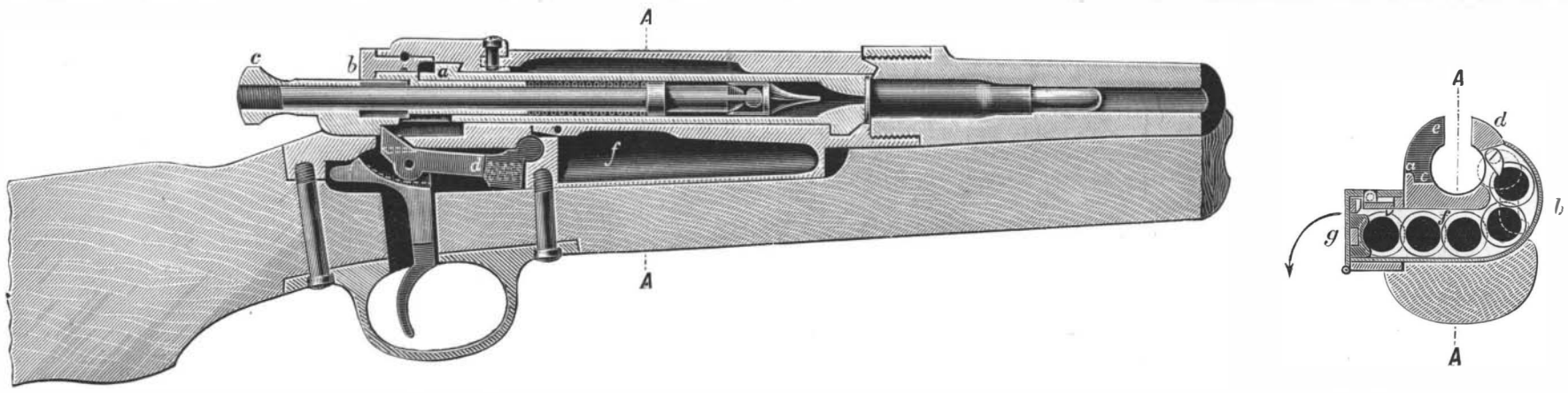
THE NEW ARMY MAGAZINE RIFLE.

The Springfield rifle, which has been the standard arm of our soldiers for many years, and is undoubtedly one of the best old style single fire pieces ever used in any army, is at last to be superseded by a modern magazine rifle, the details of which have been definitely decided upon. Ever since the conclusion of our war, in 1865, all the European governments have been expending large sums of money in experimenting upon and constantly changing the infantry arm which has been placed in the hands of their soldiers. The needle gun of Prussia aided largely in deciding the conflict of that country with Austria, in 1866, in favor of the former, and its superiority over the French chassepot in 1870 was conceded, but since that time Germany has twice changed her infantry arm. France has also made important changes, finally adopting a perfected Lebel, and a Berthier gun for cavalry service. Austria, after trying different forms of guns, has taken as its standard a Mannlicher rifle and carbine, Belgium has a form of the Mauser, and Great Britain, after most elaborate trials, has adopted in a tentative way what is known as the Lee-Speed gun, very similar to the Lee or Remington magazine gun, which was highly commended by a board of United States navy officers in 1870, and has since been in regular use in the navy.

It has been principally from a just conception of the practical state of the case, and a desire to avoid the expensive errors of the military authorities abroad, that our own army officers have been apparently slow in deciding upon the new rifle with which our soldiers are to be hereafter armed. But the work has now been done, after examinations and trials which seem, as far as the guns submitted for examination are concerned, to be thoroughly exhaustive, and in which nothing has been neglected that the experience of foreign governments could suggest.

