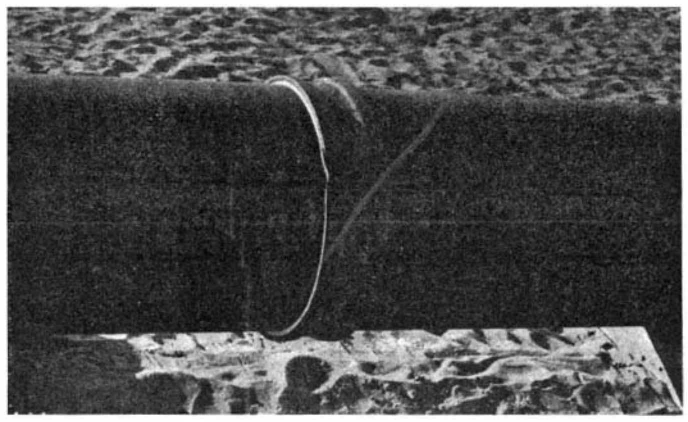
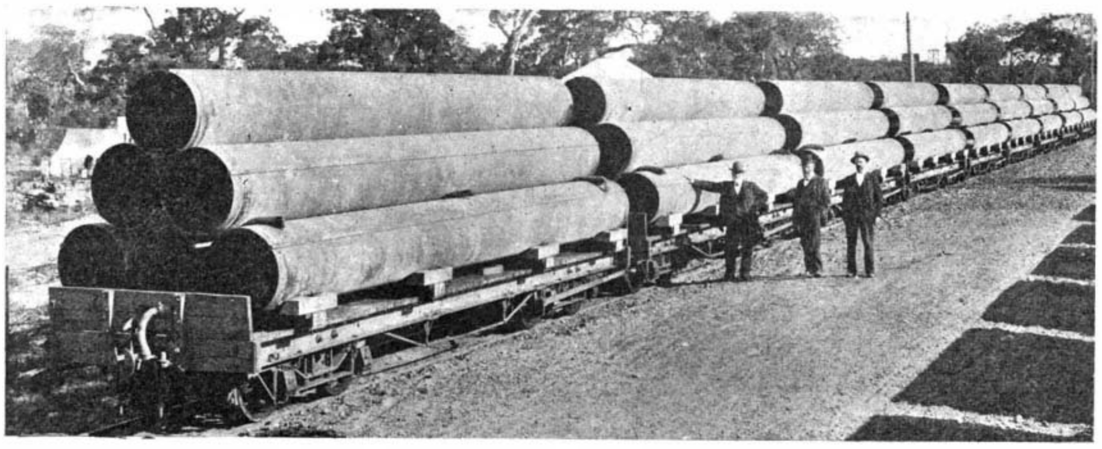
A NEW METHOD OF MANUFACTURING STEEL PIPE.

One of the most important and in some respects one of the most novel water schemes ever proposed and contracted for is that for carrying water from Perth, the capital of Western Australia, to Coolgardie, the central point of an extensive and comparatively modern group of gold fields. Unfortunately the development of this district is retarded by the lack of water, which is as scarce as gold is plentiful, the monthly output of gold for the colonies of Western Australia being nearly 200,000 ounces. Realizing that an abundant supply of good water was essential, not merely for the modern processes of gold recovery, but also for the health and comfort of the rapidly increasing population, the government sanctioned a very costly and elaborate scheme for piping water from Perth, the capital, to Coolgardie, a distance of 330 miles. The water is to be collected in a large storage reservoir at Mundaring, 24 miles from Perth, from which it will be forced through a 30-inch steel pipe by means of eight separate pumping stations, distributed along the route of the line. The total lift will be 1,200 feet. Three hundred miles of the pipe is laid in trenches and 30 miles will be carried on trestles.

