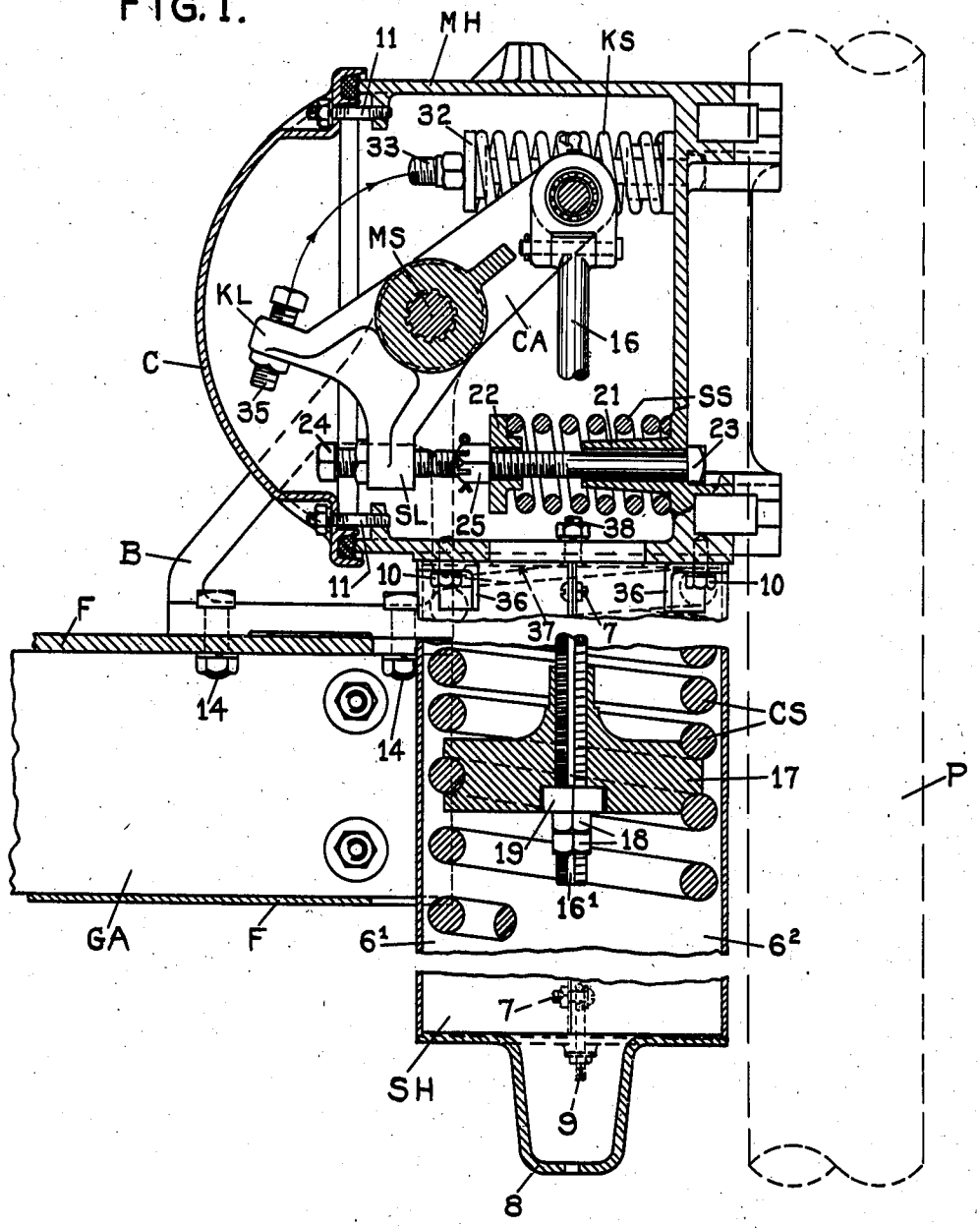
June 20, 1944. W. K. HOWE 2,351,857

HIGHWAY CROSSING GATE FOR RAILROADS

Filed May 27, 1942 3 Sheets-Sheet 1

FIG. 1.



