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THE GREAT AMERICAN DREDGES ON THE PANAMA CANAL.

Many changes have been made in these mammoth dredges since the first one (described and illustrated in the SCIENTIFIC AMERICAN of March 3, 1883) was built, some three years ago. Experience gained in actual working showed that while the principle of construction was sound, many improvements could be made in the details; these alterations have resulted in increasing the capacity and durability of the machine.

The dredge shown in the accompanying engravings is the seventh one built by the American Contracting and Dredging Company of this city for work upon the canal; it differs from the previous ones mainly in the substitution of iron for wood in the tower, derrick, and ladder, and in having greater height of tower, greater length of ladder, and increased boiler power.

The composite hull of yellow pine and iron is 116 feet long, 36 feet wide at the after end, and 30 feet wide at the forward end; the sides are curved to a radius of 106 feet. The end of the hull, which is 12 feet deep, is rounded to a radius of 11 feet. In the forward end of

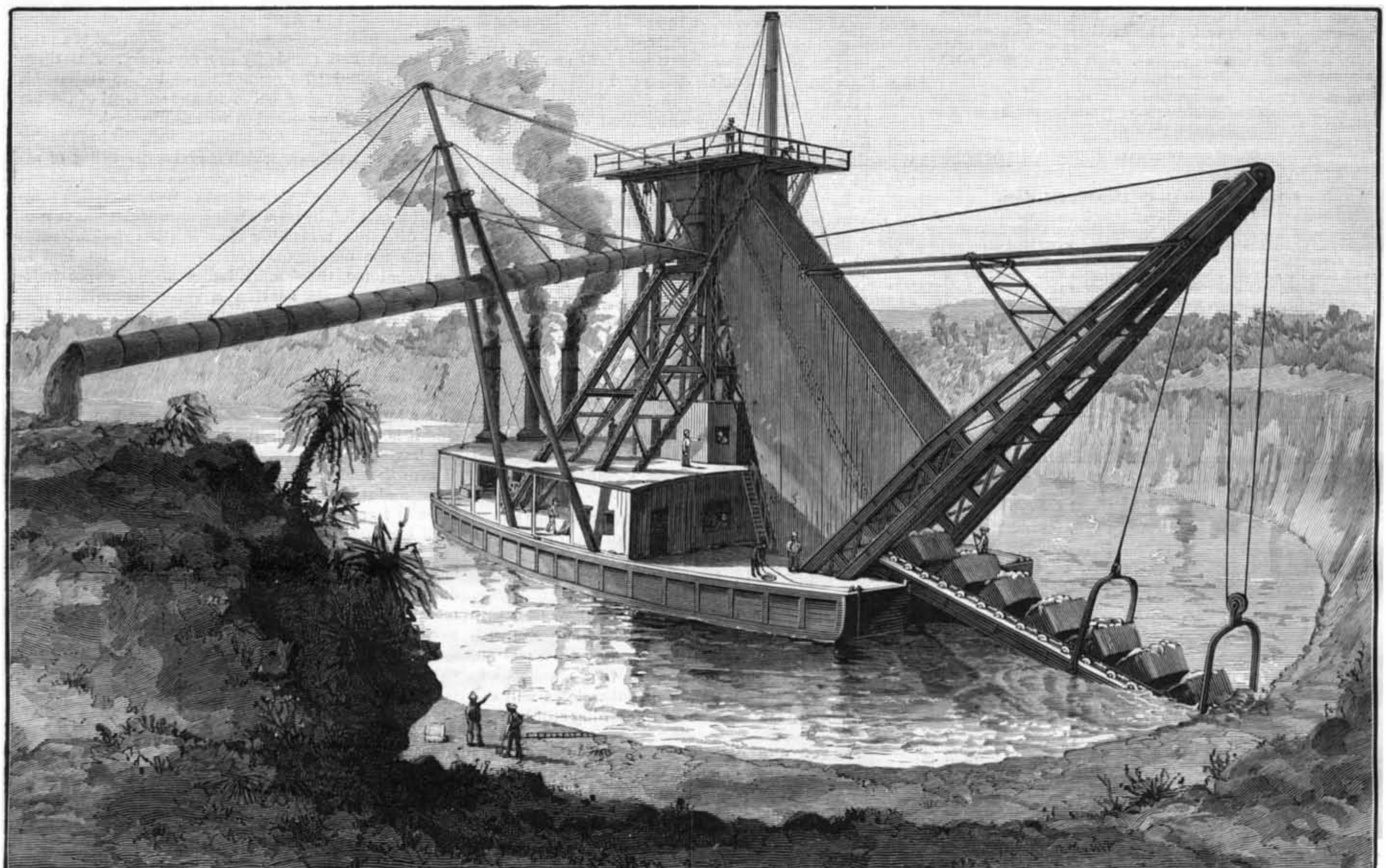

Fig. 1.—THE GREAT DREDGE AT WORK.

the hull is a slot, in which the ladder moves, 36 feet long and 7 feet wide.

