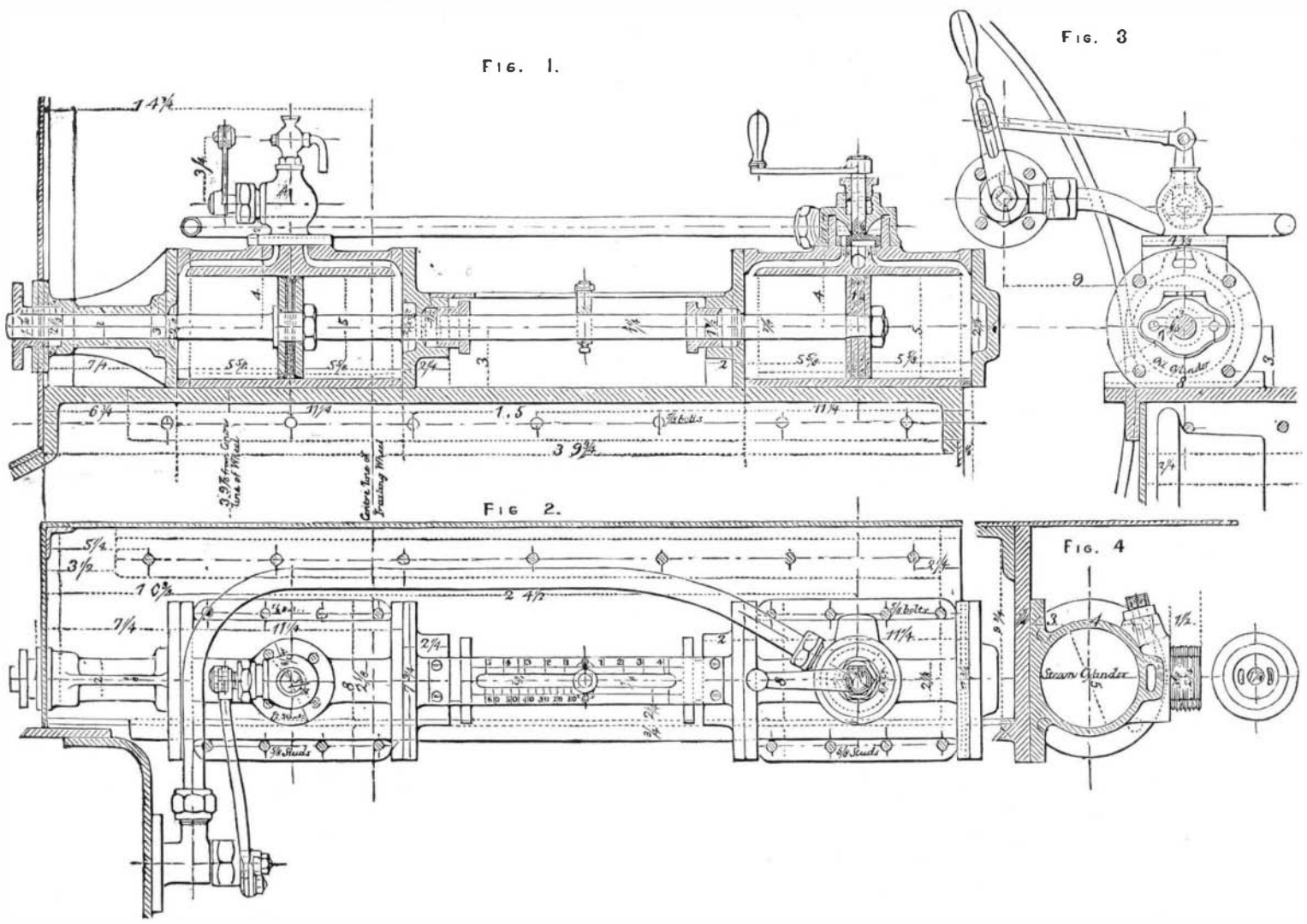
RECENT IMPROVEMENTS IN LOCOMOTIVE ENGINES.