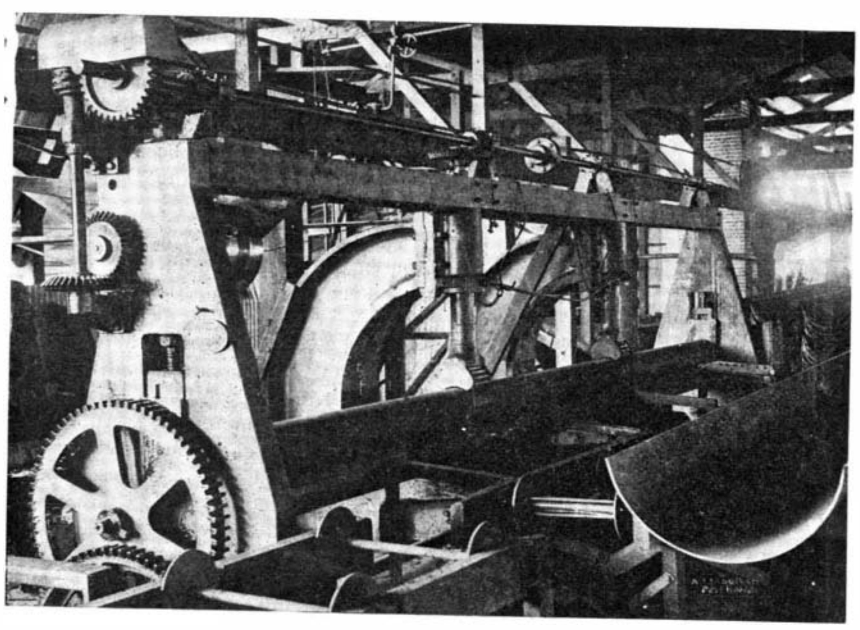
The steel pipe will be laid in 30-foot lengths. The weight of each section with joint is about one ton, and the total weight of the whole line will be about 68,452 tons. This, by the way, is, with one exception, the largest contract for steel ever undertaken, the largest contract being that for the steel necessary for the construction of the New York Rapid Transit Tunnel, which exceeds the Coolgardie pipe line, we believe, by about 10,000 tons.

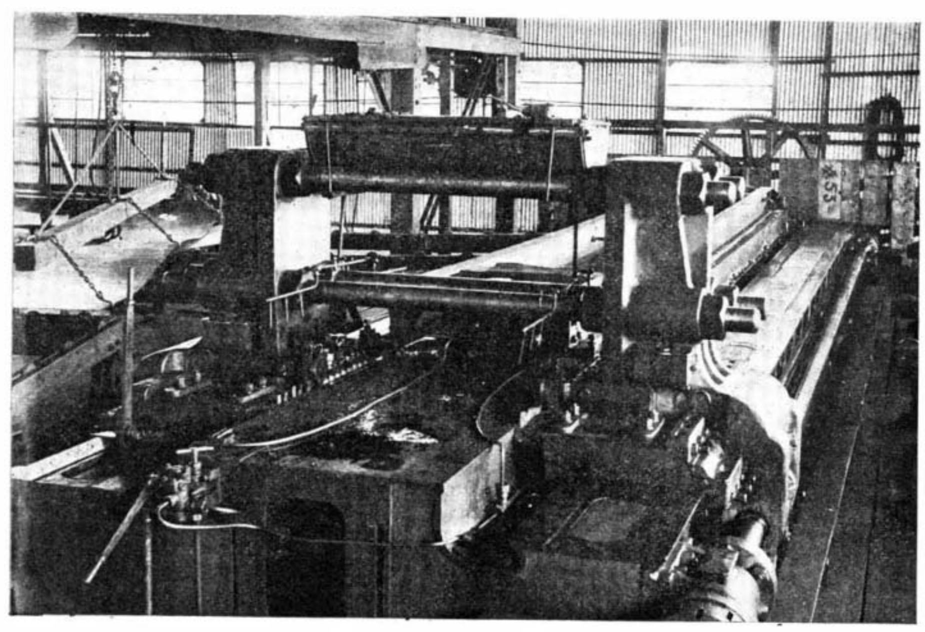
Apart from the magnitude of the undertaking, this pipe line possesses special interest because of the novel means adopted in the manufacture of the pipe itself, which is of what is known as the Ferguson locking-bar type, being so named after its inventor, Mr. Mephan Ferguson, of Melbourne, Australia, to whom we are indebted for our illustrations and particulars.