The two wooden spuds are 24 inches in diameter and 60 feet long, and are provided with iron chisel points weighing 1,800 pounds. Each spud passes completely through an opening in the hull, in which is vertically placed a cast iron tube, the interior of which is double-coned shaped, the diameter at the center, where the bases of the cones meet, being 25 inches, and the diameter of the ends 27 inches. This gives the spud a center bearing, and prevents binding during raising or lowering.

When working, the dredge is held by either spud being lowered. The spuds are handled by means of ⅞ inch chains passing through double sheave blocks to a drum operated by a pair of engines 8½ inches diameter by 12 inches stroke. A pinion on the engine shaft, which is 4 inches in diameter and 3¾ feet long, engages with a gear on the drum shaft.

From the inside of the bottom of the hull to the top of the tower is 70½ feet. The tower consists of six posts converging toward the top and arranged in two sets across the hull. The rear set is made up of 12¼ inch, and the forward set of 15 inch latticed channels, the whole being united by latticed channels and diagonal rods. The platform at the top, which is 38 feet long by 24 feet wide, rests upon three iron beams running longitudinally and supported upon the posts.

The outer parts of the platform are held by inclined braces attached to the sides of the tower. Two bars 1 by 2½ inches and 25 feet long extend from the bottom of the top panel of the tower to the extremity of the stern, and two bars 1½ by 4½ inches and 38⅝ feet long extend from the front of the

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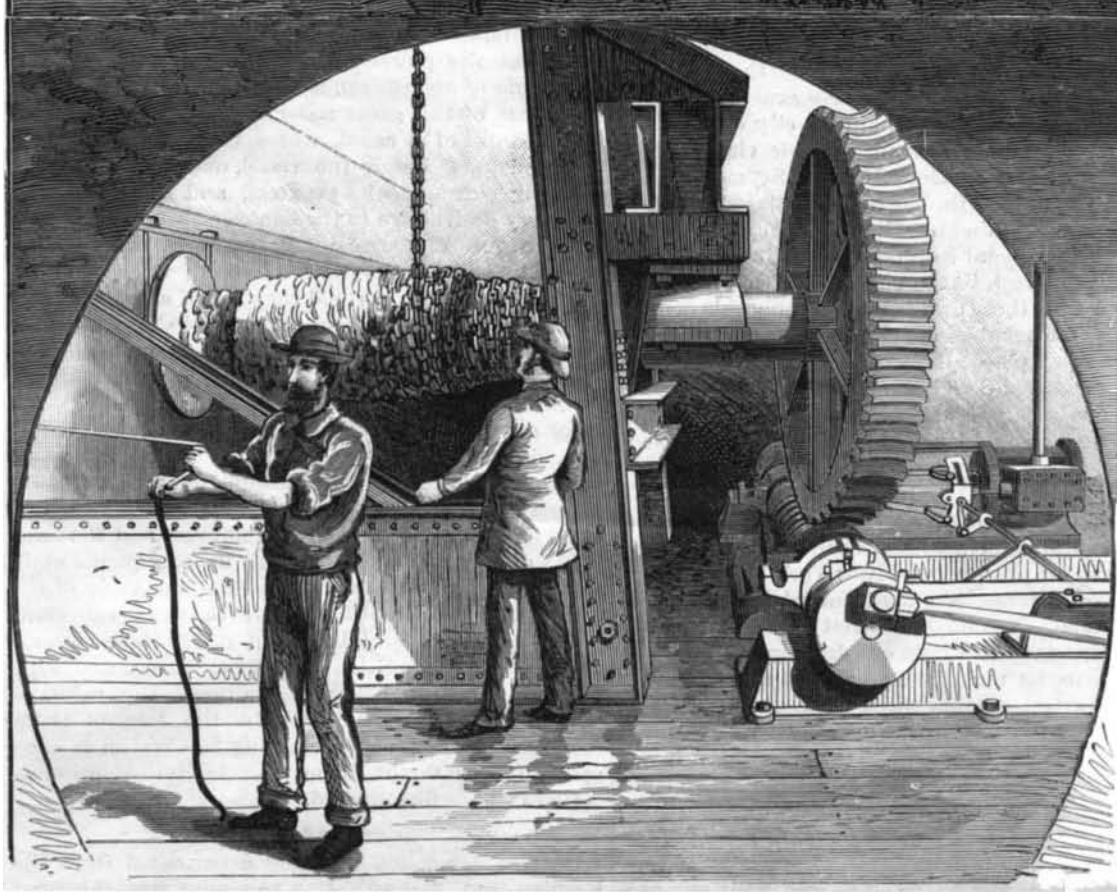

Fig 2.—ENGINES AND DRUM FOR OPERATING LADDER.

