

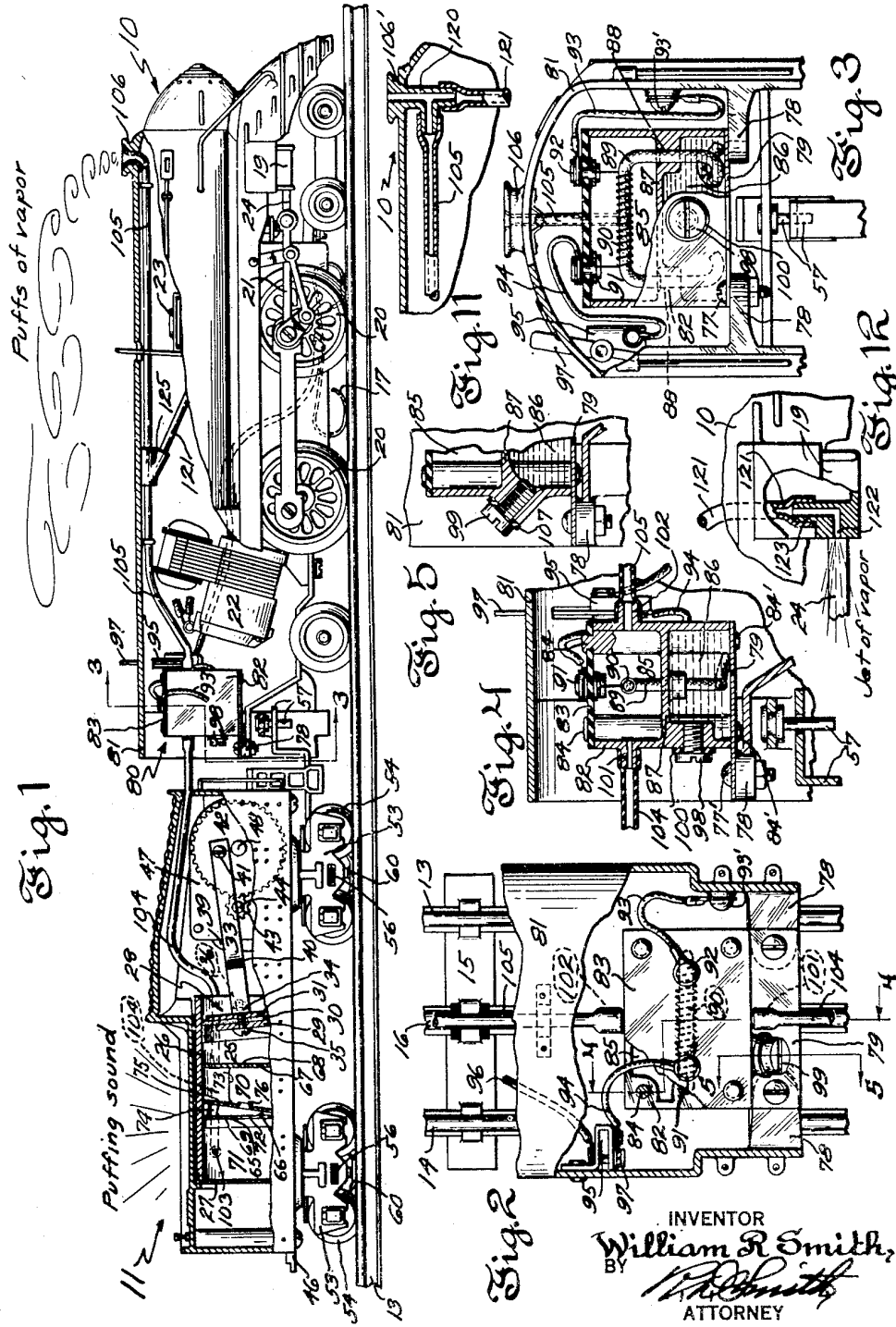
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W. R. SMITH  
VAPOR GENERATION AND PUFFING WITH  
AUDIBLE EFFECTS IN TOYS