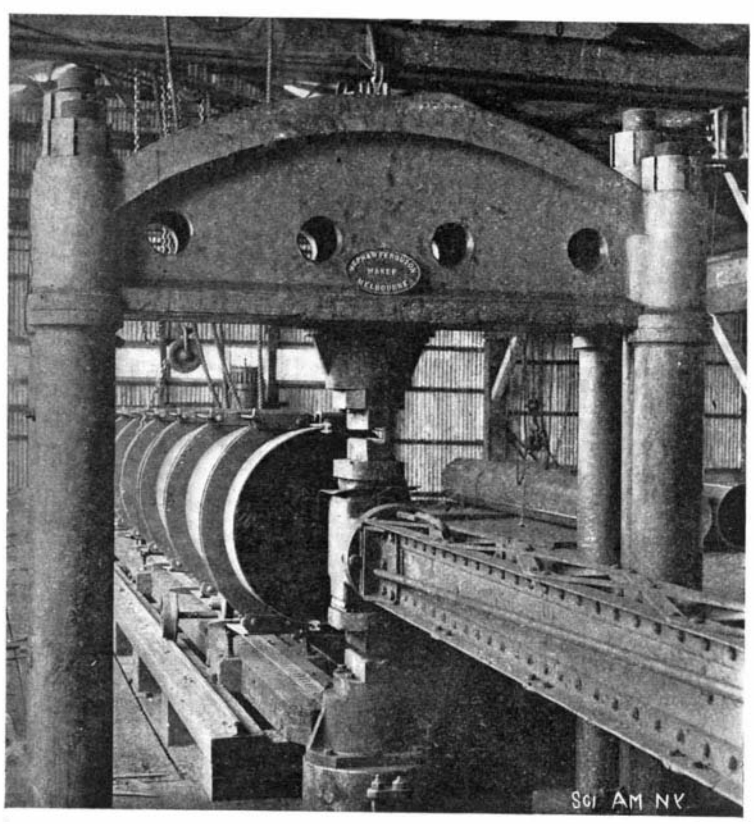

2. Wrought-Steel, Lead-Calked Joint.


1. Fifteen Hundred Feet of 30-Inch Pipe Loaded on Cars.

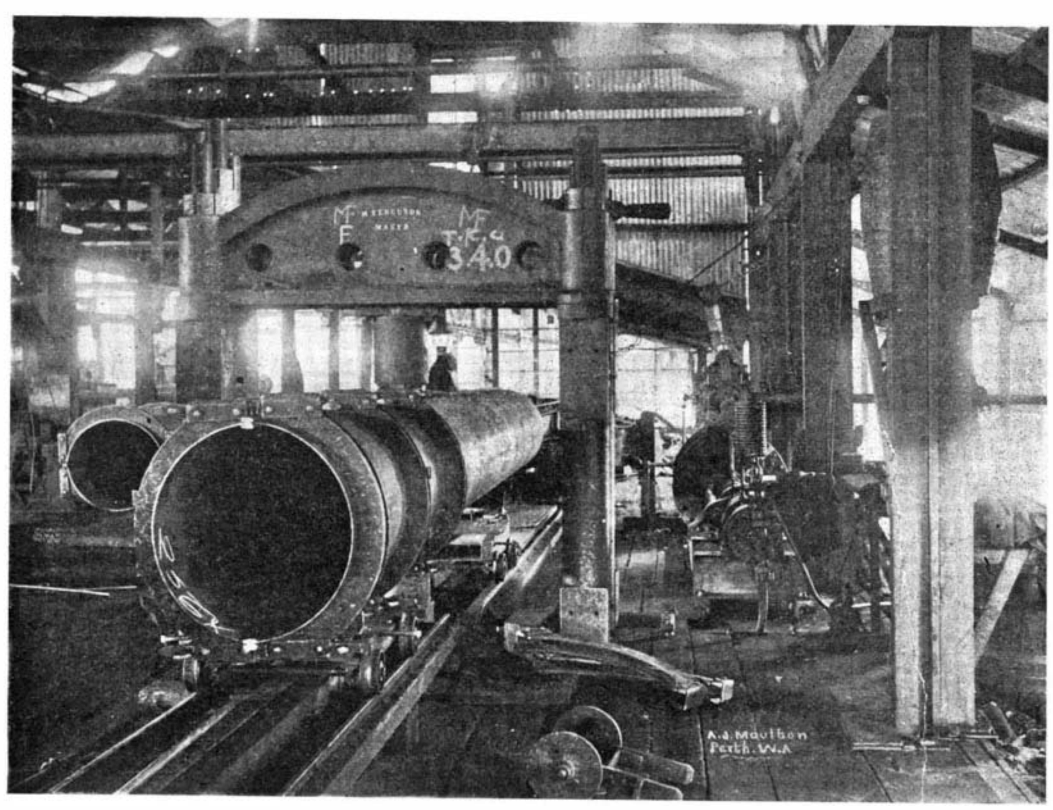
The method of manufacturing the pipe is shown in the accompanying illustrations. Each length is formed of two steel plates, each of which is bent to a half circle and its longitudinal edges upset in a special machine. Two halves are assembled together and their upset edges inserted in a pair of longitudinal locking-bars. Hydraulic pressure is then brought to bear on the locking-bars, which are thereby closed down over the upset edges of the plates, thus forming at each bar a double dovetail joint. Such, briefly stated, is the operation of manufacture. In detail it is as follows: After the plates have been put through a set of straightening rolls, they are clamped to a table upon which they are carried through two pairs of circular shears which cut them to exact length. They are then taken to the planing and upsetting machine, shown in Fig. 4, upon the bed of which they are securely clamped. On either side of the bed of the machine, which, by the way, weighs 100 tons, are mounted two massive saddles, which are connected together across the machine by heavy bolts. In these saddles are carried eight planing tools, four on a side, with each tool set slightly in advance of the one that follows it. Behind the tools are sixteen rollers, eight on each side, each of which, like the planing tools, is set some-


