SURFACE-CONDENSER FOR STEAM STREET-CARS.

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THIS invention consists of a surface-condenser that fits under the car-seats or other unoccupied space about the car, and is connected by a narrower part running under the floor, and thus connecting the two parts under the car-seats.

To facilitate the condensation of the exhaust steam from the engine, a fan or blower is employed, of any ordinary construction, to pass or force a rapid current of air through the tubes, and thus cool them.

The drawing represents a vertical section of a car with the condenser in position. A represents a car provided with seats B and suitable floor C. Under said seats and floor is arranged the surface-condenser D, and filling up, as nearly as possible, the entire space under said seats. To the bottom of the condenser may be attached the pillow-blocks or bearings *d d* for the axle E and wheels F F, it forming part of the car-body, if desirable.

A space, *b*, may be left around the sides of the condenser, and either filled in with non-conducting material, or it may be an air-space for the circulation of air.

The condenser may form the seats, sides thereof, and the floor, and may be made of iron in one piece, or riveted together out of sheets, and secured to the car itself in any suitable manner, forming, in fact, the lower part of the car-body.

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The great advantages of this condenser will be readily appreciated by those familiar with the art, and they are: large condensing surface arranged in a very small and compact space; the condenser is out of the way, and may form part of the car-body itself; the space hitherto unoccupied in street and similar cars is made use of to condense the exhaust steam, by which horses are frightened when it is allowed to escape into the atmosphere, besides causing sparks to be thrown into the air and streets, or to cause confagurations of combustible material; the condenser is very simple, and may be constructed in any suitable manner and of any suitable material, to occupy substantially the space shown and described.

COMBINED STEAM-ENGINE AND STEAM VACUUM-PUMP.

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FIGURE 1, side elevation; Fig. 2, vertical section; Figs. 3, 3' common clock-valves; Fig. 4 is a top or vertical view of the parts indicated by the letters C', B, and C, including the cylinder-heads of the pump, as shown at Fig. 1; A A, cylinders of the pump; F F F, the bottom plates of the pump-cylinders; V V are induction-valves, and *ll* are valves leading to the induction-pipes; D is a pipe for supplying water to the injecting-pump C and the boiler feeding-pump C' through the pipes *e e*, with which the pipe D connects, as shown, in the direction shown by the arrows. B is a steam-cylinder, supplied with steam by the pipe *a* through the steam-chest *c*, from which steam is admitted to the chambers or main cylinders A A through the pipes E E. L is a walking-beam, connected with the floats *x x* by means of the adjustable rods *o o*, stop-collars *h h*, and which floats, by means of said rods and walking-beam, operate the cut-off valve V² by means of the valve-stem and arm V³. C is a double-acting pump, for injecting water into the cylinders A A through pipes H H. C' is a single-acting pump, for feeding the steam-boiler through pipe *b*. *r r* is a piston stem or rod, provided centrally with a piston-head P, having expansion packing rings *d d*, as shown, and at either end having a water-piston head, *d' d'*, all as shown. *i i* are perforated hollow globes, connected to the lower ends of the pipes H H, for the purpose of breaking the water into spray when being forced into the cylinders A A.

The cylinders, and all other parts for which cast-iron is available, are made of that metal. The piston-rod *r r* is of steel, the rods *o o* of brass or other suitable metal, and the floats *x x* are made of sheet-copper or other available material, all manufactured and finished in the usual style of the machinist's art. The pump is started or put into working operation by first turning on steam through the pipe *a*, admitting it to the steam-chest *c*. The cut-off valve V² is then set in motion by means of hand manipulation of the walking-beam L, thus operating the valve V² by means of the arm and valve-stem V³, alternately admitting to and cutting off steam from the right and left-hand ports to the steam-cylinder B, as shown, and when steam is thus admitted to said cylinder the piston-rod *r r*, upon which is rigidly fixed the piston-head P, provided with expansion packing-rings, as shown, is caused to reciprocate to the right and left by regular alternate strokes, as shown, and which will be readily understood.

The piston-rod *r r* also has a suitable head or plunger rigidly attached at each end, marked *d' d'*, and it will be seen that when set in motion, as hereinafter described, the piston-heads P and *d' d'* all co-act and discharge their respective proper functions at the same time, causing the pumps C and C' each to draw water through the pipe D and branch pipes *e e*. A suitable and regular supply of water is then, with concentrated force, injected by the pump C, through pipes H H and perforated globes *i i*, into each of the cylinders A A alternately. The pump C', at the same time, forces a regular and sufficient supply of water into the steam-boiler through the pipe *b*. When the pump has thus been set in motion by hand-power, as before described, a supply of steam being in readiness for working the whole mechanism of the device, steam is admitted through the pipes E E into the cylinders A A, regularly alternating with the injection of water into said cylinders, as hereinbefore described. The alternating supply of steam through pipes E E is regulated by the lateral action of the piston-head P, thus discharging the function of a valve. The action of the piston-head P (acting as a valve) and the strokes of the pump C produce exactly equal alternating admissions of steam and injections of water into each of

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the cylinders A A, and as soon as the steam and water thus admitted and forced into either of the cylinders A A, as before described, come into contact with each other, a vacuum is instantly formed, at once causing the cylinder to fill with water forced in by atmospheric pressure from the well or reservoir through the induction pipe V, and the float *x* in the cylinder, thus filled, will be carried upon the surface of the water to the top of the interior of the cylinder; and while one of the cylinders is thus being filled, the water in the opposite cylinder is being expelled therefrom by the force of steam admitted thereto, as aforesaid, through the outlet port *l*, and when the water in said cylinder shall fall below the stop-collar *h* upon the rod *o*, the weight of the float *x*, acting by its gravity upon said stop-collar *h*, causes the steam to be cut off and reversed to the opposite port of the cylinder B, as shown, and thus causing the operation above described to be repeated.