A lively competition between three leading railroad lines carrying passengers and freight between London and Scotland has continued for some time past; and some very important improvements in locomotive construction have already been produced by the rivalry. The morning express train on the Great Northern Railway accomplishes the distance from London to Edinburgh, 399 miles, in 9½ hours, including all stoppages, one of which is long enough to allow the passengers to take dinner, and the London and Northwestern Railway is by no means behind its competitor in speed. The authorities of the Glasgow and Southwestern line, over which passes a vast amount of traffic from London to the manufacturing districts of Scotland, have recently constructed some new locomotives, which deserve the attention of all persons interested in rapid and economical railway communication. These engines have two pairs of driving wheels, coupled outside by horizontal bars, and four leading wheels are united in a bogie in front of the engine. The cylinders are 18 inches in diameter by 26 inches stroke, and the driving wheels are 7 feet 1 inch in diameter. Each engine shows a heating surface of 1,111·8 square feet: this total, which is large for a narrow gage engine, being obtained by using boiler tubes of small diameter. Mr. James Stirling, the locomotive engineer of the line, has managed to make tubes of 1½ inches diameter thoroughly efficient; and our locomotive friends are well aware that this is a problem of considerable importance, owing to the difficulty of cleaning such tubes. Mr. Stirling hinges the exhaust pipe on one side at the bottom, so that, by slackening a bolt, it can be turned out of the way, giving free access to the center tubes of the boiler.

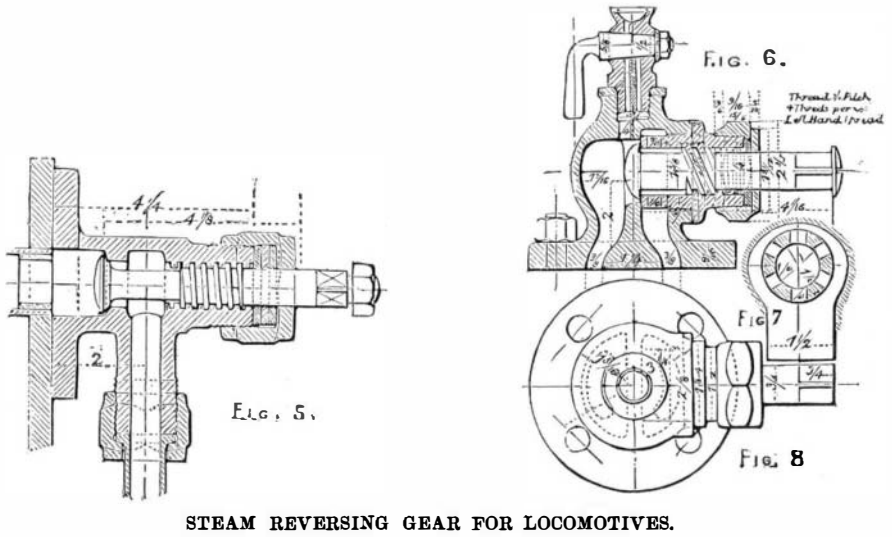
But we must now call attention to the most important improvement, which successfully solves the difficulty which locomotive engineers have hitherto found in applying steam power to the reversal of the engine: the introduction of which gives the engineer control over his engine to a degree which is found to be of the highest value when any accident happens or the signals are against him. Our readers are doubtless familiar with the ordinary reversing gear of a locomotive, constructed by attaching the ends of the rods of two eccentrics (set nearly diametrically opposite to each other) to the ends of a link, in which the die attached to the slide valve rod runs. This link regulates the cut-off of the slide valve by controlling its travel, and the position of the link is regulated by the way shaft and the reversing lever notch plate, into which the lever controlling the link is fastened. But if the engineer lifts the lever out of a notch while the steam is on, the speed of the engine and the difficulty of reversing the travel of the slide valve under steam pressure will prevent his altering the position of the link; and even when he has shut off steam, he will find great difficulty in moving the link and slide valve till the engine has considerably slackened speed. To apply steam power, therefore, to the immediate reversal of a locomotive, both when at full speed and when engaged at work which requires frequent reversal, such as shunting, is a great desideratum; and we think that our readers will find that the object has been successfully achieved in the apparatus of Mr. James Stirling, shown in Figs. 1 to 8 of the accompanying engravings.

