

ON A NEW SELF-LUBRICATING AXLE-BOX FOR RAILWAY ENGINES AND CARRIAGES, AND A SELF-ACTING SPRING CROSSING POINT.

No part of the machinery of a railway requires constant lubrication more than the axle journals of locomotives, tenders, and carriages, as the heating of one journal in the whole train is sufficient to produce the most serious results, not only in delay to the traffic, but endangering the lives of the passengers in the train.

Notwithstanding the great attention this point has received, scarcely a train that passes over our roads (in the summer more particularly), but some one or more of the axle journals heat. In one instance the writer experienced, the whole train had to be passed into a siding for more than two hours, before it could again proceed on its journey. He was induced, through what he had experienced of the difficulties attendant on the use of grease as a lubricator, and from what he knew of the use of oil in the United States, to write to the inventor of the best lubricating box in that country, knowing that the difference of cost of lubricating was more than one-half in favour of oil, with a proper box. He obtained a patent in this country for the inventor, and on application to Mr. J. E. McConnell, of the London and North Western Railway, a trial of the axle box was at once made on some of their carriages.

On no railway in the United States is grease used as a lubricator; many patents have been taken out in that country for axle boxes, but the plan now brought before the meeting seems to be preferred, and is universally adopted. The average distance that carriages run there before any additional oil is supplied to the boxes, or before the journals and brasses are examined, is 8000 miles. This fact has been fully corroborated by the working of these boxes on the London and North Western Railway. The first boxes were put on the tender of No. 182 Engine, which was immediately put on to the most trying work, during hot weather, sometimes running express trains at the highest speeds, and at other times at the worst possible work,

ballasting; and yet after running 6000 miles in four months, without any additional oil, the journals and brasses were in as perfect a condition as when new.

This axle box is shown in the accompanying engravings.

Fig. 1, Plate 81, Longitudinal section;

Fig. 2, Transverse section;

Fig. 3, Front elevation.

Fig. 4, Back elevation.

A, the axle; B, the journal; CC, a wrought-iron collar, shrunk on to the axle, having a groove turned into it, to receive the leather DD, which is shown separately in Fig. 5.

EE the brass bearing, FF the upper chamber, which is filled full of cotton waste, flax, sponge, or any other capillary material, to retain and pass the oil up to the journal; G is the lower or secondary chamber, for the reception of the dirty oil, which finds its way down the space at the back of the bridge wall, with a tap screw at the bottom to let out the oil; H, an iron plate bolted to the back of the box, to keep the leather flange to its place; I, a covering plate bolted on to the front of the box, which is the only opening into the box, besides the hole K for supplying oil, closed by a screw.

The results of the trial of the new axle boxes in the tender No. 182, upon the London and North Western Railway, have been officially reported as follows, to Mr. McConnell by his assistants. The axle boxes have, up to 20th Sept. last, run 5743 miles; the bearings have been examined, and are found in very satisfactory state. No oil has been supplied since the first day of running, four months previously; 10 quarts of oil have been supplied to the boxes altogether, and 5 quarts have been drawn off during the time from the bottom chamber, which is still good oil for screwing, drilling, and other ordinary work; the oil remaining in the boxes is considered sufficient, without more being added, to run at least from 3000 to 4000 miles more. The journals and brasses are wearing beautifully, with faces as though polished in the latter; and a great advantage is found, that the great wear endways does not take place on the brasses, as in the ordinary boxes using yellow grease or

tallow. The cost of lubrication is greatly reduced, as appears from the following account of the comparative consumption of the above tender with the new axle boxes, and another tender exactly similar, except that it was fitted with old boxes on Normanville's plan, using tallow, both tenders having run the same distance, 6000 miles, under the same circumstances of trains, and the weather being dry and dusty nearly the whole of the time.

NEW AXLE BOXES.

	s.	d.
Oil put into the boxes at starting, 10 quarts at 9d. ..	7	6
Credit by 5 quarts drawn off from the bottom chamber, at 6d. 2	2	6
Actual cost of oil	5	0
Cotton waste, 4 lbs. at 2d.	0	8
Leathers, 4½ at 1s.	4	6
	<u>10</u>	<u>2</u>

Actual cost per day, 1.54d., or ... 1½d. per day.

OLD AXLE BOXES.

