This invention relates in general to the art of screen printing, and more specifically to a screen printing head and improved squeegee assembly therefor.

In screen printing it is customary to utilize a reciprocating squeegee blade for effecting a printing and flooding stroke. Heretofore, with the known squeegee blade assemblies it was difficult, if not impossible, to regulate the angle and pressure exerted by the squeegee blade relative to the stenciling screen. Consequently any changes in the pre-set conditions of a printing operation usually resulted in an objectional jerking or intermittent printing stroke. Also unless the squeegee blades were properly set so as to exert a predetermined pressure and/or angle relative to the screen, a clean sharp print was not possible. Usually a trial and error method is required to determine the proper amount of squeegee pressure and angle of the squeegees uniform and thereby obtain optimum results due to differences in consistencies of various inks, textures of the materials printed, and other like influencing conditions. With the prior known construction such determinations could not be readily made, if at all, without an expenditure of much time, labor, and effort.

Since screen printing is generally accomplished by a reciprocating back and forth motion of a squeegee blade relative to the screen and material being printed, speed of operation in single stroke printing requires that a printing operation be accomplished on each stroke of the squeegee. In such single stroke printing operations it is essential that the pressure and angle of the squeegee be the same on the back stroke as well as the forward stroke in order to attain uniform results. Heretofore, great difficulty has been encountered in maintaining the pressure and angle of the squeegees uniform for both the forward and back strokes of the squeegees.

Therefore, an object of this invention is to provide a screen printing head having an improved squeegee assembly constructed and arranged so as to render a squeegee blade thereof readily adjustable and thereby obtain optimum results with a fine degree of accuracy.

Another object is to provide an improved squeegee assembly having a pair of individually adjustable squeegee blades constructed and arranged for effecting either independent single stroke printing or for effecting a printing and flooding stroke depending on the particular predetermined machine cycle of operation.

Still another object is to provide an improved squeegee assembly constructed and arranged for effecting independent adjustment of either the pressure and/or angle of the squeegee blade with respect to the stenciling screen.

Still another object is to provide a double squeegee blade construction in which the respective blades are rendered independently adjustable as to both angle and/or pressure in a relatively simple, expedient and positive manner.

Other features and advantages will become more readily apparent when considered in view of the drawings and descriptions thereof in which:

FIG. 1 is a plan view of a printing head for use on a screen printing machine embodying the squeegee assembly of this invention.

FIG. 2 is a detailed plan view of the squeegee assembly.

FIG. 3 is a front elevation view of the squeegee assembly, having parts thereof shown in section.

FIG. 4 is a detail sectional view of the blade holding means taken along line 4—4 of FIG. 3.

FIG. 5 is a sectional view taken along line 5—5 of FIG. 3, having portions thereof broken away, the squeegee assembly being disclosed in a neutral position.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 3.

Referring to the drawings, FIG. 1 illustrates a plan view of a printing head 10 and an improved squeegee assembly 11 therefor. Generally, the printing head 10 of the type illustrated is pivotally connected along one end thereof to a printing machine frame (not shown) for movement between raised inoperative position and lowered operative printing position in a manner well known to those skilled in the art.

The printing head 10 comprises frame 12 defined by rectangularly disposed front 13, rear 14 and opposed interconnecting side structural members 15. The frame 12 thus provides a support for a suitable printing or stenciling screen 16. Adjacent the corners of the frame 12 are connected relative short upright posts or supports 17. As shown, the posts 17 are spaced along the side members 15 of the frame 12. Connected between the space post 17 along each side 15 of the frame 12 is a guide rail 18.

In accordance with this invention opposed guide support 19 of the squeegee assembly is slidably mounted on the respective rails 18 for movement back and forth therealong. Each of the guide supports 19 comprises essentially a block 20 having a bore 21 through which the guide rails 18 extend.

Pivotal mounted to the inner side of each guide support 19 is a rocker means 22. As shown, the rocker means 22 connected to each of the guide supports includes an upper rocker cross-head 23 with a depending stem portion 24, and a vertically spaced lower rocker cross-head 25. Each of the respective cross-heads 23, 25 are pivotally connected intermediate the ends thereof to their respective guide support 19 about pivots 26 and 27, respectively. The outermost corresponding ends of the respective upper and lower cross-heads 23, 25 are interconnected by connecting links 28, the respective ends of each link 28 being pivotally connected to the cross-heads 23, 25.