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HIGHWAY CROSSING GATE FOR RAILROADS

Filed May 27, 1942 3 Sheets-Sheet 2

FIG. 2.

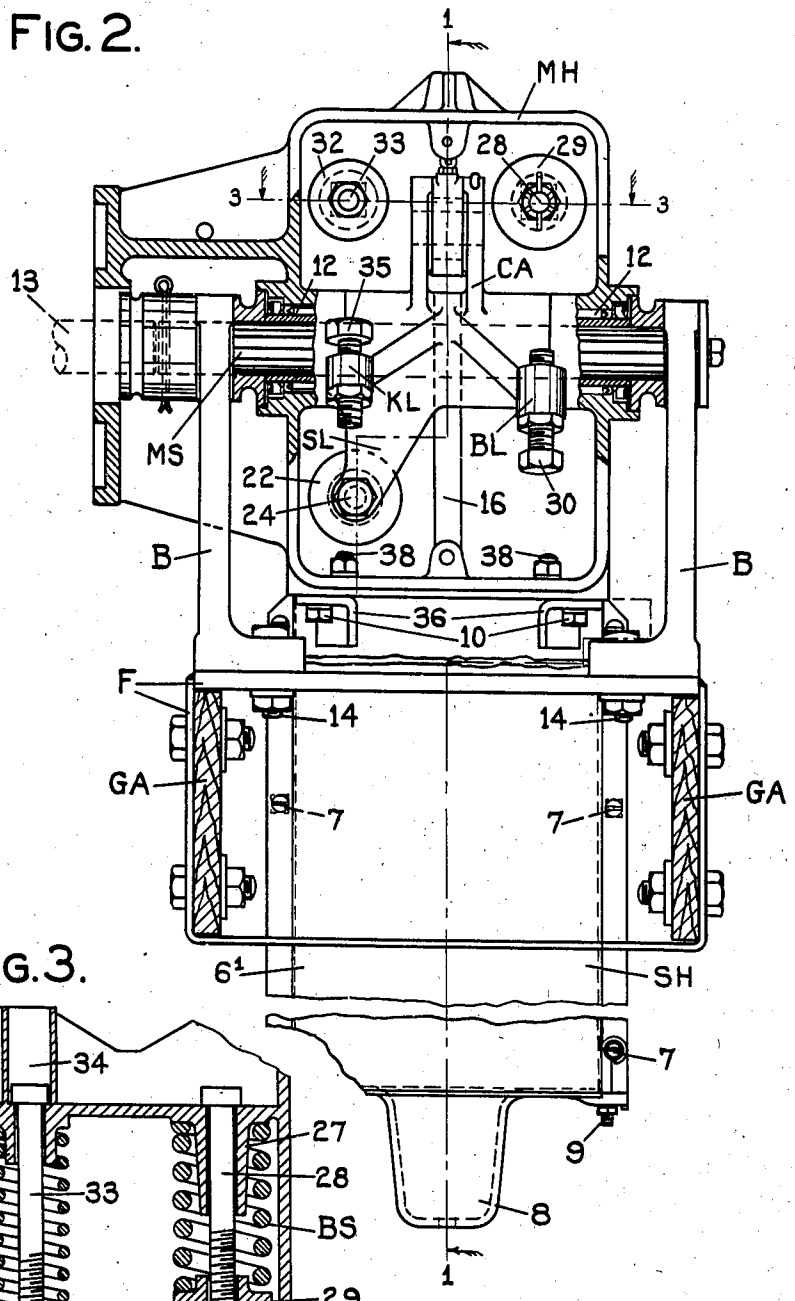


FIG. 3.

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Filed May 27, 1942 3 Sheets-Sheet 3

Deg.	Rad. Feet	Spring Pressure	Ft. Lbs.
0	.384	3070	1180
10	.43	2810	1210
20	.46	2510	1170
30	.49	2200	1080
40	.5	1860	930
50	.496	1575	780
60	.475	1260	600
70	.44	950	418
80	.384	700	268
90	.312	475	148

FIG. 4.

