

BOWERS v. SAN FRANCISCO BRIDGE CO.

(Circuit Court, N. D. California. December 12, 1898.)

No. 11,779.

1. PATENTS—BURDEN OF PROOF AS TO ANTICIPATION—MEASURE OF PROOF REQUIRED.

The burden of proving anticipation or want of originality in a patent rests upon the party alleging it, and the evidence must be so clear and convincing as to place the matter beyond reasonable doubt, particularly where the patent in suit has been held valid in a former contested case.

2. SAME—ANTICIPATION—PRIOR PATENT.

The sufficiency of the description in a prior patent, alleged to be anticipatory, must be tested by the knowledge of persons skilled in the art as it existed at the date of such patent.

3. SAME.

An impracticable prior device, not capable of performing the function of a subsequent patented device that is practicable and useful, is not an anticipation.

4. SAME—DREDGING APPARATUS.

The Bowers inventions, relating to apparatus for hydraulic dredging, embodied in patents Nos. 318,859, 318,860, 372,956, and others, were not anticipated by the English patent of Schwartzkopff, No. 350 of 1856, which, while disclosing in a general way the idea of a dredging machine intended to operate as the Bowers machine does, did not describe a machine which was effective to carry such idea to a successful result, or which was ever used.

5. SAME—CONSTRUCTION OF CLAIMS—PIONEER INVENTIONS.

The Bowers patents cover inventions which are of a pioneer character, and stand at the head of the art of hydraulic dredging, and their claims are entitled to a broad construction.

Bill in equity for infringement of letters patent Nos. 318,859, 318,860, 364,158, 364,571, 372,956, and 484,763. Decree for complainant.

John H. Miller, for complainant.

D. M. Delmas (R. Percy Wright, of counsel), for respondent.

MORROW, Circuit Judge. The original bill herein was filed March 21, 1893, by the complainant, Alphonzo B. Bowers, against the defendant, the San Francisco Bridge Company, for the infringement of letters patent of the United States No. 318,859, dated May 26, 1885, for a "dredging machine"; No. 318,860, dated May 26, 1885, for the "art of dredging"; No. 364,158, dated May 31, 1887, for "dredging apparatus"; No. 364,571, dated June 7, 1887, for "dredging apparatus"; No. 372,956, dated November 8, 1887, for an "excavator"; and No. 484,763, dated October 18, 1892, for an "apparatus for dredging and transporting spoil."

By his amended bill, filed September 15, 1893, the complainant alleges that, prior to December 9, 1876, he was the first and original inventor of certain new and useful inventions in dredging machines, machinery, and appliances, hereinafter more particularly described; that the same were new and useful inventions, not known or used by others in this country, nor patented or described in any printed publication in this or any foreign country, prior to the invention and discovery there-

of by the complainant; that they, at the time of his original application for a patent, had not been in public use or on sale in this country for two years, nor abandoned or proved to be abandoned; that, being such inventor, the complainant did, on December 9, 1876, duly and regularly make and file in the patent office of the United States an application for the issuance to him of letters patent for his said inventions, and that such proceedings were had in the matter of his application that, on April 18, 1877, his application was allowed, and a patent for his said inventions ordered to be granted and issued to him upon the payment of the final fee to the government of \$20 within six months from the date of said allowance; that the complainant failed to pay the fee within the time stated, by reason of which his application lapsed; that thereafter, on April 16, 1879, under and pursuant to the laws of the United States and the rules of the patent office in that behalf made and provided, the complainant renewed his application in the patent office for a patent for his said inventions, and filed a renewed application therefor, using the original specifications, drawings, and models which had been made and filed December 9, 1876, and which were then on file in the patent office; that both in his original application, as also in his renewed application of April 16, 1879, more than one, to wit, several independent inventions were described and claimed, which, upon examination by the proper examiners of the patent office, were found not to be dependent upon one another, and did not mutually contribute to a single result, by reason of which a single patent could not be issued to cover them; that thereafter, and before the issuance of any patent therefor, and in accordance with the requirements of the patent office, and under and in accordance with the laws of the United States, the complainant did divide his original application, and filed divisional applications for his said several inventions; that one of the inventions described and claimed in his original application of December 9, 1876, and in his renewed application of April 16, 1879, was entitled "Dredging Machine"; that, while his original application was pending, the complainant prepared and filed in the patent office a separate divisional application, describing and claiming his improvements in dredging machines; that nothing was included in his divisional application which had not been shown and described in his original application of December 9, 1876, and renewed April 16, 1879; that thereafter such proceedings were duly and regularly had and taken in the matter of his application that on May 26, 1885, letters patent of the United States No. 318,859 were duly and regularly granted and delivered to the complainant for his said invention, granting and securing to him, his heirs and assigns, for the term of 17 years from that date, the exclusive right and privilege of making, using, and vending the invention therein described throughout the United States and its territories; that one of the complainant's inventions, shown and described in his original application of December 9, 1876, and renewed April 16, 1879, was a certain new and useful invention entitled "Art of Dredging"; that, while his original application was pending, the complainant filed in the patent office a divisional application for the issuance of letters patent for said hydraulic dredging apparatus; that nothing was included in his last-

mentioned divisional application which had not been shown or described in his original application of December 9, 1876, and renewal of April 16, 1879; that such proceedings were duly and regularly had and taken in the matter of his divisional application for a patent that on May 26, 1885, letters patent No. 318,860 were regularly granted and delivered to the complainant for his said invention, granting and securing to him, his heirs and assigns, for the term of 17 years from that date, the exclusive right and privilege of making, using, and vending the invention therein described throughout the United States and the territories; that said last-named letters patent were designated by the commissioner of patents as the second division of the original application, filed and renewed as aforesaid; that while said original application, filed December 9, 1876, and renewed April 16, 1879, was pending, and prior to the issuance of any letters patent thereon, to wit, on April 29, 1885, complainant filed in the patent office a separate or divisional application comprising all the remainder of his inventions, shown, indicated, or described in his original and renewal applications, which were not included in the two prior divisional specifications upon which letters patent No. 318,859 and No. 318,860 were subsequently issued; that nothing was shown, indicated, or claimed therein which had not been shown, indicated, or described in said original application; that, upon an examination of said third divisional application by the proper officials of the said patent office, it was discovered that in this application, also, more than one, to wit, several independent inventions were shown, indicated, or described, which did not mutually contribute to a single result, by reason of which a single patent could not be issued to cover them; that thereafter, and before the issuance of any patent therefor, and in accordance with the requirements of the patent office, and under and in accordance with the laws of the United States, the complainant did divide said third divisional application into eight separate divisions, and filed divisional applications for his said several inventions; that one of the inventions described and claimed in said third divisional application was entitled "Dredging Apparatus"; that while said third divisional application was pending, to wit, on February 26, 1887, the complainant filed in said patent office a separate or divisional application, praying for the issuance to him of letters patent for said "dredging apparatus"; that nothing was included in said last-named divisional application which had not been shown and described in his third divisional application filed April 29, 1885, and in said original application of December 9, 1876, and renewed April 16, 1879; that thereafter such proceedings were duly and regularly had and taken in the matter of said divisional application for a patent on said "dredging apparatus" that on May 31, 1887, letters patent of the United States No. 364,158 were duly and regularly granted and delivered to the complainant for his said invention, granting and securing to him, his heirs and assigns, for the term of 17 years from that date, the exclusive right and privilege of making, using, and vending the invention therein described throughout the United States and its territories; that, while said third divisional application was pending, the complainant filed another separate divisional application, on March 10, 1887, praying for the issuance to him of letters patent for an inven-

tion entitled "Dredging Apparatus"; that nothing was included in said last-named divisional application which had not been shown, indicated, or described in said third divisional application, filed April 29, 1885, and in his original and renewal applications; that thereafter such proceedings were duly and regularly had and taken in the matter of said divisional application for a patent on said "dredging apparatus" that on June 7, 1887, letters patent of the United States No. 364,571 were duly and regularly granted and delivered to the complainant for his said invention, granting and securing to him, his heirs and assigns, for the term of 17 years from that date, the exclusive right and privilege of making, using, and vending the invention therein described throughout the United States and its territories; that said last-named letters patent were designated by the commissioner of patents, and are known, as the fourth division of the said third division, or the seventh division of the original application; that, while said third divisional application was pending, the complainant filed another separate divisional application, on July 16, 1887, praying for the issuance to him of letters patent for an invention entitled "Excavator"; that nothing was included in said last-named divisional application which had not been shown, indicated, or described in said third divisional application, filed April 29, 1885, and in his original and renewal applications; that thereafter such proceedings were duly and regularly had and taken in the matter of said divisional application for a patent on said "excavator" that, on November 8, 1887, letters patent of the United States No. 372,956 were duly and regularly granted and delivered to the complainant for his said invention, granting and securing to him, his heirs and assigns, for the full term of 17 years from that date, the exclusive right and privilege of making, using, and vending the invention therein described throughout the United States and its territories; that said last-named letters patent were designated by the commissioner of patents, and are known, as the sixth division of the aforesaid third division, and as the ninth division of the original and renewal applications.

