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PRIVATE AND PUBLIC DEBT IN THE UNITED STATES.

The production and trade of a country necessitate an elaborate system of debts and credits which increase proportionately to the magnitude of its commercial operations.

According to the Official Bulletin, the minimum private and public debt of the United States for the year 1890 was \$20,227,170,546. Of this sum, \$6,200,000,000 represents the debt of quasi public corporations, under which head are included railroad companies, street railways, telegraph, public water, electric and gas companies, etc., 91.44 per cent of this, or \$5,669,431,114, being the debt of the railroad companies alone.

The debts of individuals and private corporations reach a total of \$12,000,000,000, divided as follows:

Real estate mortgages.....	\$6,019,679,985
Crop liens in the South.....	300,000,000
Crop liens outside of the South.....	350,000,000
National banks, loans, etc.....	1,904,167,351
Other banks, loans and overdrafts.....	1,172,918,415
National, State and local taxes.....	1,040,473,013
Other net private debt (estimated).....	1,212,761,236
Total private debt.....	\$12,000,000,000
Total for public corporations (as above).....	6,200,000,000
Total.....	\$18,200,000,000

The public debt, less sinking fund, in which debt is included that of the United States, States, counties, municipalities and school districts, is \$2,027,170,546, which, added to the private debt, makes a total of all kinds for the country of over twenty billions.

It is significant that over 58 per cent of the combined debt on farms and homes occupied by owners was incurred for the purpose of the purchase of real estate. The large profits which were realized by the earlier purchasers or original owners of inside and outside property in and around the rapidly growing cities of the States encouraged an abnormal amount of speculation in this direction during the few years preceding the late crisis. In the middle, and particularly in the Western States, this form of speculation, if it was not directly contributory to the crisis, certainly served to render it very acute when it came.

The crop liens of the South are a legacy of the civil war. At its close the farmers possessed their land and a few mules and tools, but no money. The merchants furnished supplies in consideration of crop liens and mortgages on farm stock. The system thus begun has continued to the present day.

The loans from banks are obtained on the understanding that they are for capital.

The tax debt and the public debt are incurred "for the maintenance of justice, the promotion of public works and for education."

From the above categorical view of the various kinds of debt that go to make up the total for the country, it is seen that fully nine-tenths were incurred in the acquisition of capital and property. Less than one-tenth represents "debt necessitated by misfortune."

Next in importance to the question of the amount of debt of the country is the question of the rate of interest upon which the various loans were granted. The average rate of interest on railroad debts is 4.50 per cent; on street railways, telegraphs, etc., 5.89 per cent; on real estate mortgages, 6.60 per cent; bank loans and over-drafts, 6.60 per cent; crop liens outside the South, 10 per cent; crop liens in the South, 40 per cent; making an average rate on private debts of 6.67 per cent.

The rate on the United States public debt is 4.08 per cent; and on States, counties, and municipalities, 5.29 per cent. The average rate of interest on the total indebtedness of the country is 6.44 per cent.

Referring to the ruinous rate of interest paid on crop liens in the South, the report states that "extensive inquiries, answered by merchants and cotton buyers, who hold crop liens, point to the conclusion that the average rate on these liens must be as high as 40 per cent, rarely going as low as 25 per cent, and often going as high as 75 per cent and more."

The relatively low rate of 4.08 on the debt of the United States is partly explained by the fact of its exemption from taxation.

Referring to the average rate of interest of 6.60 per cent on real estate mortgages, it should be noted that, in the case of farms occupied by owners, this rises as high as 7.07 per cent and 7.36 per cent on acre tracts.

The percentage of debt to wealth is for:

Railway companies.....	67.48 per cent.
Street railways and telephone companies.....	66.60 "
Incumbered farms occupied by owners.....	35.55 "
Incumbered homes occupied by owners.....	39.77 "
Taxed real estate and untaxed mines.....	16.71 "
The whole United States.....	31.10 "

The total wealth of the United States corresponding to the total debt of over \$20,000,000,000 is about \$65,000,000,000.

The total per capita debt, including both public and private debt, is \$323, or \$1,594 per family of 4.93 persons, as per the census of 1890.

