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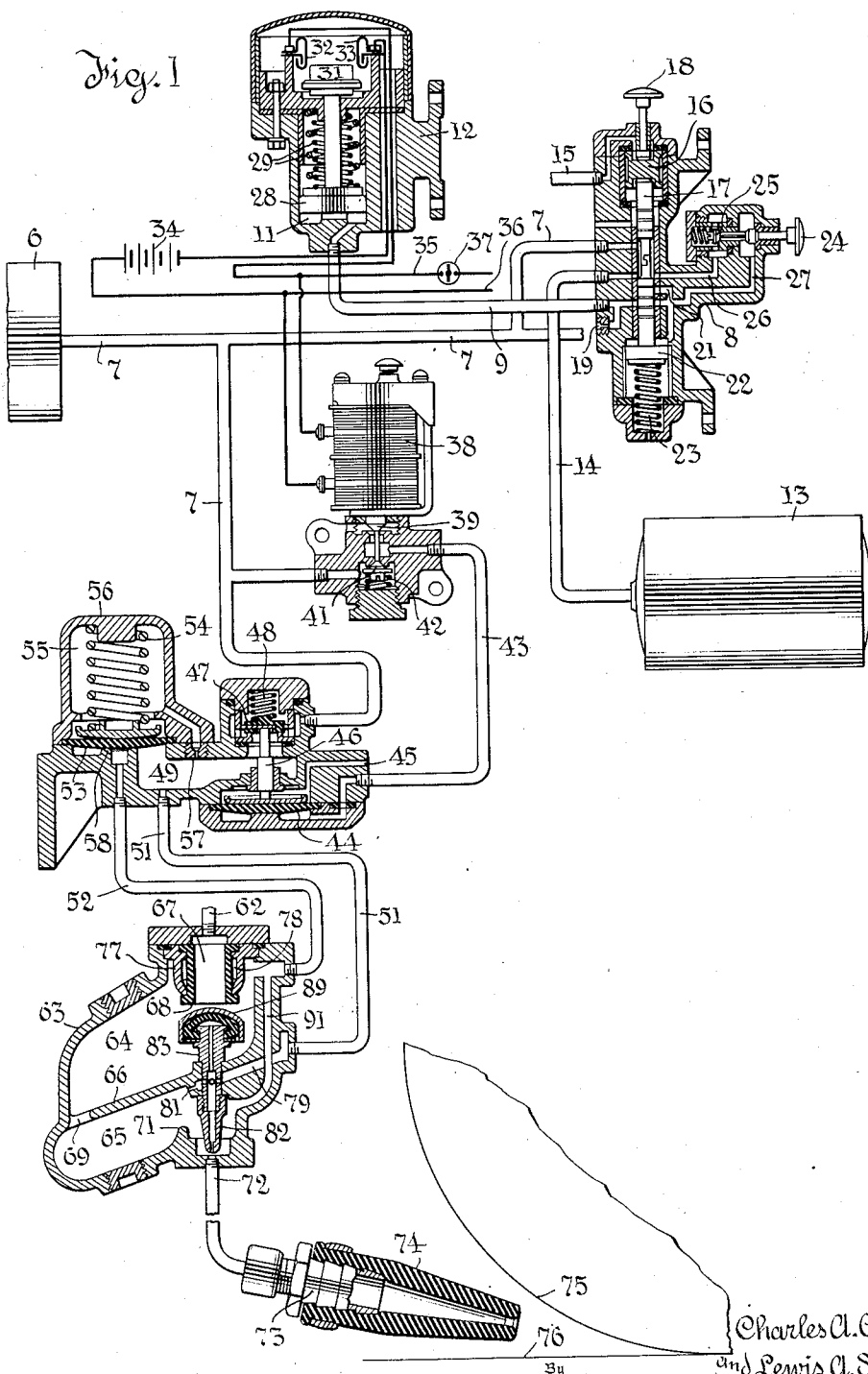
C. A. CAMPBELL ET AL