3. Bending Rolls.


4. Plate Planing and Upsetting Machine.



5. Pipe-Closing Machine, With Half-Finished Pipe.



6. Shows Pipe About to Enter Closing Machine.

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what in advance of the one that follows. The two saddles are caused to travel along the machine by means of two massive screws, one on each side. As the side saddles move along the plate, it is planed down to exact width by the tools, and then the edges, as thus planed, are upset by the rollers which follow, into the proper form for clamping into the locking-bar. The plate is then removed, a new plate inserted and similar work is performed upon it on the return stroke of the machine.

The plate is next taken to a crimping machine, not shown in our illustrations, where the necessary curve is given to the edges of the plate, so as to prepare it for the plate bending rolls which are shown in Fig. 3. These rolls, which are 30 feet in length, are provided above and below with a pair of suitable supports to prevent the rolls from springing away from the plate. The two upper supports are shown clearly in the figure referred to. The plates, after being rolled to the proper curve, are assembled with their edges resting in recesses of the two locking-bars, already mentioned. The locking-bar is roughly of a blunt I-section, as clearly shown in illustrations 5 and 6. The pipe, firmly clamped to hold the two halves and the locking bars in position, is then placed within the closing machine, Figs. 5 and 6, which consists of a massive frame carrying the upper and under closing tools, and the long mandrel in the front part of Fig. 6 which carries the inside tools. The pipe is placed upon the traveling table and run forward until the locking-bars are between the outside and inside tools referred to. Then, by means of a hydraulic piston acting upon the inclined plane on the mandrel, the squeezing tools are all brought home snugly against the two locking-bars. Hydraulic pressure is now exerted, and the locking-bars are squeezed snugly down upon the upset ends of the pipe. The amount of pipe upset at one stroke is, of course, only equal to the width of the squeezing tools, which work at the rate of about twenty strokes per minute, the pipe traveling through the closing machine upon a set of carrying trolleys, which are shown clearly in Figs. 5 and 6. The pipe is then taken to the testing machine and subjected to a pressure of 400 pounds per square inch, which is equal to a tensile strain of about 10 tons per square inch of the steel plate. After being coated with asphaltum, the pipe is ready for shipment.

We are informed that the locking-bar, *C*, of this form of pipe has shown itself, under official tests, to be stronger than two plates themselves, and as the 28-foot pipes, 30 inches in diameter, are turned out at the rate of about six per minute, it can be understood that this method of manufacture is highly economical, as compared with pipe with riveted seams. There is also the added advantage that the frictional resistance to the water is considerably less than that due to the rivet heads of a riveted pipe.

In illustration No. 2 is shown the form of joint which is used on this pipe line. It consists of a wrought steel ring, or thimble, whose inside diameter is increased from the edges inwardly, with the object that when the lead is run in at both ends, it will form a wedge joint that will act against the escape of the water.

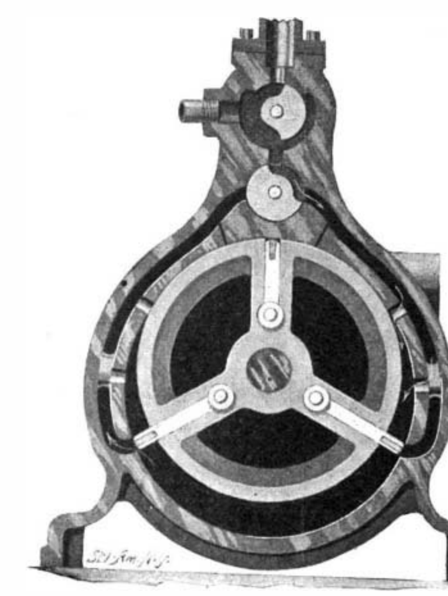
PORTER ROTARY ENGINE.

