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GRAVITY OR PNEUMATICALLY DISCHARGED RAILWAY HOPPER CAR

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FIG. 1

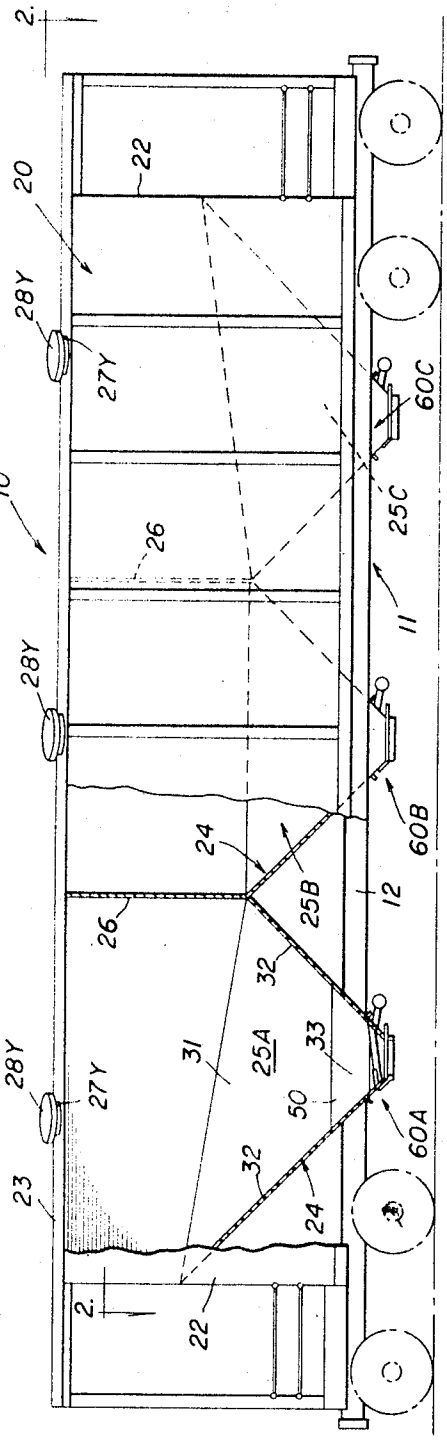
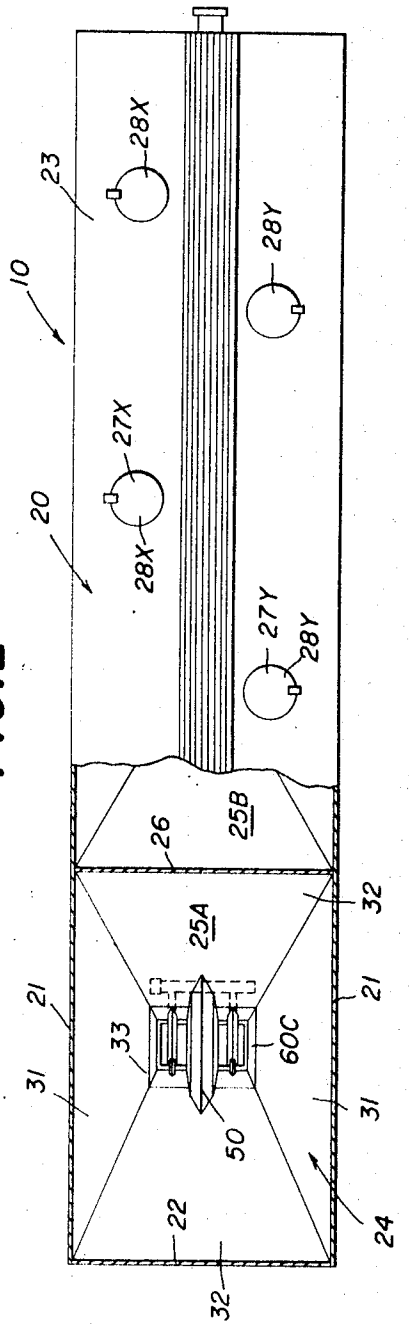


FIG. 2



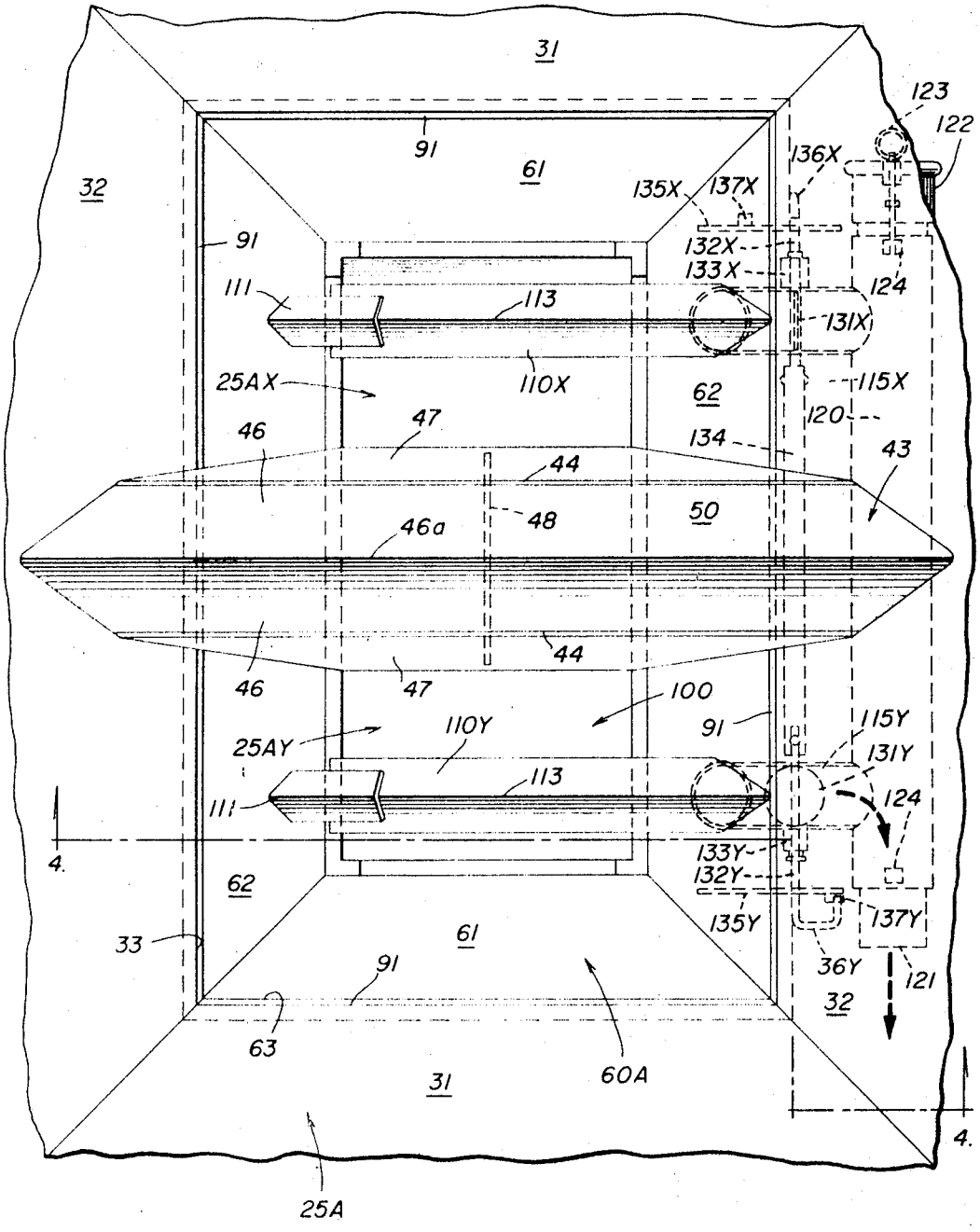
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FIG. 3

