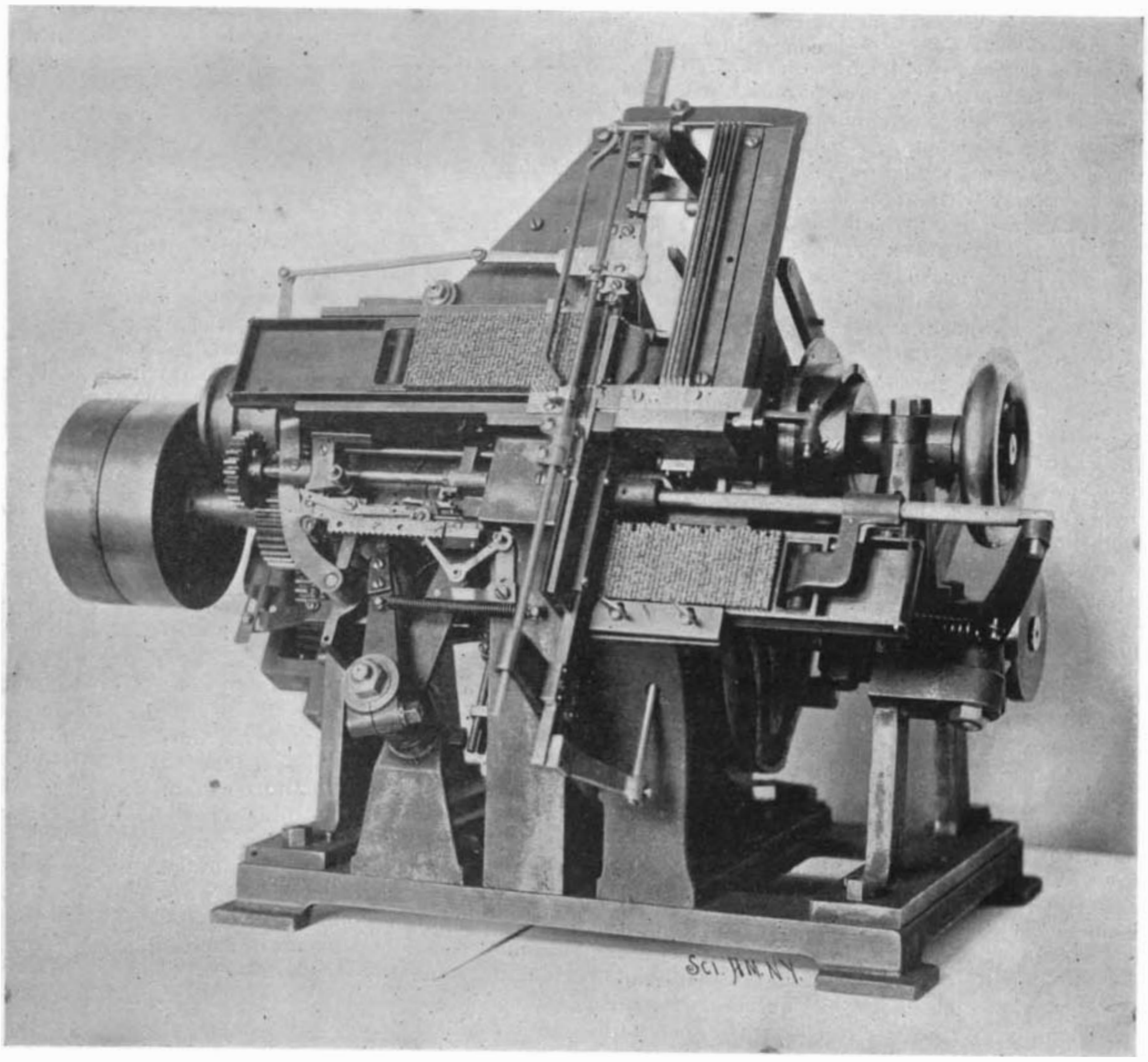
A PRINTERS' TYPE JUSTIFYING MACHINE.

