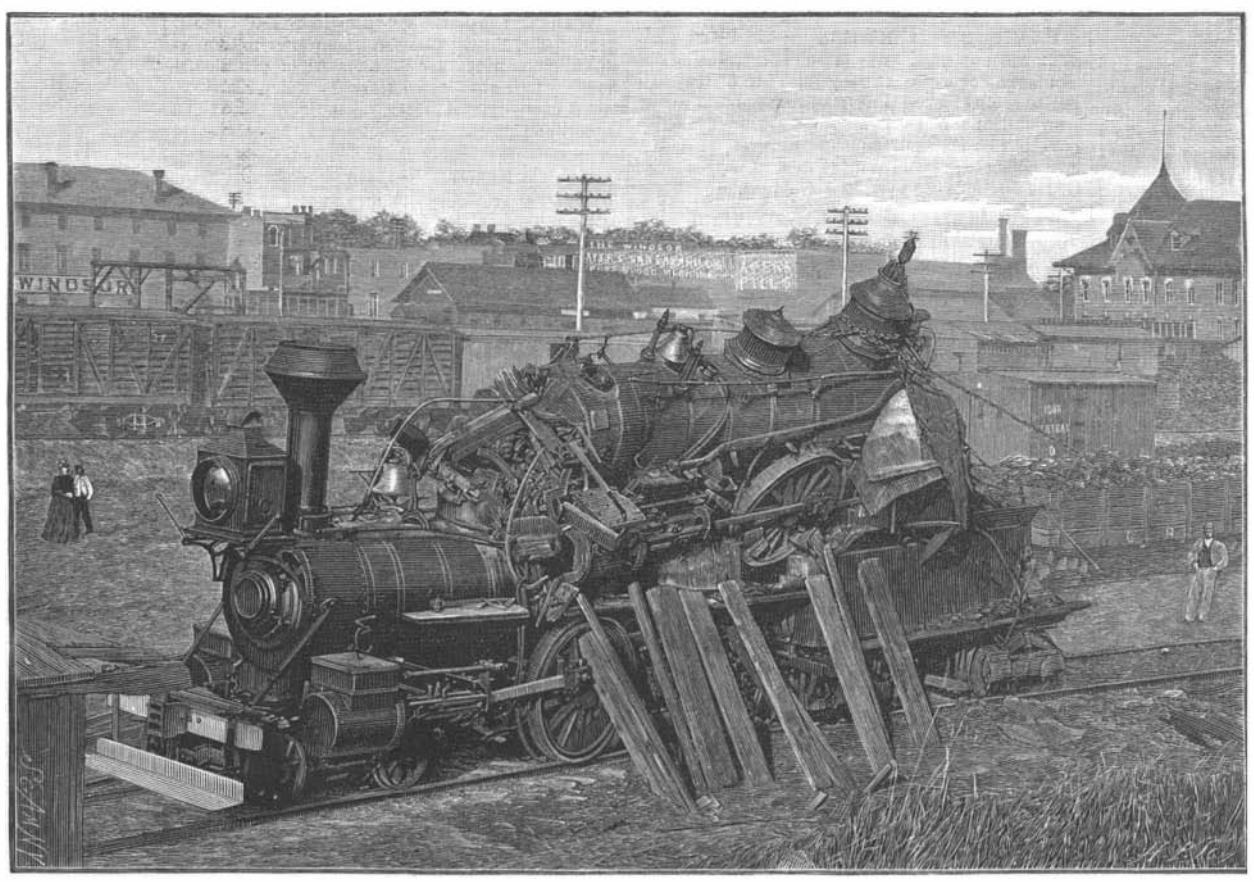
diameter by 12 in. wide, one on either side of the engine. The rims of these wheels were made with internal flanges, and were kept cool by water.