It is further alleged that the complainant, prior to June 30, 1883, was the original and first inventor of certain other new and useful inventions, not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country, prior to the invention and discovery thereof by your orator, and at the time of his application for a patent therefor had not been in public use or on sale in this country for two years, nor abandoned, nor proved to have been abandoned; that, being such inventor, the complainant did, on June 30, 1883, duly and regularly make and file in the patent office of the United States an application for the issuance to him of letters patent for his said inventions; that in said application more than one, to wit, several independent inventions were shown, indicated, described, and claimed, which, upon an examination by the proper examiners of the patent office, were also found not to be dependent one upon the other, and did not mutually contribute to produce a single result, by reason of which a single patent could not be issued to cover them all; that, while said third division of the original application of December 9, 1876, renewed April 16, 1879, and said application of June 30, 1883,

were pending, the complainant carved out of said third division and said last-named application a divisional application, and on January 5, 1886, did duly and regularly make and file in the patent office this divisional application; that some of the features of the invention shown, indicated, and described in said last-named divisional application were shown, indicated, and described in the original application of December 9, 1876, renewed April 16, 1879, and said third division thereof, and the others were shown, indicated, and described in said application of June 30, 1883, by reason whereof it became necessary and proper that the same should be jointly embodied in one application and patent, and for that reason the complainant made and filed said divisional application on January 5, 1886; that nothing was included or claimed in said divisional application of January 5, 1886, which had not been shown, included, or claimed in said original application of December 9, 1876, renewed April 16, 1879, and said third division thereof, and in said application of June 30, 1883; that the invention covered by said divisional application of January 5, 1886, was entitled "Apparatus for Dredging and Transporting Spoil," the same being the first division of the aforesaid third division, or a fourth division of the original application of December 9, 1876, renewed April 16, 1879, and a first division of the application of June 30, 1883; that thereafter such proceedings were duly and regularly had and taken in the matter of his application that, on October 18, 1892, letters patent of the United States No. 484,763 were duly and regularly granted and delivered to the complainant for his said invention, granting and securing to him, his heirs and assigns, for the term of 17 years from that date, the exclusive right and privilege of making, using, and vending the invention therein described throughout the United States and its territories. It is further alleged that the several inventions claimed and patented, and sued on, are adapted to be used, and can be used, in a single dredging machine, at one and the same time, and are capable of conjoint use in one machine, and have been so used; that ever since the issuance of said letters patent the complainant has been, and now is, the owner and holder thereof, except that heretofore he has sold and assigned to certain other persons certain rights under said patents for the state of Washington, and the Columbia river and its tributaries, and has licensed divers and sundry other persons to use said inventions in various portions of the United States; that the defendant has been and is infringing each of the inventions and patents sued upon.

By the answer to the amended bill, filed November 15, 1893, the defenses of want of patentable novelty and of no infringement were set up, and, to illustrate the prior art and sustain the defense of want of patentable novelty, certain letters patent and publications were set forth. With reference to letters patent No. 318,859 the following publications were introduced in evidence, to sustain the defense of want of novelty and anticipation: The Scientific American newspaper, of date January 10, 1852, at page 1 of No. 17 thereof, published in the city of New York, and containing a description of an improved excavator invented by Antony Frazier, of Montezuma, Cayuga county, state of New York; the Mining and Scientific Press newspaper, of date December 13, 1873, published in the city of San Francisco, state of Cali-

fornia, and containing a description of "Ball's sweeping dredger," invented by John A. Ball, of Oakland, Cal.; the Scientific American newspaper, of date May 19, 1860, at page 238 of No. 21, Vol. 2, new series, containing a description of Barcroft's improved dredging machine; "Engineering," a newspaper published in London, England, of date January 1, 1869, on pages 2 and 4 of Vol. 7, containing description and drawings of hydraulic dredging machine by Gwynne & Co. For a further defense, the answer sets out that, for more than two years prior to the alleged invention by the complainant of the invention purporting to be patented by said patent No. 318,859, said alleged inventions were known to and used by Williams & Bixler at Union Island, in San Joaquin county, state of California, and at Oakland Harbor, in the county of Alameda, in said state; also by Alexey W. Von Schmidt, in Mission Bay, in the city and county of San Francisco, at Union Island in San Joaquin county, and in Oakland Harbor, Alameda county, all in said state; also by the Broadway & Pacific Dredging Company at Broadway and Pacific wharves, on the water front in said city and county of San Francisco, and at other portions of the water front of said city and county; also by John Ball, at Broadway and Pacific wharves, in said city and county of San Francisco, and at other places along the water front of said city and county, and at Oakland Harbor, Alameda county, all in said state; also by Livingston & Co., near the Erie Railroad Company's wharves, in the harbor of New York, state of New York; also by the Spanish government, at Havana, in the island of Cuba. It is further averred that none of the inventions purporting to be patented in and by said letters patent No. 318,859 were new or useful at the time of the alleged invention of them by the complainant; that complainant actually abandoned all of the inventions purporting to be patented by said letters patent No. 318,859 before he made any application for a patent therefor; that the complainant did not make application for a patent for any of the inventions purporting to be patented in and by said letters patent No. 318,859 until more than two years after said alleged inventions were in public use; that the inventions purporting to be patented in and by said letters patent No. 318,859 are, and each of them is, substantially different from any indicated, suggested, or described in said application of December 9, 1876, or in any other application therefor; that all of the inventions purporting to be patented in and by said letters patent No. 318,859 are distinct and substantially different from any of the inventions for which a patent was ordered to be granted and issued to the complainant on April 18, 1877; that none of the inventions purporting to be patented in and by said letters patent No. 318,859 were at any time the statutory subject of a patent. The answer further alleged the pendency of another action between the same parties and for the same cause of action in this court. The answer further alleged, with respect to letters patent Nos. 318,860, 364,158, 372,956, and 484,763, that substantially the same inventions, devices, mechanisms, and combinations were shown, indicated, described, and patented in certain letters patent, which were set out therein, long prior to the invention thereof by the complainant, and in support of that defense the following letters patent were introduced in evidence, viz.:

United States Letters Patent.

Number.	Date.	To Whom Issued.	For What Issued.
(None)	April 28, 1836.	Silvanus Russell.	Improvement in machine for excavating and raising mud and stones from the bottoms of rivers, docks, etc.
24,750	July 12, 1859.	Anton Menge.	Improvement in dredging machines.
27,419	March 13, 1860.	J. Barcroft.	Improvement in ditching machines.
38,544	May 19, 1863.	William Atkinson.	Improvement in sewage apparatus.
39,194	July 7, 1863.	Charles Atkinson and William Atkinson, executors of W. Atkinson.	Improved dredging and excavating machine.
75,003	March 3, 1868.	Alfred Duvall.	Excavating under water.
75,004	March 3, 1868.	Alfred Duvall.	Excavating under water.
86,290	Jan. 26, 1869.	Alfred Duvall.	Submarine excavator.
185,600	Dec. 19, 1876.	Alexey W. Von Schmidt.	Dredging machine.
341,539	May 11, 1886.	Horace B. Angell.	Dredger.

British Letters Patent.

Number.	Date.	To Whom Issued.	For What Issued.
169	Feb. 20, 1673.	Lewis Bailey.	A new engine for cleaning and digging rivers, harbors, and havens any depth.
8,848	Feb. 16, 1841.	William Scamp.	Application of machinery to steam vessels for removal of sand and mud.
350	Feb. 9, 1856.	Louis Schwartzkopff.	Apparatus for raising mud and soil from the bottoms of rivers, etc.
907	April 24, 1858.	Rudolph Bodmer.	Apparatus for removing sand from rivers, docks, etc.
2,603	Oct. 21, 1864.	J. E. A. Gwynn.	Improvement of machinery applicable to centrifugal pumps, etc.
286	May 29, 1866.	James Robertson.	Machinery for excavating, dredging, etc.
702	March 12, 1867.	Thomas Burt.	Removing mud and sewage.
2,429	Aug. 1, 1868.	Henry O. Robinson.	Dredging machine.
2,438	Sept. 9, 1870.	Thomas Burt.	Floating dredgers.

French Letters Patent.

Number.	Date.	To Whom Issued.	For What Issued.
3,773 96,456	Oct. 15, 1832. Sept. 5, 1872.	John Byrne Madden. Xavier Buquoy.	Dredging machine, etc. Apparatus for dredging, cleaning, etc.

The following letters patent, not in the answer, were introduced in evidence. They are:

United States Letters Patent.

Number.	Date.	To Whom Issued.	For What Issued.
(None) 1,727	Nov. 18, 1830. Aug. 25, 1840.	Elisha H. Holmes. William Easby.	Improvement in dredger. Improvement in dredging machines.
4,547	May 30, 1846.	Daniel Carmichael and Jason C. Osgood.	Improvement in dredging machines.
355,251	Dec. 28, 1886.	A. B. Bowers.	Improvements in hydraulic dredging apparatus.
364,158	May 31, 1887.	A. B. Bowers.	Device for dredging.
364,571	June 7, 1887.	A. B. Bowers.	Improvements in hydraulic dredging apparatus.
388,252	Aug. 21, 1888.	A. B. Bowers.	Improvements in hydraulic dredging apparatus.
388,253	Aug. 21, 1888.	A. B. Bowers.	Improvements in hydraulic dredging apparatus.
411,183	Sept. 17, 1889.	A. B. Bowers.	Improvements in dredging apparatus.
484,763	Oct. 18, 1892.	A. B. Bowers.	Improvements in apparatus for dredging and transporting spoil.

British Letters Patent.

Number.	Date.	To Whom Issued.	For What Issued.
8,017	Sept. 27, 1839.	William Newton.	Machinery for cutting and removing earth.
1,402	Dec. 7, 1853.	Frederick Ludewig, Hahn Danchell, and William Startin.	An improved mode of ob- taining auriferous de- posits from the beds of rivers and lakes, and from pits containing water.

The specifications and drawings of complainant's letters patent No. 318,859, dated May 26, 1885, for a "dredging machine," are as follows:

"To All Whom It may Concern:

"Be it known that I, Alphonzo B. Bowers, of San Francisco, California, engineer, have invented a novel construction for dredging and transporting spoils, of which this, with the accompanying drawings, is a specification:

"It consists of a rotary, bottomless-bucket excavator wheel of moderate size, novel construction, and great capacity, combined with an hydraulic transporting device of equal capacity, by means of which the spoils may be cheaply carried to a distance of several miles, over land or water, and across navigable channels without interruption of navigation, together with novel feeding devices, through which the percentages of earth excavated by the cutting wheel and of the water therewith delivered are adjustable to the precise amount of each necessary for the most economical working, and by means of which clean work is done, the excavator going twice over no ground and missing no ground, thus saving much time, and effecting a material reduction in the cost of apparatus, repairs, and cost of dredging and of disposing of the spoils, these being the chief objects of the invention.

