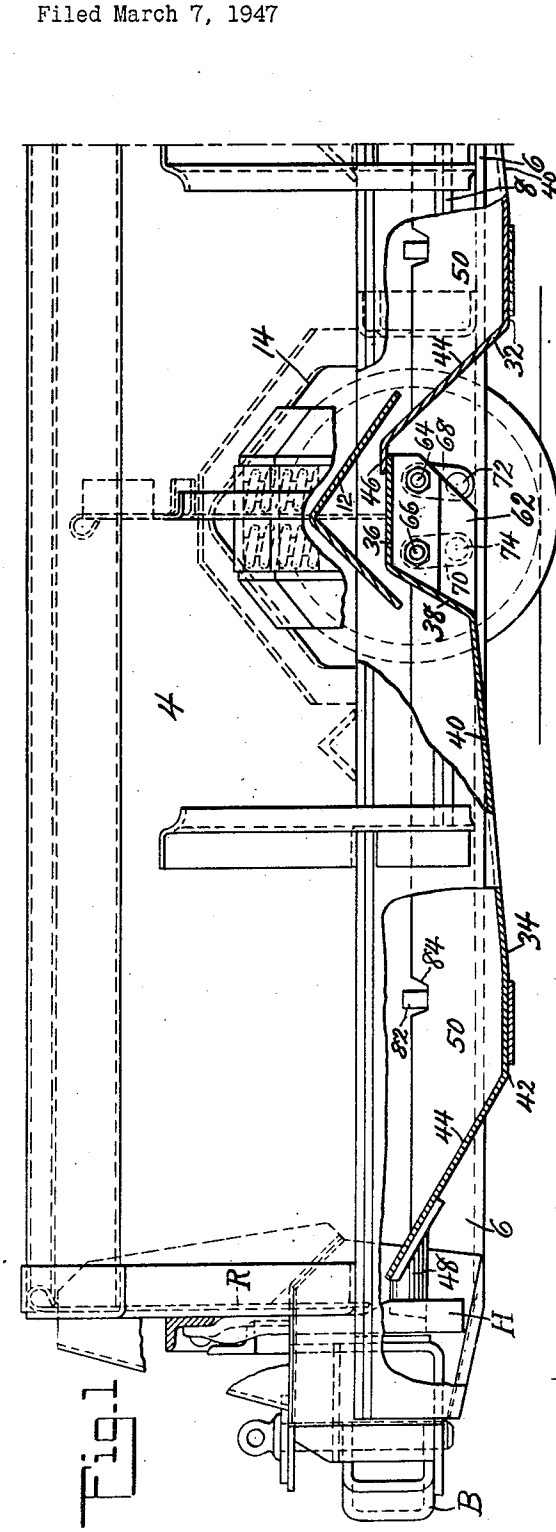
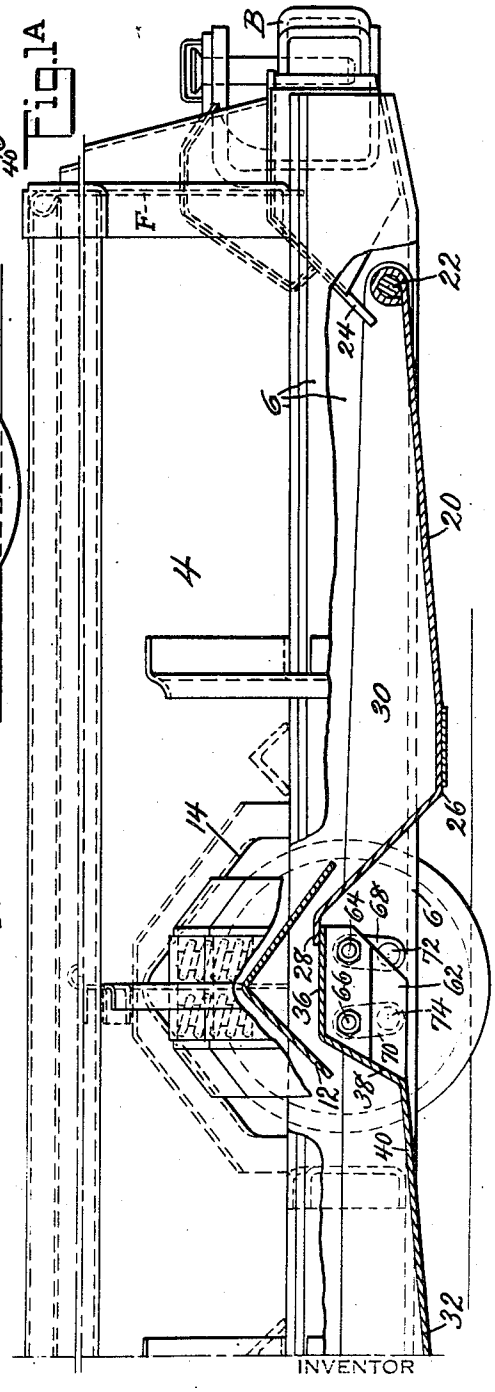
June 26, 1951 R. A. SHIELDS 2,558,710