The highly ingenious machine shown in the accompanying illustration automatically lifts lines of type from a galley and justifies them, the exactly spaced lines being deposited on a second galley, and the machine doing its work without any assistance whatever, beyond the putting on and taking off of the galleys containing the columns of matter. The machine is a recent invention of B. M. Des Jardins, of Hartford, Conn. The matter as presented to the machine is assumed to have been corrected and revised, and as it is well known that in the most careful book composition there are many corrections and revisions and rerevisions, for each of which there is the additional labor of justification, it is expected that this machine will find a practical field in such work, as well as in the justification of matter from type-setting machines which set up the type in a continuous line, requiring a special hand to do the work of spacing. In the type set up for this justifying machine the words are separated by strips of brass, which aid the machine in locating the positions of the spaces, and the lines are held apart by thin rules to protect the loose, uneven ends. A reciprocating ratchet rod operating a traveling block automatically feeds the column leftward, a line at a time, into the justifying mechanism, which is located in the middle of the machine. The first line is then lifted under a clamping bar which supports the dividend member of a mechanical computing instrument and at the same time the separating rule is removed. This dividend member acts in conjunction with a bar which records the number of places requiring spaces, and the combined position of the two determines which sizes are wanted. This division gives the first step toward the full result sought for. Three sizes of spaces are employed, which are respectively eighteen, twenty-four, and thirty one-thousandths of an inch in thickness. These are combined to make other sizes, all of which differ from each other by the same amount. Whenever the instrument's division gives a result between any of the regular sizes, it indicates the nearest smaller one and records the remainder in such a way as to cause the machine, at the required time, to shift the action to the next larger space, thereby indicating a proper combination of two sizes. The setting of the computing instrument just described occupies only the fraction of a second of time, and that is followed by another motion of the line upward, into a channel which leads directly to the receiving galley. The line is then pushed along this channel intermittently, being intercepted by the brass strips opposite the space collecting and transferring device. The latter is located below the end of the reservoir channels, and is controlled by the computing instrument. It is made to collect out of one or more of the three channels such spaces as are needed to build up the required thicknesses; and the instrument also causes the space collector to change sizes in time to use enough of the larger ones to fill out the line correctly. The transferring device also removes the original brass spaces from between the words, and inserts the new ones in their places. Upon the disposal of the last word, another action of the computing instrument starts the discharging mechanism, and the channel which now contains the line is caused to collapse and deposit its charge on the receiving galley, to the left, accurately justified.



THE DES JARDINS TYPE JUSTIFYING MACHINE.

In properly proportioning his spaces, the printer calculates by the eye, as best he can, the spaces required between the words of a line, and the greater the accuracy required the more time will be consumed in justification, but this machine secures absolute, mathematical accuracy, such as is demanded in the best work, and leaves no room for carelessness or bad judgment.

THE KENSINGTON BICYCLE.

The modern bicycle has been brought to such a state of perfection as a piece of machinery that any improvements in it at the present day are of greater interest than ever before, as indicating a still further approach to what may be not rashly termed mechanical perfection. In the cut we present illustrations of some of the features of the Kensington bicycle, which certainly show a most interesting development in the art of cycle building.

Referring to Fig. 1, which gives a section of the crank bracket, we find it shown with a cylindrical body into whose ends are screwed the ball races. The balls are retained in these by retainers shown in section. The sprocket wheel spider is brazed upon the crank shaft and is turned with a recess so as to extend over the edge of the cylinder. Directly against the spider is butted the right hand cone. This makes the sprocket side practically dustproof. The other side of the bracket is treated in much the same way, except that here the adjusting cone is threaded on the axle and is provided with lock nuts and washers, while outside of all is a dust cap also lapping over the bracket, thus securing the dustproof feature for this side also.

The oiling tubes of the crank bracket are a peculiarly happy device, being so arranged that the oil reaches the balls—something one can rarely be sure of in the ordinary type of crank bracket. It should also be mentioned that the cranks and shaft are all in one piece and that the sprocket is secured by four bolts to the spider, the spider being screwed on to the shaft and brazed.

