A shadow line device having a group of independent projector units, each of these including a light source, a shadow-producing line, and a carrier. The carriers are mounted on a guideway transverse to the shadow lines, and are positioned along the guideway by a cable system to produce movement of the shadow line corresponding to the movement of a selected machine component associated exclusively with that particular shadow line.

6 Claims, 20 Drawing Figures
SHADOW LINE DEVICE

BACKGROUND OF THE INVENTION

Stock fed into a cutting machine must be positioned accurately with respect to the paths along which the cutting action takes place, in order to maintain the most economical utilization of the material. The process of cutting planks to widths in a saw mill is a good example of this sort of operation. A gang of circular saws is normally mounted in axial alignment across the bed of a machine of substantial width, with the position of the saws along their axis of rotation being adjustable so that the spacing between the saws can establish planks of any desired width. This saw spacing is adjusted to make the most effective use of the random-width slabs that have previously been ripped off the saw logs. It is come to be common practice to utilize a shadow line guide system in conjunction with these cutting machines so that the position of the saws with respect to the slabs fed into the machine can be controlled to minimize the waste. These shadow line devices usually include a light source in conjunction with a line suspended within the sector of radiation from the light source. Arrangements are made for the variation of the position of the shadow produced by the line as it is projected on the bed of the machine where the slabs are placed for movement into the cutting station. A device of this general type is described in U.S. Pat. No. 3,368,597.

The most successful forms of the machines utilizing the shadow line principle have used a single light source and a group of shadow lines positioned by carriers in such a manner as to interrelate the line position with a particular saw so that the line will correspond to the path of cutting that the saw will produce as the slab is fed into the machine. It is obvious that a single light source operating in conjunction with a group of parallel lines in a generally horizontal plane will produce a parallax effect on variation of the thickness of the slabs being handled by the machine. In other words, the position of the shadow line will vary in a nonlinear manner with (a) variation in stock thickness, and (b) slab width and lateral placement with respect to a vertical plane through the light source. These factors tend to produce inaccuracy, and a continuing need for readjustment.

SUMMARY OF THE INVENTION

The shadow line device provided by the present invention utilizes a group of independent projector assemblies, each of these including a carrier, a light source mounted on the carrier, and an interference line suspended in fixed relationship with respect to the light source. The carriers are preferably mounted on a common guideway transverse to the shadow line, and a very simple double-loop cable system interrelates each projector assembly with respect to the selected component of the machine with which that shadow line is to be associated. The preferred guideway system includes a double path, and each of the carriers is then provided with spaced followers engaging one of these paths, these followers being in fixed position with respect to the carrier. Each carrier also has a third follower engaging the other of the two paths, with this follower having at least a limited freedom of movement with respect to the carrier in a direction transverse to the guideway. The result of this arrangement is to permit one path to establish the orientation of the carrier without interference from accumulations in the relationship of the two guideway paths. Adjacent carriers are arranged so that one of them will have the two-point engagement with one of the guideway paths, and the adjacent carrier will have its two-point engagement with the opposite path. This arrangement permits a conformation of the carriers which establishes a degree of overlap when the carriers are closely adjacent, thus making possible a very close minimum spacing between adjacent shadow lines. The shadow lines themselves are provided with a limited degree of lateral adjustability so that the orientation can be selected to wash out any errors in the location or construction of the machine. Blower equipment is provided to maintain a flow of cooling air within the structure surrounding the light source, and preferably also within the associated guideway space.

DESCRIPTION OF THE DRAWINGS

The several features of the invention will be analyzed through a discussion of the several views in the drawings, in which:

FIG. 1 is a perspective view of a complete shadow line device in condition for use.

FIG. 2 is a perspective view from the opposite side of a machine illustrated in FIG. 1.

FIG. 3 is an elevation on an enlarged scale over that of FIGS. 1 and 2, from the side of the machine illustrated in FIG. 2.

FIG. 4 is a section on the plane 4—4 of FIG. 5.

FIG. 5 is a section on the plane 5—5 of FIG. 3.

FIG. 6 illustrates the overlapped position of the carriers resulting from the placement of the shadow line units as close as possible together.

FIG. 7 is a plan view, on an enlarged scale, of the baseplate of the carrier.

FIG. 8 is an end view of the outer portion of the machine illustrated in FIGS. 1 and 2, on an enlarged scale.

FIG. 9 is a section on the plane 9—9 of FIGS. 3 and 4.

FIG. 10 is a view on an enlarged scale showing the interengagement of the guideway rods and the follower devices supporting the carrier.

FIG. 11 illustrates a modified form of the invention with respect to the form of the guideway followers.

FIG. 12 is a side elevation, partially in section, of one of the light source assemblies.