Tallow required per day, 2 lbs., at 4½d., or ...	9d.	per day.
Saving per day on the 6 New boxes,	<u>7½d.</u>	per day.

	Cwt.	Qrs.	lb.
Weight of the 6 Old axle boxes ..	3	1	0
Weight of the 6 New axle boxes ...	1	2	20
Saving in weight of the 6 New boxes ...	<u>1</u>	<u>2</u>	<u>8</u>

The advantages of this Axle box over those now in use are—

Firstly—The perfect exclusion of dirt or grit from the box, by means of the leather and wrought-iron collar.

Secondly—The certainty of constant and never-failing lubrication to the journals and brasses by means of the capillary medium placed in a separate chamber, and detached from the back of the box by means of the bridge wall, so that the hydraulic lead of the oil can be carried much higher than the joint of the leather and

collar, allowing the *upper chamber* to be full of oil if necessary, while it is impossible that any oil can leak out at the back.

Thirdly—The provision of a secondary or under chamber for the dirty oil to drop into, from which it is drawn off, refined, and again returned to the upper chamber, or is used in the machine shop for drilling, cutting bolts, and many other purposes, and is equally good as new oil.

Self-acting Point for Crossings.

This crossing point, commonly called the Frog Point, is generally used on the railways of the United States.

It is unnecessary on the present occasion to detail to practical engineers the difficulties and likewise danger experienced by running engines and carriages at high speeds over the present crossings. It will be sufficient to describe the improved crossing point, which is brought before the meeting as a remedy for the evils attendant on the crossings now used.

Fig. 6, Plate 82, is a plan of the simplest construction of the spring crossing, and Fig. 7 a transverse section. A A is the main line rail, and B B the cross line, the crossing point C being the same as usual, but the wing rails D D are each moveable on a stud at the end, acting like switches, and two pins E E, are fixed to them on the under side, passing through slots in the bed plate. An India-rubber ring, G G, is passed round these studs, which draws them together, and keeps the moveable tongues D D in close contact with the crossing point, so that the rail presents an uninterrupted surface for the trains running through either line, the flanges of the wheels opening the tongue on the opposite side, which closes again directly they have passed.

Fig. 8, Plate 83, is a plan of another construction of the crossing, and Fig. 9 a transverse section. In this the India-rubber spring G G acts as a buffer spring, being put upon a horizontal spindle H, which passes through the two studs E E on the moveable tongues D D, and has a washer at each end to confine the India-rubber buffer springs, which are constantly pressing the moveable tongues against the fixed crossing point.

The main feature in both of these arrangements is in having a complete uninterrupted tread for the wheel whilst passing through the crossing, at the same time ensuring a certainty of action in whichever direction the train is passing.

The only difference between the two buffer springs and the round spring of India-rubber is, that the former is compressed and the latter is distended; but either plan is found to work with certainty, and the India-rubber spring is found to be very durable.

Mr. McCONNELL said that he believed the statement in the Paper was correct about the results of the trial he had made of the axle-box. There was a perfect exclusion of dirt from the journal, and the keeping it constantly in contact with the oil was an important advantage. He was satisfied they must, ere long, abandon grease for oil; there was a great loss of power from defective lubrication of the carriage and waggon journals in cold weather, as there was no lubrication in action on first starting, until the journals got heated, and then they were liable to get too hot, and the grease ran away, and was scraped off the outside of the boxes and put in again mixed with grit at the stations. Oil was generally ready for action in any weather, and he thought railway companies must ultimately adopt oil for all moving journals, particularly with the present increase in the speed of trains, and the weight on the working bearings.

Mr. LEA, of London, mentioned a new material for lubrication that he was bringing into application; it had been tried some years since by Mr. Ramsbottom, with very satisfactory results; but further trials had been suspended till now, from difficulties of the inventor, who was now dead. This lubricating substance consisted of a peculiar semi-fluid composition, applicable to the present axle-boxes; oil was the basis of the composition, but thickened with India-rubber and other materials; it had an affinity for the iron bearing, which prevented the displacement of the material from the rubbing surface. The manufacture of the material was not expensive, costing

only 4d. per lb. ; and when charged at 16d. per lb. it had been found in the trial made that there was a very considerable saving in the cost of lubrication compared with the ordinary grease or tallow. He wished to make a further trial of it on railways, and thought it would prove an important improvement. There was a great advantage in this plan, from requiring no change in the present axle-boxes. No ordinary pressure in the bearings could squeeze out the lubricating material; therefore it remained between the surfaces, preventing contact, and consequently preventing any heating by friction.