THE GREAT DREDGER OF THE PANAMA CANAL.

(*Continued from first page*).

same panel to the stern. The bars support the tower against the strain of the bucket ladder. Each side of the tower is braced by latticed channels united by horizontal and diagonal members, and converging toward the side of the boat. Two plate keelsons 36 inches deep extend from the rear of the foot of the tower to the foot of the derrick, as shown in Figs. 2 and 3. The derrick is 80 feet long, and is made up of latticed channels 12¼ inches, united in the same manner as the tower. Two bars 1⅜ by 4⅛ inches extend from the top of the derrick to the bottom of the upper panel of the tower. The ladder is made in two sections jointed together, the upper part being 73 feet 10 inches long and the total length 115⅝ feet. The ladder is made of 4 by 6 inch angles joined by a web 24 inches deep and ½ inch thick, and each section is stiffened by a truss upon the under side.

The links of steel chain carrying the buckets, which are made of five-eighth inch steel and have a capacity of one cubic meter, are 3 feet long and 1⅝ by 7 inches in section; to every alternate link is attached a bucket placed between two links. All parts of the chain are made interchangeable to facilitate repairs. At the top of the tower the chain passes over a square tumbler, mounted on a shaft 14 inches in diameter and 17 feet long, and having chilled cast iron corners bolted between flange heads, so that they may be easily replaced when worn out or damaged. The chain passes under and over a six-square idler on the lower end of the ladder.

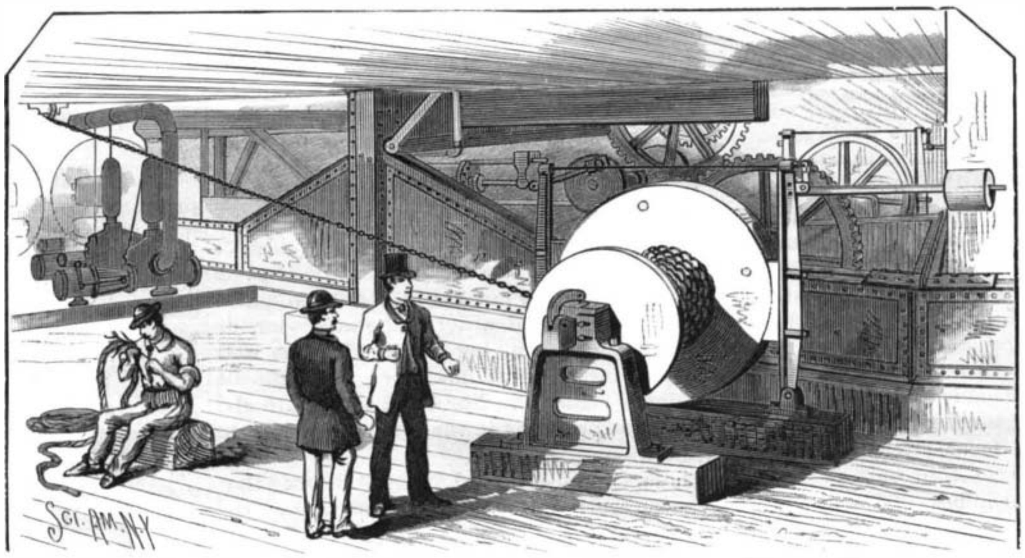

Fig. 3.—ENGINES AND DRUMS FOR OPERATING SPUDS.

The chain is operated by engines 16 by 24 inches. The driving pulley is 10 feet in diameter and 38 inches face; the belt extends to a smaller pulley mounted in the upper part of the frame, and connected by gearing with the tumbler shaft.

The ladder is raised and lowered by means of a chain attached to a bail near the end of the ladder, then passed over a pulley near the top of the derrick, then under a pulley on a bail pivoted to the end of the ladder by the same bolt that holds the idler, and then over a pulley at the extremity of the derrick, and finally to a drum operated by 8½ by 12 inch engines. At the center of the engine shaft is a worm meshing with a gear on the drum shaft, as shown in Fig. 2.