DROP BOTTOM MINE CAR

Filed March 7, 1947 2 Sheets-Sheet 1





INVENTOR

Robert A. Shields

June 26, 1951 R. A. SHIELDS 2,558,710

DROP BOTTOM MINE CAR

Filed March 7, 1947 2 Sheets-Sheet 2

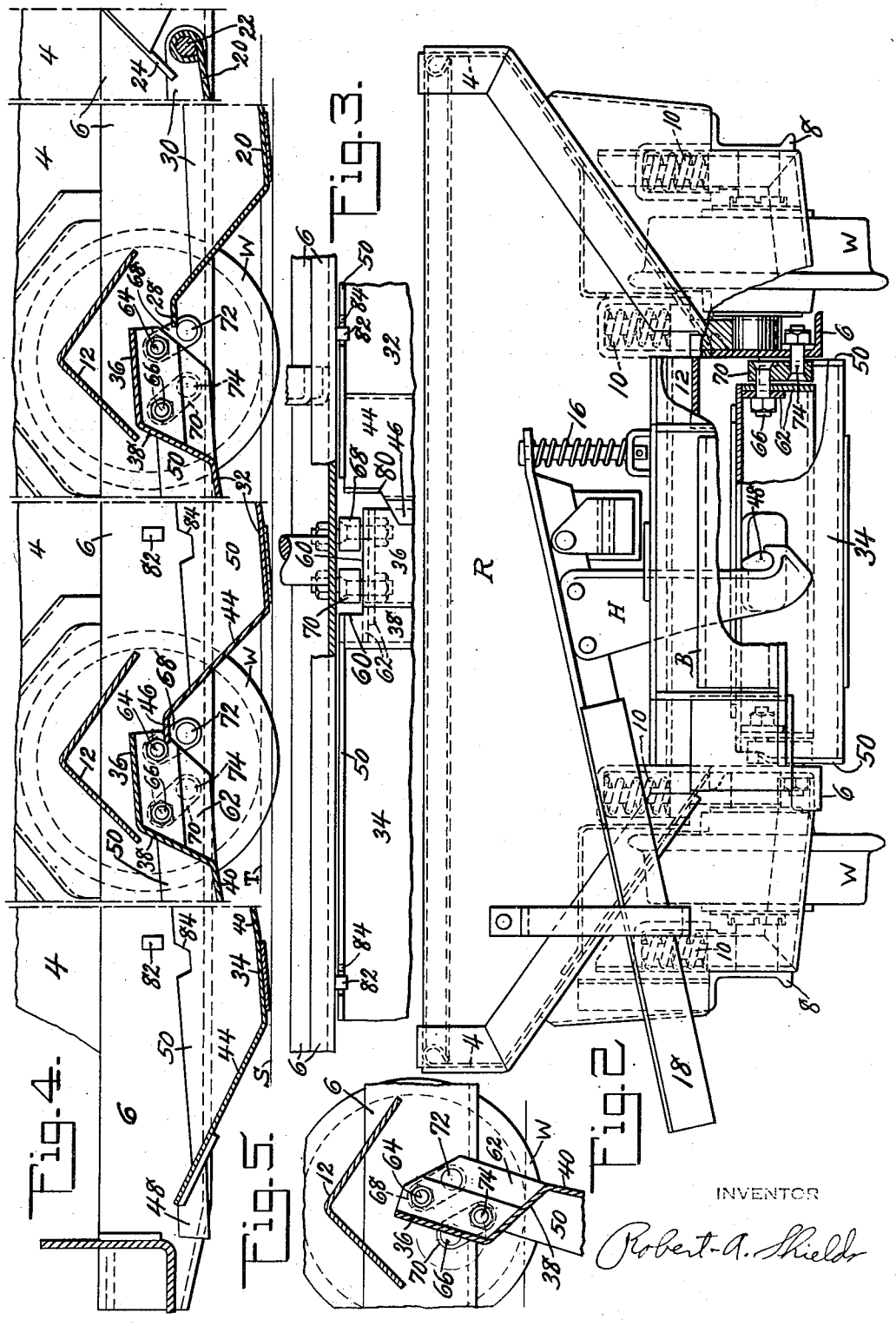


Fig. 4.

Fig. 5.

Fig. 3.

Fig. 2.

INVENTOR

Robert A. Shields

Patented June 26, 1951 2,558,710

UNITED STATES PATENT OFFICE

2,558,710

DROP BOTTOM MINE CAR

Robert A. Shields, Bloomsburg, Pa., assignor to American Car and Foundry Company, New York, N. Y., a corporation of New Jersey

Application March 7, 1947, Serial No. 732,978

17 Claims. (Cl. 105—253)

1

This invention relates to mine cars in general and in particular to drop bottom mine cars which are intended for use with coal or other mineral that breaks readily.

With certain types of minerals and coal, dropping of the material into the bins causes considerable monetary loss due to breakage of the material. This is particularly true of coal where the larger sizes bring a much higher price than do the smaller sizes. Attempts have been made to provide drop bottom cars which place the coal in the bins with a minimum of breakage but with all cars as built at present the doors must open a considerable amount before discharge of coal can take place. Building up the sides of the doors prevents leakage of coal at the sides when in the preliminary dropped positon, but, due to the relatively large opening required, coal spills over the ends of the doors and is ground to a powder on the skid plates placed at the approach end of the bin or hopper. With the doors as previously built means independent of the door had to be provided to control the movements of the doors and these means were usually carried by the car and acted on the door to control its movement independent of its hinging action. It is an object, therefore, of the present invention to provide a drop bottom door for mine cars having all controlling mechanism connected to the door and carried thereby to cause the desired shifting movements of the door.

A further object of the invention is the provision of door control means which will permit sequential opening of the doors of a car upon a slight opening movement of the doors, which movement is insufficient to permit discharge of coal or other material over the ends of the doors.

A still further object of the invention is the provision of a drop bottom mine car having interchanging doors capable of opening following a slight opening movement of the rearwardly adjacent door.