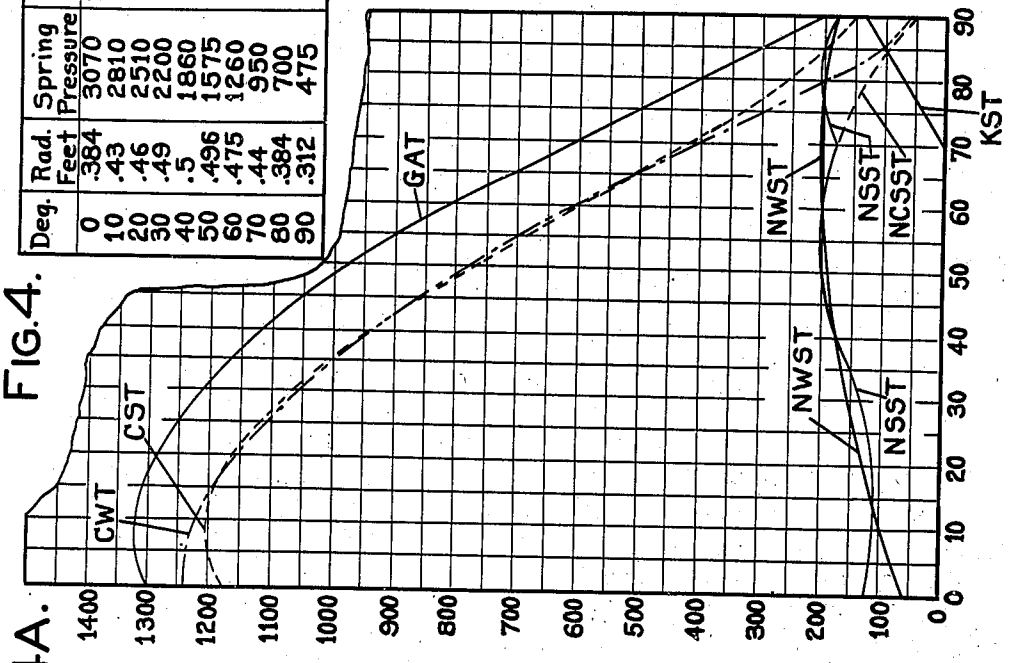
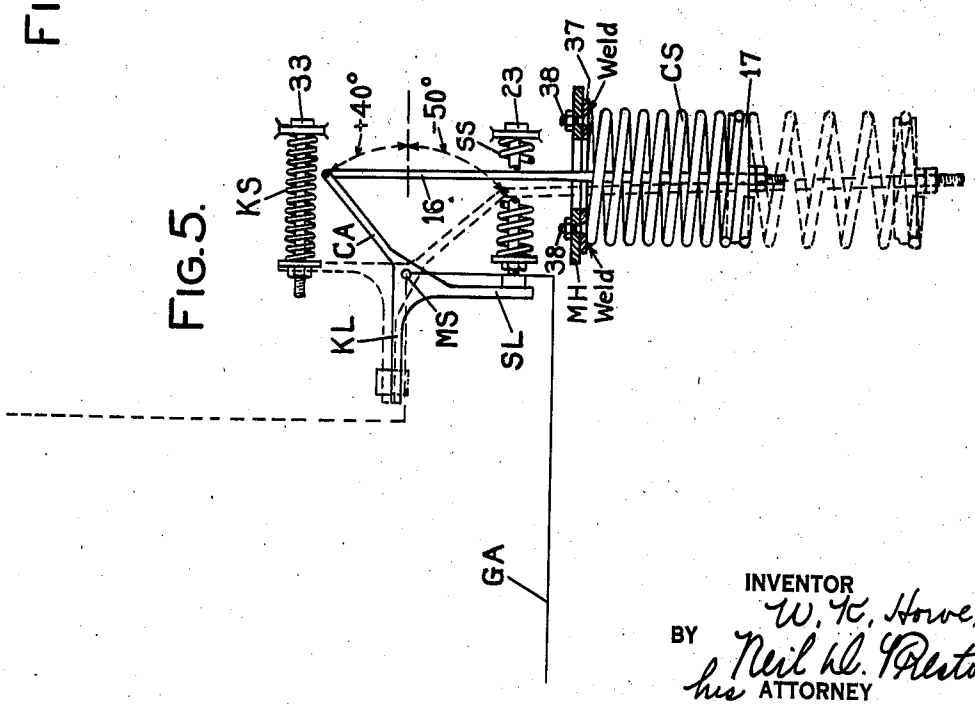


FIG. 4A.