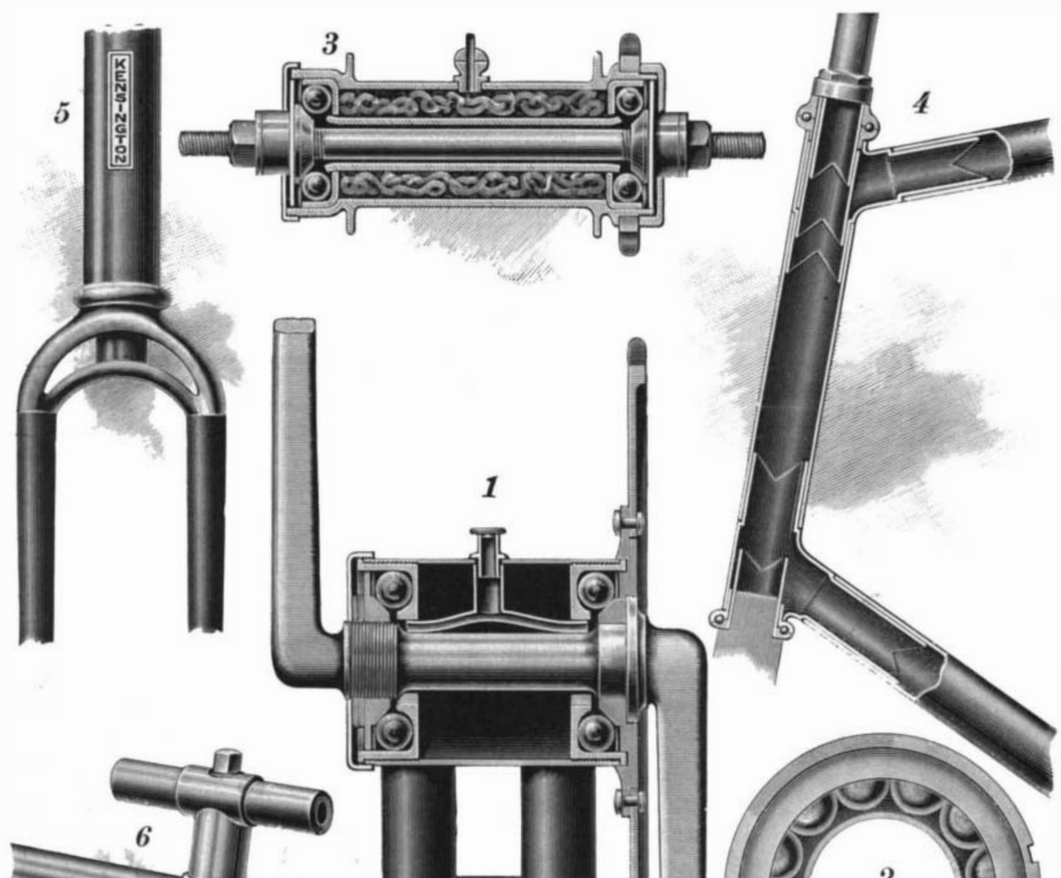
The cranks are square in section, it being considered that both their strength and appearance are improved by the adoption of this section.

As an example of a ball race, Fig. 2 is given, showing a front view of the ball retainers.

In Fig. 3 the hub of the driving wheel is shown. Here will be seen the same dustproof construction carried out on the lines explained with reference to the crank bracket. The interior of the hub is packed with waste or lamp wick and communicates by small openings with the ball races. A single oiling answers for the whole season.

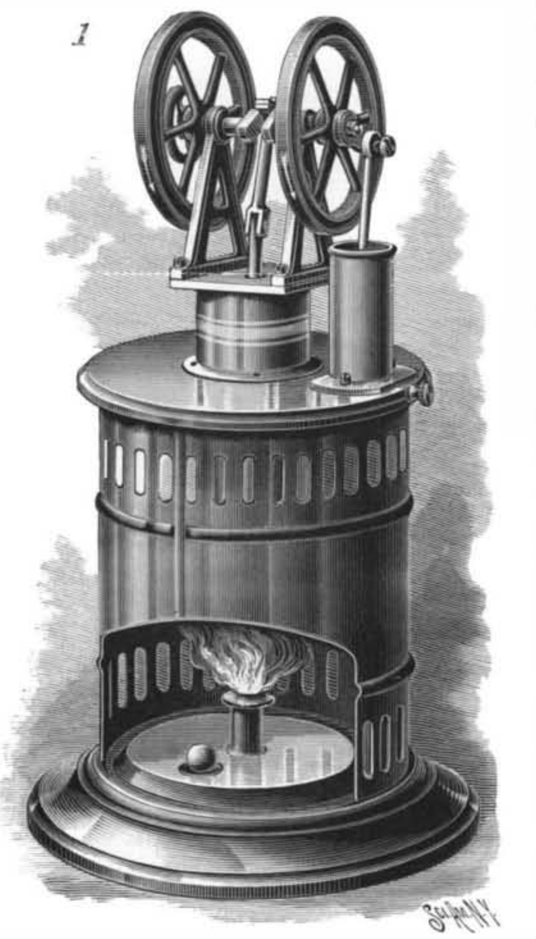
What the manufacturers term their flush joint connection forms a very interesting and valuable feature, and is illustrated in some detail in Fig. 4. By studying the illustration it will be observed that where the connections enter the tubing they are recessed, so that the tubing telescopes over the diminished portion and butts against the shoulder. This gives a perfectly flush joint, and after brazing, a most secure one. It will be observed how this principle is carried out in the different joints of the head as shown in Fig. 4, and this head may be accepted as an exponent of the system as applied to all other parts of the frame.