Connected to and between the corresponding opposed ends of the respective upper cross-heads 23 extend spaced apart rods 29 and 30. As shown, the respective rods 29, 30 define the pivot about which the upper end of the connecting links 28 are pivoted to their respective upper cross-heads 23. Interconnected between corresponding opposed links 28 of the respective rocker means 22 are rods 31 and 32 respectively, rods 31 and 32 being vertically aligned with rods 29 and 30 respectively. To maintain the vertical spacing between aligned rods 29, 31 and 30, 32, suitable spacing clamps 33 may be provided at transversely spaced intervals therealong.

In accordance with this invention a plurality of holding means 34 for supporting squeegee blades 35 are spaced along each pair of vertically aligned rods 29, 31 and 30, 32. As shown, each of the holding means 34 comprises a slide carrier or block 36 having defined in opposed surface portions thereof, a channel or groove 37. Extending through each block or carrier 36 is a pair of aligned bores 38 for accommodating the rods 29, 31 or 30, 32. Thus the arrangement is such that the carrier or block 36 is slidably supported along its respective rods, and thus can be adjustably positioned.
along the length thereof. A set screw 39 is threaded into the carrier 36 for locking the carrier 36 to one of the rods in the adjusted position thereof.

In accordance with this invention a vertically adjustable slide 40 is carried on each carrier 36. The slide 40 comprises a pair of spaced plates 41 and 42 which slide in the channels 37 formed in carrier 36. Top and bottom spaces 43, 44 respectively maintain the plates 41 and 42 at the same distance in alignment and effect a smooth sliding action between the carrier 36 and slide 40. To render slide 40 vertically adjustable relative to the fixed carrier 36, an adjusting screw 45 is threaded through a threaded opening in the top space 43 so that the lower end of the screw 45 bears on top of the carrier 36.

It will thus be apparent that mere rotating of the adjusting screw 45 will effect vertical adjustment of the slide upwardly or downwardly with respect to the carrier 36 according to the direction of screw rotation. If desired a lock or limiting nut may be threaded to the stem of adjusting screw 45 to maintain the slide 40 in its vertically adjusted position.

As shown, one plate 41 of the respective slides 40 has a depending position 41A which extends below the carrier 36. Preferably, the extended portion 41A is adapted to be in a position relative to its connected plate portion 41. In accordance with this invention, the respective squeegee blades 35 are detachably connected to the extended slide portion 41A of its associated pair of holding means 34. As shown in Fig. 4, the squeegee blade 35 has connected thereto a hinge bracket 46 having a loop 47 defined therein. The extended slide portion 41A is further provided with a pair of spaced ears 48 to ensure to embrace or straddle the ends of the hinge bracket 46 connected to the squeegee blades. Thus each of the squeegee blades 35 is detachably connected to the extended slide portions 41A by a hinge pin 49 which is inserted through the aligned hinge bracket loop 47 and pin openings in ears 48. In this manner it will be readily apparent that the respective squeegee blades 35 are pivotable about the horizontal axis of pins 49.

To adjust the angle of the blade with respect to the extended slide portion 41A, and in turn relative to the screen 16, a pair of cooperating adjusting screw means 50, 51 are provided. As shown the screws 50, 51 are each disposed on opposite sides of the hinge pin horizontal axis. Each screw 50, 51 is threaded through its respective slide extension 41A so that the ends thereof are brought to bear on the blade 35. Thus to adjust the angular position of the blade 35, one screw is projected toward the blade while the other screw is backed off. In this manner it will be apparent that the angular adjustment of the squeegee blade 35 can be rendered independently of the vertical adjustment of the blade, and vice versa.

If desired suitable lock nuts 52 may be provided for each of the screws 50, 51 to maintain the respective screws settings in the angular adjusted position of the squeegee blades.

From the foregoing description and in view of the drawings, it will be noted that each blade 35 and its cooperating adjustable holding means 34 are identical in structure but opposite in half, and the description has dealt only with one blade.