As will be seen from the views given, the apparatus consists of a pair of cylinders (each 5 inches in diameter, and of sufficient length to accommodate a stroke of about 9 inches) bolted down to a cast iron bed plate, which forms the top of the right hand trailing wheel cover. The two cylinders are almost identical, being cast from the same pattern, but in one of them—that next the firebox—the exhaust port is omitted, there being merely two passages leading from the ends of the cylinder to the face on which the regulating valve (shown in detail by Figs. 6, 7, and 8) is fixed. The other cylinder has the usual two steam ports with the exhaust port between them, and these ports are covered by a kind of revolving slide valve which can be turned so as to place either of the cylinder passages in communication with the exhaust, the other passage being at the same time made free to receive steam through an opening in the valve itself. Thus with the valve position in which it is shown in Fig. 1, the steam would be admitted to the front end of the cylinder, and exhausted from the rear end. The cylinder of which we are now speaking is fitted with an ordinary steam piston, while the other cylinder—which we may term the cataract cylinder—is fitted with a cylinder packed by two cup leathers as shown. Both pistons are attached to one rod, which passes out through the front cover of the front cylinder, and is controlled by the piston in the front cylinder, this cylinder being completely filled with oil, which, as the piston moves, is forced from one end to the other through the regulating valve, which we have already mentioned as being fixed on the top of that cylinder. As will be seen from the detail view, Fig. 6, there is provided at the top of this valve a cock, through which oil can be supplied when required to make up any losses by leakage, and thus all slack can be kept properly taken up.

One of the leading features of the arrangement is that, when the steam cock is closed, the valve regulating the flow of the oil is closed also, and thus, when the steam is shut off, the gear is firmly locked in the position it then occupies. As will be seen from the view (Fig. 3), the steam cock and oil-regulating valve are connected so that they are opened or closed together, the connection between the two being such as to admit of all requisite adjustment of their respective movements. Altogether the arrangement is very simple, and the details are well worked out, while in practice the apparatus is found to act admirably. "We may add," says *Engineering*, to which we are indebted for the engravings, "that, as the engine cannot be reversed when out of steam, it is an established rule that all engines fitted with this steam-reversing gear should be left by the drivers in mid-gear and with the handles locked. Mr. Stirling has now worked this arrangement for upwards of a year, and has experienced no bad results from moving the engines fitted with it in either direction when cold."



STEAM REVERSING GEAR FOR LOCOMOTIVES.



Peculiar Effects of Lightning on Vines

At a recent meeting of the *Société Helvétique des Sciences Naturelles*, Professor Dufour mentioned a lightning stroke which in the month of June last struck simultaneously two vineyards, distant over 360 feet apart. In one, the surface affected measured 57 feet square, and included some 330 vines. In the other the surface was about 32 feet square and about 100 vines appeared to be destroyed, while others were partially so. In August, however, those vines which appeared to be the most severely injured threw out vigorous branches, and early in September were covered with new bunches of young grapes. But on the other hand, those grapes already started, and which, had the lightning not intervened, would have formed the year's crop, ceased all development.

In his treatise on lightning, Arago cites, as remarkable facts of rare occurrence, lightning strokes apparently divided into two or three branches. Here, however, the lightning divided into two branches to strike vineyards considerably distant from each other, and then the branches must have produced 330 and 100 jets respectively in order to strike the separate vines.

It is not a difficult matter to mend harness tugs so long as harness leather, copper rivets (¾ inch) and a good steel punch are at hand. Cut two strips of leather as wide as the tug and eight inches long; join the broken ends with a strip on each side, punch three holes each side of the break, and rivet. This makes a neat, strong job.