The CHAIRMAN said they would be glad to have the results of a further trial of the new lubricating material, and to receive more particulars at the next meeting.

Mr. E. JONES observed that the use of a spring crossing point was not new in this country; it had been in regular operation, for six years, on the Great Western Railway, also on the Bristol and Exeter and the South Wales lines; and fourteen years since he remembered something of the kind in use on the Hartlepool Railway. He had made several hundreds with flat steel springs, originally of his own invention, at Bridgewater, for those lines. A $2\frac{1}{2}$ -feet spring was used for crossings of 600 feet radius, and a $3\frac{1}{2}$ -feet spring for 900 or 1000 feet radius, according to the curve. The springs were $2\frac{1}{2}$ inches wide and $\frac{3}{4}$ inch thick, tapered to 3-16ths of an inch. He gave a sketch of the spring crossing (see Plate 83, Figs. 10 to 14). He had tried some with India-rubber springs, but did not find them so lasting as steel springs, which were all adopted. The steel springs were found to answer the purpose very satisfactorily, and there was not experienced any objection to them in working. They were very durable. There had been some instances of springs breaking, but they were very easily replaced. The crossings were made safe in any case, though broken, by the tongues being prevented from rising or getting wrong, even if the bolt broke or came out, as the moving tongue was bound down by strong clips at each end.

The CHAIRMAN said he remembered that on the Stockton and Darlington Railway spring crossing points were tried at one time, but were abandoned, from getting knocked to pieces with the increase of speed and weight in the engines. He was not before aware of their general use in America. He doubted their permanent durability and use where there was large traffic.

He thought the axle-box described in the paper was a very successful application of oil, and was very likely to accomplish an important desideratum in the satisfactory employment of oil instead of grease, it being undoubtedly a much more correct material for lubrication.

Mr. ADAMS inquired about the working of Normanville's and other oil-tight grease-boxes—what was the result found in working? He observed that an axle-box had been brought out some years since by his Father, for a similar purpose, with a leather collar, to prevent the waste of grease or oil.

Mr. H. WRIGHT said that Normanville's first axle-box was intended to feed in front, with the supply of grease below the journal, and filled up close to it. But the grease was found to lose its nature and get hard below the journal; and the box was then improved by keeping the grease in a chamber above, as in the ordinary boxes. He had known several kinds of oil-boxes, but they were all liable to the spilling of the oil from side blows and oscillations. The employment of the cotton waste in the axle-box, described in the paper, he thought was decidedly a good plan to prevent the oil from spilling over, and he enquired the result that had been found in the trial on the London and North-Western Railway?

Mr. McCONNELL replied, that there appeared to be no spilling or loss of oil, and the dust and grit were effectually kept out of the box. The oil drawn off from the bottom chamber was very black and thick, and not suitable to use again in that state, though it might be fit for drilling purposes, &c.; but after being properly purified, it was very good for lubrication again. There was a bridge at the back of the axle-box, just high enough

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to prevent the oil from flowing off; the oil did not come into contact with the leather joint, which was only to prevent the entrance of grit and dust.

Mr. E. JONES said he remembered that on the North Union Railway, many years since, Mr. Williams had tried a collar or picking-up ring on the middle of the journal, which dipped into cotton waste saturated with oil whilst revolving, continually picking up a supply of oil for lubricating the journal.

Mr. CHELLINGWORTH remarked, that there was a plan of lubrication with a cork ball, about one inch diameter; two of these balls floated on the surface of the oil, rolling against the journal to distribute the oil. He believed it was a French invention, but did not know the result of its application.

Mr. McCONNELL said he was not acquainted with that plan. The leather in the new axle-boxes was not found to wear away, and appeared likely to last a long time, as there was no pressure or strain upon it; the leather was not bent, but simply fitted easily into the groove in the iron collar, which was shrunk on to the axle.