2,196,977

SANDER

Filed June 21, 1937

3 Sheets-Sheet 1



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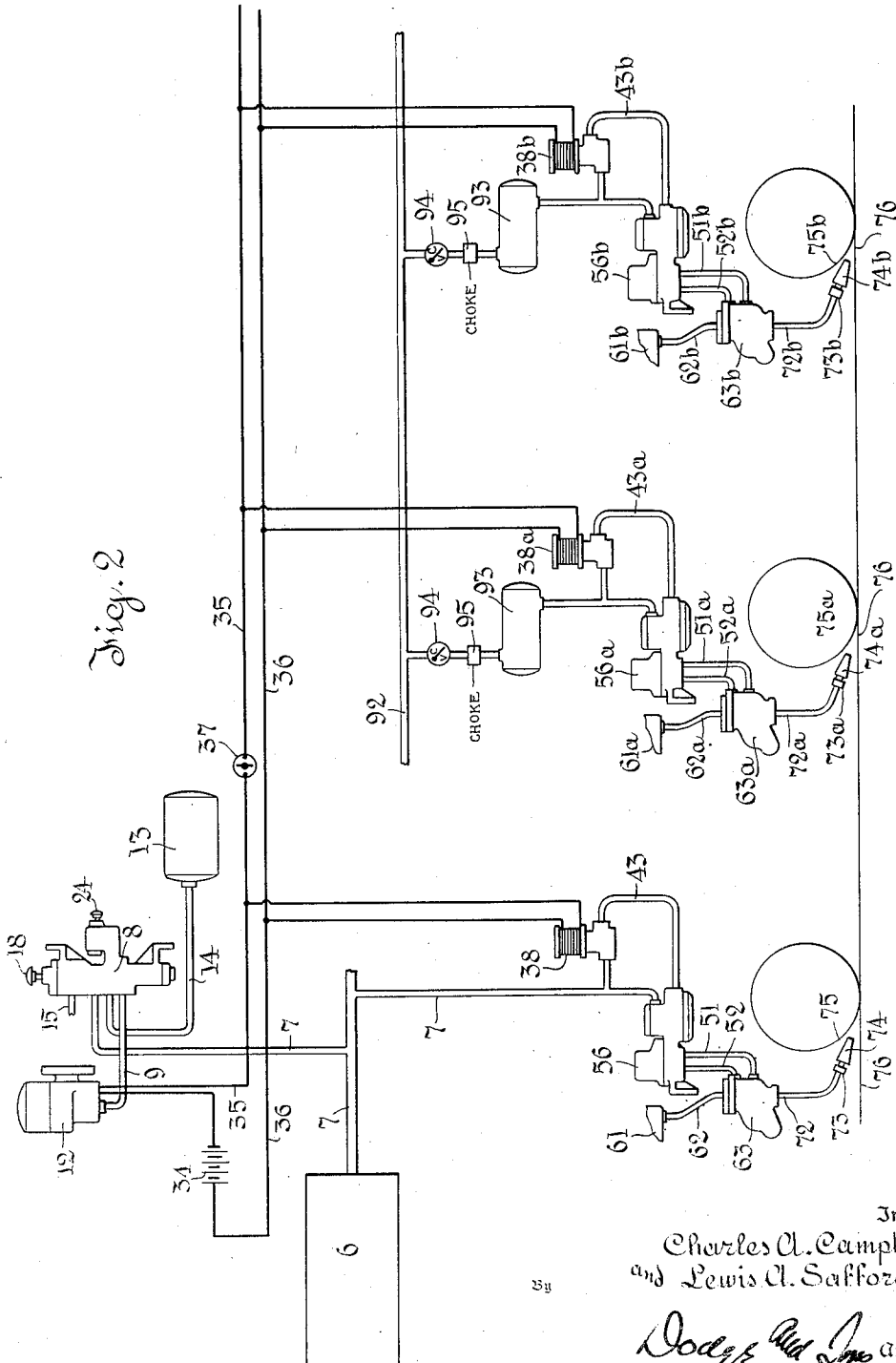
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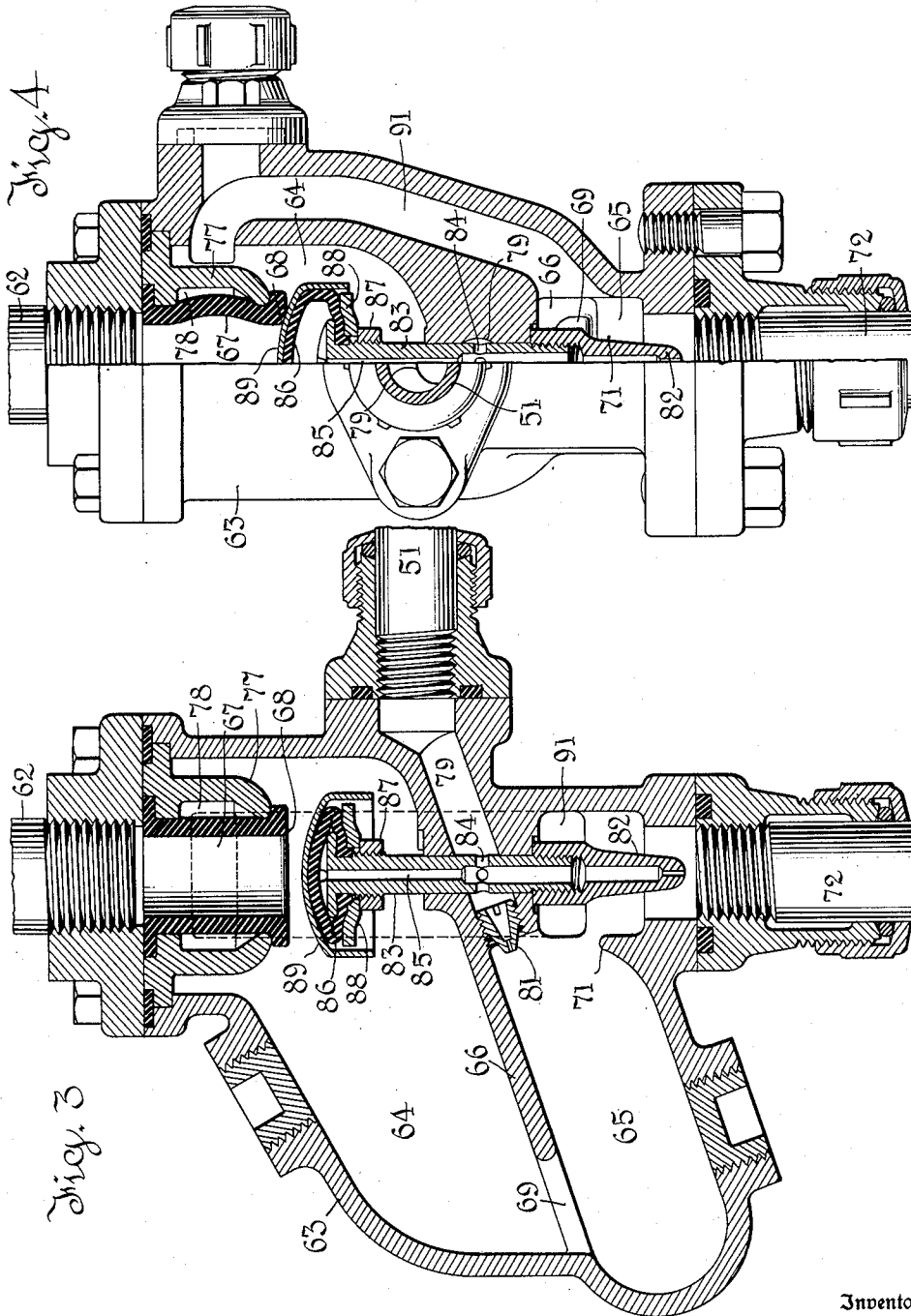
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,196,977