In connection with the above classification of the various forms of indebtedness, public and private, it is satisfactory to learn that there was a total increase

of wealth, during the ten years from 1880 to 1890, of \$21,395,091,197; the increase for the year 1889 to 1890 being nearly three billions of dollars.

NEW YORK THE BIRTHPLACE OF OCEAN STEAM NAVIGATION.

Doubtless the majority of the readers of the SCIENTIFIC AMERICAN have a more or less distinct impression that New York was in some degree associated with the development of the first steamboat; but it will, no doubt, be a pleasant surprise to learn that this city has a threefold claim to be called the cradle of the steamship. The first practical river steamer, the first vessel propelled by steam to make a deep sea voyage, the first transatlantic steamship, and the first steam warship, all owed their existence to the inventive genius of New York designers and the practical skill of New York craftsmen.

In drawing attention to this interesting coincidence, we would not detract from the fame and credit due to the earlier inventors of the sixteenth and eighteenth centuries. Blasco de Garay and Denis Papin were undoubtedly the pioneer investigators of the possibilities of steamship propulsion, and, to a certain extent, they proved its possibility; but the mechanical forms in which they embodied their ideas were crude and possessed no practical commercial value. While the theory of steam navigation was old, centuries old, it required some master mechanic to embody this idea in practical, mechanical shape, and this was what Robert Fulton, associated with R. Livingston, accomplished, when, on August 7, 1807, he saw his first steamer, the Clermont, cast off her moorings at the New York docks and start on her maiden trip to Albany.

To Colonel John Stevens, and, indirectly, to a monopoly of navigation on the Hudson, granted to the owners of the Clermont, New York owes the distinction of having built the first deep sea steamer; and the credit of building the first steamer to make a transatlantic passage is shared by New York conjointly with Savannah, Ga. The Savannah having been built at New York and engined at the Southern seaport.

Of scarcely less historic interest than the Clermont is the battle ship Fulton the First, which was named after the designer, and testifies yet further to his inventive genius.

Like the other pioneer ships in their respective classes, the Fulton was built in New York ship yards, and thus clearly establishes this city's claim to be called the cradle of the modern steam battle ship.

A cut of the original plans for this vessel will be found in the SCIENTIFIC AMERICAN SUPPLEMENT for April 21, 1894. The dimensions of this vessel prove that Fulton had the courage of his convictions, for her displacement was greater than that of the average three-decker of that period, and considerably over that of the Victory, which carried Admiral Nelson at the battle of Trafalgar.

The Fulton the First showed a trial speed of over 6 miles an hour, which was far above the average, day in and day out, speed of the fleetest sailing frigates of those times.

In many details she anticipated the modern war ship; as, for instance, in the provision that she should be "furnished with four submarine guns, to discharge a hundred pound ball into an enemy, ten or twelve feet below her water line." The cross section shows that her engines and boilers were placed low down in the hold, and that the portion above the water line was protected by side armor of 5 feet of oak, an amount which was certainly impenetrable by the ordnance of that date.

It is unquestionable that, with her greater maneuvering power, her 100 pounder guns, and the superior protection afforded to the gunners, she would have proved more than a match for the best ship of the line of that date. The close of the war of 1812 prevented her from testing her strength against the English ships; but tradition has it that the appearance of this 2475 ton monster, gliding swiftly down the bay, with no visible means of propulsion, struck terror into the "indomitable heart" of the British tar!

Analysis of Emerald.

The author has operated on the emerald of Limoges (Chanteloube, Haute Vienna). He gives the following results:

	I.	II.
Loss at a red heat.....	1.46	1.41
Silica.....	66.06	65.80
Alumina.....	16.1	16.40
Glucose (? should be glucina) ..	14.23	14.21
Ferric oxide.....	1.2	0.9
Mn ₂ O ₄	—	—
Magnesia.....	0.75	0.61
Lime.....	0.17	0.14
Phosphoric acid ..	0.11	0.09
Alkalies.....	—	—
Titanic acid.....	traces	traces
	100.11	99.67

—P. Lebeau.

Cycle Notes.