Mr. H. WRIGHT observed, that the leather would probably wear the iron away before it was worn away itself; he had found it necessary in Normanville's axle-box to increase the surface of contact by a longer bearing of the leather collar on the axle, to allow for the wearing away of the iron by the constant grinding action with the particles of grit.

Mr. ALLAN remarked, that he had used sponge in the axle-boxes of engines for the last ten years, and found the results very satisfactory. They found that the consumption of oil, which was previously six to eight quarts for the 100 miles trip between Birmingham and Liverpool, was now reduced to one quart, partly by the introduction of sponge in the axle-boxes of the ten bearings of the engine and tender. The plan still continued very successful, and they had adopted it generally in their engines and tenders.

The CHAIRMAN enquired whether the sponge was placed below, to catch the oil falling from the bearings? and was the oil fed from above as usual?

Mr. ALLAN said that was the mode of application; the sponge wiped up the oil, thus preventing the loss of the oil that would have dropped from the journal, and keeping the journal constantly oiled smoothly over.

Mr. McCONNELL thought that sponge would be liable to get hard with a hot axle, and that the cotton waste would be a better plan. In the new axle-box, the great improvement, he considered, was in having the reservoir of oil below the journal instead of above; this appeared to be the best mode of application, as any grit or impurities in the oil settled to the bottom, and were prevented from coming in contact at all with the journal by that arrangement, which could not be entirely prevented when the reservoir was above the journal. The lower separating chamber for the waste oil was also an important improvement, keeping up a constant gradual separation of the impure oil, and affording a great means of economy in using the oil over again, after being purified. The leather collar was a very effective and simple contrivance to exclude the grit and dust, which were a great source of expense and injury in the ordinary axle-boxes.

Mr. SLATE asked what was the comparative economy of the American axle-box and Mr. Allan's plan? In the latter plan, there was consumed one quart of oil for 100 miles, but in the other there was said to be five quarts for 6,000 miles, or one quart only for more than 1,000 miles.

Mr. ALLAN remarked, that the one quart of oil that he had mentioned was used for all the bearings, moveable joints, &c., of the engine and tender, not for the axle-boxes alone, as in the trial of the new axle-box; and he had no means of knowing what proportion of the whole was consumed by the axle-journals.

The CHAIRMAN asked Mr. Allan to give a sketch of his sponge axle-box, with an experimental trial on the consumption of oil in the axle-boxes alone, independent of the rest of the engine.

Mr. ALLAN said that he would give it at the next meeting of the Institution, and would try for a week or two the actual consumption of oil in the axle-boxes, to ascertain the proportion as far as was practicable.

Mr. FORSYTH (of Wolverton) remarked, that one circumstance had not been mentioned, in the description of the new axle-boxes tried on the London and North Western; the cotton was rammed in tolerably tight from the front, filling the boxes up solid except against the ends of the axles. The cotton was put in dry, and it became gradually saturated, by pouring in oil from time to time at the top hole; it would continue to absorb oil for several days. The surface of the cotton waste, when examined after running the 6000 miles, was like a metallic polished surface next the journal, but still it was found saturated with oil close up to the surface of contact. The leathers were cut straight up $\frac{3}{4}$ inch from the axle, but not bevilled, to get them into the groove of the iron collar, but no leakage was found to take place, as the cotton was not over-saturated, and the oil never came in contact with the leather so high up as the cut.

The CHAIRMAN proposed a vote of thanks to Mr. Hodge for his Paper, which was passed, and expressed a wish for further information about the results of trial of the axle-box.

The Meeting then adjourned; after which specimens were exhibited, by Mr. J. McConochie, of Wednesbury, of a new Permanent-way Chair for Railways.

