tain factor. As we understand the paper, the residual magnetism in the electric brake is only available for something less than one-half minute after the car has stopped. When this magnetism is consumed the electric barke possesses no more braking power whatever until the car is again in motion. It is right here that the air-brake shows its immense superiority, for it has the air reservoirs to draw upon when the car has stopped, and therefore ample power is available for immediate and constant use. This failure in source of supply is a tremendously weak point in an electric brake. The paper states that "the current flowing after motion ceases, though small, is found exceedingly useful in holding the car from starting itself, even on quite a heavy grade, as only a small quantity of energy, added to the already great friction of quiescence, will prevent the car from starting." We fear that at such times the advocate of electric brakes would need something more reliable and constant to lean upon. The paper says, "when an electric brake is used it seems as though the car was running into an air cushion." This pays a well-merited compliment to air-brakes for by them an air cushion stop is made possible. The paper adds "operating the brake in this manner it will at once be seen that the system is one of the utmost certainty of operation, surer even than the hand-brake, air, or other power brakes." If the speaker had not been for some years in the electric motor business, he might not take such decided exception to this claim as he does; but since working with air pressures he has found them much more reliable and safer than electricity. The inventor referred to makes 14 claims of the advantages of his brake over other brake systems. As this paper is not written for advertising effects, we purposely refrain from naming any special make of air-brake in contrasting the air-brake with the electric.

1st. He speaks of the certainty of an electric brake in operating.

So is a good air-brake certain in operation.

2d. "The enormous power and under perfect control."

A good air-brake has much more power, more constant power, and is under better control. It will be noticed that the inventor omits all reference to electric brake power being constant. This lack of constant braking power is the objectionable and fatal defect of the electric brake. It will not be noticeable on a level, but it will be only too apparent on a grade. At the Institute meeting, before which the paper on electric brakes was read, one of the members stated he had been on a train in Connecticut where two motor cars and three trailers were ascending a 9 per cent. grade. While doing so a fuse on the second motor car blew out, throwing all the work on the first motor car. This it was unable to do, and hand-brakes had to be immediately applied to prevent train from running away. The author of the paper was asked "what would you do at such a time with your electric brake?" Mr. Sperry, in reply to the question, said that a case of this kind was rather unusual, but that he would have applied the electric brakes, which would have brought the train to a stand-still, and by that time the hand-brakes could be applied to prevent the car from running backward down the grade. How then can he claim that the brake dispenses with brake shoes, and if the electric brake had been used on the train in question to the exclusion of hand-brakes and brake shoes, what would have become of the train and passengers?

3d. "The absence of all power absorption at moneyed cost from the central station."

This may be true if brake shoes are not used, but remains to be proved in daily service. Shoes probably will continue to be used. A good air-brake consumes very little power.

4th. "Its high efficiency, being far superior to compressed air; amply proven in numberless instances where electricity has replaced air. (The air requires a direct application of energy, amounting to an immense aggregate power-absorption during the day from the central station; the working parts of the air machinery are attached to the car axles and require a large quantity of energy not only while compressing, but at other times as well)."

We are unaware of a single case where electricity has replaced air. We are informed on high authority that air-compressors for driving rock drills and coal cutters so greatly outnumber electrical machinery for such purposes that hundreds of air compressors are sold for every drill or cutter sold. The statement that an air-brake requires a large quantity of energy not only while compressing, but at other times as well, is wholly inaccurate and entirely incapable of proof. A good air pump requires no perceptible power after it cuts out.

We had no intention to refer at length to electric brakes, but have felt constrained to do so because the statements we have replied to appear in the printed Transactions of the American Institute of Electrical Engineers, and should not remain uncontradicted.

Lastly it must be remembered that the magnetic clutch of this electric brake has to bear on the surface of a flat disc cast upon the car wheel. This can hardly be called "ease of application," for the brake cannot be applied to the ordinary type of street car wheel. It requires a special casting to be made on one wheel on each axle. This on a large system means an additional outlay for wheels, as "extras are charged for."

Dedel's Switch-Lock.

Mr. Louis Dedel, of New Orleans, objects to our description of his switch-lock as given in the *Railroad Gazette* of August 17, and avers that his device is his own original invention; and he sends us a copy of his patent. Of course, we do not deny Mr. Dedel's statement; and, in fact, we said nothing to conflict with it in the note we published. As all persons familiar with the Patent Office understand, the re-invention of old devices is an every-day occurrence.