"Fig. 1 is a plan of a portion of my dredging apparatus. Fig. 2 is a vertical

'fore and aft' section of a portion of the hull, through the well in which rotates the turntable, with a side view of the turntable, vertical anchors, and hoisting apparatus. Fig. 3 is a vertical cross section of a portion of the hull, through the counterbalance cylinder and longitudinal well, showing also an end view of the bucket wheel and the arrangement of the counterbalance and hoisting apparatus. Fig. 4 is a view of the inner chamber or shield, around which the bucket wheel usually revolves. Fig. 5 is a longitudinal section, through the discal ends of the bucket wheel, in the line s, s (Fig. 8), showing, also, where the shaft, R, is secured to the hub of the cutting wheel, and the outlines of two of the buckets, k, k, connecting the discal ends, b, b. Between these buckets is shown a longitudinal section of the inner chamber, T, and shaft, R, and bearing of this shaft, R'. Fig. 6 is a side view of the bucket-wheel excavator. Fig. 7 is a cross section of the bucket wheel, inner chamber, and driving shaft, through the line t, t (Fig. 6). Fig. 8 is a view of the outer discal end of the bucket wheel, showing the detachable ring knife, d, and cutting lips, c. Fig. 9 is a reduced side view of the dredge boat, A, vertical anchors, G, G², flexible connection, D, floating and oscillating discharge pipe, C', supported by hollow floats, P, flexible connection, D', between the oscillating and nonoscillating sections of the discharge pipe, mud receiver, X (the details of which are shown in Figs. 13 and 14), suspended discharge pipe, 3, with its buoys, 4, 4, submerged discharge pipe, 5, resting upon the bottom, over which a vessel is represented as passing, and guys, 6, 6, for holding the discharge pipe in proper position. Fig. 10 is a plan of the dredging and transporting apparatus, showing, also, a vessel passing over the discharge pipe, and the cut made by the dredger as it swings from side to side. Fig. 11 is an enlarged cross section of the discharge pipe, C', and hollow floats, P. Fig. 12 is a view of the under part of a section of the discharge pipe, showing numerous openings therein for the escape of the heavier and coarser material, while the water and lighter material are propelled onward to a further point of discharge. Fig. 13 is an enlarged side and part sectional view of the mud receiver, with its pipes, valves, and relay pump, showing how the charging and discharging of a large receiver may be facilitated by the duplication of the branches and valves, Y, Z. Fig. 14 is an enlarged cross section of the mud receiver, X. In all these figures, like letters indicate like parts.

"A is a floating vessel, that carries the engines, boilers, and dredging machinery. It is shown in this instance with an elongated longitudinal well for the reception of the swinging portion of the suction pipe.

"B is a large pump, that draws the spoils from the buckets of the excavator, up the suction pipe, and forces them through the discharge pipe to a place of deposit. B' (Figs. 9 and 13) is a relay pump, or other auxiliary discharging apparatus, sometimes used, in connection with a primary transporting apparatus, to carry the spoils to a greater distance than could conveniently be done by the original agent, power, or pump, or than would be practicable without subjecting the apparatus to a pressure that might endanger some of the parts, or without the use of heavier or more expensive apparatus than would be desirable for ordinary purposes. It may also be used for discharging the receiver, X, and for exhausting water from pipe, C' (when said pipe is submerged), for the purpose of raising it preparatory to floating it into a new position. As many of these pumps may be used as are necessary to transport the spoil to the required distance.

"C is a suction pipe, connecting the excavator with the pump, B. The swinging portion of this pipe is mounted at the inner end of the well upon strong trunnions, one of which forms an elbow of the pipe and passes through a stuffing box, or other suitable connection, into the suction pipe of the pump, B. Through the other trunnion passes a shaft that actuates the gears, i, that drive the shaft, R, and bucket wheel, E; and upon these trunnions the shaft, R, suction pipe, and excavator swing as the cutter is raised or lowered to suit the depth at which the work is progressing. C' is a discharge pipe. It is provided with a strong flexible section, D, or other suitable joint or mounting, at or near the turntable, F, and other pivot or center of oscillation of the dredging machine or excavating apparatus, and is constructed and arranged to permit said apparatus or machine to swing horizontally upon said pivot or pivots, without materially changing the position of said discharge pipe be-

yond said mounting, flexible connection, pivot, or pivots. When this pipe is several hundred feet in length, I usually support the inner portion by long, narrow, hollow floats, in which case it consists of two parts,—an inner oscillating or swinging section (generally composed of several short sections flexibly joined together and to the dredge boat), and an outer stationary or nonoscillating section, flexibly joined to said inner section. This permits the boat to feed forward, and the oscillating section to swing with the advancing boat (as the work progresses), on the joint connecting the oscillating and nonoscillating sections. The discharge pipe is provided with a pressure gauge, 7, Fig. 1, to give notice of overpressure and danger of choking of pipe from any sudden change in character of spoil. When pipe, C', is above deck, and extends but a short distance from the mounting, D, for discharging alongside, it requires supporting, and is usually suspended from a mast, the claim for which is reserved for another application, now on file. C'' is a pipe passing through the receiver, X, to the exhausting apparatus of said receiver. When used in connection with the pipe, C', it may be regarded as the prolongation of said pipe. C² is an auxiliary discharge pipe, used in connection with any suitable auxiliary transporting apparatus, and extends from said auxiliary to another auxiliary transporting agent or apparatus, or to the place of deposit. C³ (Fig. 10) is a discharge pipe, extending from a second relay discharging apparatus to a place of deposit. When a floating discharge pipe would impede navigation, the greater portion may lie upon the bottom, 4 (Fig. 9); and, when the water is too deep for this, it may be suspended from the buoys, 5, 5 (Fig. 9), and guys and anchors, 6, may, if necessary, be used to prevent it from being disturbed by winds, waves, or currents. When the pipe is to be submerged, it may be advisable to construct it of thin metallic plates, uniting the several sections with ball and socket or other strong flexible connections. In other cases it may be made of wood or metal, according to the preferences of the user.

"E is a rotary bucket-wheel excavator, having radiating bottomless buckets, k (Figs. 4, 5, 6, and 7), firmly secured at each end to the discal ends, b, b, of said excavator. These buckets may be stiffened, strengthened, and protected by rings or screens, d, passing around, secured to, and preferably projecting beyond the edges of said buckets (Figs. 1, 5, 6, 7, and 8). These rings may be sharp, to cut, like the revolving disk colters of plows, and serve to subdivide the material entering the buckets, and to exclude substances too hard to be cut and too coarse to pass through the pipe and pump. They serve also as fenders, to enable the cutter to ride over obstructions without catching and breaking. The edges of the bucket are sharp, and may be provided with detachable steel knives or cutters, S (Fig. 6), for working in hard material. The outer discal end (Figs. 1, 3, 6, and 8) may be provided with cutting edges, lips, or scoops, c, to obviate the danger of breakage from jamming against a hard bank as the dredger heaves in the swell of the sea. In making the necessary openings in the discal end to admit the silt from said scoops, said end plate becomes changed to the form of a spider, or series of arms, which may be strengthened by the lower ring, d, which, in turn, may be regarded as forming a series of braces, extending between the said arms at or near their outer parts. The several parts of this excavator may be made separate and detachable, or it may be cast in a single piece. I do not confine myself to the precise mode described of mounting this wheel, or of freeing it of its contents. It may be of any desired size and proportion of parts, and may discharge its contents inward through itself into any suitable conduit or receiver. The rings, d, may be omitted in soft mud, free from substances too coarse to pass through the pipes and pump, though always at the risk of the projecting buckets catching upon obstructions and getting broken.

"F (Figs. 1, 2, and 10) is a small cylindrical turntable, rotating in a circular well or frame. It is provided with a strong flange or other suitable bearing, and is rotated in any convenient manner. Two or more vertical apertures, e, e, pass through the turntable from top to bottom on opposite sides, as shown.

"G, G², are vertical anchors, passing loosely through the apertures, e, e, in the turntable, into the mud below. They are raised by blocks and tackle attached to the mast, f, or in any other usual manner.

"H is a counterbalance cylinder, connected with the suction pipe, excavator, and hoisting apparatus, to obviate the danger of breakage from pounding upon the bottom in a heavy swell. It is provided with a piston, piston rod, and gland, like a steam engine. Steam or compressed air is admitted to the upper side of the piston, the area of which is sufficient, very nearly, to balance under the given pressure the weight of the suction pipe and excavator. To the upper end of the piston is attached the hawser, L, passing over suitable sheaves in the frame, K, thence through the block, g (Fig. 3), whence it passes over other sheaves in said frame to the windlass, J, by which means the excavator can be raised or lowered by said windlass without interrupting the action of the counterbalance. When the dredger rises on a swell, the excavator rises also, and as the dredger sinks in the trough of the sea the excavator falls upon the bottom, not with the full weight of the excavator and suction pipe, but with the unbalanced weight only, striking so lightly as not to endanger the safety of the wheel. This device is necessary only when dredging a hard bottom in a heavy swell. When not required for this purpose, the cylinder, H, may be utilized as a steam or hydraulic hoist, or be dispensed with altogether.

"I is a variable winding device, of which there are many suitable forms. I prefer ordinary winding drums, driven by a separate engine, though for simplicity of illustration I have shown tapering drums, h, h, loosely mounted on a shaft, and driven (through V-shaped friction couplings and suitable connections) by the main engine. The disengaged drum gives out one warping line as the engaged drum takes in the other. The office of this device is to vary the speed of the side feed, for the purpose of regulating the percentages of earth and water delivered to the pump, without affecting the speed of other parts of the machinery. This speed, with the device shown, is dependent upon the diameter upon which the warping lines wind, and is varied by shifting the sliding guide sheaves, j, j, towards or from the larger ends of the drums by means of the hand wheels and screws, as shown.

"J is a windlass for raising and lowering the excavator.

"K is a frame from which the suction pipe and excavator are suspended.

"L is a line or chain for raising, lowering, and counterbalancing the excavator.