FIG. 13 is a bottom view of the assembly illustrated in FIG. 12, FIGS. 12 and 13 being in projection.

FIG. 14 is a section on the plane 14—14 of FIG. 12.

FIG. 15 shows a modified form of the invention with respect to the positioning of the arms supporting the shadow line.

FIG. 16 is a perspective view of the biasing spring used with the FIG. 15 assembly.

FIG. 17 shows the preferred structure for the support and placement of the shadow line with respect to the remainder of the device.

FIG. 18 is a perspective view on an enlarged scale over that of FIG. 17, illustrating the connection of the shadow line components to a line terminal.

FIG. 19 is a schematic diagram showing the relationship of the cable loops responsible for the positioning on one of the carriers along the guideway.

FIG. 20 is a perspective view showing a ceiling-mounted shadow line device, with its associated machine connection.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The shadow line device illustrated in FIGS. 1 and 2 has a frame which may be considered to include the cantilever box beam 22 and the pedestal assembly 23. The latter includes the outer pipe 24, and an inner pipe 25 telescopically received within the pipe 24. The bracket 26 is welded to the inner pipe 25, and the beam 22 is provided with tabs 27—28 which are bolted to the bracket 26. The outer pipe 24 of the pedestal assembly is normally secured to a base plate (not shown) bolted to the floor, and the telescoping relationship between the pipes 24 and 25 permits not only a vertical adjustment of the position of the beam 22, but also a rotative adjustment of the beam 22 in a horizontal plane. The latter adjustment can be maintained by the set screws 32. Where it is desirable to alter the "hand" of the installation, a set of tabs 33—36 is provided on the beam 22 for securing to a pedestal assembly on the opposite side of the device from the illustrated in FIG. 1. The ventilating blower 37 would then be surrounded by the bracket 26, with the opening 31 providing for air intake.

The projector assemblies 38—40 are mounted on the underside of the box beam structure 22. The projector 38 is fixed in
its position, and the projectors 39 and 40 are movable in response to the movement of a selected machine component with which these projector assemblies are associated. FIG. 20 illustrated an arrangement in which with shadow line device 42 and 43, and is associated with the sawing machine 44 by the cable system 45. The device illustrated in FIG. 20 projects the shadow lines 46-48 from the projection 49-51 onto the bed 52 associated with the machine 44. Planks laid upon the rollers 53-55 forming the receiving surface of the bed structure 52 can be shifted laterally in a desired relationship with respect to the lines 46-48 to obtain the most effective utilization of the material in the planks or slabs. The machine 44 is conventional in construction, and has a group of circular saws mounted in coaxial relationship. The structural details of this machine are not shown, but the purpose of the cable connections 45 is to maintain an alignment of the shadow lines 46-48 so that they represent the path of cut of the saws of the machine 44 on slabs or planks fed into the machine over the rollers 53-55. Normally the saw corresponding to the line 46 will be fixed in position, with the other two saws adjustable laterally by manipulation of the control wheels 56 and 57. The cable system 45 (which is double) will associate the projectors 39 and 40 with the control mechanisms operated by the wheels 56 and 57 so that the shadow lines 47 and 48 move exactly with the saws.

The box beam 22 is open along its underside. The cylindrical guide rails 58-63 (which may be either tubular or solid in cross section) are secured at their opposite ends to the bars 64 and 65 (refer to FIG. 4), and these bars are secured to the shelves 66 and 67 of the box beam 22. The projector assemblies 39 and 40 are each suspended from a carrier movably mounted on the guideways formed by the pairs of rails 58-59 and 62-63. The carrier for the projector 40 includes the base plate 68, the followers 69 and 70 (refer to FIG. 5) in fixed position with respect to the plate 68, and the follower 71 capable of a limited freedom of lateral movement within the slot 72 (refer to FIG. 7). The followers 69 and 70 are installed in the holes 73 and 74 with a sufficient closeness of fit to maintain the alignment of the baseplate 68 with respect to the guideways. The lateral freedom of the followers 71 eliminates any possible conflict due to accumulations of tolerance, so that the rails 62 and 63 are fully responsible, exclusively, for maintaining the angular position of the plate 68 in the horizontal plane. The follower 71 is responsible only for vertical support.

The followers 69-71 are standard items, and are similar in construction. Each of these includes a socket as shown at 71a in FIG. 10, and a bass as shown at 71b which is rotatable within the socket. The ball and the socket are both preferably of a low-friction plastic material molded to the illustrated configuration. The baseplate 75 of the carrier assembly associated with the projector 39 is similar in configuration to the plate 68 in a right-left relationship (refer to FIG. 6). The followers 76 and 77 are in fixed position with respect to the plate 75, and determine the alignment of the plate 75 through engagement with the guideway rails 58 and 59. The followers 78 is movable with respect to the plate 75 in the same manner as is the follower 71 with respect to the plate 68. The configuration of the plates 68 and 75 permits a degree of overlap, as shown in FIG. 6, permitting the closest possible approach between the projector assemblies 39 and 40. The use of different pairs of guide rails to determine the beams 68 and 75 utilizes the broadest dimension of the plate in a manner to economize on both space and cost for a given degree of stability.