SANDER

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Application June 21, 1937, Serial No. 149,493

21 Claims. (Cl. 291—3)

This invention relates to sanding devices for railway vehicles, and particularly to sanding mechanisms intended for use with modern high speed trains.

5 The high speeds characteristic of stream-lined light weight trains have introduced a serious braking problem. The stopping distance must be kept within limits heretofore attained with slower trains in order to permit operation of
10 the high speed trains with the existing signal spacing. To attain this result it is necessary to apply the brakes with an intensity which approaches the maximum permissible. In fact the brakes are controlled in response to the deceleration rate so that the initial application is severe, the brakes being gradually released by a decelerometer to maintain a substantially uniform deceleration rate until the train is brought nearly to rest, at which time the brakes are further
15 released to permit a smooth stop.

20 In operating the brakes under such conditions the danger of locking a wheel and causing it to slide is substantial. If a wheel locks it cannot be released in time to prevent serious injury to the wheel. If rail conditions were uniform the operation of the brakes could be standardized with a safe margin, but rail conditions are subject to wide variations because of rain, snow, sleet and various other uncontrollable factors. The
25 effects of rail conditions on brake performance are so great that a brake system which operates satisfactorily, and with a safe margin, under favorable rail conditions, may slide wheels under even moderately adverse rail conditions.

30 The problem therefore is to standardize the condition of the rail so that the variations encountered will be within the safe working limits of the brake system if set for good rail conditions.

35 The first recourse was to sand the rail in front of some or all the wheels of a propelling unit. This is not entirely satisfactory in some cases because the wheels near the rear of the train may start to slide before they reach the sanded rail, and if they do, the damage will be accentuated when they encounter the sanded rail. Consequently, if sanding is to be used it should, for best effect, occur simultaneously in advance of every braked wheel, and should be initiated
40 so rapidly that effective sanding commences before the braking pressure reaches a value which could cause sliding.