In Fig. 5 is shown the very characteristic fork crown, on which there has been granted a patent. This is an



NOVEL DETAILS OF THE KENSINGTON BICYCLE.

oval crown, a contour which has proved very popular with the public. The tendency of the day being toward double crowns, the manufacturers of the wheel have designed a double oval fork crown which is a solid one piece drop forging, and is therefore naturally of great strength, while the distribution of the material into two arcs of different radii introduces the truss element at least for some of the strains. Independent of its utility, the double oval crown certainly constitutes a very characteristic and handsome feature of the wheel.



SMALL CALORIC ENGINE.

A good example of how the flush joint is carried out and with what neat effects may be seen in Fig. 6. Here we have a boltless connection at the head of the center brace, with flush jointed rear stays. At first sight, it might seem a mystery how the saddle post is held in shape. The bolt head seen on top of the saddle post explains it. By turning this in one direction, a taper plug is drawn up into the lower end of the seat post, expanding it against the walls of the tube and fixing the seat post in position. By turning the bolt in the opposite direction the cone is forced downward, leaving the seat post free for adjustment. Nothing can be neater or more efficacious than this substitute for the old time cross bolt, which has so often been a source of annoyance.

With the many special and exclusive features the Kensington is regarded as one of the leaders in high grade cycle circles of to-day.

The Kensington bicycle is manufactured by the Martin & Gibson Manufacturing Company, of Buffalo, N. Y.

TWELVE WHEELED AMERICAN LOCOMOTIVE FOR THE BRAZIL RAILWAY.

Reference is made elsewhere in our columns to the trade with foreign countries in American locomotives; a trade which there is reason to believe is yet in its infancy, and will assist in the future to keep in full employment those vast establishments which have supplied the motive power to the 180,000 miles of railroad which form the system of this country.

The accompanying illustration shows a powerful locomotive of the Mastodon type, which has recently been built by the Brooks Locomotive Works, of Dunkirk, N. Y., for Estrada de Ferro Central do Brazil (Brazil Central Railway). This company is one of the leading American exporters of locomotives, and, in addition to its trade with the Spanish American states, it has recently made shipments to Japan, a country which of late has shown a disposition to make increasing use of American locomotives.

The subject of our illustration is a twelve wheeled freight locomotive, with cylinders 21 inches in diameter by 26 inches stroke. There are 8 coupled drivers, loaded to 142,000 pounds, and a leading truck carrying 28,000 pounds. The weight of the tender is 82,000 pounds, the total weight of engine and tender, in working order, being 252,000 pounds.

The boiler is of the Belpaire pattern, and is 5 feet 8 inches in diameter, the fire box being 38½ inches wide by 114 inches in length. There are 248 flues, 2¼ inches in diameter by 13 feet 10½ inches in length. There are 209 square feet of heating surface in the fire box and 1,991 square feet in the tubes, or a total of 2,200 square feet. The grate area is 29$\frac{3}{10}$ square feet, and the boiler pressure is 180 pounds.

Water is fed to the boiler by injectors and by feed pumps worked from the crossheads. With few exceptions, this handsome locomotive conforms to the standard American Mastodon type, the chief difference being in the width of the gage, 5 feet 3 inches, and the use of a pair of buffers above the pilot and on the rear of the tender. Another peculiarity which will be noticed is the use of three headlights, two of which are located at the base of the smoke box.