FIG. 5.



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Patented June 20, 1944 2,351,857

UNITED STATES PATENT OFFICE

2,351,857

HIGHWAY CROSSING GATE FOR RAILROADS

Winthrop K. Howe, Rochester, N. Y., assignor to General Railway Signal Company, Rochester, N. Y.

Application May 27, 1942, Serial No. 444,689

7 Claims. (Cl. 39—7)

This invention relates in general to railroad crossing gates, and has more particular reference to an improved crossing gate for the protection of highway traffic where highways cross railways, of the type which is substantially counterbalanced by spring means rather than usual weight means.

Crossing gates may become very long, and hence very heavy, and though it may be substantially counterweighted by means of a weight, this weight may be so bulky and heavy as to be very undesirable. The weight which can be of iron, or possibly concrete, may weigh more than a thousand pounds and thus be costly to install and maintain. Furthermore, the weight may be so large and cumbersome as to swing so close to the ground when the gate is in the vertical or clear position, as to be interfered with by deep snows and the like and, hence function improperly under adverse conditions.

With the above and other considerations in view, it is proposed in accordance with this invention to employ a system of springs to replace the usual counterweight, and thus provide a compact light-weight means for substantially counterweighting a crossing gate. This makes not only for convenience and economy in handling and dependability in operation, but also makes for economy in the initial cost of equipment.

Since a single spring builds up torque upon expansion or compression, at a rate different from that due to the weight of the crossing gate, it is proposed to employ a spring system whereby its counterweighting effect with respect to a gate will be substantially the same as that of a counterweighting system employing a usual mass of iron or concrete as a counterweight.

Further objects, purposes and characteristic features of the invention will appear as the description progresses, reference being made to the accompanying drawings showing, solely by way of example, and in no way whatsoever in a limiting sense one form which the invention can assume.

In the drawings—

Fig. 1 is a fragmentary side sectional elevation on line 1—1 of Fig. 2, and viewed in the direction of the arrows and with parts shown in elevation, of one embodiment of the invention.

Fig. 2 is a front sectional elevation with parts removed and parts broken away.

Fig. 3 is a section on line 3—3 of Fig. 2, and viewed in the direction of the arrows.

Figs. 4 and 4A are respectively a table of operating values and a series of curves, of a standard gate, and a gate spring counterbalanced in accordance with this invention.

Fig. 5 is a diagrammatic view of the improved gate.

Referring now to the drawings and first to Fig. 1, there is here shown a gate pivoted to a supporting post and operable by a motor or other suitable prime mover of the general type, for example, as shown in the patent to W. K. Howe, et al., No. 2,220,154, granted November 5, 1940.

A pole or post P supports the gate, and to this post is fastened, by U-bolts or the like, a housing comprising an upper portion or main housing MH, and a lower portion or spring housing SH, suitably interconnected by bolts 10 or the like. The main housing MH is closed by a cover C, removably fastened to the housing as by bolts 11. To facilitate assembly, as pointed out hereinafter, the spring housing SH comprises two half cylindrical portions 6^1 and 6^2 fastened together with bolts 7 to form a cylindrical casing which has a bottom portion 8 fastened thereto as by hook bolts 9. Welded to the side of this cylindrical casing at the top thereof are angle brackets 36 through which pass the bolts 10 which connect this spring housing SH to the main housing MH.

Passing through the main housing is a main shaft MS which is splined throughout its entire length and is suitably supported in the usual roller bearing assemblies 12 with the shaft extending beyond the housing to connect with an operating means, not shown, as at 13. Sleeved on the main shaft MS is a pair of brackets B which are connected to said shaft and constrained to turn therewith. These brackets are fastened by bolts or the like 14 to a frame member F of welded box-like formation to which is suitably fastened the gate arm portions GA which are generally made of wood or like material.