Fig. 1 *Longitudinal Section*

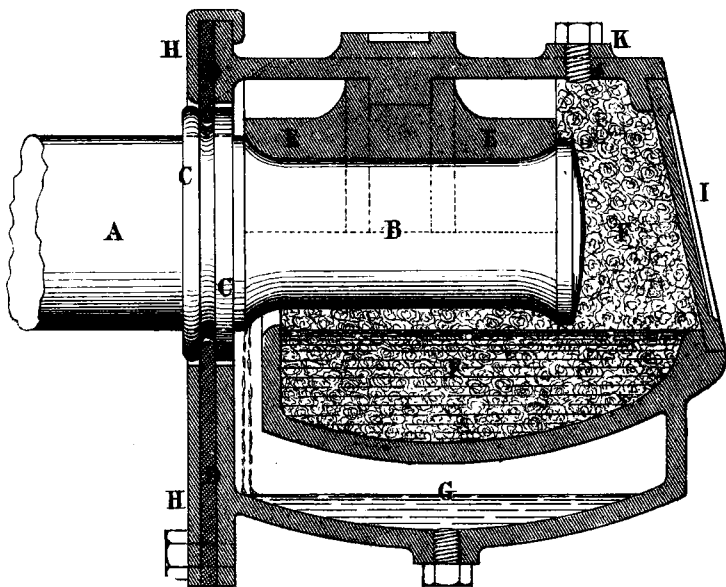


Fig. 2. *Transverse Section*

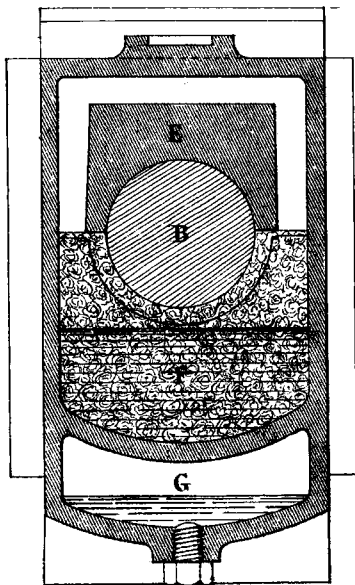
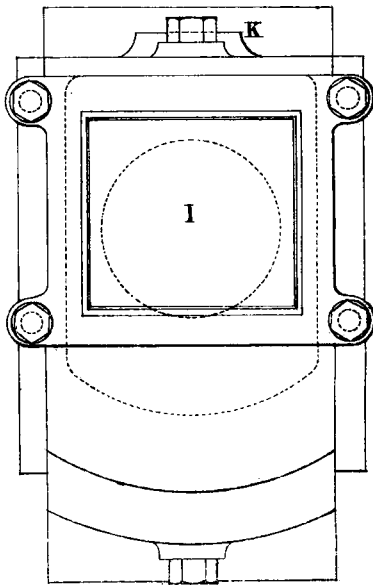


Fig. 3. *Front Elevation*



SELF-LUBRICATING AXLE BOX.

Fig. 4. *Back Elevation.*

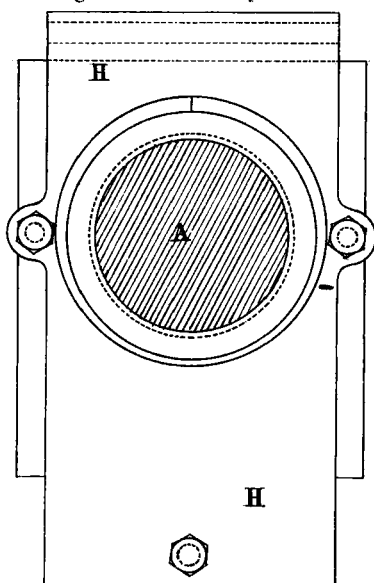
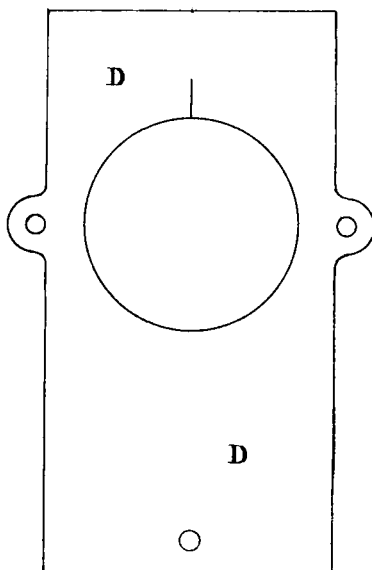