At the electric-light plant of Crawfordsville, Ind., a rotary engine invented by James A. Porter, of the same city, was recently tested with exceptionally gratifying results. The engine occupies a space 54 by 48 by 24 inches and weighs one ton. The tests proved that the engine is of 8 horse power, running one hundred revolutions per minute with an effective pressure of 12½ pounds and an expansion from 20 to 5 pounds. The high speed and steam pressure obtained make the engine very efficient.

As our illustrations show, the shaft is eccentrically mounted and the cylinder-heads are peculiarly grooved. In the center of the head is a cam-way which forms a bearing surface for rollers carried on the inner ends of the pistons. The outer groove or way in the head is engaged by the outer ends of the pistons. It is evident from our illustrations that the cam in the center serves to press the pistons into steam-tight contact with the cylinder-wall and to hold them to their proper places. Wear is taken up by spring packing.

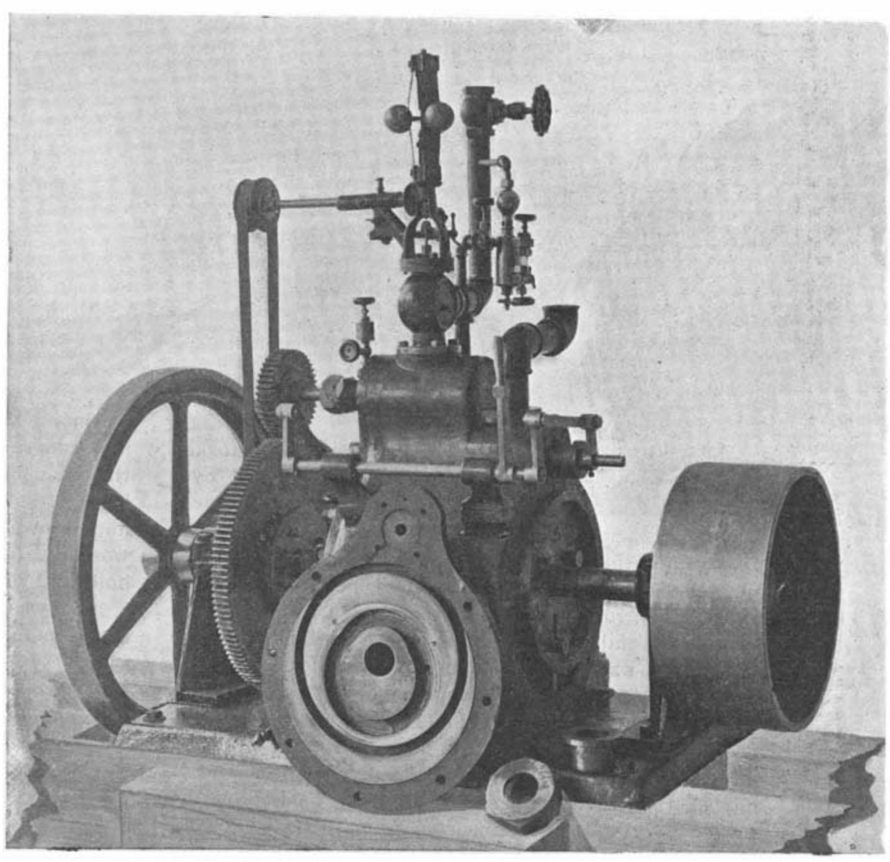
Partially surrounding the cylinder are two steam passages provided with openings leading into the cylinder, and with smaller openings to permit the surplus steam to exhaust, thereby avoiding back pressure. The arrangement of openings leading to the cylinder from the passages is such that the steam is not exhausted through one of the openings until the adjacent piston has passed the opening on the opposite side. Through these passages steam is supplied from two steam-chambers above the cylinder. In the chambers, valves are located which direct the flow of the steam. These valves are so connected by a link and levers that when one valve permits the entrance of the steam to one passage, the other valve acts as an exhaust for the steam discharged from the other passage. By means of this arrangement the motion of the shaft can be readily reversed by a single manipulation of a hand-lever.