It can thus be seen that upon rotation of the shaft, the brackets which are constrained to rotate with the shaft operate the frame and the gate carried thereby and, hence, the gate which is shown in Fig. 1 as being in the horizontal or stop position can be moved to its vertical or clear position by a rotation of the main shaft of substantially 90°.

Carried on the main shaft and within housing MH is a crank arm CA which is constrained to move with the shaft, as shown. This crank arm at its upper inner end is pivotally connected to a rod 16 which extends downwardly into the spring housing SH and passes through the convolutions of a counterbalancing spring CS which is contained in the spring housing SH but is

suitably anchored to the bottom of the main housing MH. This anchoring means is accomplished by welding a ring plate 37 to the top flat end of the spring CS and then fastening the ring plate to the main housing MH with bolts 38. (See Fig. 5). This counterbalancing spring is a heavy, compact, helical spring, the function of which is to largely replace the usual counterweight used on crossing gates. Rod 16 is slotted at its lower end, as at 16¹ and also threaded. Slidably received on rod 16 is an adjusting nut 17, which is itself threaded on its outer cylindrical face with a thread which screws into the spring CS. Nut 17 is held in position on the rod by a squared follower 19, received in a squared socket in nut 17 and keyed to the rod 16 by a key (not shown) received in the slot 16¹, and held therein by nuts 18, threaded onto the rod 16. The spring housing SH is now assembled around the spring CS and connected with the main housing as hereinbefore described.

With the construction described just above, it is obvious that the effective length of the counterbalancing spring can be readily adjusted by screwing the adjusting nut 17 into or out of the counterbalancing spring and then fixing its position by the follower 19 and nuts 18. This adjustment permits varying the effective length of the spring as just stated, and, hence permits varying the rate of pile up of spring force as the spring is compressed.

It is also possible with this construction to adjust the initial or trapped tension of the counterbalancing spring. To accomplish this it is merely necessary to slide the adjusting nut in one direction or the other without turning it within spring CS, and then fixing its position by means of the follower and nuts 19 and 18.

As shown in Fig. 1 of the drawings, the gate is positioned in the horizontal or stop position and the crank arm CA is in the raised position whereby to have compressed the counterbalancing spring CS. Upon moving the gate to the vertical or clear position crank arm CA moves downwardly and the spring expands and supplies the major portion of the power necessary to move the gate to its vertical position.

The horizontal position of the gate is determined by a stop spring SS, which is sleeved on a boss 21 and is compressed by a head member 22 adjustably carried on a threaded rod 23 which contacts with an adjusting stud 24 threaded into a stop lug SL, carried on the crank arm, upon the gate reaching its horizontal position. With this construction, it can be seen that the initial tension of stop spring SS can be readily adjusted by means of the head member 22, and its cooperating nut 25, while the point at which the spring comes into play can be readily determined by means of stud 24 in stop lug SL.

In a manner similar to the stop spring SS for controlling the horizontal position of the gate, there is a buffer spring BS (see Figs. 2 and 3) sleeved on a boss 27 and receiving a stud 28 with an adjustable head 29 thereon for cooperating with an adjustable stud 30 carried in a buffer lug BL, constituting a portion of the crank arm CA. When the gate reaches the vertical position, if it should tend to overrun slightly beyond this position, the buffer spring comes into play to buff it and stop it. The gate arm is latched up in its vertical position in the usual manner as, for example, in the patent referred to above, and in this position the buffer spring exerts no pressure on the gate.

When the gate is raised to its vertical or clear position which is considered the 90° position, upon reaching about the 70° position, a kick-off spring KS comes into play to, in effect increase the weight of the arm and thus increase the tendency of the arm to move by gravity to its stop position. This kick-off spring KS is received on a boss 31, and is controlled by a head 32 which is adjustable on a threaded stud 33 which can slide in a guide 34. As in the cases above, the initial tension of this spring can be readily adjusted, as is obvious. The kick-off spring is compressed by means of an adjustable stud 35 carried in a kick-off lug KL, constituting a part of the crank arm CA. When this stud 35 contacts member 33, further movement of the gate compresses the kick-off spring and, hence, increases the tendency of the gate to move to its horizontal or stop position.