The buckets empty into a bell of an iron chute, 3 feet in diameter and 180 feet long, and supported as shown in Fig. 1. To aid the discharge of material, when necessary, two pumps, 10 by 14 by 14, discharge water into the chute.

The engines are all double, and are link motion. Steam is supplied by three boilers—locomotive pattern —6¼ feet in diameter and 23 feet long, and of 100 horse power each. Exhaust steam is conveyed to a surface condenser. All the machinery is operated from one room located on deck, just forward of the center of the boat.

These dredges are known as the endless chain.

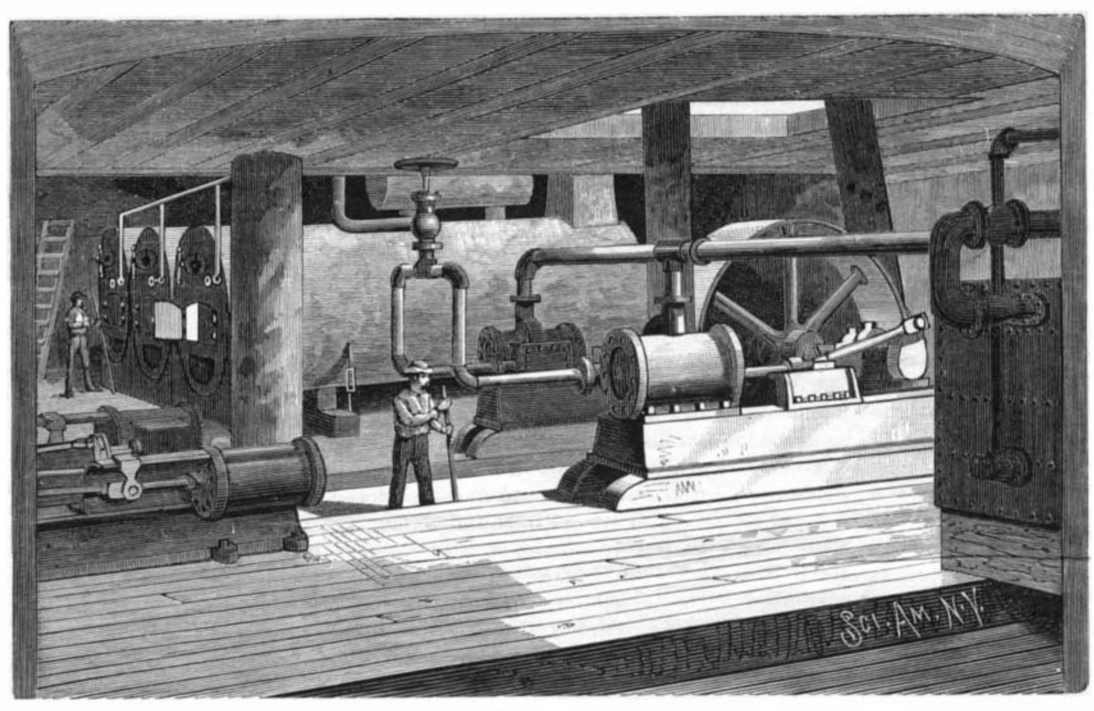

Fig. 4.—MAIN ENGINES, BOILERS, AND CONDENSER.

The Pike's Peak Railway.

The Pike's Peak Railway, which is expected to be in operation this year, will be the most notable piece of track in the world. It will mount 2,000 feet higher than the Lima & Oroya Railway, in Peru. It is now in operation to a point over 12,000 feet above the sea level. The entire thirty miles of its length will be a succession of complicated curves and grades, with no piece of straight track longer than 300 feet. The maximum grade will be 316 feet to the mile, and the average grade 270 feet. The line will abound in curves from 500 to 1,000 feet long, in which the radius changes every chain.—*American Railway Journal.*

THE London *Times* states that an air balloon railway is about to be constructed on the Gaisberg, near Salzburg, a mountain of no great height, but offering a magnificent view over the environs of the town. The balloon, which will have grooved wheels on one side of its car, will ascend a perpendicular line of rails.

Congo Red.

The following methods for using Congo red are given by Prof. Egb. Hoyer in the *Wochenschr. d. Pol. Ver.:*

This coloring matter is specially adapted for cotton, linen, jute, etc. Cotton is dyed with two per cent dyestuff, without mordant, in a bath of boiling water, in which it is left for two hours, then washed and dried. After drying, the cotton is treated in a soap bath, containing 4 to 5 per cent soft soap, in which it is left until the shade is perfectly clear, the shade obtained being similar to a Turkey red, with a yellow shade.

