roller **56** is a guide roller **66** rotatable on the rod **67** and made of a suitable material such as rubber or plastic. It will be apparent, now, that the rod **24** is clamped between the flanges of the roller **56** and the guide roller **66**. The leaf spring **57**, preferably formed of a plurality of individual leafs, is designed to exert a considerable force against the drive roller **56** thereby to produce a vertical movement of the rod **24** in correspondence with rotation of the gear **50** and to retain the rod firmly in a desired position. It may here be pointed out that the necessary inward movement of the drive roller **56**, under the action of the leaf spring is effected without interfering with the normal action of the worm and gear since, when such movement takes place, the gear merely rolls slightly on the worm.

It will now be clear that rotation of the handle **25** produces a corresponding vertical movement of the rod **24** and that, in the course of such rod movement, the pin-slot arrangement results in a simultaneous rotation of the rod throughout an angle of 90 degrees. When the rod is fully lowered, the platform **23**, see FIGURE 5, lies flush with the desk top and the projection head is in the non-operative position at a corner of the desk. When the rod is fully raised, the projection head is positioned over the transparent plate, see FIGURE 3, in the operative position. Referring back to FIGURE 6, it will be apparent that rotation of the rod **24** is effected as the pin **54** traverses the helical portion of the slot **55**. Consequently, the projection head is rotated to a position in the light beam long prior to the time that the rod **24** has been raised to a maximum extent. In consequence, the operator may raise or lower the head an appreciable distance, relative to the desk top, thereby to focus the image projected onto the screen by the projection head.

The air vents which are formed in the end wall of the desk and which have been mentioned hereinabove, are identified by the numeral **61** in FIGURE 5.

Although not shown in the drawings, the drawer carrying the optical system may be provided with a lock to prevent unauthorized opening of the drawer. Also, it is desirable to provide a plug and jack arrangement whereby the electrical circuit is broken when the drawer is moved toward the open position.

Having now described our invention, those skilled in this art will be able to make changes and modifications to meet specific applications. It is intended that such changes and modifications can be made without departing from the scope and spirit of the invention as recited in the following claims.

We claim:

1. In an overhead projector of the type comprising a light source and associated optical system for directing a light beam through a transparent member which supports the material to be projected and then through a projection head for projecting an image of the material onto a screen; the improvement wherein the transparent member closes an opening in the top of a desk, the said light source and associated optical system are disposed within a drawer of the desk, and the said head is mechanically coupled to the desk by manually-operable means for effecting a combined linear, and rotary movement of the head from an operating position in the path of the light beam to a non-operating position removed from the light beam.

2. The invention as recited in claim **1**, wherein the head is disposed proximate to a corner surface of the desk top when in the non-operating position.

3. An overhead projector comprising a disk; a transparent plate closing an opening formed in the desk top and over one of the desk drawers; a lamp, a lens and a light reflecting mirror disposed within the said drawer, said mirror directing light from the lamp along a vertical axis through the transparent member when the drawer is in the closed position; a vertical support carried by the desk; a projection head carried by the support; manually-operable means for imparting a vertical axial movement to the support; and means effective upon axial movement of the support for imparting a rotary movement thereto.

4. The invention as recited in claim **3** wherein the said support is a rod member; wherein the said manually-operable means comprises a rotatable member; and including drive means operatively associated with the rod member and the rotatable member for effecting axial movement of the rod member upon rotation of the said rotatable member.

5. The invention as recited in claim **4**, wherein the said drive means comprises a friction roller mechanically-coupled to the said rotatable member and engaging the exterior surface of the rod member; and wherein the means for imparting a rotary movement to the rod member comprises a fixed tubular member encircling the rod member, means forming a helical slot in the tubular member, and a pin secured to the said rod member and slidable within the said slot.

6. An overhead projector comprising a desk having an opening formed in the top and over a drawer; a transparent member closing said opening; a Fresnel lens disposed in fixed position under the said transparent member; a lamp, a lens and a light-reflecting mirror disposed within the said drawer, said mirror directing a vertical light beam through the Fresnel lens and the transparent member when the drawer is closed and the lamp is energized; a vertical guide tube secured to the desk and having a helical slot formed in the wall thereof; a projection head carried by a rod member having a portion slidably disposed within the guide tube; a pin secured to the said rod member and extending through the said helical slot; a drive roller having a pair of flanges, which flanges have conical facing surfaces; spring means biasing the conical surfaces of the said flanges into engagement with the said rod member, and a manually-rotatable member mechanically coupled to the said drive roller, the arrangement being such that rotation of the said manually-rotatable member causes the drive roller to impart an axial movement to the said rod member and the sliding movement of the said pin in the helical slot imparts an angular rotation to the rod member.

7. The invention as recited in claim **6**, wherein the projection head is disposed over the said transparent member and in the said light beam when the said rod member is extended a predetermined length from the guide tube and wherein the projection head is rotated out of the light beam and lowered proximate to the desk top when the rod member is retracted a predetermined length into the guide tube.

8. The invention as recited in claim **6**, wherein the upper end of the helical slot terminates in a portion extending longitudinally of the guide tube, thereby affording adjustment of the vertical spacing between the projection head and the transparent member while the head is retained in the light beam.

9. The invention as recited in claim **6**, wherein the helical slot terminates in longitudinally-extending portions spaced approximately 90 degrees apart, whereby the said rod member is subject to appreciable axial movement after the said pin traverses the helical portion of the slot.

10. The invention as recited in claim **6**, including means forming a pair of slots in the desk top at opposite ends of the said transparent member, a ribbon of transparent material carried by a supply roll rotatably disposed in the said drawer, said ribbon being adapted for passage through the said pair of slots to overlie the transparent member, a rotatable take-up roll carried by the desk

top, and means extending through the front wall of the said drawer for selectively rotating the said rolls.

11. In an overhead projector of the type comprising a light source and associated optical system for directing a vertical light beam through a transparent plate which supports the material to be projected and then through a projection head for projecting an image of the material onto a screen, an improved arrangement for selectively moving the projection head from an operating position wherein the head is disposed in the light beam at a predetermined spacing from the transparent plate to a non-operating position wherein the head is rotated out of the light beam and lowered toward the plane of the transparent member, said arrangement comprising a vertically-disposed guide tube having a helical slot formed in the wall thereof, a rod member having a lower portion slidably disposed within the guide tube and carrying a radially-extending pin extending through the said helical slot; means securing the said head to the upper portion of the said rod member; a drive roller having spaced flanges which flanges have conical facing surfaces; spring means biasing the conical surfaces of said roller into frictional engagement with the said rod member; and manually-operable means for rotating the said drive roller thereby to impart an axial movement and angular rotation of the rod member as the said pin moves along the helical slot.

12. The invention as recited in claim 11 wherein the helical slot terminates in longitudinally-extending portions which are spaced approximately 90 degrees apart, thereby affording appreciable axial movement of the rod member after the pin traverses the helical portion of the slot.

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