FIG. 11 illustrates a modified form of construction of the guideway followers. The balls 71c are placed directly in the holes 73 and 74 of the carrier plate 50, these balls being slightly larger in diameter than the diameter of the plate holes. While this arrangement does not provide a rolling engagement between the balls and the rails 58, 59, and 62-63, the use of low-friction plastic bearing materials against a polished surface on the guideway makes this arrangement acceptable where cost is a factor to be considered. The balls become wedged tightly in the holes, and the assembly of them in position is obviously very simple. The same may also be the result of the same manner in the slot 72, providing a slight rolling action along the edges of the slot as any accommodation takes place.

The structure of the projector assemblies is suspended from the carriers in the manner shown in FIGS. 9 and 10. Bolts 79 and 80 are secured to the plate 68 by the nuts 81 and 82, respectively. These bolts extend downward through the open bottom of the box beam 22, and are secured to the light source housing 83. The alignment of the projector assemblies on the guideways is improved by the presence of the compression springs 84 and 85 bearing respectively on the discs 86 and 87, which apply pressure to the similarly shaped discs of bearing material 88 and 89 which bear on the underside of the rails 60-61 and 62-63. The pulldown effect contributed by these springs maintains a more solid engagement of the units with the guide rails, the renders the position less subject to variation from outside influences.

Referring to FIG. 12, the housings 83 contain the elongated filament bulbs 90 mounted in the standard brackets 91 and 92, together with the usual associated electrical circuitry (not shown). The underside of the housing 83 is closed off by the pair of slats 93 and 94 (refer to FIG. 13) secured, respectively, by the screws 95-96 and 97-98. The spacing of these slats is determined by the cross members 94a-b to which the slats are welded. This assembly is adjustable within the freedom provided by the elongated slots at the point of engagement of the screws to allow for lateral adjustment. This slot should be in a vertical plane containing the filament of the bulb 90, and the width of the slot 99 defines the sector of radiation of light from the filament of the bulb.

The bulbs used for this application provide a very intense light, and generate a considerable amount of heat in doing so. The sides of the housing are therefore preferably defined by some perforate material, such as the punched sheet 100 (refer to FIG. 8). Since the slot 99 is quite narrow, the flow of cooling air through the housings 83 is supplemented by the effect of the blower 101, which is mounted on the side of the box beam 22. The flexible conduits 103-105 (refer to FIG. 5) deliver the output of the blower to the housings of each of the projector assemblies, and the electrical conduits 106-108 are provided to supply the bulbs 90 in each of these assemblies.

The lines 109-111 (refer to FIG. 1) are each suspended (within the sectors of radiation of the light sources directly above them) by the arms 112-117. These arms are mounted on the underside of the housing assemblies in the manner shown in FIG. 13. Screws 118 and 119 engage slots in the arms to provide a lateral adjustability of the arms that will facilitate the alignment of the lines 109-111. This arrangement avoids the necessity of unduly close manufacturing tolerances. The connection of the lines to the arms gives a further degree of lateral adjustability by virtue of the provision of the transverse bolts 120 which function as line terminals (refer to FIG. 18). The lines are connected to these bolts at a selected point along the axis of the bolts by the standard "aliginator" clips 121. It is preferable to include springs 122 interposed between the lines and the clips to establish a predetermined degree of tension. This tension is supplemented by the resilience of the arms themselves. The springs, however, need only be attached at one end of the lines. The aligator clips are preferably used at both ends.

FIGS. 15 and 16 illustrate a modified arrangement for the establishment of tension in the light interference lines. One of the ventilating perforations in the side plates 123 on the opposite side of the housing 124 may be utilized as a venting to receive the journals 125 and 126 of the spring 127. The portions 125 and 126 traverse holes in the sides of the flanges of the channel-shaped arm 128 to provide a pivotal connection, while the spring arm 129 delivers a force to the arm 128 tending to establish tension in the line 130. The arms, the line connections, and the housing assemblies associated with the FIG.
3,638,692

15-16 modification are otherwise similar to those previously described. It is preferable to incorporate one or more turns in the wire forming each side of the spring 127, as shown at 131 and 132 to increase the degree of resiliency of the unit. The tops of the coils 131 and 132 rest against the bottom of the housing 124, thus providing a point for the application of force to generate the moment urging the arm 128 outward.