Fig. 5. *Leather Flange.*



Scale $\frac{1}{4}$ th size

AMERICAN SPRING-CROSSING

Fig. 6. *Plan of N^o 1 Crossing* $\frac{1}{12}$ th size

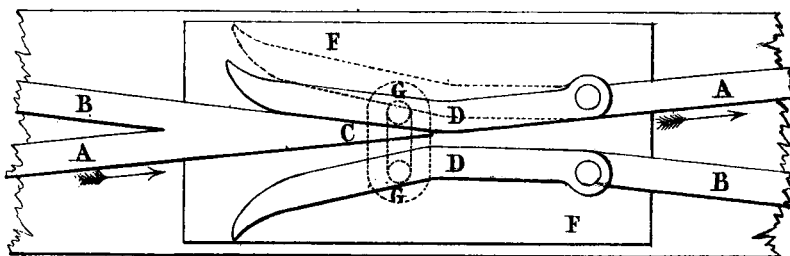


Fig. 7. *Section* $\frac{1}{16}$ th size

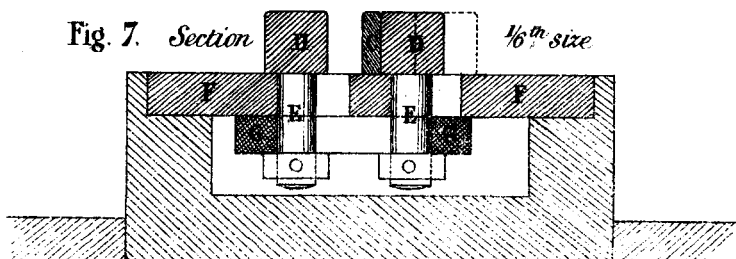


Fig. 8. *Plan of No. 2 Crossing. $\frac{1}{12}$ " size*

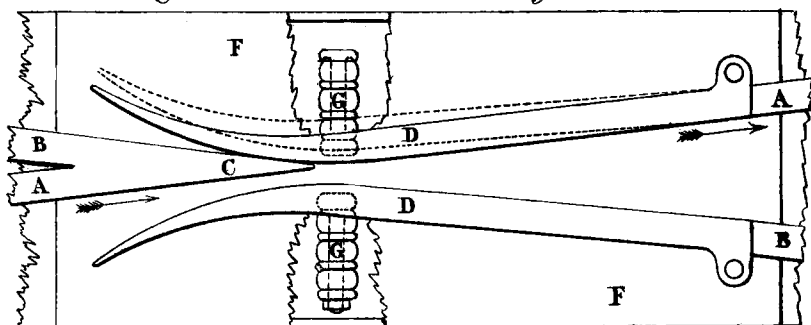


Fig. 9. *Section $\frac{1}{16}$ " size*

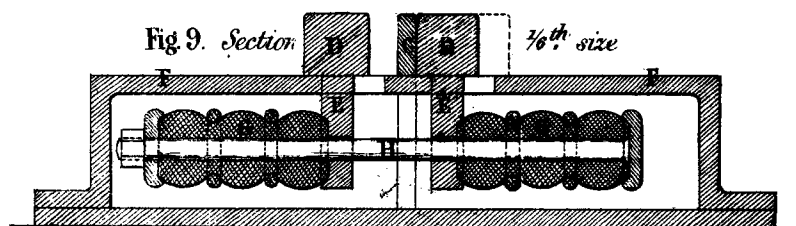


Fig. 10. *Plan of Crossing $\frac{1}{12}$ " size*

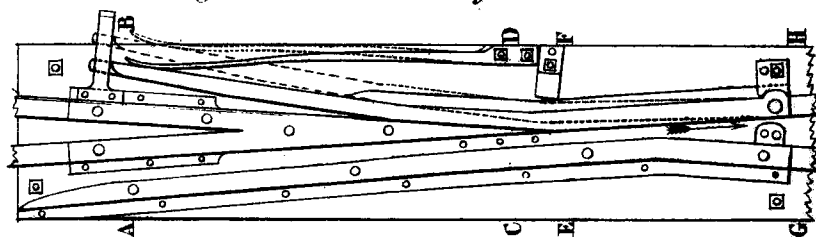


Fig. 11. *Section at A. B.*



Fig. 12. *Section at C. D.*



Fig. 13. *Section at E. F.*

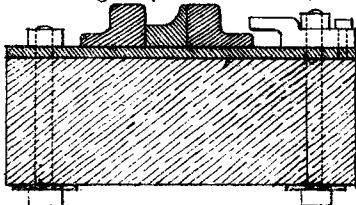


Fig. 14. *Section at G. H.*