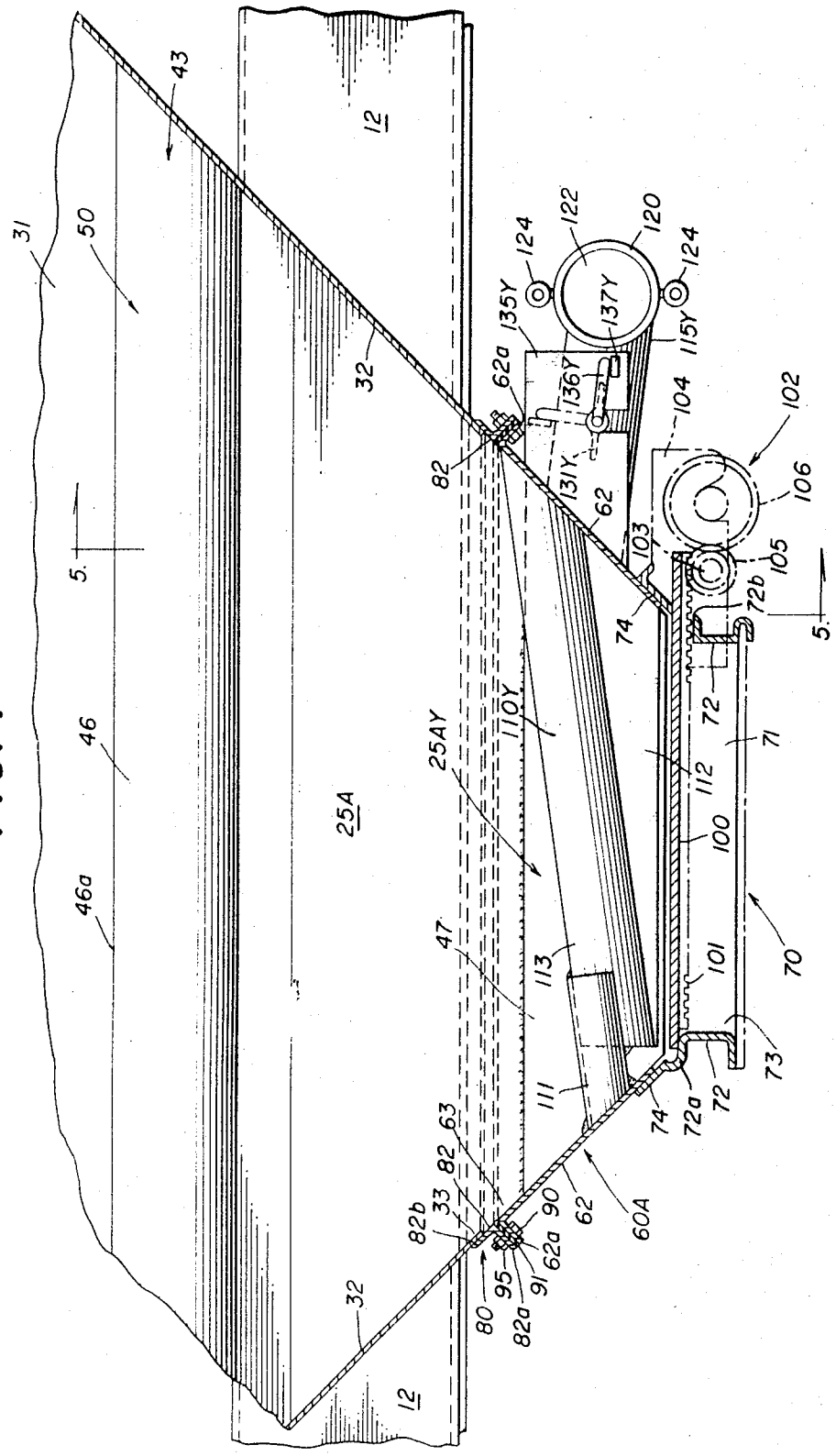


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FIG. 4



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FIG. 6

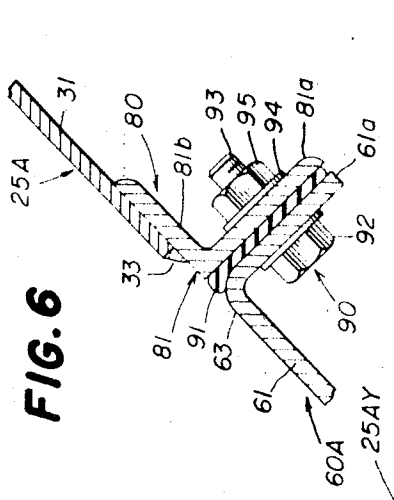


FIG. 5

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3,458,238

GRAVITY OR PNEUMATICALLY DISCHARGED RAILWAY HOPPER CAR

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Int. Cl. B65g 53/46; B61d 7/02
U.S. Cl. 302—52 7 Claims

ABSTRACT OF THE DISCLOSURE

A railway hopper car comprising a body adapted to contain granular material, the bottom of the body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, the hopper structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end sheets respectively extending downwardly and inwardly to the opposite ends of the bottom outlet and a pair of laterally spaced-apart side sheets respectively extending downwardly and inwardly to the opposite sides of the bottom outlet, a rigid collar carried by the hopper structure adjacent to the bottom outlet and disposed in surrounding relation therewith, the collar having a substantially rectangular configuration and including a pair of longitudinally space-apart end elements respectively rigidly secured to the end sheets and a pair of laterally spaced-apart side elements respectively rigidly secured to the side sheets, the pair of end elements being respectively provided with a pair of first end flanges respectively extending outwardly and downwardly from the end sheets and respectively arranged in planes disposed substantially normal thereto, the pair of side elements being respectively provided with a pair of first side flanges respectively extending outwardly and downwardly from the side sheets and respectively arranged in planes disposed substantially normal thereto, discharge structure arranged below the hopper structure and having a generally horizontally disposed and substantially rectangular top opening, the bottom outlet and the top opening being substantially congruent, the discharge structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end walls respectively extending downwardly and inwardly from the opposite ends of the top opening and a pair of laterally spaced-apart side walls respectively extending downwardly and inwardly from the opposite sides of the top opening, the pair of end walls respectively terminating at the upper portions thereof in a pair of second end flanges respectively extending outwardly and downwardly from the end walls and respectively arranged in planes disposed substantially normal thereto, the pair of side walls respectively terminating at the upper portions thereof in a pair of second side flanges respectively extending outwardly and downwardly from the side walls and respectively arranged in planes disposed substantially normal thereto, the first and second end flanges being substantially congruent and the first and second side flanges being substantially congruent, fasteners for detachably securing together the first and second end flanges and for detachably securing together the first and second side flanges, whereby the discharge structure is removably carried by the hopper structure and effects closure of the bottom outlet, and facility for discharging to the exterior of the discharge structure the granular material accumulating therein. Specifically, the discharge facility comprises both a discharge tube carried by the discharge structure for effecting pneumatic discharge therefrom of the granular material, and a gate provided in the bottom of the discharge structure adjacent to a cooperating bottom outlet provided therein, whereby the granular material may be discharged from the discharge structure by the action of gravity through the bottom outlet when the gate occupies its open position with respect thereto. Further, the discharge structure carries facility for selectively operating the gate between its open and closed positions with respect to the cooperating bottom outlet.