Cotton yarn and piece goods are dyed the same as cotton, but are not dried before soaping, being soaped directly after washing. Some kinds of cotton get better dyed with the help of a mordant, and a solution of 1 per cent alum and 4 per cent borax can be added to the dye bath, the proceeding being the same as above.

The property possessed by this coloring matter of dyeing cotton in a water bath renders its application possible also for mixed goods, the wool being first dyed in any desired shade, and the cotton is then dyed with Congo red dissolved in water.

Another method is the following: Dissolve for 50 pounds cotton wool, 1 pound 8 ounces stannate of soda in the dye kettle; add 2 pounds potash soap, raise to boil, and scum the bath. Then add to the bath 1 pound Congo, and when this is well dissolved enter cotton; boil for two hours, and leave in the bath overnight. Pass, then, the cotton through the hydro-extractor. This same method gives very good results also on cotton yarn. It is better to dye with this coloring matter at boiling point, in order to increase the fastness of the shades against light.

Advertising in the London "Times."

Somebody has calculated that the advertisements in a recent Saturday issue of the London *Times* brought in about $11,000. This would make $66,000 a week, $264,000 a month, and $3,168,000 a year. The number consisted of 24 pages, and of these 14 were filled with advertisements. This is larger than the average number, and the total income for a year from the advertising is probably not more than three-fourths the above sum, or nearly $2,500,000 a year. What the expenses of the paper are, nobody but the proprietors and two or three others know. The highest estimates have, however, never exceeded $25,000 a week, or one-half the probable receipts.

Heat Becoming Dark with Great Intensity.

Mr. W. Gadd, of Manchester, Eng., writes as follows to the *Journal of Gas Lighting:*

The account of M. Felix Lucas' experiments opens up the higher studies of heat and combustion, which have been the subject of inquiry by scientific investigators for many years past. I do not desire in any way to detract from the originality or merit of M. Lucas' work in saying that his conclusions are corroborated by earlier inquiry. As long ago as 1876 I was able to obtain from the burning of oil, under steam blast, first the white, then the gray, and lastly the invisible flame. And from a paper I read about that time. I append the following printed extract bearing on the subject:

"It has been calculated that if we increase this speed of vibration to about five millions per second, we are again made conscious of the same in the form of a faint heat emanating from the object, and that at about four hundred billions per second light commences—first a deep red, then (with further increase of speed) yellow, green, blue, and lastly violet. As these lights develop, however, with the speed, the heat at first felt fades away, and, like sound at a lower rate of motion, ceases to operate as such. If we follow the results of a further increase in speed, we find that when we reach about eight hundred billions per second all light ceases, just as if no motion whatever were in operation —in manner like unto sound and heat. It thus appears that we may consider the *modes* of motion as simply differences in speed, and that what we know as chemical action, electricity, and even life itself, are, on ultimate analysis, merely varying rates of the one all-pervading energy or motion of the particles of matter under consideration."

The difference in order of disappearance of light and heat is only apparent, as a consequence of being described from the mechanical standpoint, and is chiefly interesting as showing that the knowledge is not new, although the present contribution on the part of M. Lucas is extremely valuable. Personally, I do not lay any claim whatever in the matter, other than to a partial demonstration, in experiment, of a theory which had, previously to the date given, been repeatedly propounded.

My Boy, do You Smoke?

The United States Navy annually takes into its service a large number of apprentice boys, who are sent all over the world and taught to be thorough sailors. It has been the policy of the government since the war to educate the "blue jacket," upon the principle that the more intelligent a man is, the better sailor he is likely to become. There is no lack of candidates for these positions. Hundreds of boys apply, but many are rejected because they cannot pass the physical examination. Major Houston, one of the Marine Corps who is in charge of the Washington Navy Yard barracks, is the authority for the statement that one-fifth of all the boys examined are rejected on account of heart disease.

His first question to a boy who desires to enlist is: "Do you smoke?" The invariable response is, "No, sir," but the tell-tale discoloration of the fingers at once shows the truth. The surgeons say that cigarette smoking by boys produces heart disease, and that in ninety-nine cases out of a hundred the rejection of would-be apprentices on account of this defect comes from excessive use of the milder form of the weed. This is a remarkable statement, coming, as it does, from so high an authority and based upon the results of actual examinations going on day after day, and month after month. It should be a warning to parents that the deadly cigarette is sure to bring about incalculable injury to the young. A law passed restricting its use to the dudes would not, perhaps, bring popular disfavor, because it might reduce the number of these objects about our streets, but boys indulging in the cigarette ought to be treated to liberal doses of "rod in pickle" until the habit is thoroughly eradicated.