Yet another object of the invention is the provision of a drop bottom mine car having interengaging doors with an overlap of approximately one inch, yet which become disengaged upon an opening movement of approximately six degrees of the rearwardly adjacent door.

These and other objects of the invention will be apparent to persons skilled in the art from a study of the following description and accompanying drawings, in which

Figs. 1 and 1A taken together comprise a side elevational view of a complete car with parts broken away to better disclose the constructions;

2

Fig. 2 is an end view of the car with parts broken away to better show the hinging means for one of the doors;

Fig. 3 is a plan view of a portion of the car with parts broken away to disclose the door hinging;

Fig. 4 is a sectional view taken through the car and showing the doors in preliminary opening position, and

Fig. 5 is a sectional view showing one of the doors in substantially full open position.

Referring now to the drawings in detail it will be seen that the car is made up of a forward end F, a rearward end R joined by side walls 4. These side walls are connected to and supported by inner sills 6 and outer sills 8 forming spaced pairs of sills supported on wheel and axle assemblies W preferably by springs or other resilient means 10. The end walls F and R are connected to the end sill structures which join the side walls and in turn have connected thereto bumper and coupler elements B. In order to rigidly tie the car side walls together, deflector hoods 12 are provided and these hoods extend across the car at the points where through axles would normally have appeared, but which are absent due to the use of stub axles in the wheel and axle assemblies. These cross ties and deflectors 12 are welded or otherwise rigidly attached to the inner faces of the side sills 6 and to the wheel hood housings 14, which in turn are rigidly connected to the side walls of the car. The side walls of the car obviously can be sloping as shown in Fig. 2, or vertical, or of any other desired form, the sole consideration being that they discharge any load resting thereon into the space between the side sills. The end structure R, previously referred to, has attached thereto a release hook H normally held in the full line position of Fig. 2 by a spring or other device 16. The hook is adapted to be moved to a released position by trackside means striking the release arm 18 which is connected to the hook and car end structure. It is, of course, obvious that various other types of door release mechanism may be used but, since the operation of the type shown is well understood, it will be used for purposes of illustration.