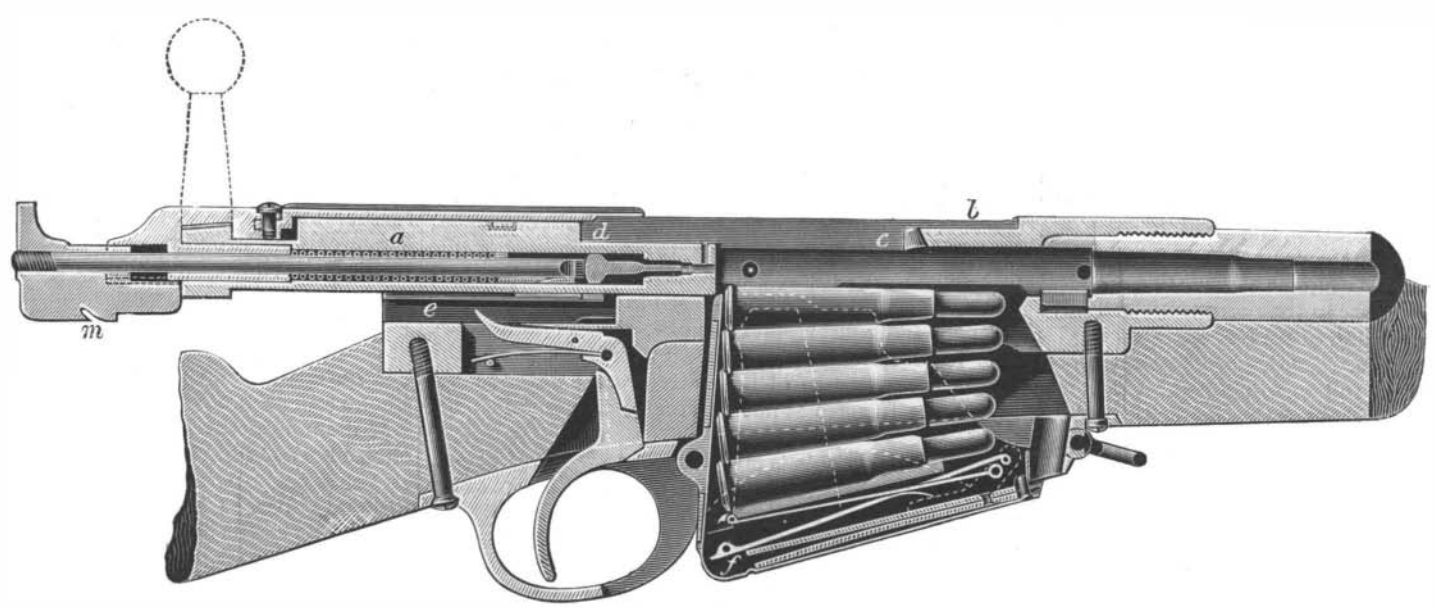
The Board on Magazine Arms, by whom this service has been performed, was constituted by an army order of December 24, 1890, and its report was submitted August 19, 1892, being signed by Lieut.-Col. Robert H. Hall, Sixth Infantry; Lieut.-Col. J. P. Farley, Ord. Dept.; Maj. H. B. Freeman, Sixteenth Infantry; Capt. S. E. Blunt, Ord. Dept.; Capt. Geo. S. Anderson, Sixth Cavalry. Fifty-three guns in all were subjected to trial, including those submitted by American and foreign inventors, and the officially adopted arms of Austria, Belgium, Denmark, England, France (for cavalry), Germany, Japan, Portugal, Roumania, Russia and Switzerland. It was unanimously decided that the gun selected should be an efficient single loader and a rapid magazine arm, holding at will the magazine in reserve, with a cut-off plainly indicating to the officers the class of fire being delivered. The bolt system of breech closure, as developed in the last few years, was also strongly recommended instead of the block system.