"M, M, are warping lines, passing from the hold to the winding drums, h, h, around which they make a sufficient number of turns to prevent slipping, whence they pass around suitable guide sheaves, to and through the anchored blocks, U, U, to the outer end of the suction pipe, to which they are secured, so that the working side strain falls mostly upon the outer end of the suction pipe (or of the ladder supporting said suction pipe, if such be used), and but lightly upon the joints or trunnions supporting the inner ends of said pipe or ladder. As the outer ends of these lines wind upon the drums in the device shown, the inner ends unwind and descend to the hold. The office of these lines is to swing the excavating apparatus or the dredger from side to side in the process of dredging, and firmly to anchor the excavator end of the dredger when it is not at work, which latter is accomplished by simply engaging both drums, h, h, in their friction couplings.

"N is a force and suction pump. It is used to exhaust the water from the discharge pipe, for the purpose of raising the submerged portion, to dilute the spoils, so that they will spread over a large area of land, or to enable them to be transported through long pipes without the aid of a relay pump, to clear the pipes when accidentally choked, should this ever occur, and to prime the pump, B, the latter or its suction pipe being provided with the usual valve or valves for that purpose. Like most steam pumps, it is provided with two suction orifices, on opposite sides of the water chamber, and a discharge directly over each suction. To the suction and discharge on one side is connected the branch pipe, O, leading into the pipe, C'. Each branch is provided with valves, in the usual manner of arranging a branch pipe to serve for suction and discharge. The discharge branch only is shown, the suction being directly under it. To the suction on the other side of the water chamber is secured a valve and pipe, communicating with any suitable supply of water (usually that in which the dredger floats), and sometimes, by a branch pipe and valve, with the hold of the vessel, for discharging leakage, and, by another branch

and valve, with pump, B, for priming said pump by suction. To the discharge above this suction is connected a pipe, or hose, that may also be used for priming the pump, B, by discharging into it, and for all the various purposes of an ordinary ship pump. When O is used as a suction pipe, to draw from pipe C', the valve on the discharge branch is closed, the suction-branch valve is opened, and the discharge is through the pipe or hose on the opposite side. When O is used as a discharge pipe, to force into pipe C', the suction-branch valve is closed, the discharge-branch valve is opened, and the suction is through the opposite suction pipe. When the suction is through the pipe opposite the suction branch of pipe O, the discharge may be through the pipe or hose above it, or through the discharge branch of O into pipe C', as regulated by the valves to suit the purposes of the user.

"O is a pipe, with branches and valves, connecting both suction and discharge on one side of the pump, N, with pipe C', and is either a suction or discharge pipe, as regulated by its valves.

"P, P, are long, narrow, hollow floats, preferably extending longitudinally along each side of the short sections of the discharge pipe, for supporting them on the water. They may be made of wood or metal, and be secured together and to the discharge pipe by pieces of scantling passing crosswise over and under the pipe and floats, and fastened with rods passing each side of the pipe and floats, as shown in Fig. 11, though I do not confine myself to this form of construction.

"Q is a pulley or gear for actuating the gears, I, and excavator, E. It may be connected with its shaft by a friction coupling.

"R is the driving shaft of the bucket wheel. It is keyed, or otherwise secured, to the hub of the wheel, whence it passes, through suitable bearings in the inner chamber, up the suction pipe, and through a stuffing box to the gears, I, by which it is actuated.

"S is a strong, detachable steel knife, sometimes used on the edges of the buckets when working in hard material. It may be serrated, chisel-toothed, or straight-edged, according to the character of the materials to be cut, a straight edge being preferable for ordinary work.

"T is an inner chamber or shield, around which the bucket wheel revolves, and into which it discharges. This chamber is provided with a strong flange, by which it is secured to a similar flange on the end of the suction pipe. It is also provided with a large opening, a (Figs. 4 and 7), through which the spoils enter from the buckets, and through this opening (Fig. 4) is seen a portion of the driving shaft, R, and the bearing of said shaft in the end of said chamber. This chamber or shield forms a bottom for the buckets, k, until they reach the opening, a, as shown in the cross section of the wheel and chamber (Fig. 7). As the buckets pass this opening, they discharge mud and water into the chamber, as indicated by the inner arrows, the outer arrow showing the direction of rotation. The office, in part, of this chamber or shield, is to prevent too large a percentage of water from entering with the mud; but when the spoils are of a character to require a large percentage of water to carry them up the suction pipe, or to send them through the discharge pipe, as may sometimes be the case, the chamber may be cut away until only enough remains to support the excavator and shaft, R.

"U, U, are blocks anchored at suitable points on each side of the dredger, through which pass the warping lines, M, M, for the purpose of swinging the dredger or the excavating apparatus from side to side. They are usually placed from 300 to 600 feet apart, and a little in advance of the ends of the first cuts made by the excavator, to allow a wide swing and avoid the necessity for too frequent change of place as the work progresses.

"V is a branch pipe and valve, through which samples of the spoils are drawn from the discharge pipe, to enable the operator properly to regulate the speed of the side feed. It is preferably placed about one-third the diameter of the discharge pipe from the lower side of said pipe, in order to secure a fair average sample.

"W is a small tank, resting upon scales. It is provided with a discharge pipe and valve. It is filled with spoils drawn from the discharge pipe through the branch and valve, V, and the speed of the side feed is increased or diminished according to the weight of the spoils.

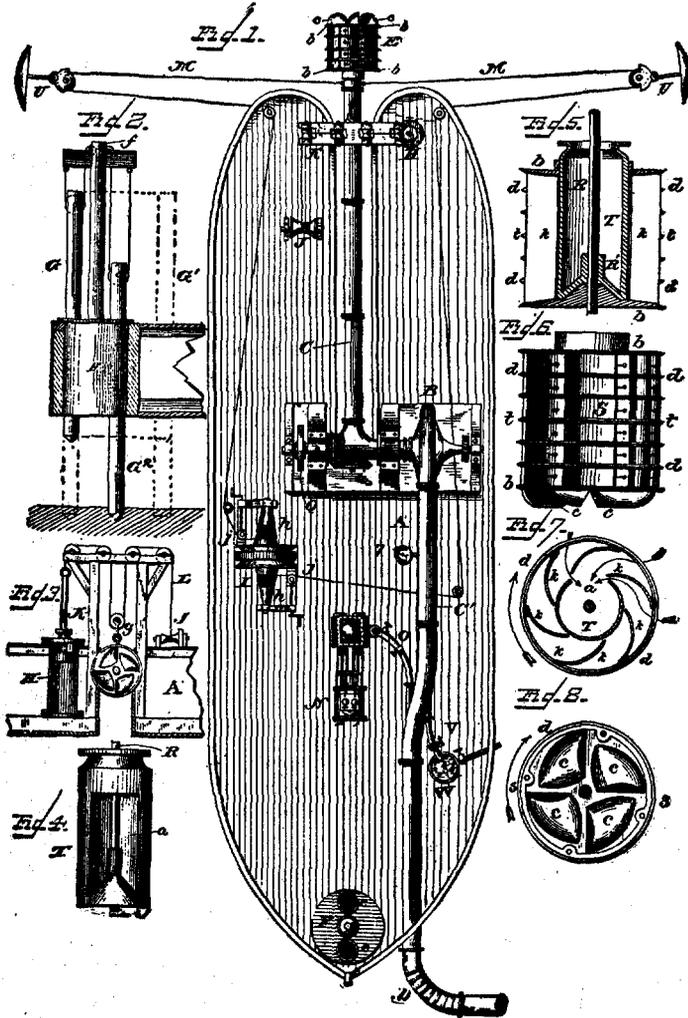
"X is a floating mud receiver, carrying the relay pump or other auxiliary discharging apparatus, B', and its actuating apparatus. The main purpose of this receiver is to permit the excavator to run continuously, although the relay pump be stopped for a little while, the receiver affording a receptacle for the spoils in the meantime. Longitudinally through this receiver passes the pipe, C", to the auxiliary discharging apparatus, B', whence the pipe, C², extends to another auxiliary discharging apparatus or to the place of deposit.

"Y is a valve on the pipe, C", within the receiver, X. This valve is adjusted to open automatically outward with slight pressure, and serves as a relief valve in case of stoppage of the pump, B', while the pump, B, is running. It serves, also, as a guide to regulate the speed of pump, B', which should be increased beyond that necessary for preventing the opening of this valve, in order to aid by suction as well as forcing. This valve may be set wide open for the purpose of filling the receiver, and may be securely closed when the pump, B, is used to force the material into the pump, B', for the purpose of increasing the efficiency of the latter. It is also opened to admit air into the discharge pipe when the water is to be withdrawn therefrom by pump, N.

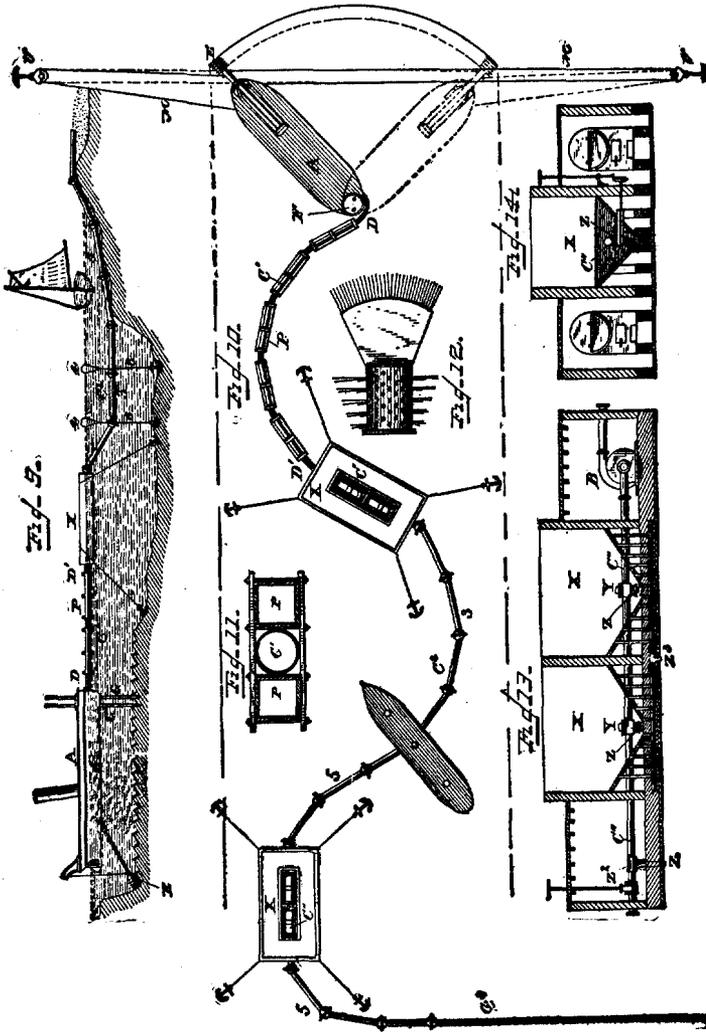
"Z is a branch and valve, through which mud is drawn from the receiver, to be discharged through the pipe, C². Z' is a branch and valve for admitting water to wash out the pipe, C², after the mud has been discharged from the receiver. Z² is a valve for closing the pipe, C', while the mud receiver is being discharged, or when said receiver is disconnected from the pipe, C', and takes the mud directly from the dumping or dredging apparatus. Z³ is a pipe and valve used for admitting water, through the bottom of the receiver, for the purpose of diluting the mud when it is too stiff to pass freely up the branch, Z. It may have branch pipes, with numerous small openings, for the more thorough dilution of the spoils. This receiver may be used, in connection with any dredging apparatus, for continuous transportation of the spoils through pipes as the work progresses; or it may be filled, towed to the place of deposit, and there be connected with a discharge pipe for putting the spoils on shore.