All cyclometers should be provided with some means of correction. It is nothing unusual to find them from three to five per cent out, owing, very likely, to the varying diameter of the wheel, depending on whether the tire is fully inflated or not. A new cyclometer is on the market which registers not only 10,000 miles, but has also a special dial for indicating the miles made on a single trip. Another dial marks the fraction of a mile.

November 22 the doors of the Agricultural Hall, London, were thrown open for the nineteenth cycle exhibition, in the name of the Stanley Club. An eager crowd of visitors was immediately admitted to mark the improvements, alterations, and innovations that were proposed for cycles and their accessories for next season's mounts.

The Simpson lever chain was one of the first of the exhibits to receive long and careful attention.

The auto-cars, the bi-tricycles and the motor cycles next received a due share of rapt attention, public interest after these exhibits had been visited becoming more general and spreading itself out impartially over the various mechanical devices thought out by the different firms and brought together under one roof by the enterprise and perseverance of the Stanley show promoters.

There are, comparatively, but few three-wheelers on exhibition, and even these few, beautifully constructed and finished as they are, receive but scant notice. There is no doubt about the matter that the bicycle is the machine for both men and women.

One of the many interesting features introduced was the display of many forms of dress considered suitable for cycling.

The extensive photographic collection in the gallery attracted attention. It is becoming more and more popular for the snap shot photographic apparatus to be numbered among the ordinary necessities of the cycling tourist's outfit, and the enlargements exhibited as the result of snap shot photography certainly suggest that the art is one that is to become of far more widespread interest than it is, even at the present stage of photographing enthusiasm. One of the great attractions of the Stanley has proved to be a machine shown by the makers of the Gladiator, boasting a $2\frac{1}{2}$ inch tread.

The relay ride from Washington to New York City was ended Monday morning, December 2, in New York, at 4:48 o'clock, when Lieutenant Libby and Private Pilkin delivered to Lieutenant Donovan, on Governor's Island, the message from General Miles, who started it from Washington, Sunday, at 7 o'clock in the morning.

The roads were execrable, the riders say, and it was often almost impossible to remain in the seat. Each rider carried ten rounds of ammunition and the regulation army pistol. The uniform consisted of a blouse, campaign hat, gauntlet, gloves and bloomers.

The race was suggested by General Miles, who is making severe tests of the bicycle in the hopes of having it generally adopted in the army. It would have been difficult to have selected a harder ride than was taken by these men, and the wheels, in each instance, stood up remarkably well.

Manufacture of Lead Pencils.

The Monde Economique, quoting from a work recently issued by Ernest Faber on the manufacture of lead pencils, published on the occasion of the business of Johann Faber, of Nuremberg, being turned into a limited company, says that there are twenty-six manufacturing of lead pencils in Bavaria, twenty-three of which are at Nuremberg. These employ 9,000 or 10,000 workmen, and turn out 4,400,000 lead pencils every week. In the above number of workmen are not included turners, boxmakers, etc. The factory of Johann Faber alone turns out 1,280,000 pencils per week. The protective customs duties of the United States prohibit the importation of cheap pencils, and this country itself turns out almost as many pencils as all the Bavarian factories put together. The best cedar wood of the States (*Cedrus virginiana*) will soon be exhausted, but at present, having the monopoly of internal production, a considerable amount is exported to India, Mexico, Japan, and Australia, at extraordinarily low prices. The duties in Italy (100 lire per 100 kilogrammes), in France (180 to 300 francs per 100 kilogrammes), and in Russia (35 copecks per pound) are also hindrances to importation. In France, it is stated that schools and government offices, and even railway companies, are forbidden to buy German pencils.

In the United States excellent lead pencils are now being made of paper, which is wound spirally upon the lead.

The Blacksmith.

In our description of this celebrated painting, in our last week's issue, we regret to note that the address of Mr. F. E. Galbraith, the owner of the painting, was omitted. The picture can now be seen at No. 19 West Twenty-fourth Street, New York, where we understand it is to remain for some time.

Hair Worms and Their Hosts.

BY HARRY MOORE.