45 In sanding devices as heretofore used, the sand has been caused to trickle down a pipe impelled by a comparatively feeble jet of air. This is slow

and often ineffective. With a train operating at 110 miles per hour, and with the possibility of cross winds, some more rapid and certain way of insuring the entrance of the sand between the wheels and the rail is vitally necessary. Accord-
5 ingly, one of the features of the present invention is the provision of means to blow the sand violently into the angle between the wheel and the rail, so violently that it is certain to arrive at the intended point of application.

10 To accomplish this result it is desirable to operate the sand traps and sander pipes under substantial pneumatic pressures, and since it is undesirable to operate the sand boxes under such pressure, an important feature of the present
15 invention is an interceptor valve, which upon initiation of the sanding operation, disconnects the sand trap from the sander box.

20 This idea of pressure sanding has another very important aspect which is that the sander nozzles are exposed and are likely to become clogged, particularly by mud, sleet or snow. An important feature of the present invention is the use of a distensible sander nozzle so designed that it will be markedly deformed under the sanding
25 pressure used, and will serve to break away any obstructions, particularly ice or sleet. Distensibility has peculiar significance with the use of sanding pressures sufficient to produce substantial distension even when the nozzle is heavily
30 coated with ice.

35 Another important feature of the invention is the arrangement of the ports in such a way that any sanding operation, whether it is initiated manually or automatically by the operation of the brake, will occur simultaneously in advance of every braked wheel. Means are provided to permit certain sanding units to be cut out if desired. For example, under favorable rail conditions it might be desirable to permit sanding
40 under the leading wheels only.

45 For the reason that most stream-lined trains are operated in one direction, it is not ordinarily necessary on such trains to provide selective sanding according to the direction of travel. It is well known, in the sanding art, to provide such selective sanding, controlled, for example, by the reversing mechanism of the propelling unit. Such a device is applicable to the present invention by the adoption of means such as that described in the patent to Schaafe 758,194, April 26,
50 1904, but this is not regarded as a feature of the present invention and hence need not be illustrated. The system of the present invention obviously can be so used.

The preferred embodiment of the invention will now be described in connection with the accompanying drawings, in which—

Fig. 1 is a diagrammatic view, chiefly in section, showing the sander control mechanism for the train and the sander mechanism for one wheel.

Fig. 2 is a diagram showing the control connections for sanders throughout a train.

Fig. 3 is a vertical section of a sand trap constructed according to the present invention and showing its actual construction.

Fig. 4 is a view half in elevation and half in section, of the sand trap shown in Fig. 3, the plane of section passing through the axis of stem 83 of the intercepting valve.

Referring first to Figs. 1 and 2, any suitable source of air under pressure is represented by the reservoir 6, assumed to be the main reservoir of the air brake system and 7 represents pipes directly connected thereto.

Control of sanding is effected by the sander valve generally indicated by the number 8 applied to its body. This valve is substantially identical in structure, and identical in function with that shown in the patent to Campbell 2,035,533, issued March 31, 1936. Reference may be made to that patent for details, and since the valve is illustrated here merely as typical control means, a brief description will suffice.

A branch of pipe 7 leads to body 8, and a pipe 9 leads from the body to the motor chamber 11 of the sander switch whose body is indicated at 12. A timing reservoir 13 is connected with body 8 by pipe 14. A pipe 15 leads to body 8 from a brake valve (not shown) which in certain applications, for example emergency applications, supplies air under pressure to the space above piston 16. Piston valve 17 may be forced downward by this means or by hand button 18.

The sander control valve in body 8 is shown in Fig. 1 in normal (inactive) position. At such time the pipe 9 is vented to atmosphere through the choke 19 with which it is constantly in communication, and since the supply port 21 in valve housing 8 is blanked by the lower head of the piston valve 17, the space 11 below the motor piston of the sander switch is at atmospheric pressure.

Timing reservoir 13 is charged from pipe 7, past the reduced middle portion of valve 17 to pipe 14. If the valve 17 be moved downward either by the piston 16 or by the button 18 the main reservoir connection 7 is blanked and the timing reservoir 13 is connected through pipe 14 and the reduced middle portion of valve 17 with the port 21. This supplies air above a piston 22 which overpowers the return spring 23 so that the valve 17 remains in its lower position until timing reservoir pressure bleeds away through the choke 19. It should be explained that a branch of port 21 leads around the lower head of valve 17 to the pipe 9 and choke 19. Consequently, the effect of depressing the button 18 or the piston 16 is to admit pressure fluid to the space below the motor piston of the sander switch and to maintain this pressure for a time, determined by the capacity of choke 19 and the volume of the timing reservoir 13. When pressure in the timing reservoir is substantially depleted spring 23 will restore the valve to normal position.