But we will give Mr. Dedel's drawings and let the writer make his own comparisons between this and the well-known English device for the same purpose. Dedel's lock, attached to a switch, is shown at A, Fig. 1. As will be seen by the other drawings in the figure, a projection on the switch-lever, when brought in contact with a similar piece fixed to the switch-stand, makes a double hooked projection upon which the lock is pushed. The essential feature of the invention is the lock, Fig. 2. The two jaws, pivoted at the center, work precisely like a pair of shears, the four flat springs, one at each end, top and bottom, tending to keep the shears constantly closed. In the cut, the lock is attached to the switch, and the key is ready to be inserted at the opposite end of the lock. It is impossible to remove the lock from the switch without the key, because the projections on the pieces C D will catch on the hooks of the jaws, which the springs are constantly pressing toward each other. But after the insertion of the key, holding the jaws apart, the lock can be withdrawn and the switch set for the side track. It is now impossible to remove the key, for the same reason that before it was impossible to withdraw the lock from

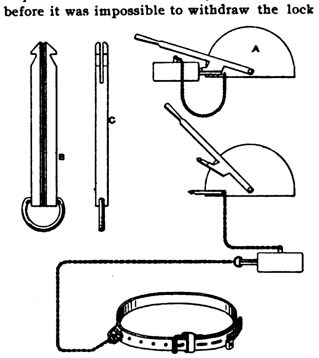

Fig. 1—Dedel's Switch-lock, Key and Belt.

the switch. When the lock is restored to the switch, the jaws are again held open so that the key can be withdrawn. The key is attached to a belt worn by the attendant, and he cannot remove the belt until it has been unlocked by the authorized person, say the signalman at the nearest station, who has previously fastened it upon him with a padlock.

Thus, the person who turns the switch must stand by

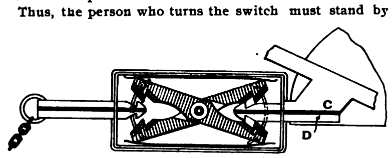

Fig. 2—Dedel's Switch-Lock.

it while it is set for the side track; and the inventor's design is accomplished. The key is shown at B and C, Fig. 1. The vertical curved pieces in the lock, to engage the slot in the end of the key, are shown in light lines in Fig. 2. These pieces prevent opening the lock by unauthorized keys.

Interlocking and Signaling in the United States.

Readers of the *Railroad Gazette* who are interested in signaling will perhaps recollect that on Sept. 19, 1884, and Nov. 20, 1885, we printed tables showing in considerable detail the extent to which interlocking machines for switches and signals, and automatic block signals, had been put in use by the various railroads of the country. These tables showed, that up to September, 1884, the Union Switch & Signal Co. had put in about 136 signal plants, aggregating 2,112 levers; and that during 15 months following that date the same company put in 547 levers, equal to more than one-quarter the total shown in the first table. This company has now favored us with a brief statement of the amount of work done since Nov. 20, 1885, from which we are able to compile the following table:

INTERLOCKING.

	Levers.
Saxby & Farmer improved	14,414
Stevens	621
Horizontal	108
Ground	158
Total mechanical levers	15,301
Electo-pneumatic	1,600
Total interlocking levers	16,901

BLOCK-SIGNALS.

Pneumatic automatic	1,500
Electric automatic	885
	2,385

It will be noticed that the electro-pneumatic machines are not included with the mechanical in the first tabular summary. In the records to Nov. 20, 1885, these were included with the rest, and we find that there were 144 levers operated by the pneumatic apparatus and 106 by hydraulic (at St. Louis). This leaves 2,409 mechanical levers previous to November, 1885; the number since then (15,301) is therefore more than 6 times as many as the total number erected previously. The first interlocking machine in the United States was erected in 1874, so that the totals recorded in 1884, and at the present time, divide the time, it will be seen, into nearly equal periods of about 10 years each.

We have also received a statement from the Johnson Railroad Signal Co., which was organized in 1888, and began the manufacture of signal apparatus in August of that year. In this period of about six years the company has erected 595 machines and the aggregate number of levers is 6,000. The number of spare spaces in these machines aggregates 973. The company has favored us with a list showing the location of each machine included in this report, from which we have made up the table which appears below. The average number of levers to each machine is reduced by the fact that a considerable proportion of the apparatus furnished to the New York, Lake Erie & Western was for block signal towers where there were only two levers in each machine. In the first part of the table, showing 14 roads, we have included every road to which was supplied more than 99 levers, and the names are arranged alphabetically; in the second part the roads have been named in geographical order, as near as possible.