It can be seen from Fig. 5, which is a diagrammatic showing of the gate structure and operating means, that the weight of the gate, multiplied by its lever arm, gives the value of torque in a downward direction, and this varies at all points since the length of the lever arm so varies. On the other hand, the counterbalancing spring is compressed to a greater and greater extent, as the gate arm moves to the horizontal position, and thus the spring force varies. In this case, the lever arm through which the spring operates also varies so that the gate torque and the counterbalancing spring torque do not follow the same curve or, in other words, do not parallel each other. When the gate reaches its vertical or clear position, the counterbalancing spring torque tends to approach the gate torque, and leave very little resulting net downward or stop torque. If this were not rectified under conditions of high wind, in a given direction, the gate might fail to move by gravity to its stop position when unlatched.

To correct this situation, and rectify this fault, the kick-off spring KS comes into operation between the 70° and the 90° or clear position to offset some of the effect of the counterbalancing spring CS and give a net downward stop producing torque at the 90° position, sufficient to insure that the gate under all conditions will certainly move to stop position when unlatched.

In Fig. 4 is shown a table including a series of torque values, stated in foot pounds, a series of corresponding spring pressures, a series of lever arm lengths, in feet, and a series of corresponding degrees of arm movement at which they occur. It can be seen that the lever arm, through which the counterbalancing spring operates depends upon the position of the crank arm CA and as shown in Fig. 5, this crank arm moves from a position 40° above the horizontal when the gate arm is horizontal to a position 50° below the horizontal when the gate arm is vertical.

Turning to Fig. 4A the various curves here shown are largely self-explanatory. The curves in solid line are curves of torque in foot pounds, plotted against gate arm angular position, which torque is exerted in a downward or stop producing direction of the gate. The curves in dash and dot and dash lines represent foot pounds of torque, plotted as before, but which torques are exerted in an upward or clearing direction of the gate.

The curve GAT shows the torque at various positions of the gate, which is produced by the weight of the gate and, hence, is the gate arm torque, and is exerted downwardly. There is no

counterweight employed with this gate, but the operative characteristics of such a counterweighted gate is considered substantially ideal and, hence, the curve CWT is shown in dot and dash lines and is the upward torque which is produced by a usual properly proportioned counterweight. The difference at all points of movement of the arm between these two curves is the net resulting downward torque which is considered ideal and which is shown by the curve NWST or net weight stop torque.

In this Figure 4A is shown in dash line the torque curve of the counterbalancing spring CS designated as CST, or counterbalancing spring torque and is a torque tending to clear the gate. A curve KST kick-off spring torque starting at the 70° position, and running to the 90° position, is shown in full lines since this torque exerted by the kick-off spring is a downward torque tending to move the gate to the stop position. If this curve KST is combined with the curve GAT and from the resultant is subtracted the curve CST, a resulting curve which is the net spring stop torque is obtained. This is shown in solid lines as NSST, and starts at the zero position somewhat above the ideal net weight down torque curve NWST, then passes below the ideal, and then above it, to pass below it at the 70° point, and then due to the effect of the kick-off spring, passes up slightly above the ideal. If the kick-off spring were not employed, this resulting down torque when the gate is counterbalanced by a spring would follow the dotted portion of the curve NCSST, that is, net counterbalancing spring stop torque, and at the 90° position would be too small to insure the certain movement of the gate to the stop position upon being unlatched. It can be noted that the resulting net spring stop torque, the curve NSST, closely approximates the resulting net weight stop torque which is obtained with the usual counterweight, that is, curve NWST.

It can be realized from the above that the present arrangement and construction provides a cheaper, more dependable, and less cumbersome counterbalancing means than can be realized with a counterweight of the usual construction. Furthermore, the net stop producing torque throughout the entire range of operation of the gate, so closely approximates the ideal, that it is itself ideal. Thus, the full advantage of the usual counterweight is secured without any of its many disadvantages.