2,461,664

Filed Aug. 30, 1941

2 Sheets—Sheet 1



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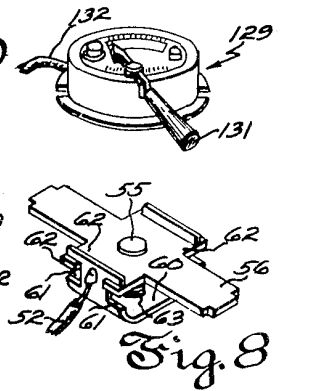
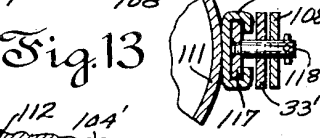
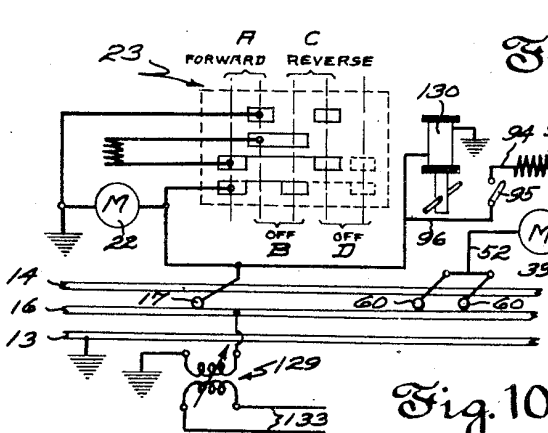
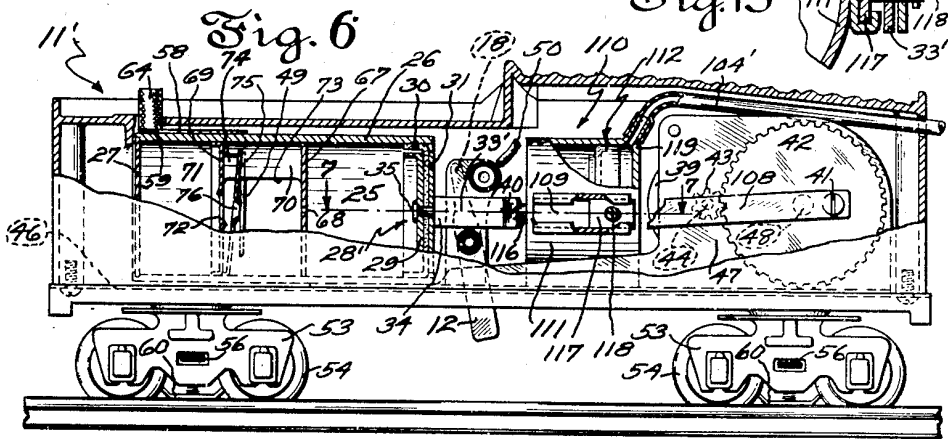
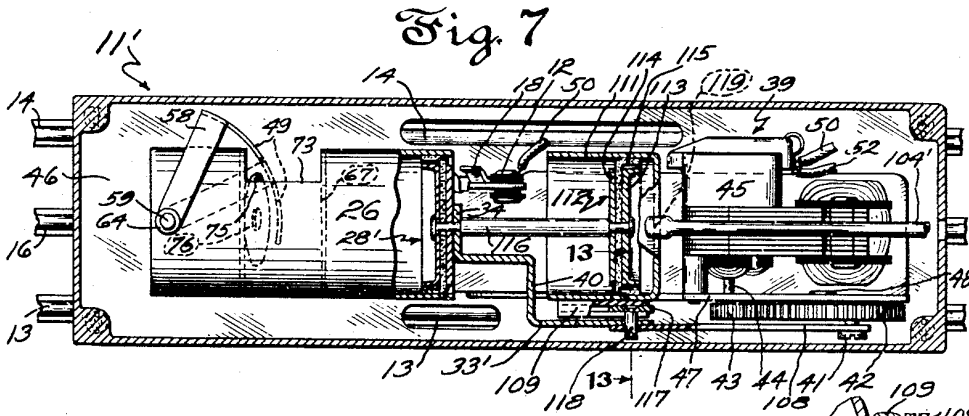
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# UNITED STATES PATENT OFFICE

2,461,664

## VAPOR GENERATION AND PUFFING WITH AUDIBLE EFFECTS IN TOYS

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Application August 30, 1941, Serial No. 409,056

53 Claims. (Cl. 46—113)

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A copending application Serial No. 366,892, now U. S. Patent No. 2,317,974, discloses sound producing apparatus incorporated in electrically powered toy trains or model trains for effectively imitating the puffing noise of a steam locomotive.