The present invention relates to a railway hopper car comprising a body adapted to contain granular material; and it is a general object of the invention to provide in such a railway hopper car body, wherein the bottom of the body terminates in hopper structure having a substantially frusto-pyramidal configuration and provided with a generally horizontally disposed and substantially rectangular bottom outlet, discharge structure arranged below the hopper structure and having a substantially frusto-pyramidal configuration and provided with a generally horizontally disposed and substantially rectangular top opening, the bottom outlet and the top opening being substantially congruent, improved facility for detachably connecting the top of the discharge structure to the bottom of the hopper structure, whereby the discharge structure is normally removably carried by the hopper structure and effects closure of the bottom outlet, and facility carried by the discharge structure for effecting the discharge to the exterior of the granular material accumulating therein.

Another object of the invention is to provide a railway hopper car of the character described, wherein the facility for detachably securing the bottom of the hopper structure to the top of the discharge structure essentially comprises a collar carried by the hopper structure adjacent to the bottom outlet and disposed in surrounding relation therewith, the collar being of substantially rectangular configuration and the four individual elements thereof being respectively rigidly secured to the four individual and adjacent sheets of the hopper structure, the four individual elements of the collar respectively carrying four individual flanges respectively extending outwardly and downwardly from the four adjacent sheets and respectively arranged in planes disposed substantially normal thereto, and wherein fasteners extend through the four individual flanges, so as to be readily accessible from the exterior of the hopper structure and the discharge structure incident to placement and to removal of the discharge structure, as required.

A further object of the invention is to provide a railway hopper car of the character described, wherein the upper portion of the four individual walls of the discharge structure terminate adjacent to the top opening in four corresponding additional flanges respectively extending outwardly and downwardly from the four adjacent walls and respectively arranged in planes disposed substantially normal thereto, and wherein fasteners extend through the four additional flanges, so as to be readily accessible from the exterior of the hopper structure and the discharge structure incident to placement and removal of the discharge structure, as required.

A still further object of the invention is to provide a railway hopper car of the character described, wherein the discharge structure is carried in its entirey by the hopper structure through the detachable connection mentioned, and wherein the discharge structure is of unitary character incorporating totally the facility for effecting the discharge to the exterior thereof of the granular material accumulating therein.

Further features of the invention pertain to the particular arrangement of the elements of the railway hopper car, whereby the above-outlined and additonal operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be best understood by reference to the following specification, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a side elevational view, partly broken away, of a railway hopper car including a body terminating in three hopper structures respectively detachably supporting three discharge structures and embodying the present invention;

FIG. 2 is a plan view, partly broken away, of the railway hopper car, as shown in FIG. 1;

FIG. 3 is an enlarged fragmentary plan view of one of the end hopper structures incorporated in the railway hopper car, as shown in FIGS. 1 and 2, and the cooperating discharge structure removably carried thereby;

FIG. 4 is an enlarged fragmentary longitudinal sectional view of the one end hopper structure and the cooperating discharge structure removably carried thereby, this view being taken in the direction of the arrows along the line 4—4 in FIG. 3;

FIG. 5 is an enlarged fragmentary lateral sectional view of the one end hopper structure and the cooperating discharge structure removably carried thereby, this view being taken in the direction of the arrows along the line 5—5 in FIG. 4; and

FIG. 6 is a greatly enlarged cross-sectional view of the joint between the bottom of the one end hopper structure and the top of the cooperating discharge structure carried thereby, this view being taken in the area of the circle 6 in FIG. 5.

Referring to FIGS. 1 and 2 of the drawings, the railway hopper car 10 there illustrated and embodying the features of the present invention comprises an elongated longitudinally extending underframe 11, including a center sill 12, and carrying an elongated longitudinally extending body 20 of box-like configuration. The body 20 comprises a pair of upstanding longitudinally extending and laterally spaced-apart side walls 21, a pair of upstanding laterally extending and longitudinally spaced-apart end walls 22, a roof 23 and bottom wall structure 24 defining in the bottom of the body 20 three individual hoppers 25A, 25B and 25C arranged in adjacent longitudinally spaced-apart relation. In the arrangement, the end hoppers 25A and 25C are somewhat larger than the middle hopper 25B, but all of the hoppers 25A, 24B and 25C are characterized by a single basic structure described more fully below. As illustrated: the contiguous hoppers 25A and 25B may be completely separated by an upstanding laterally extending bulkhead 26; and similarly, the contiguous hoppers 25B and 25C may be completely separated by another upstanding laterally extending bulkhead 26. However, this complete separation of the upper portions or principal body portions of the hoppers 25A, 25B and 25C, as described above, is not essential; whereby these upper portions of the hoppers 25A, 25B and 25C may be commonly interconnected by the expedient of omitting the bulkheads 26, in an obvious manner.

The hoppers 25A, 25B and 25C are especially adapted to contain finely divided or granular material, such as, flour, malt, plastic resin beads, or the like; whereby the roof 23 carries a corresponding plurality of pairs of individual and substantially identical loading hatches 27X and 27Y. In the arrangement: three of the loading hatches 27X are carried on one side of the roof 23 and respectively communicate with the three hoppers 25A, 25B and 25C; and three of the loading hatches 27Y are carried on the other side of the roof 23 and respectively communicate with the three hoppers 25A, 25B and 25C. The loading hatches 27X and 27Y are of conventional construction and arrangement and are provided with corresponding conventional latch covers 28X and 28Y. Each hatch cover 28X and 28Y is selectively operative between

open and closed positions with respect to the associated loading hatch 27X and 27Y; and each hatch cover in the closed position effects a water-tight closure of the associated loading hatch; all in a well-known manner.

As previously noted, the hoppers 25A, 25B and 25C are of the same basic construction and arrangement; whereby it is noted that the bottom of the hopper 25A comprises a pair of longitudinally extending and laterally spaced-apart side sheets 31 and a pair of laterally extending and longitudinally spaced-apart end sheets 32; the hopper side sheets 31 extend downwardly and inwardly from the respectively adjacent body side walls 21; and the hopper end sheets 32 extend downwardly and inwardly from the respectively adjacent body end wall 22 and body bulkhead 26. Thus, the hopper 25A has an inverted frusto-pyramidal shape, as clearly shown in FIGS. 1 and 2; and the extreme bottom of the hopper 25A is provided with a substantially rectangular bottom outlet 33. As best shown in FIGS. 1, 4 and 5, the bottom of the hopper 25A projects downwardly below the center sill 12 of the underframe 11; whereby a section of the center sill 12 projects longitudinally through the lower portion of the hopper 25A, and the bottom opening 33 is positioned below the bottom of the center sill 12.