The table comprising a portion of Fig. 4, gives various values and various positions of the gate which are used to plot various of the curves described above. The derivation of the curve CWT counterweight torque, and of the curve NWST, net weight stop torque, is not gone into in detail in this disclosure since this is recognized as standard practice by those skilled in the art and hence, readily understandable.

The above rather specific description of one form which this invention can assume is given solely by way of example and is not intended, in any manner whatsoever, in a limiting sense. It is obvious that various modifications and adaptations can be made from time to time, as they may appear expedient, without thereby departing from the scope and the spirit of this disclosure, except insofar as it is limited by a reasonable construction of the appended claims.

Having described my invention, I now claim:

1. In a crossing gate for railways, in combination, an elongated gate pivoted near one of its ends and movable from a horizontal stop position to a vertical clear position, a counterbalance spring, means connecting the gate to the spring so as to progressively distort the spring as the gate moves from its clear to its top position, and a second spring operatively associated with the gate so as to be progressively distorted as the gate effects a substantial portion of its final portion of travel from its stop to its clear position.

2. In a crossing gate for railways, in combination, an elongated gate pivoted near one of its ends and movable from a horizontal stop position, to a vertical clear position, a helical counterbalancing spring, means connecting the gate to the spring so as to progressively compress the spring throughout its entire travel as the gate moves from its clear to its stop position, whereby to oppose gravitational effect on the gate and a second helical spring operatively associated with the gate so as to be progressively compressed as the gate effects its final substantially 20° portion of travel from its stop to its clear position whereby to aid gravitational effect on the gate.

3. In a railway crossing gate, in combination, an elongated gate pivoted adjacent one of its ends and movable under the force of gravity from a vertical clear position to a horizontal stop position, a helical spring, means operatively connecting the spring and gate so as to progressively distort the spring as the gate moves from its clear to its stop position, and independently operative means for respectively and independently adjusting the effective length of the spring and the amount of trapped tension in the spring.

4. In a railway crossing gate, in combination, an elongated gate pivoted adjacent one of its ends and movable under the force of gravity from a vertical clear position to a horizontal stop position, a helical spring, means operatively connecting the spring and gate so as to progressively compress the spring as the gate moves from its clear to its stop position, means operative for independently adjusting the effective length of the spring and the amount of trapped tension in the spring, and a kick-off helical spring positioned to be progressively compressed by the gate as it moves its last substantially 20° of its travel toward its clear position.

5. In a railway crossing gate, in combination, an elongated gate pivoted adjacent one of its ends and movable under the force of gravity from a vertical clear position to a horizontal stop position, a helical spring, means operatively connecting the spring and gate so as to progressively compress the spring as the gate moves from its clear to its stop position, a kick-off helical spring positioned to be progressively compressed by the gate as it moves its last substantially 20° of its travel toward its clear position, and means to adjust the amount of travel over which the gate compresses the kick-off spring.

6. In a railway crossing gate, in combination, an elongated gate pivoted adjacent one of its ends and movable under the force of gravity from a vertical clear position to a horizontal stop position, a helical spring, means operatively connecting the spring and gate so as to progressively distort the spring as the gate moves from its clear to its stop position, means operative for independently adjusting the effective length of the spring, and the initial tension in the spring, comprising, a rod passing through the coils of the spring, a nut slidably received on the rod and threaded to screw onto the convolutions of the spring, and adjusting means for the nut.

7. In a railway crossing gate, in combination, an elongated gate pivoted adjacent one of its ends and movable under the force of gravity from a vertical clear position to a horizontal stop position, a helical spring, means operatively connecting the spring and gate so as to progressively distort the spring as the gate moves the entire distance from its clear to its stop position, and means for independently adjusting the effective length of the spring and the initial tension in the spring, comprising, a rod passing through the coils of the spring, a nut slidably received on the rod and threaded on its outer face to screw into the convolutions of the spring, adjusting means for the nut, including, a squared socket in the nut, a squared matching follower slidable on the rod and receivable in the socket, and lock nuts threaded on the rod for bearing against, and backing up the follower.

WINTHROP K. HOWE.