If timed sanding is not desired, manually controlled sanding can be had by depressing the button 24 which unseats the valve 25 and allows main reservoir air to flow via pipe 7 past the reduced portion of valve 17, passage 26, valve

25, and passage 27, to the branch of port 21, and via pipe 9 to the space 11. As long as button 24 is held depressed the sanding switch will be energized. Thus the control valve, generally indicated at 8, provides for timed sanding say for sixty seconds. This may be manually initiated by depressing button 18 or may be automatically initiated by a brake application through the operation of the piston 16. Sanding at will may be secured by depressing the button 24 and will continue as long as the button is held depressed and there is sand in the traps.

Referring now to the sander switch. The development of pressure in the motor chamber 11 below the piston 28 forces this up against the resistance of the coil springs 29 causing a contactor head 31 to bridge the contacts 32 and 33. This energizes a sander circuit, represented by the battery 34 and the wires 35 and 36, which, as indicated in Fig. 2, extend throughout the train. The switch 37 may be provided to cut out the rear sanding units of the train, if desired, but the normal position of the switch 37 is "closed" so that all the sanders throughout the train will operate simultaneously.

The leading sanding unit on the train will now be described with reference to Fig. 1.

Connected between the wires 35 and 36 forward of the switch 37, and hence not subject to control thereby, is solenoid winding 38. When this winding is energized its armature is forced downward to close and exhaust poppet valve 39 and open an inlet poppet valve 41 controlling flow from main reservoir pipe 7. This motion is resisted by a coil compression spring 42. In a normal position, shown in Fig. 1 (winding 38 deenergized) valve 41 interrupts the supply of air from the main reservoir pipe 7 to branch pipe 43, and valve 39 vents branch pipe 43 to atmosphere.

When the solenoid is energized and the vent is closed, main reservoir air is admitted to the pipe 43. Pipe 43 leads to the space below the diaphragm 44. The space above this diaphragm is vented to atmosphere at 45, and a stem 46 which makes a close sliding fit in a guide bushing, and hence is practically protected against leakage, is provided to unseat the poppet valve 47 which is normally closed by a compression spring 48. This valve 47 controls flow from a branch of the main reservoir pipe 7 to the space 49. From the space 49 a pipe 51 leads to the jet connections of the sand trap, hereinafter described.

When sanding commences it is desired to admit supplemental or cleaning air at high pressure and in large volume to the sand trap but only for a brief period. The clean out pipe connection is indicated at 52 and the clean out timing valve comprises a diaphragm 53 subject on its lower face to pressure in chamber 49 and subject on its upper side to the pressure of a coil compression spring 54 assisted by the pressure in chamber 55 within cap or housing 56. There is a choke connection 57 from the space 49 to the chamber 55. When pressure is admitted beneath diaphragm 44 valve 47 is unseated, and main reservoir pressure is immediately established in the chamber 49 but not in the chamber 55 because of the delaying action of the choke 57. It follows that diaphragm 53 moves upward and then as pressure is equalized through the choke 57 moves downward. Diaphragm 53 serves as a valve in conjunction with the annular seat 58, to control flow to the clean out pipe 52. It follows that when pressure is established in the chamber 49

air flows through the pipes 51 and 52 in parallel, but the flow through the pipe 52 is terminated after a relatively short interval, determined by the volume of chamber 55 and the flow capacity of choke 57.

The construction of the sand trap is shown diagrammatically in Fig. 1, and in its actual form in Figs. 3 and 4. Sand flows from the sand box 61 through the pipe 62 to sand trap 63, whose form is best shown in Figs. 3 and 4. This comprises an upper chamber 64 and a lower chamber 65 separated by the inclined partition 66 except for opening 69. Sand supplied through the pipe 62 flows downward through the combined distensible approach 67 and valve seat 68 into the upper chamber 64 and thence through port 69 to the lower chamber 65 where it accumulates behind a dam or crest 71 over which the sand must flow to enter the nozzle pipe 72. The nozzle pipe 72 leads to a fitting 73 on which is mounted a distensible nozzle 74 formed of resilient rubber or like material. This directs the discharging sand into the angle between the tread 75 of the related wheel and the top 76 of the rail. The distensible approach 67 and the valve seat 68 are also formed of resilient rubber or similar material, and are held in place by a fitting 77 whose lower rim sustains the valve seat portion 68 and which also affords a recess or cavity 78 into which the portion 67 may be expanded or distended.

When the sander is out of action, said flows through the pipe 62 through the valve seat 68 into the upper chamber 64 from which it flows through the passage 69 into the lower chamber 65. Flow is arrested by the dam 71 at the angle of repose of the sand, so that between operations of the sanding device the sand trap receives the entire charge of sand to be used in the succeeding sanding operation.