INTERLOCKING APPARATUS MADE BY THE JOHNSON RAILROAD SIGNAL CO.

Boston & Maine, levers	100	
Central of New Jersey	132	
Chesapeake & Ohio	194	
Chicago & Northern Pacific	200	
Delaware, Lackawanna & Western	194	
Grand Central Station, New York	108	
Illinois Central	113	
Long Island	320	
Manhattan	330	
New York Central & Hudson River	914	
New York, Lake Erie & Western	857	
New York, New Haven & Hartford	1,024	
Old Colony	232	
Pennsylvania	159	4,877
Boston & Albany	16	
Fitchburg	52	
New York & New England	12	
Brooklyn Elevated	20	
Prospect Park & Coney Island	92	
Suburban Rapid Transit	36	
Delaware & Hudson	12	
New York, Ontario & Western	60	
Poughkeepsie Bridge	2	
Camden & Atlantic	8	
West Jersey	14	
Philadelphia, Wilmington & Baltimore	16	
Lehigh Valley	30	
Philadelphia & Reading	54	
Beech Creek	4	
Northern Central	12	
Chicago & West Michigan	10	
Flint & Pere Marquette	11	
Cincinnati, New Orleans & Texas Pacific	34	
Nashville, Chattanooga & St. Louis	10	
Savannah, Florida & Western	20	
Atlantic & Danville	6	
Cleveland, Cincinnati, Chicago & St. Louis	20	
Chicago, Burlington & Quincy	36	
Chicago & Western Indiana	90	
Chicago & Eastern Illinois	72	
Chicago, Madison & Northern	40	
Lake Shore & Michigan Southern	12	
Lake Street Elevated (Chicago)	28	
Terminal Railroad Association of St. Louis	68	
Missouri Pacific	56	
St. Louis, Keokuk & Northwestern	44	
Miscellaneous, including 4 for Cuba	126	1,123
Total number of levers		6,000

The Pecos Valley Railroad.

The extension of the Pecos Valley Railroad from Eddy north to Roswell, New Mexico, begun last April, was completed Oct. 6, and the road was formally opened on the 5th by a public celebration in Roswell, which was attended by those identified with the great work being accomplished in the Pecos Valley, by the Governor and leading men and politicians of the territory, and by people attracted by means of special excursion rates for the occasion.

The railroad, though but a part of the great project which has for its ultimate object the reclamation of an immense region of arid land is none the less an important piece of work for the times. The company was organized during the summer of 1890 and building was begun in the autumn of that year from Pecos City, Tex., a station on the Texas & Pacific. The line was completed to Eddy, N. M., in the spring of 1891, and now the entire surveyed route has been put in operation, giving a line of 164 miles through what is destined to become a most fruitful and productive valley. The road is bonded at $12,000 a mile in Texas and $15,000 in New Mexico.

The right of way is along a gently sloping prairie country with maximum grades of less than one per cent. There are no sharp curves and in the entire distance only five truss bridges will be needed. At present only temporary bridges are in place. The line is of standard gage. The present equipment consists of two Cooke, two Baldwin and two Schenectady locomotives of 80,000 lbs. weight each; two combination sleeping and reclining chair cars, built by the Barney & Smith Car Co., of Dayton, O.; four day coaches, four combination coach and baggage cars, 30 platform, 30 box cars, and soon there will be added a like number of stock cars. The company has an authorized capital of $8,000,000. J. J. Hagerman, of Colorado Springs, is President; Percy Hagerman, Treasurer; Arthur S. Goetz, Secretary; and J. N. Miller, General Manager.

In order that the true significance of this railroad may be understood, it is necessary to review briefly the great irrigation scheme for that valley. When cattle raising was a very prosperous business, C. B. Eddy, a prominent stockman, located a range in the Pecos Valley. The Pecos River rises in the snow-clad Rocky Mountains of New Mexico, and follows the foot hills for about 200 miles, and then flows southward across the desert country between high grassy bluffs, until its course for 200 miles further is through a gently sloping plateau from which the hills recede, leaving a great sandy track, which, if well watered, would support a great number of people. The river receives along its course a number of small streams and many springs issue from the limestone bed underlying the entire valley. The flow of these springs is considerable, and is unfailing. Even where the entire flow of the river is diverted by the irrigating dams and canals, the river below is apparently as wide and as deep as though none of its flow had thus been taken off.

With such a country the cattle grower was delighted, and his herds of cattle found an unlimited range for graz-