At Betchworth, Surrey, just where the road crosses the River Mole, I picked up a specimen of *Pterotichus madidus*, Fab., from which, upon being placed in the cyanide bottle, a *Gordius aquaticus*, L., endeavored to escape. About three inches of it extrude, and, judging by its girth, an equal or greater length remains inside, yet the abdomen of the beetle is but nine millimeters in length.

Nearly every observer of the slightest experience has some acquaintance with hair worms, even if it is only a hazy recollection of the horse hair legend of his schooldays. Numerous notes are scattered through the early volumes of Science Gossip and a further one upon the variety of the hosts *Gordius* infests may not be unacceptable. The family *Nematoidæ*, to which the *Gordiaceæ* belong, contains many species of more than ordinary interest, first on account of their curious cycle of development, and then their value in the economy of nature, for not only are they in a measure beneficial in checking over-production in certain insects, but more or less dangerous when introduced into the human system. Their life history may be briefly described as follows: The eggs are laid in long strings; upon hatching, the young larvæ bores through the membrane, and for a short period lives a free aquatic life. It then becomes parasitic upon various fly larvæ, etc.; these hosts in their turn are devoured by other creatures, and the worms become incepted in their intestines, where they remain some months, finally making their way into the intestinal cavity and escaping per ano in due course.

It is rather singular, however, that, whereas hair worms are most commonly found infesting beetles in England, they prefer the orthoptera (grasshoppers and allied insects) in America. In both countries spiders have been noted as hosts, in America the human being, and an instance has come under my own notice where there was strong presumptive evidence the worm had been voided by a sparrow. Various writers cite fishes and frogs, and several mention caterpillars, but the parasites observed in lepidopterous larvæ probably belonged to the allied genus *Mermis*. In America, *Mermis acuminata*, Leidy, has been observed in the larvæ of the codlin moth (*Carpocapsa pomonella*, L.) and a similar parasite has been seen in larvæ by several of our London workers.

In enumerating the hosts of *Gordius aquaticus*, the common European hair worm, several difficulties arise, for whereas, as I have already mentioned, carnivorous beetles are chiefly infested this side of the Atlantic, the observers do not always seem to have determined their species. Several references of this sort will be found in Science Gossip (vol. i, page 198, vol. xii, page 71, vol. xv, page 281, etc.) If any of our present readers can furnish something more definite, we shall be able to get along with our list. I have come across no mention of coleoptera being infested in America, in any note to which I have access; but the following are some of the authenticated instances among the orthoptera:

G. aquaticus has been found in the cricket (*Gryllus neglectus*) and in *Acheta abbreviatus*, Serville—the short winged field cricket found in woods beneath logs and stones; *Gordius robustus*, Leidy, infests *Stenopelmata fasciata*. Thomas, one of the stone or camel crickets usually found beneath stones and along the margins of woodland streams and logs, and in damp woods (Blatchley), and *Orchelimum gracile*, a grasshopper confined to low moist meadows; *A. Gordius* (species ?), eight and a half inches long, has been taken from a pupa of *Xiphidium ensiferum*, Scudder, whose perfect body measures but half an inch in length. The life history of this orthopteron is of exceptional interest, the ova being deposited from several up to one hundred and seventy "in the turnip-shaped galls produced by a small fly belonging to the *Cecidomyidæ* on certain species of willow (*Salix cordata*, etc.)."

I have now but to mention *Caloptenus spretus*, Thomas, the Rocky Mountain locust, which is infested with *G. aquaticus*, Linn., and *G. varius*, Leidy, although repeated dissections by various American observers (Riley, Whitman, etc.) have shown that not more than a small percentage of the locusts are infested, yet when we consider the loss incurred annually in the United States from locusts alone is estimated at £8,000,000, anything which tends to mitigate the plague becomes of importance.

The question, How are we to account for the presence of these aquatic parasites inside terrestrial insects? upon consideration, is not of easy solution. Of course they are introduced with their food while in a minute immature state, but whether as ova or larvæ I think there is room for discussion. It will be noticed all the insects mentioned are associated with damp places that are more or less subjected to floods; but I don't think that sufficient reason for believing they have all fed upon the various aquatic fly larvæ in which the hair worm larvæ are said to pass their first period of larval life, though in the case of grasshoppers Packard thinks they swallow them as larvæ. I am inclined to

believe there are several points in the life history of these parasites yet to be cleared up; perhaps some of our microscopists can elucidate them.—Science Gossip.