The center sill 12 essentially comprises a pair of longitudinally extending and laterally spaced-apart channel elements 41 tied together by a longitudinally extending bottom plate 42 rigidly secured thereto, as by welding; and the section of the center sill 12 that projects through the lower portion of the hopper 25A is enclosed by a hollow longitudinally extending and centrally disposed upstanding box or tube 43, as best shown in FIGS. 3, 4 and 5, thereby to maintain the granular material contained in the hopper 25A out of contact with the center sill 12. Specifically, the tube 43 comprises a pair of upstanding side walls 44 arranged in laterally spaced-apart relation, a bottom wall 45 and a top wall 46, the top wall 46 being crowned or peaked, as indicated at 46*a*, so as to prevent the accumulation of granular material thereupon incident to unloading of the granular material from the hopper 25A. The opposite ends of the tube 43 are secured in water-tight relation with the adjacent portions of the hopper end sheets 32 so that the longitudinal extension of the section of the center sill 12 through the lower portion of the hopper 25A does not puncture the hopper 25A with respect to the outside. A pair of longitudinally extending and laterally spaced-apart baffle plates 47 are respectively arranged on the opposite sides of the tube 43 and project downwardly and somewhat outwardly therefrom, as best shown in FIG. 5. The top of each baffle plate 47 is rigidly secured, as by welding, to the bottom of the adjacent side wall 44 of the tube 43; and the opposite ends of each baffle plate 47 are rigidly secured, as by welding, to the respectively adjacent hopper end sheets 32. The lower ends of the baffle plates 47 are rigidly braced against inward movements toward each other by a laterally disposed strut 48 extending therebetween, the opposite ends of the strut 48 being rigidly secured to the respectively adjacent lower ends of the baffle plates 47, as best shown in FIGS. 3 and 5. The extreme lower edges of the baffle plates 47 terminate substantially in the generally horizontal plane of the bottom opening 33 of the hopper 25A, for a purpose more fully explained below. The tube 43, together with the baffle plates 47, constitute an upstanding divider structure 50 extending longitudinally through the lower portion of the hopper 25A and defining therein a pair of longitudinally extending and laterally spaced-apart pockets 25AX and 25AY respectively disposed on opposite sides of the divider structure 50. In the arrangement, the two pockets 25AX and 25AY have substantially identical configurations respectively disposed in left-hand and right-hand positions with respect to each other, as viewed in FIG. 5.

As best shown in FIG. 1, the top of the divider structure 50 is disposed well below the tops of the hopper

sheets 31 and 32, so that the principal portion (the upper or body portion) of the hopper 25A is in direct communication with the tops of the pockets 25AX and 25BX; and the bottom of the pockets 25AX and 25BX are in direct communication with the hopper bottom opening 33.

Individual discharge structures 60A, 60B and 60C are respectively arranged below the bottom of the hoppers 25A, 25B and 25C and are respectively detachably secured thereto and carried thereby, as explained more fully below.

Preferably the discharge structures 60A, 60B and 60C are identical; whereby, as best shown in FIGS. 4 and 5, the discharge structure 60A that is detachably secured to the bottom of the hopper 25A has an inverted frusto-pyramidal configuration and is provided with a rectangular top opening 63 that is substantially contiguous with the bottom outlet 33. More particularly, the discharge structure 60A includes a pair of laterally spaced-apart side walls 61 respectively extending downwardly and inwardly from the opposite sides of the top opening 63 and a pair of longitudinally spaced-apart end walls 62 respectively extending downwardly and inwardly from the opposite ends of the top opening 63. The pair of side walls 61 respectively terminate at the upper portions thereof, adjacent to the top opening 63, in a pair of side flanges 61*a* respectively extending outwardly and downwardly from the side walls 61 and respectively arranged in planes disposed substantially normal to the side walls 61; and specifically, the side flanges 61*a* are respectively formed integrally with the upper portions of the side walls 61. Similarly, the pair of end walls 62 respectively terminate at the upper portions thereof, adjacent to the top opening 63, in a pair of end flanges 62*a* respectively extending outwardly and downwardly from the end walls 62 and respectively arranged in planes disposed substantially normally to the end walls 62; and specifically, the end flanges 62*a* are respectively formed integrally with the upper portions of the end walls 62. The bottom of the discharge structure 60A terminates in a substantially rectangular frame 70 that defines a bottom opening 73 into the bottom of the discharge structure 60A, as clearly illustrated in FIGS. 4 and 5. Specifically, the frame 70 comprises a pair of side members 71 and a pair of end members 72; the side members 71 are substantially vertically disposed and are provided at the tops thereof with upwardly and outwardly directed flanges 73 that are rigidly secured to the outer surfaces of the respectively adjacent lower portions of the side walls 61; and the end members 72 are substantially vertically disposed and are provided at the tops thereof with upwardly and outwardly directed flanges 74 that are rigidly secured to the outer surfaces of the respectively adjacent lower portions of the end walls 62. Accordingly, it will be understood that the discharge structure 60A is of strong rigid construction and of unitary character.

The discharge structure 60A is detachably secured to the bottom of the hopper 25A by an arrangement including a rigid collar 80 carried thereby adjacent to the bottom outlet 33 and disposed in surrounding relation therewith, as best shown in FIGS. 4, 5 and 6. The collar 80 has a substantially rectangular configuration and includes a pair of laterally spaced-apart side elements 81 respectively rigidly secured to the side sheets 31, and a pair of longitudinally spaced-apart end elements 82 respectively rigidly secured to the end sheets 32. The elements 81 are identical to each other and comprise an appropriate length of angle structure having two flanges 81*a* and 81*b* disposed substantially 90° apart. Similarly, the elements 82 are identical to each other and comprise an appropriate length of angle structure having two flanges 82*a* and 82*b* disposed substantially 90° apart. Specifically, the side flanges 81*b* of the side elements 81 are respectively rigidly secured to the outer surfaces of the adjacent ones of the side sheets 31, and the end flanges 82*b* of the end elements 82 are respectively rigidly secured to the outer surfaces of the adjacent ones of the end sheets 32. Accordingly, the side flanges 81*a* respectively extend outwardly and downwardly from the adjacent ones of the side sheets 31 and are respectively arranged in planes disposed substantially normal thereto. Similarly, the end flanges 82*a* respectively extend outwardly and downwardly from the adjacent ones of the end sheets 32 and are respectively arranged in planes disposed substantially normal thereto. In the arrangement the side flanges 81*a* of the collar 80 and the side flanges 61*a* of the discharge structure 60A are congruent; and similarly, the end flanges 82*a* of the collar 80 and the end flanges 62*a* of the discharge structure 60A are congruent. Accordingly, the discharge structure 60A may be readily placed and removed, as required, with respect to the hopper 25A. Specifically, when the discharge structure 60A is placed in proper position below the hopper 25A, the flanges 61*a* and 62*a* carried about the top of the discharge structure 60A adjacent to the top opening 63 are respectively positioned adjacent to and below the mating flanges 81*a* and 82*a* carried by the collar 80 about the bottom of the hopper 25A adjacent to the bottom outlet 33; whereby the cooperating flanges 61*a*, 81*a* and the cooperating flanges 62*a*, 82*a* may be secured together by a plurality of fasteners 90 extending through aligned openings provided therein. As illustrated, a rectangular gasket 91 formed of rubber, or the like, is arranged between the mating flanges 61*a*, 81*a* and 62*a*, 82*a* for the purpose of sealing the bottom of the hopper 25A to the top of the discharge structure 60A, with the bottom outlet 33 and the top opening 63 in open communication with each other.

Specifically, the fasteners 90 comprise bolts that extend through aligned openings respectively formed in the cooperating flanges 61*a*, 81*a* and the intervening gasket 91 and through aligned openings respectively formed in the cooperating flanges 62*a*, 82*a* and the intervening gasket 91. Each bolt 90 comprises an enlarged head 92 terminating a threaded shank 93 that receives a cooperating washer 94 and an associated nut 95. When the nuts 95 are tightened upon the shanks 93, the cooperating flanges 61*a* and 81*a* and the cooperating flanges 62*a* and 82*a* are clamped together with the gasket 91 in compression therebetween. Thus, it will be appreciated that the discharge structure 60A may be readily placed and removed, as required, with respect to the hopper 25A by proper manipulation of the bolts 90 and the cooperating nuts 95. The above described arrangement for detachably securing the discharge structure 60A to the hopper 25A is very advantageous by virtue of the circumstance that the bolts 90 and the cooperating nuts 95 are always readily accessible, since the flanges 61*a* and 62*a* are disposed substantially normal to the respective walls 61 and 62 and since the flanges 81*a* and 82*a* are disposed substantially normal to the respective sheets 31 and 32.