"The operation of dredging is as follows: The vertical anchors and excavator being raised to allow freedom of motion, the dredger is placed in position, with the turntable in line with the longitudinal axis of the proposed cut. The turntable is then rotated until the vertical anchors are also in line with said axis, and both anchors are then dropped into the mud. The discharge pipe is placed in position, the blocks, U, U, anchored at suitable points for swinging the machine, and the dredger swung around until the excavator reaches the side of the proposed cut, as shown in Fig. 10. The lines, M, M, are drawn taut, and the excavator lowered below the surface of the water. The pump, B, is then primed and started, and the excavator set in motion and lowered its entire diameter into the mud. The proper winding drum is then engaged, and the dredger, swinging on the turntable as a pivot or center of oscillation, rapidly cuts its way to the opposite side. To secure a steady side feed, the friction coupling of the unwinding drum may be adjusted to keep the unwinding line sufficiently taut to prevent the veering of the dredger with wind or tide. Upon reaching the opposite side, the winding drum is disengaged, the excavator again lowered its full diameter, the side feed reversed, and the dredger cuts back again. This process is repeated until the proper depth is obtained. The excavator is then raised above the bank in front, the anchor, G, raised, as shown in Fig. 2, and the turntable rotated upon the anchor, G², until G is squarely in front of G², in line with the longitudinal axis of the proposed excavation, as indicated by the broken-lined outline, G' (Fig. 2). G is then dropped into the mud, and the work proceeds as before, the dredger having been fed forward the distance between the centers of the vertical anchors, which is fixed to correspond with the cut capable of being made by the excavator. This arrangement for feeding forward keeps the center of oscillation of the dredger coincident with that from which the arc to be cut by the excavator should be described. A less perfect forward feed is secured by placing the dredger so that the excavator is at the side, and the turntable in line with the longitudinal axis of the proposed excavation. The turntable is then rotated until the vertical anchors are in a line parallel with the transverse axis of the dredger, where it is made sta-

tionary. This leaves one anchor diagonally in advance of the other, the dredger lying diagonally across one-half of the line of the proposed excavation. The forward anchor is now dropped into the mud to form a pivot, upon which the dredger swings as it cuts to the opposite side. The dredger then lies diagonally across the other half of the line of the proposed excavation, the swing having brought the rear anchor to the front. This anchor, in its turn, is dropped to form a new pivot, and the other anchor is then raised. The dredger swings, first upon one and then upon the other anchor, these anchors being alternately raised and lowered for this purpose. As this mode of feeding, by swinging alternately upon two different pivots, gives a wedge-shaped cut, requiring two full swings to make one full cut, it is equivalent



to a loss of one-half of the time, and is used only to prevent stoppage of work when the apparatus for rotating the turntable is stopped, for repairs or other cause, in which case it becomes valuable. I do not herein claim the method of oscillating the boat, nor of raising, conveying, and diluting the spoils, the same being claimed in a division of this application filed April 24, 1885, to which division the patent office has given the serial No. 163,262; nor do I claim, broadly, the combination of a rotary excavator having inward delivery with a suction pipe, nor the methods of relieving pressure in the pipe and of raising the pipe, the same being claimed in still another division of the original application, filed April 29, 1885, to which division the patent office has given the serial No. 163,888."



This patent contains 103 claims. The claims charged to have been infringed by the defendant are claims 9, 10, 11, 12, 16, 22, 25, 26, 53, 54, 59, 75, and 87, as follows:

"(9) A dredge boat, having a self-contained pivot, forming a center of oscillation, with devices for swinging and working said boat upon said pivot, in combination with a suction pipe and exhausting apparatus.

"(10) A dredge boat, having a self-contained pivot, forming a center of horizontal oscillation, with devices for swinging and working said boat upon said pivot, in combination with a suction pipe, exhausting apparatus, and rotary excavator.

"(11) A dredge boat, having a self-contained pivot or center of oscillation, with devices for swinging and working said boat upon said pivot, in combination with a pipe for discharging the spoils.

"(12) In a dredging apparatus having a side feed and self-contained pivot or center of oscillation, a discharge pipe, flexibly mounted at or near said pivot, to allow said apparatus to swing without material alteration of the position of said discharge pipe."

"(16) A dredge boat and oscillating section of a conduit discharge, flexibly joined to a nonoscillating section, to allow said boat to feed forward, and said oscillating section to swing upon the flexible joint connecting said oscillating and nonoscillating sections."

"(22) A discharge pipe, consisting of a series of sections flexibly joined together, in combination with a dredge boat having a self-contained pivot or center of horizontal oscillation, with devices for swinging and working said boat on said pivot."

"(25) A discharge pipe, consisting of a series of sections flexibly joined together and supported by floats, in combination with a dredger having a rotary excavator.

"(26) A conduit for transporting earthy and semiliquid substances, said conduit consisting of an outer rigid nonoscillating section flexibly joined to an inner oscillating section, the inner end of said oscillating section being flexibly joined to a discharging device."

"(53) The combination, with a nonrotative suction pipe, of a rotary excavator having an inward delivery through said excavator.

"(54) The combination, with a dredge boat and nonrotative suction pipe, of a rotary excavator having an inward delivery through said excavator."

"(59) A rotary excavator, with inward delivery, in combination with a nonrotating suction pipe, mounted upon strong trunnions or equivalent joints, to permit the excavator and outer end of the suction pipe to be raised and lowered to suit the depth at which the work is progressing."

"(75) In dredging machines, a nonrotating suction pipe, in combination with a rotary excavator provided with excavating devices arranged to deliver inward to a space in the interior of said excavator."

"(87) In combination with a dredge boat having devices for swinging and working said boat with a side feed, a hauling line having connection direct from the anchorage to the excavator support and near the point of resistance, and arranged to throw a large portion of the strain of the side feed on the outer end of the apparatus carrying the excavating device."

In the brief of counsel for complainant, the charge that the defendant had infringed claims 26 and 75 is withdrawn.

The specifications and drawings of letters patent No. 318,860, dated May 26, 1885, for the "art of dredging," are as follows:

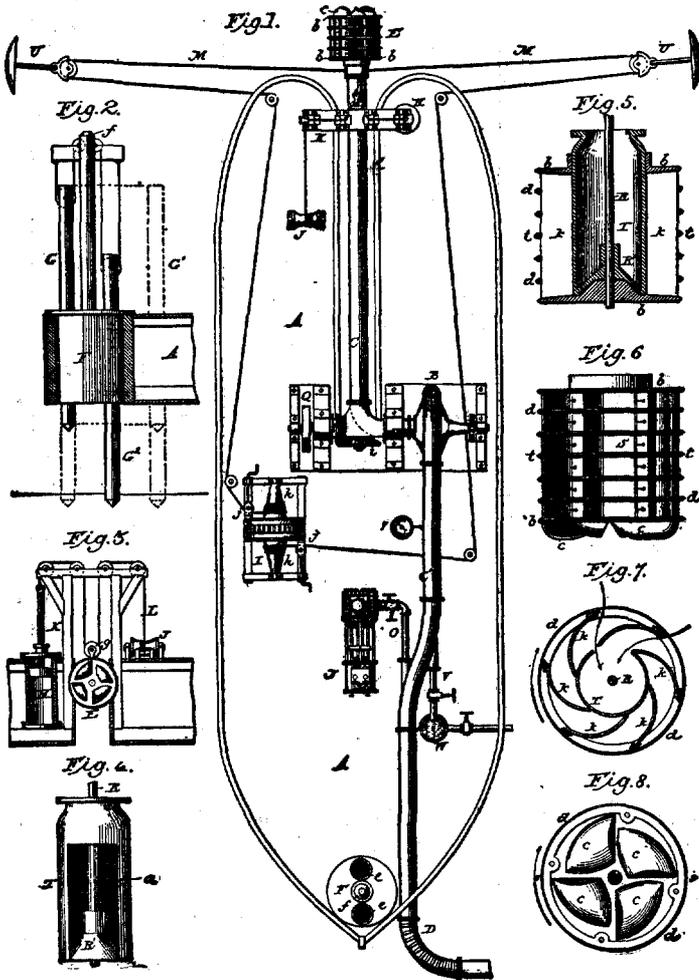
"To All Whom It may Concern:

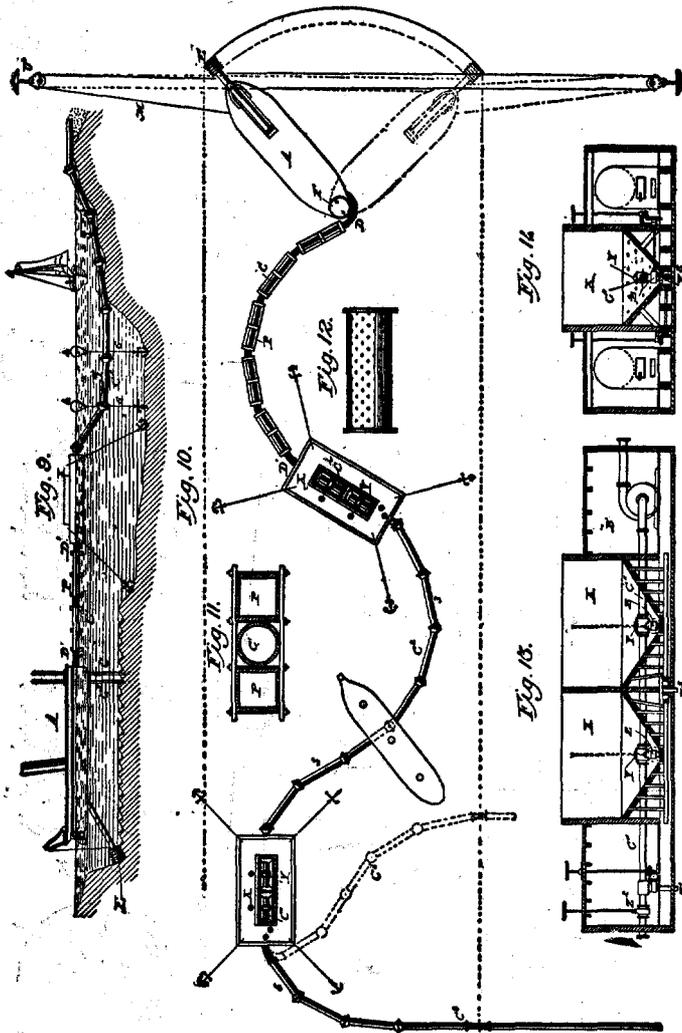
"Be it known that I, Alphonzo B. Bowers, civil engineer, residing at San Francisco, in the county of San Francisco and state of California, have invented certain new and useful improvements in the art of dredging, of which the following is a specification, this application being a division of my application filed December 9, 1876, renewed April 16, 1879:

"This invention relates to dredging, and it consists in certain improve-

ments in the art of dredging, by which the dredge boat may be conveniently moved into operative position, and worked to advantage in such position, my said art of dredging also including methods by which the excavated material is raised and conveyed to a distance; also, in methods by which the excavated material may be forced to a very considerable distance and the conduit prevented from choking,—these steps, constituting my improvement, being hereinafter pointed out in the claims. I do not herein claim the apparatus described and illustrated in the accompanying drawings, nor the method of raising submerged pipes, the same being claimed in other divisions of my original application, hereinbefore referred to; but this apparatus can be conveniently used to carry my improvements, herein set forth, into operation.”

(Here follow the drawings and specifications contained in letters patent No. 318,859.)





This patent contains eight claims. The claims charged to have been infringed are claims 3 and 5, as follows:

"(3) The improvement in the art of dredging, which consists in oscillating the boat on a contained center, thereby making an arc-shaped cut during the side movement of the boat, substantially as described."

"(5) The described method of dredging, which consists in oscillating the dredge boat on a center, and by such oscillation forcing an excavator continuously sidewise, thus making an arc-shaped cut, and drawing the excavated material inboard by suction."

The specifications and drawings of letters patent No. 372,956, dated November 8, 1887, for an "excavator," are as follows:

"To All Whom It may Concern:

"Be it known that I, Alphonzo B. Bowers, of San Francisco, California, civil engineer, have invented an improvement in excavators, of which this is a description:

"This is a ninth division of the application filed December 9, 1876, and renewed April 16, 1879, being illustrated in part in original Figures 1 to 9, inclusive, 21, 22, and 23, and described on pages 3, 4, and 7 of the original specification. It consists of a rotary excavator, constructed to work with a side feed and either outward or inward delivery, in combination with any suitable device for removing the spoil, said excavator being provided with peripheral spirally arranged edges or blades having a drawing cut, with devices by which these edges or blades are braced and bound together, and with excavating edges on its outer end, inclined backward from the direction of rotation, to avoid hooking against obstructions, and to give to these edges a drawing cut.

"Figure 1 is a plan showing one form of this excavator in combination with a suitable device for receiving and withdrawing the spoil. Fig. 2 shows the end-cutting edges and lower ring of the excavator. Fig. 3 shows a cross section through the excavator, through an inner section of suction pipe sometimes used, and through the excavator shaft, R. Fig. 4 is a plan of the lower end of said suction pipe and of a portion of said shaft. C may be any of the well-known devices suitable for removing the spoil from either inside or outside of the excavator. As here shown, it is a suction pipe arranged to take its spoil from the inside, although it may be arranged to take it from the outside also, as described and claimed in the eighth division of the original application. Its lower end, T, in the device shown, extends into the hollow excavator, E, to support the bearing, R', of the shaft, R, and is enlarged and cut away on one side to form an opening, G, for receiving the spoil. The excavator and device for removing the spoil, when used for dredging, is usually supported by a swinging ladder, suspended from a derrick or crane by a chain attached to the eye, c, or to a ring passing around the suction pipe at this point, the chains that give the side feed being also attached to said

Fig. 1.

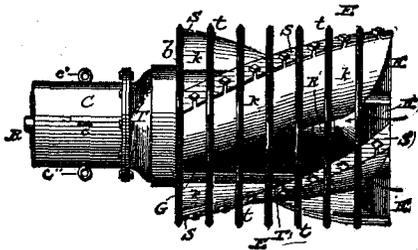


Fig. 2.

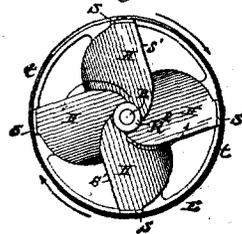


Fig. 3.

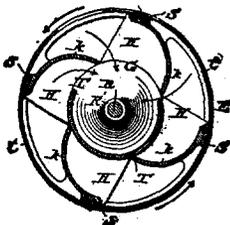
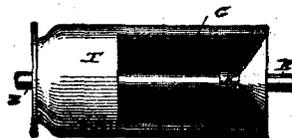


Fig. 4.



ring or to the eyes, c', c". E, as here shown, is a hollow rotary excavator, identical with that described and claimed in letters patent No. 318,859, issued to me May 26, 1885, except that in the present instance all its excavating edges are constructed and arranged to make a drawing cut, and, like said excavator, some or all of its several parts may be made separate and detachable, or the whole may be cast in a single piece. The vanes, k, may consist simply of spiral cutting blades, of suitable form and strength, cast with or secured in any suitable manner to a hub, R², in the outer end of the excavator (by which rotation is communicated by any suitable power through the shaft, R), and to one or more circumferential ring or rings, by which they are braced and bound together, though, when the excavator is cast, it is better to provide these vanes with detachable steel knives, S, extending from ring to ring, or from end to end of the excavator, according to the preference of the user or builder. The cutting edges, S and S', are set at an angle, to give a free clearance and suitable lead. The stiffening, bracing, binding rings, t, are preferably, though not necessarily, made with beveled cutting edges projecting outward beyond the spiral blades, the more easily to subdivide the spoil, and to serve as fenders to enable these blades to ride over, and prevent them from catching against, obstructions; and the ring, b, on the inner end of the excavator, when used with a central suction pipe, is preferably extended inward to or near said pipe, where it may be provided with a strong flange, to serve as a bearing or hub to run on said pipe, as shown.

"I confine myself to neither an inward nor an outward delivery, nor to the devices or form of construction shown."

This patent contains 18 claims. The claims charged to have been infringed by the defendant are 1, 12, 13, and 15, as follows:

"(1) In combination, a rotary excavator, constructed and arranged to work with a side feed, provided with excavating edges or blades running spirally along its periphery, a device for bracing and binding said edges or blades together, and a device for removing the spoil."

"(12) A hollow rotary excavator, with inward delivery, and constructed to operate with a side feed, and provided with excavating devices having a drawing cut, a shaft for actuating said excavator, and a suction pipe for removing the spoil."

"(13) In combination, a rotary excavator, consisting of peripheral excavating devices, spirally arranged, braced, and tied together by a circumferential ring or by circumferential rings, and firmly connected to a hub in the end of said excavator, an actuating shaft secured to said hub, a bearing for said shaft in the interior of said excavator, and a suction pipe opening into said interior for removing the spoil."

"(15) In combination, a rotary excavator, constructed and arranged to work with a side feed, provided with excavating edges or blades running spirally along its periphery, and delivering their spoil to the interior of said excavator, and a device for removing said spoil."

No evidence appears to have been introduced in support of the charge in the bill, as amended, that the defendant had infringed letters patent No. 364,158, dated May 31, 1887, for a dredging apparatus, or in support of the charge that the defendant had infringed letters patent No. 484,763, dated October 18, 1892, for an apparatus for dredging and transporting spoil; and in the brief of counsel for complainant the charge that the defendant had infringed letters patent No. 364,571, for a dredging apparatus, is withdrawn.

The first patent sued on in this case, No. 318,859, is the same patent which was involved in the case of *Bowers v. Von Schmidt*, 63 Fed. 572, in this court. The claims which were involved in that case are claims 10, 16, 25, 53, 54, and 59. These same claims are also involved in the case at bar. It was held in that case that claims 10, 16, 25, 53, 54, and 59 were valid. 63 Fed. 572. This decision was affirmed on

appeal to the circuit court of appeals. 25 C. C. A. 323, 80 Fed. 122. Application was made to the supreme court for the issuance of a writ of certiorari for a review of the decision, but the application was denied. 166 U. S. 720, 17 Sup. Ct. 1002. Bowers, the complainant in this suit, was held, in the case referred to, to be a pioneer inventor in the art of dredging, and that, therefore, his patents were entitled to a broad and liberal interpretation. In arriving at the conclusion that Bowers was a pioneer inventor, the circuit court of appeals, Judge Ross delivering the opinion, used the following language:

"It will be seen from the foregoing that the fundamental elements of the complainant's patent 318,859, and of the machine covered by it, are: A boat and excavator capable of working with a side feed, a nonrotating suction pipe, an exhausting and discharging apparatus, a discharge pipe, a self-contained pivot or center of oscillation on which the boat swings from side to side while it is working, devices for swinging and for working the machine from side to side, devices for moving the machine ahead preparatory to a new cut, a floating discharge pipe when the spoil is to be transported over water, a submerged discharge pipe when the spoil is to be carried across a navigable channel without impeding navigation, and an outer stationary section of discharge pipe when the spoil is to be carried over land.