The space between the side sills 6 and end structures F and R is adapted to be closed by a plurality of doors mounted for swinging movement longitudinally of the car. The forward door 20 has its forward edge rolled around a transversely extending bar 22 carried by the side sills beneath a sloping shed or protector plate 24 forming part of the forward end structure. This forward door 20 extends rearwardly

and downwardly to a low point 26, thence upwardly and rearwardly to terminate in a substantially horizontal portion 28 forming the free edge of the door. The sides of the door are formed by plates 30 adapted to closely engage the inner surface of the side wall structures and form a pan shaped door with sides of sufficient height so that when the door is dropped to its preliminary open position, the sides will not drop below the lower edge of the side sills 6 as clearly shown in Fig. 4. In this manner spillage of coal at the side edges of the door is prevented. The intermediate door or doors 32 and rear door 34 have their forward edges formed substantially identical and as shown are formed with a substantially horizontal forward portion 36, a downwardly and rearwardly inclined portion 38 positioned at a relatively steep angle and a main downwardly and rearwardly sloped portion 40 which extends to a low point 42. From the low point of the doors 32 and 34 the plate slopes upwardly and rearwardly as at 44 to the free edge of the door. In the case of the intermediate doors 32, the free edge of the door is formed by directing the free edge of slope 44 rearwardly as at 46 to provide a substantially horizontal portion adapted to overlie and rest upon the forward portion 36 of the rearwardly adjacent door. The rear door 34 may have its slope 44 provided with a similar edge but in the instance shown the free edge or slope 44 has attached thereto a lug 48 adapted to be engaged by the hook H previously referred to. The side edges of doors 32 and 34 are formed by upwardly extending plates 50 securely welded or otherwise attached to the sloping portions 38, 40 and 44 and these sides are of sufficient height as to always be located above the bottom edges of the sills 6 except when the doors are dropped over the bins or hoppers. As clearly shown in Fig. 5 the edge portions of flat part 36 and parts of slope 38 are cut away as at 60 and these portions adjacent the cut away portion are tied together by gusset plates 62 welded or otherwise secured to the sloping portion 38 and flat portion 36. These gusset plates 62 are pierced to receive a forwardly disposed bolt 64 and a rearwardly disposed bolt 66 providing respectively forward and rearward axes for the door. Bolts 64 and 66 are pivotally connected to the upper ends of a forward link 68 and a rearward link 70, the lower ends of which are pivoted on forward axes 72 and rearward axes 74. These forward and rearward axes 72 and 74 are provided with bolts or pins extending through the links and through the side sills 6. As most clearly shown in Figs. 1 and 2 the axes 64 and 66 are located forwardly and rearwardly respectively of vertical planes through axes 72 and 74. In other words, planes through axes 64 and 72 and through axes 66 and 74 will converge downwardly. It is, of course, obvious that slight rearrangements in the positions of these axes may be made, but it is to be understood that each change will produce a different action of the connected door. In order to clear the links 68 and gusset plates 62, the rear side edges of doors 20 and 32 will be cut away slightly as indicated at 80 in Fig. 3. Also, in order to prevent any possibility of doors 32 following door 34 in the opening movement and prior to disengagement between edges 46 and 36, a lug 82 is attached to the side sill and engages in a shallow notch 84 formed in the side edges 50 of doors 32. These lugs and notches perform no function during the closing of the doors by the door ramp (not shown) but merely prevent the doors 32 from following the next rearward door in its opening movement until the forward edge of the rearward door has cleared the free edge of the forward door. With the doors as shown the forward edges of doors 32 and 34 are supported upon upwardly diverging or downwardly converging struts 68 and 70 which, due to the connection to the door and side sill, form quadrilaterals preventing any relative shift of the door except that accompanied by rotation.