As previously noted, the discharge structure 60A that is detachably secured to the hopper 25A is of unitary structure, and the same is provided with both gravity discharge facility and pneumatic discharge facility, as described more fully below.

Specifically, the top of the frame 70 carries a substantially rectangular gate 100 that is disposed immediately above the bottom opening 73 therethrough. More particularly, the upper portions of the pair of frame side members 71 are provided with a corresponding pair of substantially horizontally aligned ledges 71*a* that are arranged just above the bottom opening 73 and that receive the opposite sides of the gate 100 so as to support the same in a substantially horizontal position immediately above the bottom opening 73, and so as to mount the same for longitudinal sliding movements between open and closed positions with respect to the bottom opening 73. The upper portion of one of the frame end members 72 is also provided with a ledge 72*a* that is disposed in the plane of the ledges 71*a* provided upon the upper portions of the frame side members 71; which ledge 72*a* receives and supports the corresponding end of the gate 100, when the gate 100 occupies its closed position with respect to the

bottom opening **73**, as shown in FIG. 4. Also, the upper portion of the opposite frame end member **72** has a laterally extending slot **72***b* therein, as shown in FIG. 4, in which the gate **100** is movable in its sliding movements between its open and closed positions.

As best shown in FIG. 4, the gate **100** may be moved longitudinally, toward the left, through the slot **72***b* into its fully closed position, wherein one end of the gate **100** engages the ledges **72***a* and the other end of the gate **100** projects somewhat outwardly and to the right of the slot **72***b*. Also, the gate **100** may be moved longitudinally, toward the right in FIG. 4, through the slot **72***b*, into its fully open position, wherein the one end of the gate **100** is disposed adjacent to the slot **72***b* and the other end of the gate **100** projects well outwardly beyond and to the right of the slot **72***b*.

For the purpose of sliding the gate **100** between its closed and open positions, a pair of laterally spaced-apart racks **101** are rigidly secured to the lower surface of the gate **100** respectively adjacent to the opposite sides thereof, as best shown in FIG. 4. Also, conventional mechanism, indicated at **102** in FIG. 4, is provided for actuating the gate **100** via the racks **101**. For example, the mechanism **102** may comprise a laterally extending shaft **103** mounted for rotation upon a pair of laterally spaced-apart brackets **104** carried by the frame end member **72** in which the slot **72***b* is formed; which shaft **103** carries a pair of laterally spaced-apart pinions **105** respectively meshing the racks **101**. Further, the mechanism **102** comprises a pair of rotatably mounted elements **106** respectively carried by the frame brackets **104** adjacent to the opposite ends of the frame end member **72** and thus adjacent to the opposite frame side members **71**, as best shown in FIG. 5; which elements **106** also cooperate in drive relation with the shaft **103**. Specifically, each of the elements **106** may be operated independently of the other to effect sliding of the gate **100**; rotation of either one of the elements **106** in one direction slides the gate **100** towards its closed position; and rotation of either one of the elements **106**, in the opposite direction slides the gate **100** towards its open position. As shown in FIG. 5, rotation of either one of the elements **106** may be effected by engagement thereof with a cooperating pneumatic driven torque wrench, indicated at **106'**. This conventional mechanism **102** accommodates operation of the gate **100** from either side of the hopper car **10** by a single mechanism employing a pneumatic driven torque wrench in a simple and ready manner.

In view of the foregoing description of the hopper **25**A, it will be understood that the granular material contained therein may be readily unloaded therefrom on a gravity basis simply by operating the mechanism **102** to slide the gate **100** from its closed position into its open position. Of course, the two bodies of granular material in the two pockets **25**AX and **25**AY fall through the respectively adjacent portions of the hopper bottom opening **33**, and the granular material in the upper or body portion of the hopper **25**A falls down into the tops of the pockets **25**AX and **25**AY. The peak-like shape **46***a* of the top wall **46** of the divider structure **50** prevents the accumulation of the granular material thereon, so that the granular material falls or flows downwardly along the side walls **44** and the baffle plates **47** of the divider structure **50** and thence through the bottom opening **73**, with the gate **100** in its open position, as described above.

Considering further the construction of the discharge structure **60**A, the same comprises pneumatic discharge facility, as previously noted; and particularly, a pair of elongated longitudinally extending and laterally spaced-apart hoods **110**X and **110**Y are respectively arranged in the pockets **25**AX and **25**AY, as shown in FIGS. 3, 4 and 5. The hoods **100**X and **100**Y are identical and are carried fundamentally by the end wall **62** that is disposed above the frame end member **72** in which the slot **72***b* is formed through which the gate **100** is movable (which end wall **62** is hereinafter referred to arbitrarily as the right-hand end wall **62**, since the same is best shown in right-hand positions, as viewed in FIGS. 3 and 4); and the left-hand ends of the hoods **110**X and **110**Y are secured in place by respective clips **111** rigidly secured thereto and to the adjacent portions of the left-hand end wall **62**. Each of the hoods **110**X and **110**Y has an inverted trough-like lateral configuration, as best shown in FIG. 5; whereby each of the hoods **110**X and **110**Y includes a pair of longitudinally extending and laterally spaced-apart sides **112** and a sharply-peaked cap **113**; whereby the hoods **10**X and **110**Y define corresponding elongated longitudinally extending tunnels **110**XT and **110**YT therethrough. The inner sides **112** of the hoods **110**X and **110**Y are spaced well laterally outwardly from the adjacent ones of the baffle plates **47**; and the outer sides **112** of the hoods **110**X and **110**Y are spaced well laterally inwardly from the adjacent side walls **61**; all as shown in FIG. 5; whereby the shapes of the caps **113**, together with the spacings of the sides **112** prevent interference by the hoods **110**X and **110**Y with gravity unloading of the granular material from the respective pockets **25**AX and **25**AY, when the gate **100** occupies its open position, as previously described.

In the arrangement, the bottom edges of the sides **112** of each hood **110**X and **110**Y are spaced somewhat above the upper surface of the gate **100** in its closed position, so as to define therebetween a pair of elongated longitudinally extending and laterally spaced-apart slots **114** respectively communicating with the opposite lower sides of each tunnel **110**XT and **110**YT. Thus, when the gate **100** occupies its closed position, the granular material contained in the pocket **25**AX spills laterally from opposite sides of the hood sides **112** and through the slots **114** and accommodates in two corresponding elongated longitudinally extending piles in the bottom of the tunnel **110**XT and so as to prevent obstruction of the top of the tunnel **110**XT, particularly immediately below the cap **113**. Similarly, the granular material contained in the pocket **25**AY spills laterally from opposite sides of the hood sides **112** and through the slots **114** and accumulates in two corresponding elongated longitudinally extending piles in the bottom of the tunnel **110**YT and so as to prevent obstruction of the top of the tunnel **110**YT, particularly immediately below the cap **113**. On the other hand, the bottom edges of the baffle plates **47** project downwardly closely adjacent to the upper surface of the gate **100** in its closed position so as to prevent the spilling of the granular material from the pockets **25**AX and **25**AY laterally and below the tube **43** incorporated in the divider structure **50**.