The present invention relates to ways and means for producing either in conjunction with such puffing sounds, or in the absence thereof, the emission of visible fume laden smoke-like vapor from a toy locomotive or other toy structure in realistic puffs, and in the case of a toy locomotive so that the performance of the vapor shall simulate the familiar puffs of smoke and steam which are discharged by a real locomotive at each stroke of the pistons in their power cylinders and without of necessity being limited to synchronism with the traction wheel speed of my toy locomotive.

An object of the invention is to produce puffs and wafting billows of visible vapor in miniature form which shall resemble in color and density, and in wafting and dwelling behavior the actual puffs of steam and smoke given off by a real steam engine such as drives a locomotive.

A further object is to augment the effectiveness of the above mentioned imitative puffing sound by the added spectacle of visible smoke puffs given off preferably in predetermined time relation, and if desired in substantial synchronism, with the occurrence of the puffing sounds.

A further object is to generate and store for thus being ejected from a toy locomotive or other toy structure visible vapor smoke or fumes which shall be entirely harmless to a child playing with the toy, even if he were to breathe such vapors or if they were to come in sustained contact with sensitive tissues of the body. It is also an object to produce realistic visible vapor which shall be harmless to any of the home furnishings with which it may come in contact, and which shall be non-corrosive with respect to all metal and other materials of which the track or rolling stock of a toy train is composed.

A further object is to provide apparatus for generating and storing a continuous supply of such harmless vapor in sufficient quantity to produce under both stopped and running conditions of the toy train a satisfactory volume of vapor for the indicated purpose and yet which apparatus shall be of miniature size and be containable entirely within the unenlarged interior of a conventional toy locomotive or other piece of toy rolling stock hauled thereby, so that neither the presence nor the location of the vapor generating and storing apparatus shall in any way be indicated to the casual observer.

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A further object is to produce the visible vapor from a consumable material which shall undergo a small rate of consumption in proportion to the volume of vapor produced so that in the process of generating the vapor the material will last for a maximum period before needing replenishment.

A further object is reliably to confine the material from which the vapor is generated against spilling or accidental escape regardless of whether the toy rolling stock by which it is carried is overturned or violently shaken. Another object is to provide for very convenient replenishment of the material whenever required.

A still further object is to generate visible vapor in sufficient volume by the use of heat of such low degree that no temperature capable of burning or harming children can be built up in any of the structure of the toy rolling stock, locomotive or other toy structure which can come into contact with the person of a child playing with it.

A still further object is to utilize, for generating the heat that is made use of to convert the material into visible vapor, electric current derived from the same track rails by which the locomotive is powered.

A further object is to produce visible vapor in the form of fumes free from unpleasant odor, and scented with any agreeable odor desired. It will enhance the realism of the toy to scent the fumes to simulate the odors of steam and smoke given off by a real steam locomotive.

A further object is to make use of a common source of fluid pressure for producing the puffing noise and for ejecting the visible vapor, and to cause such pressure to act through instrumentalities involving fluid communication between the sound producing device and the means for generating or storing the vapor.

A still further object is to make use of a common motivator or a common prime mover separate from the tractional motor of the toy locomotive for operating the sound producing devices and the vapor ejecting devices.

Still another object is to make the vapor generating and ejecting apparatus easily applicable to and removably from an otherwise conventional toy locomotive or other form of hollow toy or rolling stock, and to make the vaporizable substance easily replenishable when needed without so removing the apparatus.