The gun finally selected is a modification of what has been heretofore known as the Krag-Jorgensen gun, adopted by Denmark for its army, but the piece has been considerably changed to meet the severe tests required by the board. A longitudinal section of the breech mechanism, with the bolt in the firing position, and showing also the magazine space, is given in our illustration, the small figure being a section of the magazine and receiver. The bolt differs from the Danish gun in the absence of a half-cock notch on the cocking piece and the introduction of a safety lock similar to that on the German and several small arms. The lock is operated by a thumb-piece, *b*, which causes the spindle to turn down into a notch, *a*, in the body of the bolt, locking the firing pin when in the firing position and preventing the opening of the bolt. The form of the thumb of the firing pin and cocking piece is slightly altered. A spiral spring, *d*, is substituted for an original flat sear spring. An ejector, *e*, *f*, is placed in a cut in the bottom of the receiver, a channel in the lower side of the bolt extending nearly to the bolthead, and permitting it to pass freely over the ejector until, in withdrawing the bolt, the head strikes the knob, causing the longer arm of the lever, *f*, to rise, and, with a blow on the cartridge shell, throw it clear of the receiver. The magazine space itself does not, as in the Danish gun, project beyond the left face of the stock, and the gate is hinged horizontally and opens downward, instead of swinging out to the right, as in the Danish gun.

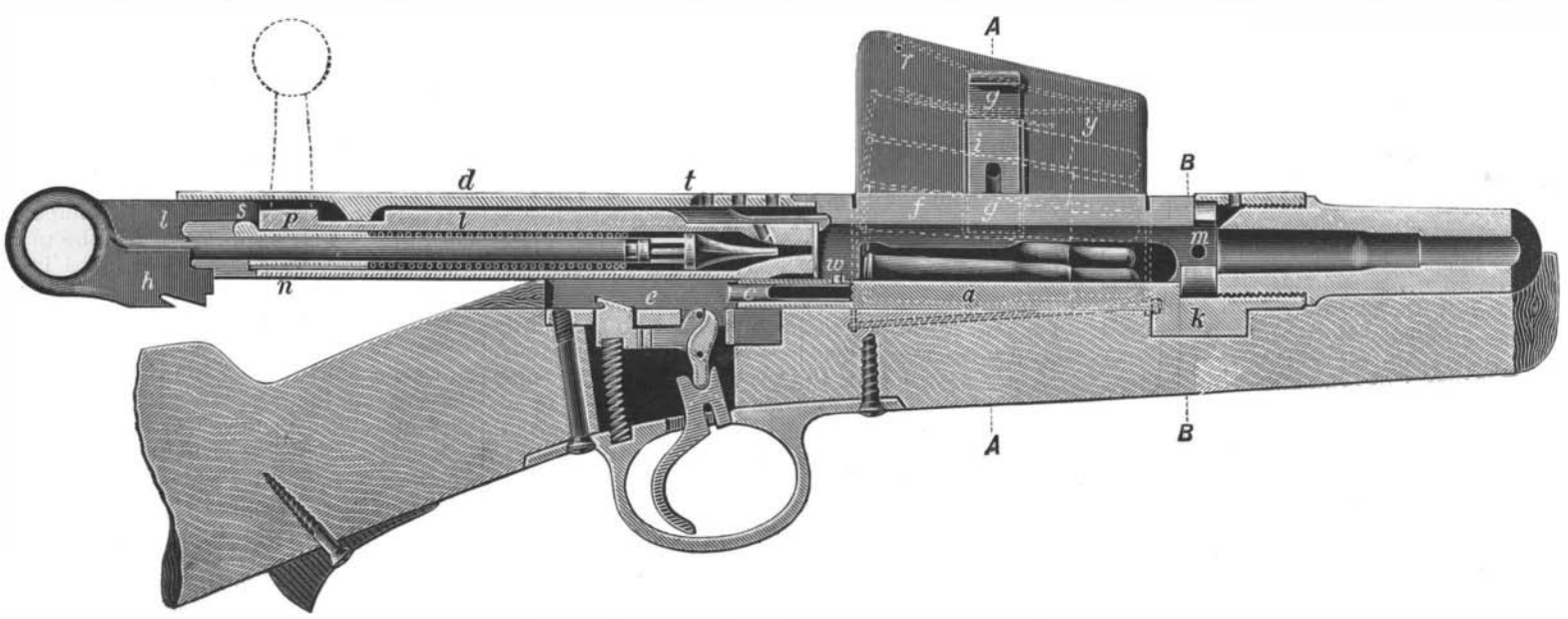


THE NEW UNITED STATES SERVICE MAGAZINE RIFLE, ADOPTED AT THE RECENT TRIALS.