Further, a pair of outlet conduits **115**X and **115**Y that are also carried by the right-hand end wall **62**, as shown in FIGS. 3, 4 and 5; which outlet conduits **115**X and **115**Y extend longitudinally and are disposed in laterally spaced-apart relation; and which outlet conduits **115**X and **115**Y respectively communicate at the inner ends thereof with the adjacent outer ends of the tunnels **110**XT and **110**YT. More particularly: the right-hand ends of the hoods **110**X and **110**Y are rigidly secured and sealed to the right-hand end wall **62**, as by welding; the inner ends of the outlet conduits **115**X and **115**Y are rigidly secured and sealed into corresponding parts formed in the right-hand end wall **62**; and the openings into the inner ends of the outlet conduits **115**X and **115**Y respectively communicate directly with the right-hand ends of the tunnels **110**XT and **110**YT. The outer ends of the outlet conduits **115**X and **115**Y carry a laterally extending suction header **120** commonly communicating therewith. As best shown in FIG. 4, the outlet conduits **115**X and **115**Y and the suction header **120** are positioned well above the plane of the upper surface of the gate **100**, thereby to prevent interference with the longitudinal sliding movements of the gate **100** between its open and closed positions, as previously described.

The opposite ends of the suction header **120** are provided with identical barrels **121** that, in turn, respectively removably carry identical end caps **122**. Each end cap **122** is normally secured in place upon the adjacent barrel **121** and in covering and sealing relation with the adjacent open end of the suction header **120** by a cooperating pair of eye-bolts **123** respectively engaging a cooperating pair of fixtures **124** carried by the adjacent end portion of the suction header **120**. Also, it is noted that upon removal of either one of the end caps **122** a cooperating suction main, not shown, may be operatively connected to the barrel **121** of the suction header **120** so as to produce a suction action within the suction header **120** in an obvious manner in order to effect pneumatic unloading of the granular material from the hopper **25A**, as explained more fully below.

The pneumatic unloading arrangement further comprises a pair of butter-fly valve elements **131X** and **131Y** respectively arranged in the intermediate portions of the outlet conduits **115X** and **115Y**; the valve element **131X** is carried by a spindle **132X** mounted for rotation upon a bearing member **133X** carried by the outlet conduit **115X**; the valve element **131Y** is carried by a spindle **132Y** mounted for rotation upon a bearing member **133Y** carried by the outlet conduit **115Y**; the spindles **132X** and **132Y** are arranged in lateral alignment with each other; and the inner ends of the spindles **132X** and **132Y** are interconnected by a hollow tube **134**. The outer end of the spindle **132X** is mounted for rotation in an opening provided in a plate **135X** carried by the adjacent portion of the right-hand end wall **62**; and likewise, the outer end of the spindle **132Y** is mounted for rotation in an opening provided in a plate **135Y** carried by the adjacent portion of the right-hand end wall **62**. The extreme outer end of the spindle **132X** terminates in a hand-grasp **136X** disposed adjacent to the plate **135X** and accommodating rotation of the valve elements **131X** and **131Y** from the corresponding side of the hopper car **10**; and similarly, the extreme outer end of the spindle **132Y** terminates in a hand-grasp **136Y** disposed adjacent to the plate **135Y** and accommodating rotation of the valve elements **131X** and **131Y** from the corresponding side of the hopper car **10**; whereby the valve elements **131X** and **131Y** may be simultaneously selectively operated from either side of the hopper car **10** employing the adjacent hand-grasp **136X** or **136Y**.

In the arrangement of the valve elements **131X** and **131Y**, there is a displacement by an angle of 90°, so that when one of these valve elements occupies its open position, the other of these valve elements occupies its closed position. In order to define the positions of the valve elements **131X** and **131Y**, the plates **135X** and **135Y** respectively carry two stops **137X** and **137Y** that respectively cooperate with the handles **136X** and **136Y**. Specifically: when the valve elements **131Y** and **131X** are respectively open and closed, the handle **136Y** engages the stop **137Y**; and when the valve elements **131Y** and **131X** are respectively closed and open, the handle **136X** engages the stop **137X**.

Considering now the pneumatic unloading of granular material from the hopper **25A** and assuming that the unloading is to proceed first from the pocket **25AY**, the valve elements **131X** and **131Y** are operated into their respective closed and open positions, as shown in FIG. 3. Also, assume that the unloading is to take place from the side of the hopper car **10** adjacent to the pocket **25AY**, the corresponding end cap **122**, not shown, is removed from the adjacent barrel **121** of the suction header **120**, as indicated in FIG. 3. At this time, one or both of the two hatch covers **28X** and **28Y** for the loading hatches **27X** and **27Y** communicating with the hopper **25A** are opened, so as to admit conveying air thereinto. Further, the suction main, not shown, is operatively connected to the exposed barrel **121** of the suction header **120**. Now assuming that the suction equipment, not shown, that is operatively connected to the suction main, is operated, a suction condition is produced in the suction header **120** and consequently in the tunnel **110YT**, by virtue of the open position of the valve element **131Y** in the communicating outlet conduit **115Y**; however, no suction condition is produced in the tunnel **110XT**, by virtue of the closed position of the valve element **131X** in the communicating outlet conduit **115X**. Air in the hopper **25A** passes through the granular material contained therein and flows laterally through the slots **114** into the tunnel **110YT** and then forms a current therein passing longitudinally through the tunnel **110YT** and through the communicating outlet conduit **115Y**, with the valve element **131Y** in its open position, and thence into the suction header **120**. Of course, the air current passing longitudinally through the tunner **110YT** entrains the granular material in the two longitudinally extending piles in the bottom of the tunnel **110YT**; whereby the granular material is conveyed with the air current described. Of course, the conveying air carrying the entrained granular material passes through the suction header **120** and thence into the suction main, not shown; and ultimately, the granular material thus pneumatically unloaded from the hopper **25A** is separated from the conveying air and stored for further processing or use, as required.

The great mass of the granular material contained in the hopper **25A** may be pneumatically unloaded therefrom via the pocket **25AY**; however, some of the granular material will ultimately become trapped in the pocket **25AX**, so that it can not be unloaded therefrom with the valve elements **131X** and **131Y** in the respective closed and open positions. At this time, when only air is passing via the empty pocket **25AY** into the communicating outlet conduit **115Y**, the operator actuates the handle **136Y** to its opposite position, so as to open the valve element **131X** and to close the valve element **131Y**. Closure of the valve element **131Y** prevents the passage of air through the empty pocket **25AY** into the suction header **120**; while opening of the valve element **131X** causes the granular material in the pocket **25AX** to be pneumatically unloaded therefrom via the tunnel **110XT** and the communicating outlet conduit **115X** and into the suction header **120**. The pneumatic unloading of the granular material from the pocket **25AX** proceeds in a manner identical to that described above in conjunction with that of the pocket **25AY** until the pocket **25AX** is also empty.

In view of the above description of the modes of gravity unloading and pneumatic unloading of granular material from the hopper **25A**, it will be understood that such unloadings of the granular material from the hoppers **25B** and **25C** take place in like manner; whereby these operations are not reiterated in the interest of brevity.

In a constructional example of the unloading mechanism **30A**: the longitudinal distance between the inside surfaces of the frame end members **72** was $24\frac{11}{16}$"; the lateral distance between the inside surfaces of the frame side members **71** was $50\frac{1}{16}$"; the lateral distance between the centerline of the divider structure **50** and the centerline of each of the hoods **110X** and **110Y** was 18"; the lateral distance between each frame side member **71** and the side of the adjacent baffle plate **47** was 15"; the lateral distance between the inside surfaces of the sides **112** of each hood **110X** and **110Y** was 6"; each of the slots **114** had a height of $\frac{3}{4}$"; and the dimensions of the other elements were related to those noted above substantially in accordance with the scale of FIGS. 3, 4 and 5 of the drawings.