The above and other objectives will become more thoroughly apparent from the following description of an illustrative embodiment of the invention in which description reference is had to the accompanying drawings, wherein:

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Fig. 1 is a side elevation showing partially in section an electrically impelled toy locomotive fashioned after a real steam locomotive together with the toy tender hauled thereby as part of a full toy train (not shown) incorporating apparatus embodying the present inventions.

Fig. 2 is a plan view of the rear end or cab section of the locomotive drawn on an enlarged scale and showing the roof of the cab broken away to expose certain vapor generating and storing apparatus contained therein.

Fig. 3 is an end view of the cab compartment of the toy locomotive taken partly in section on the planes 3—3 in Fig. 1 looking in the direction of the arrows.

Fig. 4 is a fragmentary view taken in section on the planes 4—4 in Fig. 2.

Fig. 5 is a fragmentary view taken in section on the plane 5—5 in Fig. 2.

Fig. 6 is a view showing on an enlarged scale in side elevation with side walls partially broken away a toy tender incorporating apparatus embodying a modified form of the invention.

Fig. 7 is a plan view taken partially in section on the plane 7—7 in Fig. 6.

Fig. 8 is a perspective view of one of the current collector shoes detached from one of the wheel trucks of the tender of Fig. 1 or 7.

Fig. 9 is a perspective view of a voltage modulating and current switching electrical controller which may be employed in the electrical system of Fig. 10.

Fig. 10 is a diagram of the electrical apparatus and circuit connections.

Fig. 11 shows a modified provision for tubing connection at the stack.

Fig. 12 is a fragmentary view of the cylinder section of the locomotive shell broken away to expose interior construction.

Fig. 13 is an enlarged fragmentary view taken in section on the plane 13—13 in Fig. 7 looking in the direction of the arrows.

As in the aforesaid Patent No. 2,317,974, Fig. 1 of this application shows the ordinarily empty hollow space within the enclosing walls or body shell of locomotive tender 11 to contain a sound producing apparatus which operates to imitate faithfully puffing sounds made by the intermittent exhaust of steam and smoke in a real steam locomotive. The structure of the fluid impulsing or fluid activating sound producing apparatus includes a horizontal hollow cylinder 26 one end of which may be completely closed by a cap 27 and the other end of which is open and receives in sliding engagement therewith an impulser or reciprocator here shown in the form of a conventional composite air pump plunger 28 made up of a rigid disc 29 of somewhat smaller diameter than the inside of the cylinder 26 to which disc is secured a cupped washer 30 of very flexible material, such as oil-soaked leather, whose flexible peripheral flange fills and slidably engages with the interior surface of the cylinder 26 in a manner fully to partition the latter even when disc 29 occupies positions of oblique inclination to the axis of the cylinder as indicated in Fig. 1. The inner face of plunger 28 thereby serves as an air impelling instrumentality for generating air flow. Flexible washer 30 is backed up by a stiff plate 31. Plunger 28 is pulled and pushed back and forth lengthwise of the cylinder by a pitman bar 33 whose bent over end 34 has threaded engagement with screw 35 and is clamped fixedly against backing plate 31 by means of this screw which penetrates and holds together the disc 29, cup

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washer 30, and backing plate 31. A lock nut 36 prevents these parts from working loose.

To permit a prime mover in the form of an electric motor, indicated as a whole by 39, to be located at the end of cylinder 26 within the tender 11, pitman bar 33 is provided with an offset bend 40. At its end remote from plunger 28 pitman 33 is pivotally connected at 41 to the outer face of a gear 42 which is rotatably supported on frame plate 47 at 48 and thus serves as a crank for reciprocating pitman 33. Gear 42 is constantly in mesh with a small pinion 43. Pinion 43 is fast on one end of the armature shaft 44 of motor 39 which shaft has bearings in bearing plates such as 47 of the motor which structural details are more fully shown in U. S. Patent No. 2,317,974. The motor is fixedly carried on the floor 46 of tender 11 by means of the aforesaid upright frame plate 47 which may be secured to floor 46 by spot welding, or if preferred in some detachable manner as by removable screws or the like.