"The record shows that for many years the complainant was investigating the subject of dredging, and had familiarized himself with most, if not all, of the dredgers in existence. He was familiar, too, with the sand pump. The latter, while it would pump sand, would not cut and remove hard material. Before the complainant did anything in the direction of invention, there were also dredgers in existence and in use that would cut and remove hard material. There were the 'scoop,' and the 'clam shell,' and the 'chain bucket,' and Hart's dredger, and Fraser's dredger, and the patent to D. S. Howard of January 9, 1855, and Atkinson's patent of July 7, 1863, and the rotary wheel dredge of Fondé and Lyons, and other rotary dredgers of which the complainant had knowledge; for in the original specification contained in his application for a patent he himself stated that: 'For more than two centuries rotary dredgers have shown a capacity for cutting and lifting far in excess of any other dredging device; but in the forms of construction hitherto adopted it has been necessary to make the diameter of the wheel much greater than the depth to be dredged, thus making them too unwieldy for ordinary uses, while the best appliances for removing the spoils have fallen far short of the dredging capacity of the wheel.' But prior to the complainant coming into the field there was no machine, by whatever name known, that would, by the simultaneous and continuous co-operation of its various elements, cut and remove hard material from a water way, and itself transport the same to any desired distance and place. The complainant undertook to accomplish that thing. The accomplishment of the purpose necessarily involved the severing of the material in place, the lifting of it, and its transportation, through some sort of conduit, to the desired place of deposit.

"The evidence shows that the complainant, having devoted much study and thought to the subject, embodied his ideas in a drawing marked 'Exhibit DD,' and which was introduced in evidence. Upon its face the drawing is dated July 13, 1864. Counsel for the appellant assert in argument that this date is false; that the drawing was actually made in the year 1884, and antedated 20 years. The ground of this contention on the part of the appellant is that the words 'inward delivery,' which appear upon Exhibit DD, do not appear in the complainant's proceedings in the patent office prior to March, 1884. The words 'inward discharge' appear, instead, in the complainant's original specification. The two expressions mean one and the same thing. The use of the word 'discharge,' in place of the word 'delivery,' in the original specification, is explained by the complainant by saying that the first draft of the specification was prepared by his attorney, who used the term 'inward discharge,' instead of 'inward delivery,' and that when he (the complainant) revised and redrafted the specification before sending it to the patent office, he followed

the phraseology of his attorney, but that subsequently, when he took personal charge of his application, he redrafted the specification and claims, and adopted the phraseology originally used by him in the drawings of 1864. There is nothing in the circumstance relied on by the appellant to cast any doubt upon the testimony of the complainant in respect to the true date of Exhibits DD and EE, especially as there is much testimony corroborative of that of the complainant, which is to the effect that he made the drawings on the day they respectively bear date.

"The complainant testified that, while holding a position as clerk in the office of the United States surveyor general for the state of California, he was thrown in daily contact with all matters pertaining to swamp land and swamp-land reclamation, and had many conversations with people desirous of reclaiming such lands, and in regard to the best mode of doing so. 'This led me,' said the witness, 'to continue my investigation of dredging and ditching machinery, and I soon came to the conclusion that the proper mode of leveeing a river was to take the material from the bed of the river. I then conducted a series of experiments with regard to the carrying capacity of water in pipes. I discovered that, by cutting holes in the bottom of the pipe, the sand would drop through those holes, while the water would pass over and be discharged, where I wished to deposit the sand, and in this way I could build sand embankments. This led me to devise a hopper, with an injection pipe entering the bottom of the hopper directly opposite to the mouth of a discharge pipe, and the material to be dumped into this hopper and carried by the injection stream through the discharge pipe. I then considered the mode of applying this method with reference to putting the material from the river on shore. This led me to connect, with my pipe, floats for supporting it. I then became convinced that centrifugal pumps would carry off a larger quantity of material than could be handled by ordinary dredgers, and I began to investigate for the purpose of discovering some method of supplying the pump with all the material that it could handle. This led to the combination with the aforesaid apparatus of a rotary excavator, and on the 13th day of July, 1864, I made a drawing showing this combination, which I now produce and offer in evidence (being Exhibit DD). The date above mentioned appears upon the drawing itself. I fix this date in three ways: First. Because I was so elated with the idea that I would never forget it if I would live to be a thousand years old. I thought I had discovered something that was going to make me a fortune. Second. Because of the date appearing on the drawing itself. Third. Because I was introduced the day before, by John S. Hittell, to the librarian of the Mercantile Library, and while in that library on the 12th day of July, I found, in Cressley's Encyclopedia of Engineering, an account of Bailey's rotary excavator, used in the time of King Charles II., of England, and that set me to thinking, and led me to devise the combination which I thought out during the night, and of which I made a drawing the next day. This drawing represents a rotary excavator with inward delivery through itself to a suction pipe. These buckets are of themselves bottomless, and revolve around an inner cylinder, which forms a bottom to the buckets until they reach a depression in the top of said inner cylinder, where the material is discharged into a receiver communicating with the suction pipe. Objection being made to this sketch by certain parties to whom I showed it, on the ground that material might wedge in between the buckets and the drum, I devised and made a drawing of the rotary bucket-wheel excavator, with hinged falling bottoms, to obviate this difficulty. This drawing last referred to was made the following day, July 14, 1864, and that drawing I now produce and offer in evidence' (being complainant's Exhibit EE).

"This testimony of the complainant in respect to the time when the drawings, Exhibits DD and EE, were made, finds corroboration in the testimony of the witnesses Houghton, McGann, Crane, Bender, Shaw, and Gray. We are satisfied, from the evidence, that they, together with the memoranda appearing upon them, were made at the time they respectively bear date. * * * They show, not only an altogether new combination of elements for the transportation of the spoils, but also something radically new in rotary excavators, namely, a rotary excavator with inward delivery through itself, in combination with a suction pipe. They show a dredge boat having two

self-contained pivots or centers of oscillation for the swinging of the boat while at work; a flexible joint near the pivots; a discharge pipe, consisting of an inner flexible oscillating section, a series of sections flexibly jointed together and supported by floats, and an outer rigid nonoscillating section; a suction pipe; a rotary excavator having inward delivery; the arc-shaped cuts of the excavator made by the dredge while swinging from side to side on the pivot, and devices for its working with a side feed. All of these are also shown in the complainant's patent 318,859.

"In 1868 the complainant made four models, showing different forms of construction of his invention, marked M², M, N, and II, respectively, and which were introduced in evidence and are inserted in the margin. While these models show details of construction not shown in the drawings upon Exhibits DD and EE (II, among other things, showing the inner cylinder at the end of the suction pipe partially cut away, and N showing it entirely removed, and N also showing the trunnions of claim 59 of patent 318,859), they each and all embody the principle of the invention represented by those drawings and the memoranda thereon. * * * The complainant did not, however, make any application for a patent for his invention until December 9, 1876. But from the time of its conception he was indefatigable in his efforts to perfect it and to demonstrate its practical utility. His long delay in applying for a patent, the appellant contends, constituted an abandonment of whatever invention was made by him. To review the many pages of evidence going to show the reasons for the delay in the complainant's application would serve no useful purpose. It is enough to say that, so far from showing any intentional abandonment on the part of the complainant, they show the most persistent and continuous efforts on his part, against very adverse circumstances, to perfect the invention and avail himself of its benefits, and excuse the laches with which he might otherwise be justly charged. It was so held by the patent office, where the question of abandonment was raised, and was decided in favor of the complainant. * * *

"The original application of the complainant for a patent for his invention was filed in the patent office, as has been said, December 9, 1876. It embraced a description of his invention and claims, and was accompanied by a model. The original specification and claims were prepared by the complainant's attorneys, and met with objections in the patent office. After amendments by the attorneys, the patent office allowed 20 of the 54 claims embraced in the application. The complainant refused to accept the claims as allowed, on the ground that they failed to properly cover his invention, and allowed his application to lapse by failing to pay the government fee within six months after the allowance; but within two years after that date, to wit, April 16, 1879, he filed a renewed application for letters patent for his said invention, asking therein that the original specification, oath, drawings, and model be used as a part thereof. Based upon the renewed application, the patent office demanded of the complainant's attorneys further description and illustration of the invention, which the attorneys insisted were unnecessary. Much correspondence ensued between the attorneys and the patent office upon that question, and finally the complainant concluded to take personal charge of his application, and accordingly addressed to the commissioner of patents the following communication:

"613 Mission St., San Francisco, June 13, 1882.

"To the Commissioner of Patents, Washington, D. C.—Sir: Unable to fee attorneys to prosecute my cases at the patent office, they hang fire, while I grow gray. It becomes necessary for me to do the best I can with them myself. The power of attorney heretofore granted by me to Dewey & Co., of San Francisco, and A. H. Evans, of Washington, D. C., is hereby revoked in the case of the renewal application for improvements of dredging machines. Ignorant of the changes that may have been made in specifications or drawings, I inclose \$5 for copy of contents of the file wrapper. I cannot give the serial number.