The particular constructions and arrangements of the pneumatic unloading facility and of the gravity unloading facility in the bottom of the discharge structure **60A** are preferably the same as those disclosed and claimed in the copending application of Albert E. Price, Ser. No. 430,807, filed Feb. 8, 1965, now U.S. Patent No. 3,325,-223, granted June 13, 1967.

In view of the foregoing, it is apparent that there has been provided in a railway hopper car, a body adapted to contain granular material, the bottom of the body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, discharge structure arranged below the hopper structure and having a horizontally disposed and substantially rectangular top opening, the bottom outlet and the top opening being substantially congruent, fasteners for detachably securing the bottom of the hopper structure to the top of the discharge structure; whereby the discharge structure is removably carried by the hopper structure and effects closure of the bottom outlet, and facility for discharging to the exterior of the discharge structure the granular material accumulating therein. More particularly, the discharge structure is of unitary character; whereby the same may be completely assembled prior to fastening thereof to the hopper structure. In the arrangement, the discharge facility comprises both pneumatic unloading facility for discharging the granular material to the exterior of the discharge structure upon a pneumatic basis, and gravity unloading facility for discharging the granular material to the exterior of the discharge structure upon a gravity basis.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit of the invention.

What is claimed is:

1. A railway hopper car comprising a body adapted to contain granular material, the bottom of said body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, said hopper structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end sheets respectively extending downwardly and inwardly to the opposite ends of said bottom outlet and a pair of laterally spaced-apart side sheets respectively extending downwardly and inwardly to the opposite sides of said bottom outlet, a rigid collar carried by said hopper structure adjacent to said bottom outlet and disposed in surrounding relation therewith, said collar having a substantially rectangular configuration and including a pair of longitudinally spaced-apart side elements respectively rigidly secured to said end sheets and a pair of laterally spaced-apart side elements respectively rigidly secured to said side sheets, said pair of end elements being respectively provided with a pair of first end flanges respectively extending outwardly and downwardly from said end sheets and respectively arranged in planes disposed substantially normal thereto, said pair of side elements being respectively provided with a pair of first side flanges respectively extending outwardly and downwardly from said side sheets and respectively arranged in planes disposed substantially normal thereto, discharge structure arranged below said hopper structure and having a generally horizontally disposed and substantially rectangular top opening, said bottom outlet and said top opening being substantially congruent, said discharge structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end walls respectively extending downwardly and inwardly from the opposite ends of said top opening and a pair of laterally spaced-apart side walls respectively extending downwardly and inwardly from the opposite sides of said top opening, said pair of end walls respectively terminating at the upper portions thereof in a pair of second end flanges respectively extending outwardly and downwardly from said end walls and respectively arranged in planes disposed substantially normal thereto, said pair of side walls respectively terminating at the upper portions thereof in a pair of second side flanges respectively extending outwardly and downwardly from said side walls and respectively arranged in planes disposed substantially normal thereto, said first and second end flanges being substantially congruent and said first and second side flanges being substantially congruent, fastening means for detachably securing together said first and second end flanges and for detachably securing together said first and second side flanges, whereby said discharge structure is removably carried by said hopper structure and effects closure of said bottom outlet, and means for discharging to the exterior of said discharge structure the granular material accumulating therein.

2. The railway hopper car set forth in claim 1, and further comprising a resilient substantially rectangular gasket arranged between said first and second end flanges and between said first and second side flanges for sealing the bottom of said hopper structure to the top of said discharge structure.

3. A railway hopper car comprising a body adapted to contain granular material, the bottom of said body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, said hopper structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end sheets respectively extending downwardly and inwardly to the opposite ends of said bottom outlet and a pair of laterally spaced-apart side sheets respectively extending downwardly and inwardly to the opposite sides of said bottom outlet, a rigid collar carried by said hopper structure adjacent to said bottom outlet and disposed in surrounding relation therewith, said collar having a substantially rectangular configuration and including a pair of longitudinally spaced-apart end elements respectively rigidly secured to said end sheets and a pair of laterally spaced-apart side elements respectively rigidly secured to said side sheets, said pair of end elements being respectively provided with a pair of first end flanges respectively extending outwardly and downwardly from said end sheets and respectively arranged in planes disposed substantially normal thereto, said pair of side elements being respectively provided with a pair of first side flanges respectively extending outwardly and downwardly from said side sheets and respectively arranged in planes disposed substantially normal thereto, discharge structure arranged below said hopper structure and having a generally horizontally disposed and substantially rectangular top opening, said bottom outlet and said top opening being substantially congruent, said discharge structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end walls respectively extending downwardly and inwardly from the opposite ends of said top opening and a pair of laterally spaced-apart side walls respectively extending downwardly and inwardly from the opposite sides of said top opening, said pair of end walls respectively terminating at the upper portions thereof in a pair of second end flanges respectively extending outwardly and downwardly from said end walls and respectively arranged in planes disposed substantially normal thereto, said pair of side walls respectively terminating at the upper portions thereof in a pair of second side flanges respectively extending outwardly and downwardly from said side walls and respectively arranged in planes disposed substantially normal thereto, said first and second end flanges being substantially congruent and said first and second side flanges being substantially congruent, fastening means for detachably securing together said first and second end flanges and for detachably securing together said first and second side flanges, whereby said discharge structure is removably carried by said hopper structure and effects closure of said bottom outlet, said discharge structure also having a generally horizontally disposed bottom opening, a gate arranged in the lower portion of said discharge structure and cooperating with said bottom opening, said gate being selectively movable

between open and closed positions with respect to said bottom opening, whereby the granular material accumulating in said discharge structure is discharged therefrom to the exterior through said bottom opening when said gate occupies its open position, and means carried by said discharge structure for selectively moving said gate between its open and closed positions.

4. A railway hopper car comprising an elongated longitudinally extending center sill, an elongated longitudinally extending body adapted to contain granular material, the bottom of said body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, said hopper structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end sheets respectively extending downwardly and inwardly to the opposite ends of said bottom outlet and a pair of laterally spaced-apart side sheets respectively extending downwardly and inwardly to the opposite sides of said bottom outlet, said center sill extending longitudinally through the lower portion of said hopper structure and projecting through passages provided in said end sheets and located between said side sheets and spaced laterally inwardly therefrom and the bottom of said center sill being positioned above said bottom outlet, a rigid collar carried by said hopper structure just below said center sill and just above said bottom outlet and disposed in surrounding relation therewith, said collar having a substantially rectangular configuration and including a pair of longitudinally spaced-apart end elements respectively rigidly secured to said end sheets and a pair of laterally spaced-apart side elements respectively rigidly secured to said side sheets, said pair of end elements being respectively provided with a pair of first end flanges respectively extending outwardly and downwardly from said end sheets and respectively arranged in planes disposed substantially normal thereto, said pair of side elements being respectively provided with a pair of first side flanges respectively extending outwardly and downwardly from said side sheets and respectively arranged in planes disposed substantially normal thereto, discharge structure arranged below said hopper structure and having a generally horizontally disposed and substantially rectangular top opening, said bottom outlet and said top opening being substantially congruent, said discharge structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end walls respectively extending downwardly and inwardly from the opposite ends of said top opening and a pair of laterally spaced-apart side walls respectively extending downwardly and inwardly from the opposite sides of said top opening, said pair of end walls respectively terminating at the upper portions thereof in a pair of second end flanges respectively extending outwardly and downwardly from said end walls and respectively arranged in planes disposed substantially normal thereto, said pair of side walls respectively terminating at the upper portions thereof in a pair of second side flanges respectively extending outwardly and downwardly from said side walls and respectively arranged in planes disposed substantially normal thereto, said first and second end flanges being substantially congruent and said first and second side flanges being substantially congruent, fastening means for detachably securing together said first and second end flanges and for detachably securing together said first and second side flanges, whereby said discharge structure is removably carried by said hopper structure and effects closure of said bottom outlet, whereby granular material in said body passes downwardly through said hopper structure and about the opposite sides of said center sill and through said bottom outlet and said top opening into said discharge structure, and means for discharging to the exterior of said discharge structure the granular material accumulating therein.