To effect operation of the squeegee assembly 11 to accomplish either a printing stroke, or a printing and flooding stroke, means are provided to oscillate the crossheads of the rocker means 22 about their respective pivots 24. From the described structure it will be apparent that oscillation of the rocker means 22 will alternately cause one of the squeegee blades 35 to move toward the printing screen 16 as the other blade is moved off the screen. In accordance with this invention, the means for oscillating the respective rocker means 22 comprises a piston and cylinder assembly 55 which is connected to each guide support 19 by a suitable bracket 56. It will be understood that the cylinder and piston assembly 55 may be either hydraulically or pneumatically actuated. If desired, an electrically operated solenoid may be employed instead.

As shown, the piston rod 57 of the cylinder assembly 55 is arranged to reciprocate through a bore 53 formed in the guide support 19. Connected to the end of the piston rod 57 is a cam roller or follower 58 which is adapted to ride in a cam groove 59 formed in the stem portion 24 so as to ensure an alternate reciprocation and retraction of the piston rod 57 and its connected follower 58 will effect an oscillating movement of the rocker means 22 about its respective pivots 26, 27.

Reciprocation of the guide supports 19 and the squeegee assembly 11 connected thereto across the screen is obtained by a chain drive 60. As shown, in FIG. 1 an endless chain drive is disposed along each side of the printing head frame 12. Each of the chain drives 60 is similar in construction, and therefore the description of one will be sufficient for the understanding of the invention.

Journalized adjacent the front and rear ends 13 and 14 of the printing head frame 12 are paired sprockets 61 over which a flexible drive or chain 62 is threaded. Disposed intermediate the length of chain 62 in one flight thereof is a double acting piston and cylinder assembly 63. As shown, a piston rod 64 extends from both ends of the cylinder 65 integral with the cylinder assembly 63. The chain 62 in turn is connected intermediate the end thereof to a bracket 65 fixed to the guide supports 19 of the squeegee assembly 11. Thus it will be apparent that fluid introduced on one side of the piston (not shown) and cylinder assembly 63 will exert a force on the piston to drive the piston in one direction, whereas the introduction of fluid on the opposite side of the piston will drive the piston rod 64 in the other direction. Consequently, by a proper timing sequence, the squeegee assembly is reciprocated back and forth across the screen 16 to effect either a printing stroke or a printing and flooding stroke, depending on the machine cycle.

It will be noted that the action of the piston and cylinder assembly 55 actuating the rocker means 22 is timed to the operation of the chain drive piston and cylinder assembly 63 to effect the appropriate oscillating movement of the rocker means at the end of each stroke of the squeegee assembly.

If desired the chain drives 60 are protected or shielded by suitable guards 65 which are only fragmentally shown.

From the foregoing description it will be noted that the respective squeegee blades can be individually adjusted as to both angle and pressure; and that either of the latter adjustments can be effected independently of one another. With the described construction it thus becomes apparent that the respective squeegee blades can be adjusted so as to exert a uniform pressure on the screen on either stroke of the blades. Thus in single stroke printing, identical stroke forces are attained in both the forward and backward stroke of the squeegee assembly. Consequently uniform results are assured. Further, it will be apparent that the respective squeegee blades can be readily adjusted vertically and angularly with a minimum of effort, simply by adjusting screw 45 and screws 50, 51 accordingly. Thus the pressure and angle exerted by the respective squeegees can be regulated in a manner to obtain the most optimum results.

While the instant invention has been disclosed with reference to a particular embodiment, it is to be appreciated that the invention is not to be taken as limited to all of the details thereof as modifications and variations the same, or of may be made without departing from the spirit or scope of the invention.

What is claimed is:

1. A printing head for use on a printing machine comprising a frame for holding a printing screen, said frame being mounted for movement between operative and inoperative positions, a guide rail extending along op-
posed sides of said frame, a guide support slidably mounted on each of said guide supports, each rocker including a T-shaped member having a cross-head and an integrally connected stem portion, each rocker being fulcrum mounted to its respective guide support about a point intermediate the end of said cross-head, a pair of spaced apart rods interconnecting said rockers, each of said rods being connected to and havin a corresponding opposed end portion of said cross-heads, a pair of squareege holding means connected in laterally spaced relationship to each of said rods, a pair of squareege blades, means for detachably securing one of said squareege blades to each pair of said holding means, each of said holding means including means for adjusting said squareege blades, means connected to each of said guide supports for oscillating its associated rocker for alternately raising one of said pairs of squareege blades while lowering the other, and means for reciprocating said guide supports and squareege blades connected thereto back and forth across a printing screen supported within said frame, each of said holding means including a rider slidably connected to said rod, a slide member connected to said rider for vertical adjustment relative thereeto, an adjusting screw threaded to the upper end of said slide member for effecting relative adjustment of said slide member relative to its respective rocker, a lock nut threaded to said adjusting screw, an extension integrally connected to said slide member depending below said rider, said extension being disposed at an angle relative to said slide member, means for pivotally connecting a squareege blade to said extension, and means for angularly adjusting said squareege blade about its pivot.