The hauling capacity of these locomotives on a straight, level road, at 10 miles an hour, is about 5,073 tons, exclusive of the weight of the engine and tender.

A MINIATURE CALORIC ENGINE.

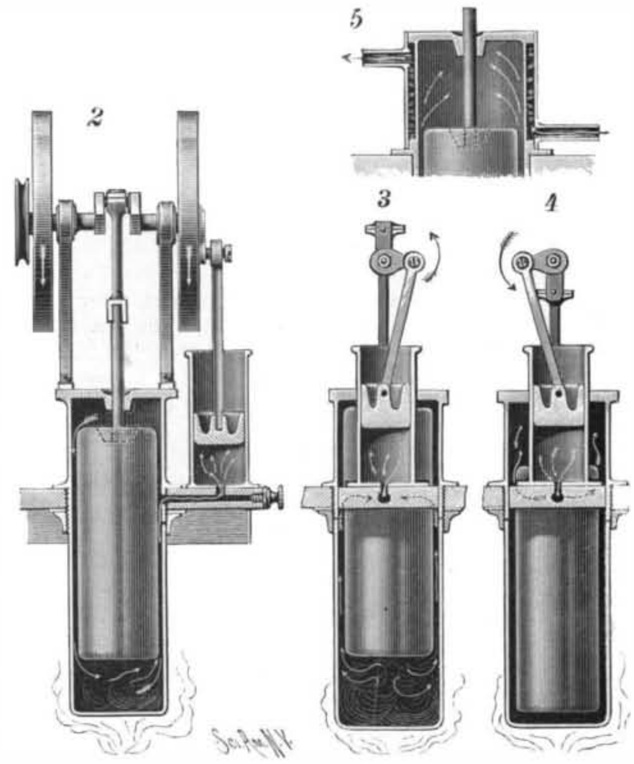
The hot air engine is not a very recent invention. A number of engines of this class, of different sizes, were devised and used in the early part of the present century, and in the latter part of the last century there were in existence engines constructed to be operated by the expansion of air.

Nothing in the way of a motor, aside from a windmill or water wheel, can be more simple than this, and it is a pity that it is not capable of more general application. Motors of this kind have been used to some extent for driving light machinery, and they have been largely employed in pumping water.

Quite recently caloric engines have been made in the form of a toy, as illustrated in the larger of our engravings. In the motor here shown, the air contained in the expansion cylinder is alternately heated and cooled, and no fresh air is introduced. This action is so rapid in a small engine that the crank shaft can make 600 or 700 revolutions a minute. By examining the sectional views (2, 3 and 4) a good idea of the construction and operation of the motor may be obtained. In brief, the larger and longer of the two cylinders (the expansion cylinder) contains a long hollow piston called the "transfer piston," which fits the cylinder very loosely. To this piston is attached a rod extending through a close fitting sleeve in the top of the cylinder, the piston rod being provided with a connecting rod fitted to the crank at the middle of the shaft. The upper part of the expansion cylinder is furnished with a wide flange forming a cap which fits over the sheet iron fire box, and to the top of the expansion cylinder are secured the standards in which is journaled the crank shaft.

To the flange is attached the power cylinder, which is shorter and smaller in diameter than the expansion cylinder. This cylinder is provided with a piston to which is pivotally connected the lower endof a connecting rod, the upper end of which receives a crank pin projecting from one of the fly wheels at right angles to the transfer piston crank. A hole bored in the flange connects the expansion cylinder and the bottom of the power cylinder, as shown in Fig. 2, and the outer end of the hole is stopped by screw plug which can be removed for cleaning the hole, should it becomed stopped by oil or otherwise.

An alcohol lamp is provided for heating the expansion cylinder, it being placed in position to heat the lower end of the cylinder, as shown in the larger view. The top of the lamp is provided with a hemispherical cavity, at the bottom of which is the aperture for filling.