The sanding jet pipe 51 leads to a passage 79 in which is mounted a small jet nozzle 81. This delivers a jet of air beneath the partition 66 and substantially parallel thereto. The jet stirs up the sand in the chamber 65 during the sanding operation. The effect of this is to cause the sand to flow over the crest 71 where it enters the influence of a second jet controlled by nozzle 82 and directed down the pipe 72. The nozzle 82 is screwed on to the lower end of a hollow stem 83 which passes through the passage 79 and is ported at 84 to communicate therewith so that when air is supplied to the pipe 51 it flows to both the jets 81 and 82. It also flows upward through an axial bore 85 into a flattened bulb 86 secured to a flange on the upper end of the stem 83 by a nut 87 and bearer plate 88. A cup-like valve element 89 is mounted over the bulb 86 and when this bulb is inflated the valve 89 is moved upward to seal against the seat 68. Consequently when the sander comes into operation, the supply of sand is intercepted at the seat 68.

If the intercepting of the sand were all that were required a relatively simple problem would be afforded, but it is necessary not only to intercept the sand but to produce an air-tight seal so that if substantial pressure is developed in the sand trap the sand boxes will be protected against back flow. Sand flowing down through the approach 67 has a tendency to arch and resist closure of the valve 89. This tendency, however, is defeated by the distension of the approach 67 into the space 78. In other words, the distensible approach offers a pocket into which

sand is forced to permit complete closure and air tight seating of the valve.

The clean out air 52 is delivered directly to the upper chamber 64 of the sand trap, entering adjacent the fitting 77 and is also delivered by way of the bypass 91 to the space around the nozzle 82. This space is in direct communication with the lower chamber 65.

It follows that when the valve 47 is unseated air jets are delivered at the nozzles 81 and 82, the sand supply is intercepted at the valve seat 68 and a tight air seal is there produced. Air in large quantity is also delivered to both chambers of the trap and to the nozzle 74 for a short period. If the nozzle 74 is clogged by mud, ice, snow or sleet, it will be subject suddenly to heavy internal pressure and will be distended so markedly that the obstruction is blown clear. If the sander nozzle is clear the development of pressure within the sand trap and the nozzle will be less marked. In any case the sand will be delivered by a rapidly flowing jet into the angle between the tread of the wheel and the rail.

Referring now to Fig. 2, the arrangement of the sanding units, other than the leading one, will be explained. The essential difference is that these sanders do not derive their operating air directly from the main reservoir. It is not ordinarily convenient to run a main reservoir pipe throughout the entire length of the train, but there usually is a brake pipe or supervisory line which is normally charged to main reservoir pressure or to a pressure slightly lower. Such a brake pipe is indicated in Fig. 2 at 92.

For each sanding unit there is a small reservoir 93 which may, for example, be fed from the brake pipe through a check valve 94 and a flow restricting choke 95, the purpose of the flow restricting choke being to prevent derangement of the braking system by the demand of the sanding system for air. This scheme is merely representative of any local source of sanding air. So far as the present invention is concerned it is immaterial how the air is supplied.

As indicated in Fig. 2, the remainder of the sanding equipment on the various cars is identical with that shown in Fig. 1. Similar reference numerals, with the distinguishing letters *a* and *b*, are used to distinguish the second and third units from the leading units previously described. While only three units are shown in Fig. 2, and while only the leading wheel of the truck is shown, it will be understood that the sanding apparatus is repeated throughout the entire length of the train, and every braked wheel or at least the leading wheels of every truck are sanded.

The operation of the device has been explained as the description proceeded, and only a brief recapitulation is needed.

Operation of any of the instrumentalities associated with the sander valve 8 causes energization of the sander switch 12 to close the circuit, energizing the windings 38, 38a, 38b, etc., simultaneously. The effect of this is to deliver air through the jet pipes 51, 51a, 51b, and simultaneously through the clean out pipes 52, 52a, 52b, of the sanders. The effect is to start the jets into operation and isolate the sand traps from the sand boxes. Then if any nozzle 74, 74a, 74b is obstructed, the immediate development of high pressure will clear the obstructed nozzle. At this and at any nozzle which is not obstructed, rapid delivery of sand to the rail will occur and will continue until the sand in the trap is exhausted unless sooner terminated by

the valve 8. Upon termination of sanding, pressure in the pipe 51 (or 51a or 51b), will be dissipated and the corresponding intercepting valve will move to its lower position permitting its trap to be recharged with sand.

The invention has been described in considerable detail, but the description is intended to be illustrative and not limiting.