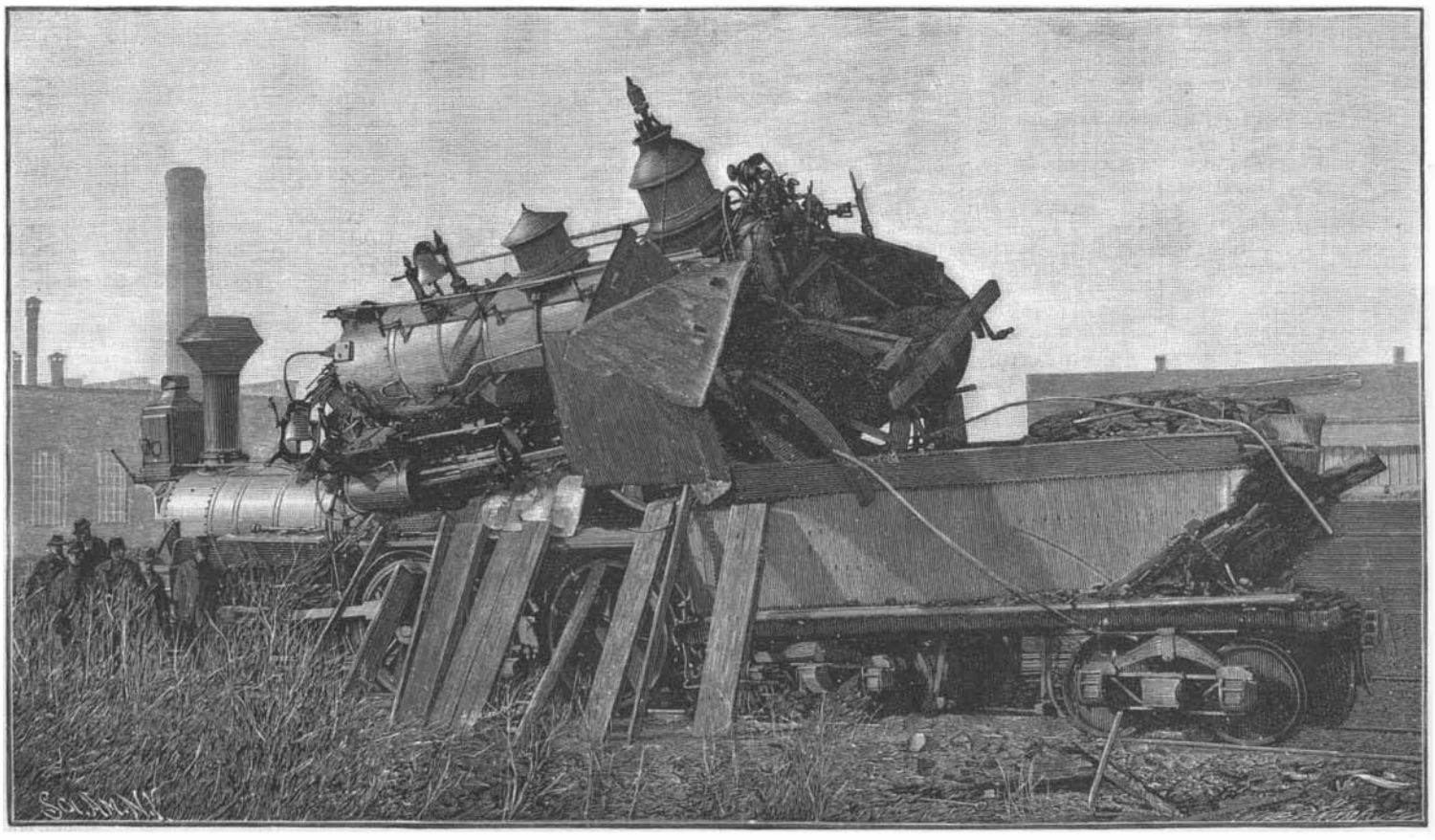
When desired, these engines are placed under locomotive boilers constructed for a working pressure of 165 lb. per square inch; the smokebox resting upon a pedestal fitted to the cylinders, and the ashpit being bolted between the channel irons, which are prolonged beyond the crankshaft bearing.

A Tangye duplex boiler feeder, supplying the boiler, is fitted to the ashpit casting alongside the firebox, in order to leave free access to one side of the engine. One end of the crankshaft is lengthened; a single large flywheel and an outer bearing are supplied. The even distribution of power which is attainable with this class of engine, and its steady running at high speeds, commend it for extensive use where these qualities are of importance.—*Engineering.*

REMARKABLE RAILWAY COLLISION IN IOWA.