One of the steam-chambers communicates with a



SECTION OF THE PORTER ENGINE.

steam-chest; the other serves as an exhaust. Within this steam-chest is a cut-off valve operated by gearing from the driving shaft of the engine, so that the steam can be cut off at any desired point of the piston-travel and used expansively. In order to start the engine when the cut-off valve is closed, steam is allowed to flow through a valved by-pass extending from the steam-supply pipe below the cut-off valve. As soon as the engine is in motion the by-pass is closed.



THE PORTER ROTARY ENGINE, SHOWING DETACHED CYLINDER-HEAD.

Million-Mile Railroad Records.

BY G. E. WALSH.

The relative longevity of the modern high-speed locomotive is interesting in view of some of the reports concerning the working-life of some of the older forms of engines. There have been several English locomotives which have made million-mile records, and they are still in use on some of the small branches. These English locomotives, however, were run on much finer roadbeds than those built in this country years ago, and the wear and tear on them must have been correspondingly less. It has been demonstrated many times in the history of railroading that the condition of the track more than the high speed determined the life of the locomotive.

In the past most of the American locomotives would average runs of 200,000 miles before going into the repair shops. To cover this distance it would require from three to five years. There are plenty of engines on the best roads which average 200 miles a day, or something like 1,200 miles a week. From 60,000 to 70,000 miles per year for a locomotive engaged in drawing heavy mail and passenger cars makes a record that is considered excellent. This record has been exceeded, and will be more than increased by one-third in the future by the more powerful engines, but the average of the fast engines to-day is really lower than this. Most train experts put the annual run for a good express engine at 50,000 miles a year. At this rate it would take twenty years for the engine to make the million-mile record if she was not condemned to the scrap-pile before that.

On many of the Western roads there are locomotives in service to-day that started business twenty and thirty years ago, and while no record has ever been kept of the number of miles they covered in that period it can be inferred from figures given that they have crossed the million-mile mark. Until within a few years there was running on the Chicago, Milwaukee & St. Paul Railroad an old Lawrence inside connection engine built in 1857. This engine was employed in all sorts of work, and during its period of usefulness extending upward of forty years it must have covered fully a million miles.

The active life of some of the modern heavy locomotives is something to be determined by the future. Like the swift ocean steamers they must deteriorate more rapidly when driven at their maximum speed, but after serving as fast mail expresses they will have a long period of usefulness on runs not quite so exacting. The modern big locomotives on the long-distance runs average more miles a day and week than the old-timers, and they will consequently cover the million-mile record in much less time. It is estimated that some of the crack locomotives engaged in carrying the fast transcontinental mails will reach this high record within ten or twelve years.

A few years ago the London & Northwestern Railroad published some statistics concerning one of their locomotives. According to these figures, published by F. W. Webb, locomotive engineer, she made the million-mile record in nine years. Every day except Sunday this locomotive made the run between London and Manchester and back, covering in the round trip 367 miles a day. The engine was 50 feet long, and weighed 33 tons, with a tender weighing 25 tons and carrying 1,800 gallons of water. Either trip of 183½ miles was made regularly on schedule time of 4¼ hours, and not once in the nine years did the engine lose a day except on Sundays. These days were used for fixing her up and making such necessary repairs as were demanded. Her record is without parallel in English or American railroading.

Cinematograph for the Blind in France.

Dr. Dussaud, of the Psychological Institute of Paris, gave a lecture on February 16, at the Hospital des Sociétés Savantes, on the education of the blind and deaf. A large audience witnessed interesting experiments founded on his method for supplementing the senses of these two classes of unfortunates.

The cinematograph for the blind is a machine which passes under the fingers of the blind a series of reliefs representing the same object in different positions—the branch of a tree, a bird, or any other object. The blind person has the illusion of moving scenes just as photographs passing over a luminous screen lend the illusion to those with sight.

Dr. Dussaud has also arranged an electric vibration for the use of the deaf who are incurable. This gives them the notion of musical rhythm. For those not entirely deaf, he has invented a "gradual amplifier of sounds," which supplements the organs of hearing and in some instances improves them.

Dr. Dussaud expressed the hope that these two inventions would materially aid in the education of the deaf and blind. The doctor gave a number of statistics already furnished by him to the Academy of Medicine and the Society of Biology, showing that his method had been applied during the last four years to more than three hundred patients affected either with blindness or deafness, and that in most cases the results obtained had been extremely satisfactory.

Through the death of Prof. J. D. Whitney, its former owner, the famous Calaveras skull has come into the possession of the Peabody Museum of American Archæology and Ethnology. Prof. Putnam visited the Calaveras region last summer to examine the various gravels in the Mattison mine, where the skull was discovered.