The arrangement for positioning the projectors laterally along the guideways is shown schematically in FIG. 19. A first cable loop 133 is positioned by the pulleys 134 and 135 so that the run 136 has an axis close to the top of the carrier plates. At a convenient point on the carrier plates, holes 137 and 138 (refer to FIG. 7) receive the bolts 139 and 140 (refer to FIG. 10) which secure the clamping piece 141 to establish that the carrier moves exactly with that portion of the run 136. A similar arrangement is provided for each of the carriers. Each of the loops 133 is also associated with a loop 142 having the run 143 positioned within the box beam 22 by the pulleys 144 and 145. The loop 142 extends from openings in the box beam 22 to the machine with which the shadow line device is associated, in the manner illustrated in FIG. 20, the cable system 45 including whatever number of loops 142 are being used. The particular loop 142 is associated with a machine component that positions a particular saw by the clip 146, with the result that the movement of the saw is duplicated exactly by the movement of the carrier plate 68, as a result of the attachment of the run 147 of the loop 133 to the run 143 of the loop 142 by the clip 148. The placement of pulleys 149-152 can be determined according to the needs of the particular machine.

The use of plastic bearing materials within the box beam 22 makes it desirable to assure that the temperature in this area does not exceed the allowable temperature of the materials selected. Since the heat from the light sources tends to cause the heated air to rise and fill the box beam, it is desirable to provide the supplemental ventilation delivered by the blower 37 (refer to FIG. 2). This blower has the effect of delivering a blast of air through the beam, with some of it emerging through the bottom, and the remainder going through the opening 22a and 22b through which the cables pass.

We claim:

1. A shadow line device including a frame, a light source, a line disposed within the radiation sector from said light source to project a shadow on a reference surface, and positioning means adapted to induce movement of said line in predetermined relationship with an associated machine component, wherein the improvement comprises:
   guideway means mounted on said frame;
   at least one carrier having followers means engaging said guideways, said light source being mounted on said carrier, said positioning means including a cable system determining the movement of said carrier along said guideway means and connected to said machine component;
   a housing for said light source secured to said carrier, and also including blower means operatively connected to induce a flow of cooling air in said light source housing;
   a guideway housing, said blower means being mounted on said guideway housing, and flexible air conduit means interconnecting said blower means and said light source housing.

2. A device as defined in claim 1, wherein said housing has a bottom opening, portions of said carrier being disposed to traversed said openings, and additionally including a second blower means, said second blower means being operatively connected to induce a flow of cooling air in said guideway housing.

3. A shadow line device including a frame, a light source, a line disposed within the radiation sector from said light source to project a shadow on a reference surface, and positioning means adapted to induce movement of said line in predetermined relationship with an associated machine component, wherein the improvement comprises:
   guideway means mounted on said frame said guideway means comprising a pair of guideways;
   two carriers having followers means engaging said guideway means the follower means of one carrier engaging one of said guideways at two spaced points and the other guideway at one point, the follower means of the other carrier engaging said other guideway at two spaced points and said one guideway at one point, said carriers having a configuration providing overlap when said carriers are in close proximity to each other, each of said carriers having a light source and positioning means associated exclusive-ly therewith, said positioning means including a cable system determining the movement of said carriers along said guideway means and connected to said machine components;
   a pair of arms mounted on each of said carriers having the ends thereof disposed in spaced relationship in a direction transverse to said guideway means and within the radiation sector of said light source associated with said carriers, respectively, said line being connected to said arms.

4. A shadow line device including a frame, a light source, a line disposed within the radiation sector from said light source to project a shadow on a reference surface, and positioning means adapted to induce movement of said line in predetermined relationship with an associated machine component, wherein the improvement comprises:
   means on said frame forming a pedestal;
   guideway means mounted on said frame, said guideway means being angularly movable on said pedestal in a horizontal plane;
   at least one carrier having follower means engaging said guideway, said light source being mounted on said carrier, said positioning means including a cable system determining the movement of said carrier along said guideway means and connected to said machine component;
   a housing for said light source secured to said carrier, and also including blower means operatively connected to induce a flow of cooling air in said light source housing;
   a guideway housing, said blower means being mounted on said guideway housing, and flexible air conduit means in-

5. A device as defined in claim 4, wherein said guideway means is rotatable about the axis of said pedestal.

6. A device as defined in claim 4, wherein said pedestal includes telescoping relatively rotatable pipes.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Andrew G. Carter and Charles L. Morgan

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3 Line 50 "bass" should be --ball--
Column 4 Line 2 "bells" should be --balls--
Column 4 Line 17 "53" should be --63--

Signed and sealed this 20th day of November 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. RENE D. TEGTMeyer
Attesting Officer Acting Commissioner of Patents