The accompanying illustrations, reproduced from pictures made by Mr. Theodore A. Brown, a photographer of Marshalltown, Iowa, represent the curious result of a railway collision which took place in that neighborhood, on the Iowa Central Railroad, on October 30. The accident, if such it may be called, was caused by "a mistake in train orders," and two men were seriously injured, but no one was killed. The crews of both engines jumped just before the collision. A regular freight train was going west with orders to "run regardless of all trains," when a switch engine, with two empty flat cars, was ordered to back east for some miles on the same track, to take on a load of stone. The two trains met, both running at a high rate of speed. The engine of the westward-bound freight train made kindling wood of the two flat cars that were backing east, then made almost a clean jump over the tender of the other locomotive, and landed upon its back. The lower engine and tender did not leave the track, although its tank was knocked loose, and in the position shown both engines were hauled back to the station at Marshalltown. The coal in the tender took fire, and was burning fiercely when the two engines reached the station.





REMARKABLE RAILWAY COLLISION IN IOWA.

Dangers to Street Car Motors by Lightning.

The *Electric World* says: We recently received from a correspondent a very instructive account of a singular accident from lightning, which happened the past summer, on a Sprague electric road of moderate size. The vulnerability of railway apparatus to lightning has been the cause of considerable loss to the various companies, more especially as the dynamo is subject to injury, but now and then armature and field coils on cars are burned out from the same cause. So far as the dynamo is concerned, the powerful shunt winding has a tendency to force the discharge through to the core of the armature instead of choking it as is ordinarily the case with a series-wound motor. On the particular occasion to which we are referring, a severe thunder storm occurred while the cars were out upon the line. Now the road in question has rather severe grades, produced by a series of ridges over which the road passes in succession.

During the course of the storm the trolley wire was struck by lightning at a time when three of the cars were running down grade on three of the ridges before mentioned by gravity alone, the current having been cut off as usual. The other cars were in motion several of them on heavy grades. The result of the shock was to disable the three cars that were running down grade and to leave the others quite unharmed, although from their position they were at least as much exposed as the injured ones. On subjecting the damaged cars to a careful examination it was found that the injuries received by them were almost precisely similar. In each case the "A" coil was the one damaged, and injury had occurred by the discharge from the coil to the magnet core. The cause of this selective injury of the three cars running down grade is not far to seek.

In the method of field commutation employed the "A" coil, as is well known, remains always charged, even when the motor is not running. Consequently when the lightning got upon the trolley wire it was free to pass down into the motors, and then broke through the insulation and jumped across to the cores. In the cars that were running, this discharge was checked by the high self-induction of the magnet coils, and what small amount could pass through was free to go to earth without injury to the motor. In the cars where the current was shut off, however, there was little of this checking action, and consequently the lightning jumped across to the core and went to the earth. The electrical superintendent of the road in question, who is more than usually ingenious in the matter of repairs, saw the point of the accident at once and promptly changed the connections, so that the "A" coil should not be charged when the motor is not in action, but should be cut off at the switch box. Since that time the line has not been struck, so that the efficiency of this arrangement has not been tested, but the arrangement certainly lessens the likelihood of damage to the motors.

THE latest and fastest, for her size, torpedo boat is the Bathurst, built by Yarrow & Co., London, for the Argentine government, 130 feet long, 13½ feet beam. Displacement, 76 tons, with load of 14 tons. Locomotive boiler, with heating surface of 1,500 square feet. Makes over 8 tons of steam per hour, 200 pounds pressure. Consumption of fuel, 2½ pounds per horse power per hour. Engine—four cylinders, on the quadruple expansion plan, 1,230 indicated horse power. Cylinders, 14, 20, 27, 36 inches, 439 revolutions, maximum 500 revolutions per minute. Average speed of two hours' run, 24·426 knots, or 28·1 statute miles per hour. Maximum speed on measured mile, 26·086 knots, or a little over 30 miles per hour

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