For illustration purposes, the struts 68 and 70 have been shown as two and one-half inches long, with the spacing between axes 72 and 74 four inches and that between axes 64 and 66 as four and one-half inches. From such a relationship it can be calculated that the door as mounted in Fig. 1 is hinged about a trunnion point approximately twenty inches below the door. It is to be remembered, however, that this is only true for the normal supported condition of the door and changes instantly when the door starts to open. However, it will serve to clearly indicate the movement of the door in its initial opening. When the car, with the doors in closed position as shown in Figs. 1 and 1A, moves into the dumping station, the hook H will be disengaged from the lug 48 of rear door 34 and this door can then immediately drop to the position shown in Fig. 4, at which position it is supported upon a skid plate S indicated by the line of Fig. 4 and which is located approximately an inch and a half below the rail or track surface T upon which the wheels rest. With such a placement of the skid plate the low portion of the doors drops approximately two and one-half inches or roughly four and one-half degrees for a thirty-six inch door. During dropping of the door 34 to the position of Fig. 4 links or struts 68 and 70 rotate to the position shown in Fig. 4, but since the links converge downwardly with a normal support at a virtual axis twenty inches below the door, the slight dropping of the door causes a considerable shift of the door to the rear of the car. This large rearward shift of the door with slight rotational movement causes the flat portion 36 of door 34 to move from beneath the flat portion 46 of door 32. As soon as this has opened door 32 can drop, moving rearwardly so that flat portion 28 of forward door 20 will clear the flat portion of intermediate door 32. It will be seen that when the doors are in the preliminary open position of Fig. 4, the point of intersection of the planes through axes 64 and 72 and 66 and 74 will be nearer the door than in the normal position. This means, of course, that the angle of upward divergence or downward convergence between the links has increased. As the doors move off of the skid plate S and into the hopper (not shown) they may swing to their open position as shown in Fig. 5. During this opening the links or struts 70 will move a more or less constant speed with axis 66 rotating in an arc about axis 74. The axis 64, however, will rotate around axis 72 at a variable rate of speed since, due to the position of the axes, 64 approaches axis 74 and then recedes to the position as shown in Fig. 5. In other words, while strut 70 rotates about axis 74, strut 68 oscillates about axis 72. From a study of Fig. 5 it will be seen that the links 68 and 70 are substantially parallel in their full open position. This means that the upwardly diverging links support the door in normal position and during opening the angle of upward divergence increases constantly to a maximum, then changes to a downward divergence decreasing constantly and approaching infinity as a limit,

in other words, with the links substantially parallel. From this it will be seen that a positive check is placed on the doors preventing their swinging and slapping with consequent binding as is now met with under the present type of door hinging.

During closing of the doors a reverse action takes place, that, is the links 68 and 70 move from their substantially parallel position of Fig. 5 to a position in which they diverge downwardly and this angle of divergence increases constantly bringing axis 64 toward axis 74 until it reaches the limiting position, after which the links diverge upwardly with the angle decreasing constantly until it reaches the minimum position with the doors in their fully raised condition as shown in Figs. 1 and 1A.

From the preceding description of the structure and its operation it will be seen that a large overlap can be obtained between the doors and the doors shift rearwardly a large amount with a very slight degree of opening, which, accompanied by the shape of the doors and the cooperating car structure, prevent discharge of coal from the cars until they have reached the dumping station. Also, with the linkage as shown, the doors are positively checked in their swinging movements, thereby preventing the doors from swinging into each other and locking in an open position preventing further movement of the car until the doors are disengaged. Likewise, during closing of the doors the linkages will positively shift the doors to their forward position beneath the next forward door and without the use of any exterior guide surfaces on the car or trackside. While the car and doors have been described more or less in detail, it will be obvious that various modifications, other than those shown and described, may be made and all such modifications and rearrangements of parts are contemplated as will fall within the scope of the following claims defining my invention.

What is claimed is:

1. A drop bottom dump apparatus comprising a frame, a forward door and a rearward door, transversely spaced apart pairs of struts pivotally supporting each door adjacent its forward edge on the frame with the struts of each pair disposed longitudinally of the frame whereby each door may swing downward at its rearward edge for opening, means holding said rearward door closed, and means on the rearward edge of said forward door adapted to engage the forward edge of said rearward door to hold said forward door closed.