Archæological Discoveries.

Another ancient Greek hymn set to music, recalling the discovery made in the latter part of 1893 (vol. iii, page 866, of Current History, published by Garretson Cox & Company, Buffalo, N. Y.), has been brought to light by the French excavations at Delphi. It is inscribed on two large slabs of stone, which have been unearthed in the building described by Pausanias as the "Treasury of the Athenians."

The find of 1893 included fourteen fragments of various sizes, four of which were distinguished from the others by a difference in the notation of the music. These four were introduced to the public last year as the "Hymn to Apollo" (vol. iv, page 251). The latter find includes another large fragment, to which the remaining ten of the first discovery can be adjusted, thus giving us a second hymn. The decipherment and transcription of the words and music have, as before, been intrusted to MM. Henri Weil and Theodore Reinach.

The purport of both the hymns is substantially the same. After an invocation of the Muses, the poet gives various legends of Apollo's life and works, ending with the slaughter of the Gauls at Delphi in 279 B. C.; and then implores the god's protection for Delphi and Athens and the government at Rome. The date is, therefore, after 146 B. C., when the Romans took possession of Greece. Apart from the music, the hymns are not particularly interesting.

The duration of the musical notes is indicated by the syllables that were sung with them. Thus, for example, where three notes are attached to a word of one long syllable followed by two short syllables, they answer roughly to a crochet followed by two quavers. The pitch of the notes is indicated by various letters of the alphabet. In the first hymn the letters were those that the Greeks prescribed for use with voices; but in this second hymn they are those that were prescribed for use with instruments. As the Delphians would not likely have written down the accompaniment and omitted the song itself, it is supposed that the instruments and voices were here in unison.

A discovery of importance for the history of early Christian literature is credited to Dr. Karl Schmidt, of Cairo, Egypt. In the library of the cloister of Ackmim—the same library in which the Gospel and the Apocalypse of Peter and Apocalypse of Elijah were found—Dr. Schmidt recently came across an old Coptic manuscript containing a record of conversations between Christ and his disciples. Both the beginning and the conclusion have been lost through mutilation of the manuscript.

The chief subject of conversation is the resurrection of Christ, which is reported in detail and in such a manner as to combine the narratives of the four gospels. The object of the writing is to warn the reader against unbelief, especially gnosticism. There is a long discussion of the resurrection of the body. The work shows itself to be an apocryphal missive of the apostles to the congregations, and reveals the congregational orthodoxy in the early church. Like the Apocalypse of Peter, it shows also that the church was not always able to resist the temptation of following the gnostic trend of thought. Its date, approximately, is 160 A. D.

The Pasteur Institute's Farm.

The New York Therapeutic Review says that a farm of about 200 acres of land, in the vicinity of Tuxedo Park, New York, one hour's ride from the city, has been purchased for use as an experimental station for the New York Pasteur Institute.

The farm, which is already provided with ten cows and the antitoxin horses and mules of the institute, will receive in addition many donkeys, goats, sheep, dogs, rabbits, guinea pigs, etc., for which especial barns are now being built, and also a laboratory for the preparation of the antitoxic serums, vaccine virus and other biological products.

Research will be conducted there upon infectious diseases of animals as well as of man.

The extensive character of the work done at the institute rendered indispensable the establishment of this experimental station.

Synthetic Formation of a New Ketonic Acid.

The compound in question has been obtained by the action of camphoric anhydride upon benzene in presence of aluminum chloride. Its composition is $C_{15}H_{20}O_2$. It forms white crystals of a nacreous luster which melt at $135-137^\circ$ and boil at 320° at a pressure of 760 mm. They are almost insoluble in water, sparingly insoluble in ligroine, but readily soluble in acetic acid, alcohol, ether, benzene, chloroform, and carbon disulphide. The author has formed and examined its ammonium, barium, silver, copper, cobalt, nickel, zinc, and lead salts. He has also obtained its ethylic and methylic ethers, its anhydride, amide, and hydrazide.—E. Burker.