An electrical switch 12 carried by tender 11 is connected to throw motor 39 into or out of circuit with the power rail 16 and traction rails 13, 14 through lead wires 50 and 52, the swingable blade 17 of which switch is grounded to the frame of the tender and is thus electrically in circuit with traction rails 13, 14 through the truck 53 and wheels 54 of the tender. A spring stud 55 is fixedly carried in the insulated bar 56 which spans the width of each wheel truck 53 and has its ends fixedly lodged in apertures in the side walls of the wheel truck. As best shown in Fig. 8, the U-shaped current collector shoe 60 has upwardly extending ends whose side edges are notched at 61 to be guided and limited as to vertical movement by forked arms 62 formed on the insulated bar 56 and occupying the notches 61 in the shoe. A coiled spring 63 is conductively anchored to the bottom end of stud 55 and extends to and presses downward against a central struck-up projection in shoe 60 by means of which the bottom end of spring 63 is retained against lateral displacement. The flexible lead wire 52 from motor 39 is soldered to shoe 60.

The use of the current collector shoe 60 on each of the two trucks of the tender insures uninterrupted performance of the vapor puffing effect even though one of these collector shoes might fail to be in contact with the current supply rail at some position in which the train comes to rest near a turn-out track switch or the like.

Cylinder 26 may be regarded as made up of three end-to-end tubular sections such as pump section 25 forming a pump compartment in which a pump piston such as plunger 28 reciprocates, section 70 forming an air discharge compartment, and section 71 forming the sound compartment. The pump and air discharge compartments are separated by a stationary partition 67 which may be cast integrally with the cylindrical walls or may take the form of a wall of sheet metal or other material thinner than shown in the drawing and peripherally fitting the interior of cylinder 26 so as to make a pneumatically tight joint. Partition 67 contains a small central orifice 68 at which a stream of air may be generated and projected toward the left in Figs. 1 and 6 when plunger 28 moves in that direction. The air discharge compartment and sound compartment are separated by a stationary partition 69 which is preferably rigid throughout and may take the form of a dished cup of sheet metal or the like whose peripheral flange fits and forms an air tight joint with the interior surface of cylinder 26.

Partition 69 is provided with means for fluctuating air flow in the form of an elongated aperture 72 which is both wider and longer than orifice 68, and whose ends are bordered by oppositely inclined lips 65 and 66 of eyelid shape formed by warping, in respectively opposite directions from the plane of the partition, the otherwise flat sheet material of which partition 69 is composed, as is more clearly set forth in the aforesaid Patent No. 2,317,974.

In the last said patent it is set forth that orifice 68 may be .076" in diameter, circular hole 76 may be  $\frac{3}{8}$ " in diameter and aperture 72 may be  $\frac{3}{8}$ " wide by  $\frac{1}{8}$ " long, where the diameter of the sound chamber is  $1\frac{1}{8}$ " and the spacing from partition 67 to partition 69 is  $1\frac{1}{8}$ "; and that the foregoing are merely suggestive dimensions which may be varied proportionally or in degree. They in no way limit the scope of the appended claims. Gear 42 may have sixty-four teeth and pinion 43 may have ten teeth whereupon if the gear turns 80 to 120 R. P. M. the pinion would rotate six times as fast, these also being but illustrative specifications.

Whereas partition 69, having a lipped aperture as described, is adequate to produce sounds for some of the purposes of this invention, it has been found in practice that the realism of various sounds it is desired to produce can be enhanced by the addition of other means for fluctuating air flow in the form of an auxiliary stationary baffle plate 75 containing a simple centrally disposed circular hole 76 spaced from aperture 72 toward the ejection orifice 68. It has further been found of advantage to incline plate 75 in relation to the axis of partition 69 and cylinder 26 and preferably at about the angle shown in Fig. 1. The entire periphery of hole 76 may be lipped toward the stream of air coming toward it from orifice 68 as shown in Fig. 1 and this lipped hole may be made  $\frac{1}{4}$ " in diameter in which case  $\frac{1}{8}$ " is a satisfactory width for aperture 72. For the purpose of so holding baffle plate 75 in relation to partition 69, mounting tabs such as 74 are provided having suitable differing axial length which may be secured to partition 69 by soldering, welding or in a removable manner if preferred. A cut-out 73 in the wall of the cylinder section 70 gives generous communication with ambient air which enables the jet or flow of air from orifice 68 to play upon the hole 76 and aperture 72 and thereby become fluctuated with desirably loud sound effect. This cutout 73 plays a further important part in the pneumatic performance of the fume puffing apparatus next to be described.