2. A drop bottom dump apparatus comprising a frame, a forward door and a rearward door, transversely spaced apart pairs of struts pivotally supporting each door adjacent its forward edge on the frame with the struts of each pair disposed longitudinally of the frame whereby each door may swing downward at its rearward edge for opening, means holding said rearward door closed, and means on the rearward edge of said forward door adapted to engage the forward edge of said rearward door to hold said forward door closed, said last named means moving out of engagement with said rearward door whereby said forward door may open upon release of said first named means and downward swinging of said rearward door through an angle of less than six degrees.

3. A drop bottom dump apparatus comprising a supporting frame, wheels supporting the frame for travel along rails, a plurality of doors interengaging when closed and normally cooperating with the frame to carry lading, and transversely spaced apart pairs of struts pivotally supporting the forward edge of one of said doors on the frame with the struts of each pair disposed longitudinally of the frame, said struts being so constructed and arranged as to provide a transversely extending virtual pivot axis for said closed door below the lowermost plane of the rails.

4. A drop bottom dump apparatus comprising a supporting frame, wheels supporting the frame for travel along rails, a plurality of doors interengaging when closed and normally cooperating with the frame to carry lading, and longitudinally swinging linkage pivotally supporting the forward edge of one of said doors on the frame and providing a transversely extending virtual pivot axis for said closed door located below the lowermost plane of the rails.

5. A drop bottom dump apparatus comprising a supporting frame, wheels supporting the frame for travel along rails, a plurality of doors interengaging when closed and normally cooperating with the frame to carry lading, and longitudinally swinging linkage supporting the forward edge of one of said doors and providing a transversely extending virtual pivot axis for the door when substantially closed which is located below the plane of the frame and which is located above the plane of the frame when the door is in substantially open position.

6. A drop bottom dump apparatus comprising a supporting frame, a plurality of doors interengaging when closed and normally cooperating with the frame to carry lading, and a pair of longitudinally swinging struts pivotally supporting each forward side edge of one of said doors on said frame, the individual struts of each pair being spaced longitudinally of the frame.

7. A drop bottom dump apparatus comprising a supporting frame, a plurality of doors interengaging when closed and normally cooperating with the frame to carry lading, and a pair of longitudinally swinging pivotally mounted struts supporting each forward side edge of one of said doors on said frame, the individual struts of each pair being spaced longitudinally of the frame and pivoted to said frame adjacent their lower ends and to said one door adjacent their upper ends.

8. A drop bottom dump apparatus comprising a supporting frame, a plurality of doors interengaging when closed and normally cooperating with the frame to carry lading, and a pair of longitudinally swinging pivotally mounted struts supporting each forward side edge of one of said doors on said frame, said struts being pivoted to said frame at longitudinally spaced apart points adjacent their lower ends and to said one door at more widely spaced apart longitudinally disposed points adjacent their upper ends.

9. A drop bottom dump apparatus comprising a supporting frame, a plurality of doors interengaging when closed and normally cooperating with the frame to carry lading, and a pair of longitudinally swinging pivotally mounted struts supporting each forward side edge of one of said doors on said frame, said struts being pivoted at longitudinally spaced points to said frame adjacent their lower ends and to said one door adjacent their upper ends, one of said struts of each pair rotating about its pivotal mount on the frame and the other of said struts of each pair

oscillating about its pivotal mount on the frame during opening of said one door.

10. A drop bottom mine car comprising, a supporting frame, a rearward door, a pair of struts pivotally mounted on said frame adjacent each forward side edge of said rearward door and being pivotally connected to said door to support the forward edge thereof, the individual struts of each pair being spaced longitudinally of the car, a forward door pivotally mounted on said frame and having its rearward edge in supporting engagement with the forward edge of said rearward door, and means to support the rearward edge of said rearward door.

11. A drop bottom mine car comprising, a supporting frame, a rearward door, a pair of struts pivotally mounted on said frame adjacent each forward side edge of said rearward door and being pivotally connected to said door to support the forward edge thereof, the individual struts of each pair being spaced longitudinally of the car, a forward door pivotally mounted on said frame and having its rearward edge in supporting engagement with the forward edge of said rearward door, and means to support the rearward edge of said rearward door, said struts being upwardly divergent whereby the virtual pivotal axis for said closed rearward door is located a substantial distance below said frame.