"Respectfully,

A. B. Bowers.'

"On the next day, June 14, 1882, the complainant sent to the patent office a communication amending his specification 'by striking out all thereof save

the signatures, preparatory to submitting a new specification in accordance with the views of the examiner'; and on July 26, 1882, he filed in the patent office the new and substituted specification. The examiner having found that the specification as thus amended included new matter not disclosed in the original application, the complainant struck out all of the amended specification except the signatures, and on November 13, 1882, filed a second new and substituted specification. Much correspondence thereupon ensued between the patent office and the complainant, resulting in the complainant going to Washington in person, and there, concluding that his invention could not be covered by a single patent, and that several patents would be necessary to properly cover it in all of its parts, determined to, and accordingly did, divide his application into several divisional applications. The first divisional application so filed by him culminated in patent No. 318,859, issued May 26, 1885. His second divisional application was patented on the same day, May 26, 1885, by patent No. 318,860, for 'the art of dredging.' His third divisional application embraced all the remainder of his original application not comprised in the first and second divisions. This third divisional application was filed April 29, 1885, while the original application was pending, and before the issuance of any patent. In the prosecution of this third divisional application it was found that several independent inventions were described, and that it, too, would have to be divided accordingly. The complainant divided it into nine different divisions, and filed divisional applications therefor, while the third divisional application was pending, and before the issuance of any patent therefor."

With reference to the broad and liberal interpretation to which the claims of complainant's patent 318,859 were entitled, the court, after stating that the complainant was not to be limited to the specific devices described in his patents, says:

"He [Bowers] was the first to invent, not only a rotary excavator having an inward delivery through itself to a suction pipe, but also of the combination of such an excavator with transporting and discharging devices by means of which hard material in place can be severed, lifted, and continuously carried, over water or land, to any desired place of deposit. He is, therefore, justly entitled to be regarded as standing at the head of the art in those respects, and to a broad and liberal construction of his claims thereto. * * * When the complainant claimed, in claim 10 of his patent 318,859 [one of the claims involved in the case at bar], 'a dredge boat having a self-contained pivot, forming a center of horizontal oscillation, with devices for swinging and working said boat upon said pivot, in combination with a suction pipe, exhausting apparatus, and rotary excavator,' he was not claiming a result, which, of course, he could not do. Nor did he thereby limit himself to any particular form of construction of the several devices therein mentioned. What he there claimed, and what he, as the first inventor of any combination that would accomplish the desired result, had a right to claim, was the combination of a dredge boat, itself containing a pivot forming a center of horizontal oscillation, with devices for swinging and for working the boat on the pivot, a rotary excavator for the severing of the material in place, a suction pipe for its receipt and transmission to the exhausting apparatus, and the latter for the transportation and discharge of the spoils to the desired place of deposit. The record shows that the complainant was the first to combine those elements at all, and that the functions performed by his machine so constructed were entirely new. Hence, he had the right to make the broad and generic claim embodied in claim 10, without any limitation as to the form of construction of the particular elements, and all subsequent machines which employ substantially the same means to accomplish the same result are infringements, notwithstanding the subsequent machine may contain improvements in separate mechanism which go to make up the machine [citing cases]. Of course, it remained open to any subsequent inventor to accomplish the same result by substantially different means.

"Claim 16 of the complainant's patent 318,859 is a combination of a dredge boat, a floating pipe, and land pipe, and a flexible joint between them. The

same combination was, for the first time in the history of the art, made by the complainant July 13, 1864, and illustrated by the drawings and memoranda upon Exhibit DD. Claim 25 is for a combination of a discharge pipe, consisting of a series of sections flexibly joined together, floats for supporting the pipe on water, and a dredger having a rotary excavator. Claim 53 is for a combination of a nonrotative suction pipe with a rotary excavator having an inward delivery through itself. Claim 54 added to the combination covered by claim 53 a dredge boat; and claim 59 added to the combination covered by claim 53 trunnions or equivalent joints to permit the excavator and outer ends of the suction pipe to be raised and lowered to suit the depth at which the work is progressing. The trunnions embraced by claim 59 are not shown in the complainant's drawings of 1864, but are shown in the model, N, made by him in 1868, and are thus described in his specifications: "The swinging portion of this [suction] pipe is mounted at the inner end of the well upon strong trunnions, one of which forms an elbow of the pipe, and passes through a stuffing box, or other suitable connection, into the suction pipe of the pump, B. Through the other trunnion passes a shaft that actuates the gears, I, that drive the shaft, R, and bucket wheel, E; and upon these trunnions the shaft, R, suction pipe, and excavator swing, as the cutter is raised or lowered, to suit the depth at which the work is progressing.

"The contention on the part of counsel for the appellant that no successful machine can be built and operated in accordance with the complainant's patents is not at all supported by the record, which contains abundant evidence to the effect that machines have been so built, and have ever since been operated with very great success."

I have quoted thus liberally from the opinion of the circuit court of appeals in the case of *Bowers v. Von Schmidt* for the reason that in that case the state of the art was thoroughly and exhaustively considered, and that most of the claims of patent 318,859 now involved in the case at bar were at issue in that case. Moreover, much of the evidence in the two cases is the same. It is true that in the case at bar the defendant was not a party to the case of *Bowers v. Von Schmidt*, and, therefore, that decision cannot be regarded as *res judicata* as to the defendant in the present case; but many of the issues and questions in the two cases are common to one another, and the decision of the circuit court of appeals in that case, upon questions not contested or disputed in the present case, must be accepted as very persuasive, if not entirely controlling.

So far as new matter or new issues have been introduced in the present case, the decision of the circuit court of appeals in *Bowers v. Von Schmidt* is, of course, not controlling. But such new questions and new issues require an independent examination and adjudication. The claims involved in this case, which were not involved in the case of *Bowers v. Von Schmidt*, are Nos. 9, 11, 12, 22, and 87. The decision rendered in the case of *Bowers v. Von Schmidt* establishes, as already stated, that *Bowers* was considered a pioneer inventor in the art of dredging. It is contended, by the learned counsel for the defendant in this case, that evidence in the case at bar, not introduced or considered in the case of *Bowers v. Von Schmidt*, shows that the art of hydraulic dredging and mechanisms for practicing it, substantially as the complainant claims them, were invented long before he came upon the scene, and that, conceding to him all he claims to have invented, he is, at most, an improver, and not a pioneer, entitled, if entitled to anything, only to the specific improvements which he has invented. In support of this contention, it is claimed that an English patent, not considered in the case of *Bowers v. Von Schmidt*, for

"apparatus for raising mud and soil from the bottoms of rivers, etc.," dated August 9, 1856, and issued to Louis Schwartzkopff, of Berlin, anticipated the complainant's invention, and, therefore, does not entitle him to the position of being a pioneer inventor in the art of dredging. This English patent, issued to Schwartzkopff August 9, 1856, which plays such an important part in the present litigation, is as follows:

"Apparatus for Raising Mud and Soil from the Bottoms of Rivers, &c.

"Letters Patent to Louis Schwartzkopff, of Berlin, for the Invention of Improvements in Apparatus for Raising Mud and Soil from the Bottoms of Rivers and Other Waters.

"Sealed the 9th August, 1856, and dated the 9th February, 1856.

"Provisional specification, left by the said Louis Schwartzkopff at the office of the commissioners of patents, with his petition, on the 9th February, 1856:

"I, Louis Schwartzkopff, of Berlin, do hereby declare the nature of the invention for 'improvements in apparatus for raising mud and soil from the bottoms of rivers and other waters' to be as follows:

"This invention has for its object apparatus for raising, by a centrifugal or rotary pump, the mud and soil from the bottoms of rivers and other waters. For this purpose, a centrifugal or rotatory pump is fixed on board a suitable vessel, together with a steam engine or other means of working the same. From the pump descends a suction pipe, arranged suitably to admit of its lower end being moved to and fro. The lower end of the suction pipe is fitted with a head or instrument (or the head or instrument may be separate), which, on being moved together with the lower end of the pipe, stirs or moves the mud and soil at the bottom of the river or other water, by which means the mud or soil, together with some water, will be continually raised by the pump, and the same may be allowed to run onto a bank at the side of the river or other water, or into any barge or vessel employed for carrying away such soil or mud.

"Specification, in pursuance of the conditions of the letters patent, filed by the said Louis Schwartzkopff in the great seal patent office on the 9th August, 1856.

"To all to whom these presents shall come, I, Louis Schwartzkopff, of Berlin, send greeting:

"Whereas, her most excellent majesty, Queen Victoria, by her letters patent bearing date the ninth day of February, in the year of our Lord one thousand eight hundred and fifty-six, in the nineteenth year of her reign, did, for herself, her heirs and successors, give and grant unto me, the said Louis Schwartzkopff, her special license that I, the said Louis Schwartzkopff, my executors, administrators, and assigns, or such others as I, the said Louis Schwartzkopff, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of Man, an invention for 'improvements in apparatus for raising mud and soil from the bottoms of rivers and other waters,' upon the condition (amongst others) that I, the said Louis Schwartzkopff, my executors or administrators, by an instrument in writing under my, or their, or one of their, hands and seals, should particularly describe and ascertain the nature of the said invention, and in what manner the same was to be performed, and cause the same to be filed in the great seal patent office within six calendar months next and immediately after the date of the said letters patent:

"Now know ye, that I, the said Louis Schwartzkopff, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof (that is to say):

"This invention has for its object the arrangement of apparatus for raising, by a centrifugal or rotary pump, the mud and soil from the bottoms of rivers and other waters. For this purpose a centrifugal or rotary pump is fixed on board a suitable vessel, together with a steam engine or other means of

working the same. From the pump descends a suction pipe, arranged suitably to admit of its lower end being moved to and fro. The lower end of the suction pipe is fitted with a head or instrument (or the head or instrument may be separate) which, on being moved together with the lower end of the pipe, stirs or moves the mud and soil at the bottom of the river or other water, by which means the mud or soil, together with some water, will be continually raised by the pump, and the same may be allowed to run onto a bank at the side of the river or other water, or into any barge or vessel employed for carrying away such soil or mud.

"And in order that my said invention may be most fully understood and readily carried into effect, I will proceed to describe the drawing hereunto annexed.

"Description of the Drawing.

"Figure 1 is a longitudinal section of part of a vessel fitted with dredging apparatus, arranged according to my invention. Figure 2 is a transverse section, and figure 3 is a plan of the same. Figure 4 shows, on a smaller scale, an end view of the dredging vessel and apparatus employed therewith when in operation.

