

iron—instead of thin, cheap cast iron—having common-sense doors, and located in centre of length of car, come very near satisfying all requirements.

Steam heating—at low pressure—with the heat supply located in a portion of the train not occupied by passengers, fills all requisites except *c* and *e*, the more recent inventions being endeavours to meet these particular requirements.

The Martin system receives its steam supply from the locomotive. It has for distribution, one through or continuous train pipe under each car, with a metallic double-ball-coupling and expansion-sleeve for connection at each end, and a double vertical line of piping (for heating purposes) on each side of car below seat level, having, however, no provision for keeping car warm when it is not attached to locomotive, or coupled up to station steam warming pipes, or to external portable boiler. Similar crude attempts at steam warming have been made ever since Stephenson's day. The metallic flexible coupling for the through pipe appears to be its distinctive feature; but it is open to doubt if a claim for originality could be sustained should this patent be subjected to legal test. (See historical notice in "The Artisan," July 1st, 1863, page 147.)

The cost of equipment is \$200 for engine, \$200 for ordinary cars, and \$250 for sleeper and parlour cars.

The Sewall and Emerson systems appear in many respects to be identical. They draw their steam supply from the locomotive, and use a hot well under the car to receive the water of condensation. Below the well a fire is placed when the car is standing detached, the car heating pipes being arranged so as to give independent circuit with this reservoir boiler. The auxiliary source of heat—be it coal fire, oil lamp or gas jet (and all have been used)—is dumped, or otherwise dispensed with, as soon as the car is to be coupled up with train, thus meeting requisite *b*.

Many-ply rubber-hose is used to allow of adjustability in the continuous couplings. The expense of renewing each hose may amount to \$3 or \$4 per year. Sewall has a simple and effective metallic hose coupling, locking by gravity, and readily separating when cars become detached, which will permit of a free interchange of cars with foreign railways on through runs. Emerson has apparently not given this most important point any special attention, and as each car with his equipment, has an independent outlet by pet-cock for the excess of steam and water, there is produced with this arrangement a vapour sometimes obscuring the windows, and the annoyance of a constant drip of water has been noticed. Sewall has a small opening in the through