12. A drop bottom mine car comprising, a supporting frame, a rearward door, a pair of struts pivotally mounted on said frame adjacent each forward side edge of said rearward door and being pivotally connected to said door to support the forward edge thereof, the individual struts of each pair being spaced longitudinally of the car, a forward door pivotally mounted on said frame and having its rearward edge in supporting engagement with the forward edge of said rearward door, and means to support the rearward edge of said rearward door, said struts being so constructed and arranged as to shift said rearward door out of supporting engagement with said forward door upon less than a six degree opening movement of said rearward door.

13. A drop bottom mine car comprising, a supporting frame, a rearward door, a pair of struts pivotally mounted on said frame adjacent each forward side edge of said rearward door and being pivotally connected to said door to support the forward edge thereof, the individual struts of each pair being spaced longitudinally of the car, a forward door pivotally mounted on said frame and having approximately a one inch width along its rear edge in supporting engagement with the forward edge of said rearward door, and means to support the rearward edge of said rearward door, said struts being so constructed and arranged as to shift said rearward door out of engagement with said forward door upon less than a four inch drop of the rear edge of said rearward door.

14. A drop bottom mine car comprising, a supporting frame, a rearward door adapted to rotate down to open position, a pair of struts pivotally mounted on said frame adjacent each forward side edge of said rearward door and being pivotally connected to said door to support the forward edge thereof, the individual struts of each pair being spaced longitudinally of the car, a forward door pivoted to said frame and adapted to swing down to open position, a rear portion of said forward door engaging and supported on the forward edge of said rearward door when closed, and means to retain said rearward door in closed position, said struts diverging upwardly from their pivotal mount on the frame to thereby produce a large rearward shift of the rearward door upon a slight opening rotation thereof.

15. A drop bottom mine car comprising, a supporting frame, a door adapted to rotate downward from a closed to an open position about its forward edge, a pair of longitudinally swinging struts pivotally connected to the door adjacent each forward corner thereof and being also pivotally connected to the frame at points below their pivotal connections to the door, the individual struts of each pair being longitudinally spaced and diverging upwardly to support the door in closed position and diverging downwardly to support the door in substantially open position.

16. A drop bottom mine car comprising, a supporting frame, a door adapted to rotate downward from a closed to an open position about its forward edge, a pair of longitudinally swinging struts pivotally connected to the door adjacent each forward corner thereof and being also pivotally connected to the frame at points below their pivotal connections to the door, the individual struts of each pair being longitudinally spaced and diverging upwardly to support the door in closed position and diverging downwardly to support the door in substantially open position, the angle of upward divergence of said struts increasing constantly during the initial opening of the door and the angle of downward divergence decreasing constantly during the final opening movement of the door to thereby check the swinging of the door.

17. A drop bottom mine car comprising, a supporting frame, a door adapted to rotate downward from a closed to an open position about its forward edge, a pair of longitudinally swinging struts pivotally connected to the door adjacent each forward corner thereof and being also pivotally connected to the frame at points below their pivotal connections to the door, the individual struts of each pair being longitudinally spaced and diverging upwardly to support the door in closed position and diverging downwardly to support the door in substantially open position, the angle of upward divergence of said struts increasing to a maximum then changing to an angle of downward divergence decreasing to substantially zero during rotation of the door from closed to open position.

ROBERT A. SHIELDS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,387,962	Baerwaldt	Aug. 16, 1921
1,407,740	Evans	Feb. 28, 1922
1,606,517	Dixon	Nov. 9, 1926
1,817,773	Sipe	Aug. 4, 1931
1,888,345	Cummings	Nov. 22, 1932
2,250,555	Schroeder	July 29, 1941

OTHER REFERENCES

"Elements of Mechanism," by Schwamb, Merrill and James. Wiley & Sons, Inc. N. Y., 1921. Pages 221–229 inclusive, and 244–248 inclusive. (A volume of this reference, privately owned in Div. 34 of the Patent Office, is available for photostatic copies.)