What is claimed is:

10 1. The combination of a sand trap or the like and a sand intercepting valve adapted to seal air tight said valve comprising valve elements relatively movable toward and from one another, at least one of said elements being resilient and
15 affording a distensible pocket into which sand trapped between the valve elements is forced during closing movement of the valve, to an extent sufficient to permit tight closure of the valve elements.

20 2. The combination of a sand trap or the like and a sand intercepting valve, said valve comprising a resilient rubber-like valve seat member having a distensible tubular walled approach passage; means for sustaining said seat while
25 leaving the walls of said approach passage free to expand; and a valve movable toward and from said seat, the distension of the approach passage, when sand is compacted by closing movement of the valve serving to permit retrograde
30 movement of the sand and tight closure of the valve.

3. The combination of a sand trap or the like and a sand intercepting valve, said valve comprising a valve seat member; a distensible conduit forming member leading thereto; and a
35 valve movable toward and from said seat, the distensibility of said conduit member serving to relieve the arching tendency of the sand and thus permit complete closure of the valve.

40 4. The combination of a source of sand; a sand trap normally in communication with said source and arranged to receive a charge of sand by gravity flow therefrom, said trap including a duct through which the trap may discharge sand
45 to a point of use and sand feeding jet means substantially aligned with said duct; means for supplying air under pressure to said jet means to discharge sand through said duct; and pressure operated means rendered effective by the
50 supply of such air to seal the trap from said source.

5. The combination of a source of sand; a sand trap normally in communication with said source and arranged to receive a charge of sand
55 by gravity flow therefrom, said trap including a normally inactive duct through which sand may be propelled against the action of gravity to a point of use, and sand propelling jet means substantially aligned with said duct; means serving to
60 isolate said trap from said source; and means serving to operate the last named means and substantially simultaneously supply pressure fluid to said jet means to cause discharge of sand from the trap through said duct.

65 6. The combination of a sand trap arranged to be operated under substantial pneumatic pressure during the sanding operation, said trap including sand-feeding jet means; means for supplying pressure fluid to said trap and jet means;
70 and a sanding nozzle arranged to be fed by said trap and subject to pressure in the trap, said nozzle being deformable by the pressure used to operate the trap, and the parts being so arranged that the nozzle will be deformed and tend
75 to clear itself at least if the trap is under oper-

ating pressure and flow through the nozzle is materially impeded.

7. The combination of a pneumatic sand trap arranged to be operated under substantial internal air pressure when flow therefrom be resisted; and a distensible nozzle through which
5 said sand trap discharges, said nozzle being arranged to be distended and thus clear itself as an incident to the development of pressure in said trap.

8. The combination of a train having a plurality of braked wheels; a plurality of pneumatic sand traps, said traps corresponding to different wheels, and each arranged to be operated
15 under substantial internal air pressure when flow therefrom is resisted; distensible sanding nozzles corresponding to the various traps and through which such traps deliver said to the wheels, said nozzles being arranged to be
20 distended and hence each to clear itself as an incident to the development of pressure in a corresponding trap; and means for delivering air under pressure to all said traps simultaneously.

9. The combination of a train having a plurality of braked wheels; a plurality of pneumatic sand traps, said traps corresponding to different wheels, and each arranged to be operated
25 under substantial internal air pressure when flow therefrom is resisted; distensible sanding nozzles corresponding to the various traps and through which such traps deliver sand to the wheels, said nozzles being arranged to be
30 distended and hence each to clear itself as an incident to the development of pressure in a corresponding trap; and means operable by the braking system as an incident to a brake application for delivering air under pressure to all said
35 traps simultaneously.

10. The combination of a source of sand; a sand trap connected therewith and adapted to
40 receive a charge therefrom; a sanding nozzle to which said trap serves to deliver sand; a clean-out connection; at least one air nozzle for pneumatically delivering sand from said trap to said
45 sanding nozzle; means for supplying air under pressure simultaneously to said clean-out connection and to said air nozzle to initiate sanding, and for then terminating the supply of air to the clean-out connection; and pressure operated
50 means operated by pressure of air supplied to the air nozzle and serving to isolate said trap from said source.

11. A sand trap comprising in combination a body having a lower chamber having a discharge
55 opening and a crest over which sand may flow to the discharge opening, and an upper chamber having a supply connection and a passage for delivering sand from the upper to the lower chamber in position to be arrested by the crest;
60 connections for supplying clean-out air to both chambers simultaneously; jet means for stirring sand in the lower chamber for causing it to flow over the crest; jet means for propelling sand through said discharge opening; pressure operated means for closing the supply connection to
65 said upper chamber; and means for supplying air under pressure to said clean-out connection, jet means and pressure operated means.