5. A railway hopper car comprising a body adapted to contain granular material, the bottom of said body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, said hopper structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end sheets respectively extending downwardly and inwardly to the opposite ends of said bottom outlet and a pair of laterally spaced-apart side sheets respectively extending downwardly and inwardly to the opposite sides of said bottom outlet, a rigid collar carried by said hopper structure adjacent to said bottom outlet and disposed in surrounding relation therewith, said collar having a substantially rectangular configuration and including a pair of longitudinally spaced-apart end elements and a pair of laterally spaced-apart side elements, each of said elements consisting of a corresponding length of angle structure having two flanges disposed substantially 90° apart, given end flanges of said end elements being respectively rigidly secured to said end sheets and first end flanges of said end elements respectively extending outwardly and downwardly from said end sheets and respectively arranged in planes disposed substantially normal thereto, given side flanges of said side elements being respectively rigidly secured to said side sheets and first side flanges of said side elements respectively extending outwardly and downwardly from said side sheets and respectively arranged in planes disposed substantially normal thereto, discharge structure arranged below said hopper structure and having a generally horizontally disposed and substantially rectangular top opening, said bottom outlet and said top opening being substantially congruent, said discharge structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end walls respectively extending downwardly and inwardly from the opposite ends of said top opening and a pair of laterally spaced-apart side walls respectively extending downwardly and inwardly from the opposite sides of said top opening, said pair of end walls respectively terminating at the upper portions thereof in a pair of second end flanges respectively extending outwardly and downwardly from said end walls and respectively arranged in planes disposed substantially normal thereto, said pair of side walls respectively terminating at the upper portions thereof in a pair of second side flanges respectively extending outwardly and downwardly from said side walls and respectively arranged in planes disposed substantially normal thereto, said first and second end flanges being substantially congruent and said first and second side flanges being substantially congruent, fastening means for detachably securing together said first and second end flanges and for detachably securing together said first and second side flanges, whereby said discharge structure is removably carried by said hopper structure and effects closure of said bottom outlet, and means for discharging to the exterior of said discharge structure the granular material accumulating therein.

6. A railway hopper car comprising a body adapted to contain granular material, the bottom of said body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, said hopper structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end sheets respectively extending downwardly and inwardly to the opposite ends of said bottom outlet and a pair of laterally spaced-apart side sheets respectively extending downwardly and inwardly to the opposite sides of said bottom outlet, a rigid collar carried by said hopper structure adjacent to said bottom outlet and disposed in surrounding relation therewith, said collar having a substantially rectangular configuration and including a pair of longitudinally spaced-apart end elements respectively rigidly secured to said end sheets and a pair of laterally spaced-apart side elements respectively rigidly secured to said side sheets,

said pair of end elements being respectively provided with a pair of first end flanges respectively extending outwardly and downwardly from said end sheets and respectively arranged in planes disposed substantially normal thereto, said pair of side elements being respectively provided with a pair of first side flanges respectively extending outwardly and downwardly from said side sheets and respectively arranged in planes disposed substantially normal thereto, discharge structure arranged below said hopper structure and having a generally horizontally disposed and substantially rectangular top opening, said bottom outlet and said top opening being substantially congruent, said discharge structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end walls respectively extending downwardly and inwardly from the opposite ends of said top opening and a pair of laterally spaced-apart side walls respectively extending downwardly and inwardly from the opposite sides of said top opening, said pair of end walls respectively terminating at the upper portions thereof in a pair of second end flanges respectively extending outwardly and downwardly from said end walls and respectively arranged in planes disposed substantially normal thereto, said pair of side walls respectively terminating at the upper portions thereof in a pair of second side flanges respectively extending outwardly and downwardly from said side walls and respectively arranged in planes disposed substantially normal thereto, said first and second end flanges being substantially congruent and said first and second side flanges being substantially congruent, fastening means for detachably securing together said first and second end flanges and for detachably securing together said first and second side flanges, whereby said discharge structure is removably carried by said hopper structure and effects closure of said bottom outlet, and means including a pneumatic discharge tube carried by said discharge structure for discharging to the exterior thereof the granular material accumulating therein.

7. A railway hopper car comprising a body adapted to contain granular material, the bottom of said body terminating in hopper structure having a generally horizontally disposed and substantially rectangular bottom outlet, said hopper structure having a substantially frutso-pyramidal configuration and including a pair of longitudinally spaced-apart end sheets respectively extending downwardly and inwardly to the opposite ends of said bottom outlet and a pair of laterally spaced-apart side sheets respectively extending downwardly and inwardly to the opposite sides of said bottom outlet, a rigid collar carried by said hopper structure adjacent to said bottom outlet and disposed in surrounding relation therewith, said collar having a substantially rectangular configuration and including a pair of longitudinally spaced-apart end elements respectively rigidly secured to said end sheets and a pair of laterally spaced-apart side elements respectively rigidly secured to said side sheets, said pair of end elements being respectively provided with a pair of first end flanges respectively extending outwardly and downwardly from said end sheets and

respectively arranged in planes disposed substantially normal thereto, said pair of side elements being respectively provided with a pair of first side flanges respectively extending outwardly and downwardly from said side sheets and respectively arranged in planes disposed substantially normal thereto, discharge structure arranged below said hopper structure and having a generally horizontally disposed and substantially rectangular top opening, said bottom outlet and said top opening being substantially congruent, said discharge structure having a substantially frusto-pyramidal configuration and including a pair of longitudinally spaced-apart end walls respectively extending downwardly and inwardly from the opposite ends of said top opening and a pair of laterally spaced-apart side walls respectively extending downwardly and inwardly from the opposite sides of said top opening, said pair of end walls respectively terminating at the upper portions thereof in a pair of second end flanges respectively extending outwardly and downwardly from said end walls and respectively arranged in planes disposed substantially normal thereto, said pair of side walls respectively terminating at the upper portions thereof in a pair of second side flanges respectively extending outwardly and downwardly from said side walls and respectively arranged in planes disposed substantially normal thereto, said first and second end flanges being substantially congruent and said first and second side flanges being substantially congruent, fastening means for detachably securing together said first and second end flanges and for detachably securing together said first and second side flanges, whereby said discharge structure is removably carried by said hopper structure and effects closure of said bottom outlet, said discharge structure also having a generally horizontally disposed bottom opening, a gate arranged in the lower portion of said discharge structure and cooperating with said bottom opening, said gate being selectively movable between open and closed positions with respect to said bottom opening, whereby the granular material accumulating in said discharge structure is discharged therefrom to the exterior through said bottom opening when said gate occupies its open position, means including a pneumatic discharge tube carried by said discharge structure for discharging to the exterior thereof the granular material accumulating therein when said gate occupies its closed position, and means carried by said discharge structure for selectively moving said gate between its open and closed positions.

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