The rod *o* may be adjusted by means of thumb-screws in the ends of the walking-beam L, so as to check the downward movement of the floats *x x* at any desired point, and by this means the pump may be caused to work at any percentage or degree below its maximum capacity; and this is a feature in my invention of great importance in an economical point of view.

The floats *x x* are made a trifle smaller than the interior diameter of the cylinders A A, for the purpose of preventing downward pressure of steam upon their upper surfaces, all fitting loosely upon the rods to permit them to move freely up and down thereon.

The pump C' enables me to dispense with the use of a separate pump to supply water to the steam-boiler, as heretofore used in steam vacuum-pumps, thereby saving much expense.

GRINDING AND POLISHING.

By JOSHUA ROSE.

No. 1.

ARTICLES of metal requiring to be polished require to have the surface removed before the polishing can be performed, because the materials used in polishing are too fine and cut too little to reach the fine hollows upon the surface of the articles.

Grinding may be aptly termed the first stage of polishing, because a ground surface has a certain amount of polish to it, and the finer the grinding the greater the polish. Grinding, however, as generally understood, is the operation of removing by abrasion the outer surface sufficiently to remove the forged or cast surface, and thus prepare the work for the polishing process.

The appliances used in grinding are first the grindstone, which is of large diameter for ordinary or flat work and small when the surface of the work requires to be concave, as in the case of razor grinding. The stones are run at a high speed, and kept wet with water. The work is performed with the stone running from the operator. It is of great importance that these stones should run true, because in that case the work can be performed much more rapidly and true. An instance of this occurred some years ago, when a large railroad company desired to have the surfaces of their locomotive guide bars fitted up by the piece. The work, which, together

with the fitting of the guide blocks, had been costing about ten dollars per engine, was taken by one of the workmen for \$8.00, which price was paid for a period of about a year. During this time there had been made several experiments with a view to grind the bars as true as possible. The method adopted was as follows: The stone upon which the operation was performed was about 4 feet 6 inches in diameter, and ran at about 300 revolutions per minute. The bars were held upon the stone so that the grinding marks ran crosswise of the stone; hence the width of the face of the bars would grind concave unless the bars were given a slight motion. This, however, the grinder so successfully performed, that with a surface plate to test with, he managed to grind the surfaces so true that it took more work to efface the grinding marks than it did to finishing the truing of the surfaces; notwithstanding that the top as well as the bottom bars were made, both on the inside edges as well as on the faces, very true to a surface plate, and it was required that the finishing should be done with a superfine smooth file, and that no scratches should be left in the work. To save the work entailed in filing out the grinding marks, which latter proved very destructive to files, it was first attempted to grind the bars length-

wise on the stone; but this was found impracticable, inasmuch as it was not possible, with the utmost of care, to grind the surfaces flat. The stone was made as true as possible and the experiment repeated, but still the faces of the bars were rounding, entailing a deal of extra work to true them before commencing the draw-filing. The next experiment made was to grind them crosswise of the stone and true to the surface plate, and then draw them lengthwise along the stone, performing just sufficient grinding to alter the direction of the grindstone marks. This, too, proved a failure, because the stone not being quite true—and it is impracticable to keep such a stone true—the bar would jar and tremble upon the stone, and the motion would cause the face of the bar to become rounded. In course of time, however, the machinist left the shop, and estimates for the job were tendered by many others among the workmen. One, however, offered to do them—that is, the eight guide bars and the four guide blocks—for \$4.00 per engine. This price was considered too low to enable the workman to deliver good work and make day wages, let alone the customary \$2 per day, which was allowed for piece-workers. He, however, had the bars ground crosswise of the stone and trued as usual, after which he drew them lengthwise along a stone running so slowly that the inequalities of the stone did not cause the bars to jar or tremble in the least; and so no matter if the stone was half an inch out of true, it would not affect the truth of the bar faces. By this simple expedient he saved one half of the work, and earned on the bars and blocks, for over ninety locomotives, an average of 2.33¢ a day, or 30 cents a day more than had been earned when more than double the price was paid. The difference, however, is made more apparent by considering the time taken to perform the work, which was by the first workman an average of about 4½ days per set, and by the second workman in a little over 1½ days. The edges of the bars were rounded to a ¼ inch radius and the corners of the guide blocks were filed to fit those of the bars. The shop in which this took place employed at least 100 men upon vise work, and yet none of them perceived the manner in which this saving was effected; so that after the second workman left that shop no one could be found, not even among the apprentices, many of whom had served five or six years at the trade, to take the work at the same price. This circumstance occurred ten years ago, and the simple expedient above described has not, even yet, been discovered.

The method of truing large stones true is by hacking them, which is performed as follows: The stone is run at a speed of about 100 revolutions per minute, while the operator resting his hand upon the grinder's seat or saddle holds a piece of coal or chalk so closely to the stone that it will touch the high spots, and by moving the position of his hand he makes across the face of the stone a series of marks about ¼ inch apart, and made upon the high places only.

The distinctness of these marks informs the operator of the amount necessary to take off in order to true the stone. To do this he stops the stone, and taking an implement, such as shown in Fig. 1, strikes the stone as with an axe, crossing the cuts as shown in Fig. 2, in which A represents a grindstone, B, B, B, B the circumferential marks made by the piece of coal, and denoting the high spots of the stone, and the diagonal marks on B, B, B, B, showing the hacking marks, which are mere indentations. It will be observed that the hacking marks are heavier and closer together at 1, 4, and 5