The present improvements involve in particular the addition of smoke-like visible vapor generating storing and ejecting apparatus to the means for producing puffing sounds which has hereinbefore been described, and in a form adapted, as is the sound producing means, to be contained entirely within the unenlarged interior of a conventional toy locomotive or other piece of toy rolling stock hauled thereby so that neither the presence nor the location of the vapor generating and puffing apparatus shall be obvious to a casual observer of the toy train while in natural position on its track.

In keeping with these objectives, the smoke-like vapor generating and storing unit or fume reservoir of these improvements, which is indicated as a whole by 80, is located within the rear end or cab section 81 of the locomotive 10 just back of the locomotive traction motor 22. It consists of a compartmented box-like container 82 the en-

closure of whose interior is completed by a top plate 83 of electrical insulating material secured to container 82 in any desirable fixed or removable manner as by means of screws or rivets. Herein for simplicity and permanence of construction the container is shown to be die cast from a preferably ductile metal to form the upstanding stud formations 84 which project through holes in plate 83 and are peened over atop the same. Similar stud formations 84' hold the floor plate 79 of container 82 in liquid tight contact with the bottom edges of the side walls of the container and plate 79 projects rearwardly beyond such walls to form a mounting flange removably secured by screws 77' on top of support bosses 78 cast on the interior of the locomotive cab 81. Container 82 is divided into an upper smoke storing chamber reservoir 85 and a repository receptive to a replenishable substance herein illustrated as a lower oil containing chamber 86. Such reservoir and repository may be separated by means of a horizontal partition 87 which may be cast integral with the side walls of the container. Holes 88 which extend through respectively thickened sections of partition wall 87 comprise the only openings between the two chambers and these holes are completely filled and plugged by spaced stretches of a continuous length of wicking 89 which extends unbroken from one hole 88 to the other hole 88 within smoke chamber 85 but which has its two ends dangling on the floor wall of container 82 within the oil chamber 86.

Around a stretch of wick 89 made of braided asbestos or any other suitable material affording good capillary attraction for oil and occupying smoke chamber 85 there is tightly wound a coil of electrical resistance wire 90 whose ends connect respectively to binding posts 91 and 92 which are mounted on and penetrate through plate 83 being thus insulated from the metal of container 82. Ordinary non-oxidizing resistance wire of about .004" diameter by 8" long will be found to produce an acceptable degree of heat for the present purpose of converting the oil in wick 89 into potentially visible fumes when subject to a range of 7 to 15 volts, although the size and length of wire may be varied at will to suit conditions. Binding post 92 is grounded to the frame of the locomotive at 93' by means of lead wire 93 or in any other desired manner to insure good electrical connection for placing binding post 92 in circuit with traction rail 13, 14 through the medium of locomotive wheels 20, etc. Binding post 91 is connected by lead wire 94 to one terminal of an electric cut-out switch 95 whose other terminal is connected by lead wire 96 to the current collector shoe 17 of locomotive 10 which shoe constantly wipes against the "third" or power rail 16 of the electrified track. A handle 97 projects from the locomotive as a means for manually furnishing or cutting off current supply to heating coil 90 at will.

For replenishing the oil in chamber 86 the filler plug screw 98 may be removed. Gasket washer 100 clamped under the head of screw 98 prevents leakage of oil. Completely filling chamber 86 with oil through the opening plugged by screw 98 requires turning the locomotive up on end. However, an alternatively usable filler plug screw 99 whose head clamps the gasket washer 107 may serve as means for completely filling chamber 86 with oil without even removing the locomotive from its track or separating it from tender 11.

Smoke chamber 85 comprises a reservoir of

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