2. A squareege assembly comprising a pair of spaced apart guide rails extending along opposed sides of a printing head, a guide support slidably mounted in each of said guide rails, a rocker means pivotally connected to each of said guide supports, each of said rocker means including an upper cross-head and a lower cross-head which are pivotally mounted intermediate the ends thereof to their respective guide supports, link means interconnecting the corresponding opposed ends of each upper and lower cross-heads of the respective rockers, an integrally connected stem portion connected to one of said cross-heads of the respective rockers, rod means interconnecting said rocker means, said rod means including a pair of vertically spaced rods connected between operative and inoperative position, a guide rail extending along opposed sides of said frame, a guide support slidably mounted in each of said guide rails, a rocker means pivotally connected to each of said guide supports, each of said rocker means including an upper cross-head and a lower cross-head, each being pivotally mounted intermediate the ends thereof to their respective guide supports, interconnecting the corresponding opposed ends of each upper and lower cross-heads of the respective rocker means, an integrally connected stem portion connected to the upper cross-head of the respective rockers, rod means interconnecting said rocker means, said rod means including a pair of vertically spaced rods connected between the respective rocker means, means clamped between each pair of vertically spaced rod means for maintaining vertical alignment therebetween, a pair of holding means slidably mounted on each pair of rods, means for securing said carrying in laterally adjusted position on said rods, a slide member carried on each of said carriers, said slide member being mounted thereon for vertical adjustment relative thereeto, an adjusting screw for effecting vertical adjustment of said slide member relative to its respective carrier, a lock nut threaded to said adjusting screw, an extension integrally connected to each of said slide members, said extension depending below said carrier, a squareege blade, means for hingedly supporting a squareege blade therebetween a pair of said holding means, said hinge means including cooperating lugs and hinge loop connected to said extension and squareege blade respectively, a hinge pin for detachably connecting the same, and a pair of adjusting screws threaded through said extension so as to be disposed on opposite sides of said hinge pin for effecting angular adjustment of said squareege blade about said hinge pin, means for oscillating said squareege blades for horizontally adjusting same, means for reciprocating the guide supports and squareege blades connected thereto back and forth across a printing screen supported within said frame.

4. An improved reciprocating squareege assembly for use on a printing head of a screen printing machine comprising a pair of spaced apart guide supports mounted for reciprocal movement on the printing head, a rocker pivotally mounted on each of said guide supports, each of said rockers being fulcrum mounted to its respective guide support about a point intermediate thereof, a pair of spaced apart rods interconnected between said rockers, each of said rods being connected to and being in corresponding opposed end portions of said rockers, a pair of squareege holding means connected in laterally spaced relationship to each of said rods, a pair of squareege blades, means for detachably securing one of said squareege blades to each pair of holding means, each of said holding means including relative sliding means for individually adjusting said squareege blades vertically with respect to a printing screen to adjust relative squareege pressure therebetween, and means connected to one of said relatively sliding means for angularly adjusting the connected squareege blade with respect to a printing screen, means connected to each of said guide supports for oscillating its associated rocker for alternately raising one of said pairs of squareege blades while lowering the other, and means for reciprocating said guide supports and squareege blades connected thereto back and forth across a printing screen.

5. The invention as defined in claim 4 wherein said holding means includes a rider slidably connected to said rod, a slide member slidably connected to said rider for vertical adjustment relative thereto, means for adjusting
and maintaining the slide vertically relative to its rider, an extension integrally connected with said slide member, and said angular adjusting means including an extension disposed at an angle relative to said slide member, means for pivotally connecting a squeegee blade to said extension, and means for angularly adjusting said squeegee blade about its pivot.

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