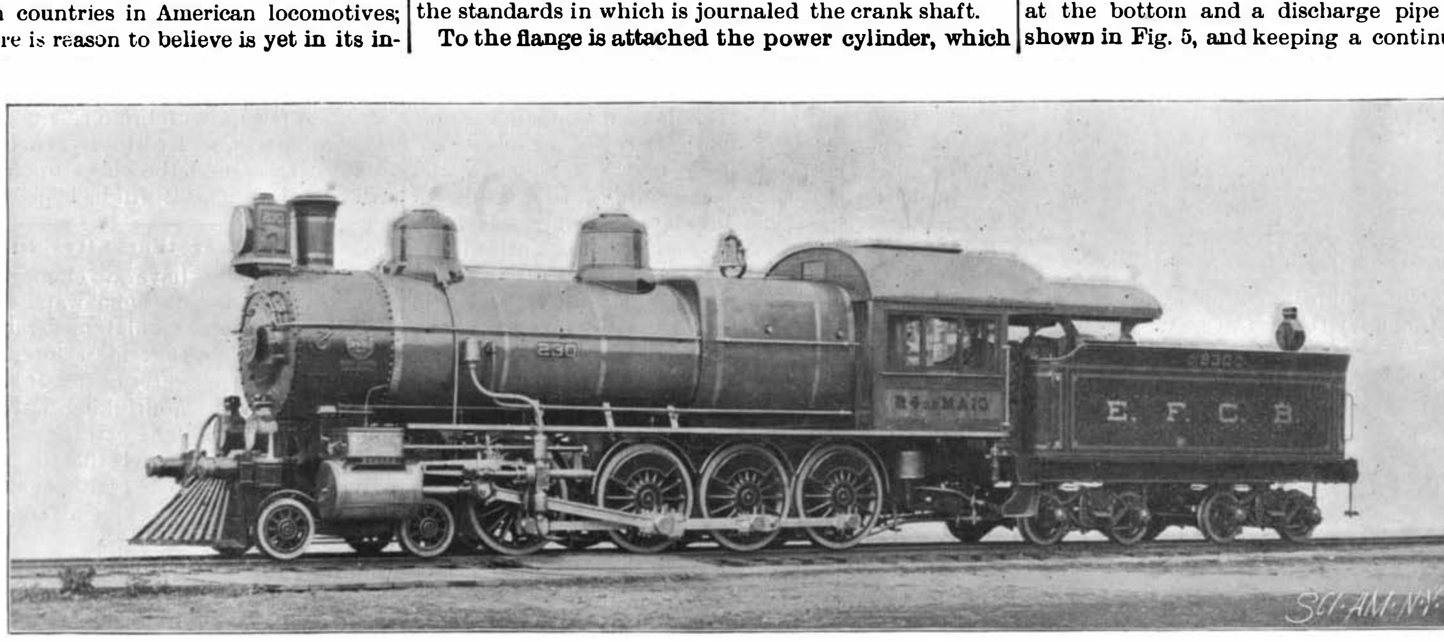


SECTIONAL VIEWS OF SMALL CALORIC ENGINE.

The stopper consists of a marble dropped into the hemispherical cavity and serving the double purpose of stopper and safety valve.

The expansion and power cylinders contain a certain amount of air which is never changed during the operation of the engine, except by expansion and contraction. Heat having been applied to the lower end of the expansion cylinder, the engine is started by giving the crank shaft one or two turns in the direction indicated by the arrows on the rims of the fly wheels. The air at the top of the expansion cylinder is transferred to the lower end of the cylinder by the transfer piston as it rises; at the same time the power piston descends, and by this time the air is heated in the lower part of the expansion cylinder and begins to expand. The power piston is in position to be pushed up by the air pressure. As the power piston reaches the upper end of its stroke, the transfer piston descends and transfers the heated air to the upper end of the expansion cylinder, where it is cooled, thus reducing the pressure and allowing the power piston to descend again. This operation is repeated at every stroke. It is almost impossible to believe that the air can be heated and cooled so rapidly.

The efficiency of the motor can be increased by surrounding the upper portion of the expansion cylinder by a water jacket provided with a water supply pipe at the bottom and a discharge pipe at the top, as shown in Fig. 5, and keeping a continual flow of cool



TWELVE WHEELED AMERICAN LOCOMOTIVE FOR THE BRAZIL CENTRAL RAILWAY.

Cylinders, 21 inches by 26 inches; diameter of boiler, 5 feet 8 inches; heating surface, 2,200 square feet; grate area, 29·3 square feet; diameter of drivers, 54 inches; weight of engine, 170,000 pounds; hauling capacity, 5,073 tons at ten miles an hour on level.