12. The combination defined in claim 11 in which the stirring jet is directed toward the upper
70 portion of the lower chamber at a point adjacent the passage from the upper to the lower chamber, and in a direction away from the crest.

13. The combination defined in claim 11 in which the two jet means and the pressure op- 75

erated closing means receive air simultaneously from one connection which is distinct from the clean-out connection, the clean-out connection being of relatively larger flow capacity.

14. The combination defined in claim 11 in which the stirring jet is directed across the upper portion of the lower chamber toward the passage from the upper to the lower chamber and in a direction away from the crest, and the propelling jet is directed substantially axially into said discharge opening, both jets being fed by a single connection.

15. The combination defined in claim 11 in which the pressure operated supply closing means comprises a valve, one element of which includes a distensible pocket serving to permit retreat of the sand as the valve closes.

16. The combination of a sand supplying means; a sand-trap comprising a body having a lower chamber formed with a discharge opening and a crest over which sand may flow to the discharge opening, and an upper chamber normally in free communication with said supplying means, and having a discharge opening for delivering sand to the lower chamber in position to be arrested by said crest; a large capacity clean-out connection for delivering air to both said chambers simultaneously; two jet nozzles, one for directing stirring air into the lower chamber, and the other for directing a propelling jet through said discharge opening; a pressure operated interceptor for isolating the sand trap from the sand supplying means; a second connection for supplying air under pressure to said jet nozzles and pressure operated interceptor; and means for supplying air simultaneously to said connections and then terminating the supply to the first-named connection while continuing the supply to the second connection.

17. The combination of a sand supplying means; a sand-trap comprising a body having a lower chamber formed with a discharge opening and a crest over which sand may flow to the discharge opening, and an upper chamber normally in free communication with said supplying means, and having a discharge opening for delivering sand to the lower chamber in position to be arrested by said crest; a clean-out connection for delivering air to both said chambers simultaneously; two jet nozzles, one for directing stirring air into the lower chamber, and the other for directing a propelling jet through said discharge opening; a pressure operated interceptor for isolating the sand trap from the sand supplying means; a second connection for supplying air under pressure to said jet nozzles and pressure operated interceptor; means for supplying air simultaneously to said connections and then terminating the supply to the first-named connection while continuing the supply to the second connection; and a pressure deformable self-clearing nozzle connected with the discharge opening of said lower chamber and arranged to discharge sand to a point of use.

18. A sanding mechanism comprising in combination a sand trap including a body having a lower chamber provided with a discharge opening and a crest over which sand may flow to the

discharge, and an upper chamber having a supply connection and a passage for delivering sand from the upper to the lower chamber in position to be arrested by the crest; connections for supplying air to both chambers simultaneously, said connections including a relatively large pressure-equalizing passage connecting said chambers; a distensible nozzle through which said trap discharges, said nozzle being arranged to distend and clear itself if subjected to abnormal internal pressure; jet means for feeding sand over said crest through said discharge to said nozzle; means for sealing said supply connection; and means for operating said sealing means, and supplying air under pressure to said large capacity connections at least during the initial portion of the sanding operation, and for supplying air under pressure to said jet means during the sanding operation.

19. The combination of a sand feeding device and a sand intercepting valve adapted to seal air-tight, said valve comprising a seat element and a valve element movable relatively toward and from one another, the seat element being resilient and affording a distensible pocket into which sand trapped between the two elements may be forced and the valve element including a resilient bulb distensible upon admission of pressure fluid thereto to cause closure of said valve element against the seat element.

20. The combination of a source of sand; a sand trap connected to be fed thereby; a sanding nozzle to which said trap delivers sand; a clean-out connection; at least one air nozzle for pneumatically delivering sand from said trap to said sanding nozzle; means for supplying air under pressure simultaneously to said clean-out connection and to said air nozzle to initiate sanding, and for then terminating the supply of air to the clean-out connection; and pressure operated means serving to isolate said trap from said source and arranged to be controlled by said air-supplying means.

21. The combination of sand supplying means; a sand trap comprising a body having a chamber arranged to be fed by said supplying means; and having a discharge opening and a crest over which sand may be caused to flow to the discharge opening; a clean-out connection for delivering air under pressure to said chamber; two jet nozzles, one for directing air to propel sand over said crest and the other for directing a propelling jet through said discharge opening; a second connection for directing air under pressure to said nozzles; a pressure-operated interceptor arranged to be actuated by pressure developed in one of said connections and serving when active to isolate said chamber from said sand supplying means; valve means operable to supply air under pressure simultaneously to both said connections and then to terminate the supply to the first while continuing the supply to the second; and a pressure-deformable self-clearing nozzle connected with said discharge opening and arranged to discharge sand to the point of use.

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