It is difficult to imagine a more trying series of tests than those to which the different arms before the board were subjected, and in all of which the finally selected piece proved its eminent superiority. The gun was first fired twenty shots from the shoulder, magazine loaded, and held in reserve till the last; then as rapidly as possible for two minutes, both as single-loader and as a magazine gun. An endurance test of 500 continuous rounds, without cleaning, followed, both with using the magazine and holding it in reserve. Afterward the piece was exposed in a mechanical dust box to a most severe dusting, and then tested after



THE "BRUCE" MAGAZINE RIFLE.



THE "HAMPDEN" MAGAZINE RIFLE.

simply wiping with the bare hand. Still further tests consisted in thoroughly rusting the breech mechanism, and then firing the arm in this condition, while yet other tests were made by using defective cartridges in the gun, to determine its liability to being permanently disabled from such cause, as occasionally happens in actual service.*

From the first, the board made every possible effort to induce American inventors to enter these competitive trials, desiring especially to secure for the service an arm of distinctively American origin. And it was the general expectation at the outset that American inventors would lead all others in this field, but the guns of home design presented, although containing many highly ingenious features and some special merits of high character, were generally found wanting in the combination of qualities which had been decided upon as the standard. The delay of inventors in presenting their arms caused an undue prolongation of the work of the board, some of the arms tested being withdrawn several times for correction and improvement. There is reason to believe that a knowledge of the rules laid down by the board, and a general understanding of the manner in which these exhaustive tests were conducted, will have the effect of stimulating American inventors to making renewed efforts in this line.

Among the other guns tested by the board which made a remarkably good showing, notwithstanding the severity of the trials, was one presented by the inventor, Mr. L. F. Bruce, of Springfield, Mass., of which we give a sectional view of the breech mechanism, with the action open and magazine full. The left wall serves as a guide and support for the long rib, *a*, of the bolt, and in front the casing, *b*, considerably overhangs the receiver with a helicoidal surface, *c*, which, when the nose, *d*, of the guide rib comes into bearing, cams the bolt around to the right. A channel, *e*, in the tang permits the passage of the cocking piece, *m*. The magazine is a hinged box revolving down and to the rear, and it can be cut off and held in reserve while the gun is used as a single loader.

In the tests of this gun 15 shots were fired as a single loader in 55 seconds, the magazine being then turned on and its five shots fired in 15 seconds. Thirty-six shots were then fired, using the gun as a single loader, in two minutes, 38 shots being fired in two minutes at another trial. As a single loader the fire was more rapid than as a magazine loader. In the endurance trial the bolt worked stiffly as the gun became heated toward the close of each set of 50 shots, and some minor but apparently easily remediable defects were disclosed. The dust test also disclosed some defects, there being difficulty in extracting shells, and the mechanism working stiffly. No injury was done to the piece by the use of defective cartridges, or by excessive charges, but the mechanism always required the exertion of considerable force to operate it.

The "Hampden" arm, shown in section with the action opened in one of the illustrations, is so named in honor of Hampden County, Mass. It was submitted by the inventor, Mr. Thomas B. Wilson, of Springfield, Mass., and showed wonderfully good qualities when subjected to the prescribed tests. The magazine mechanism, including the cut-off, is entirely contained in the cartridge packet, which is placed in a receptacle to the left of and above the receiver. The latter is cut away at the right side, having a straight shoulder, *a*, upon which the long guide and locking rib of the bolt rests when ready for firing.

In the tang is a channel, *e*, for the passage of the nose of the cocking piece, *h*, and the extractor, *d*, has hooks engaging over the body of the bolt and the sleeve assembling the parts of the bolt. In the top of the cartridge packet is a folded leaf spring, *y*, one end secured under a cross bar, *r*, while the other end acts as a follower, the weight of the cartridges assisting the action of the spring. The cut-off, *g*, is a flat piece of spring steel sliding in the socket, *i*. From the position and form of the cartridge packet, by simply using larger packets a greater number than five cartridges can be introduced into the magazine, the number being limited only by the convenience of handling the packets and the amount of projection above the gun.

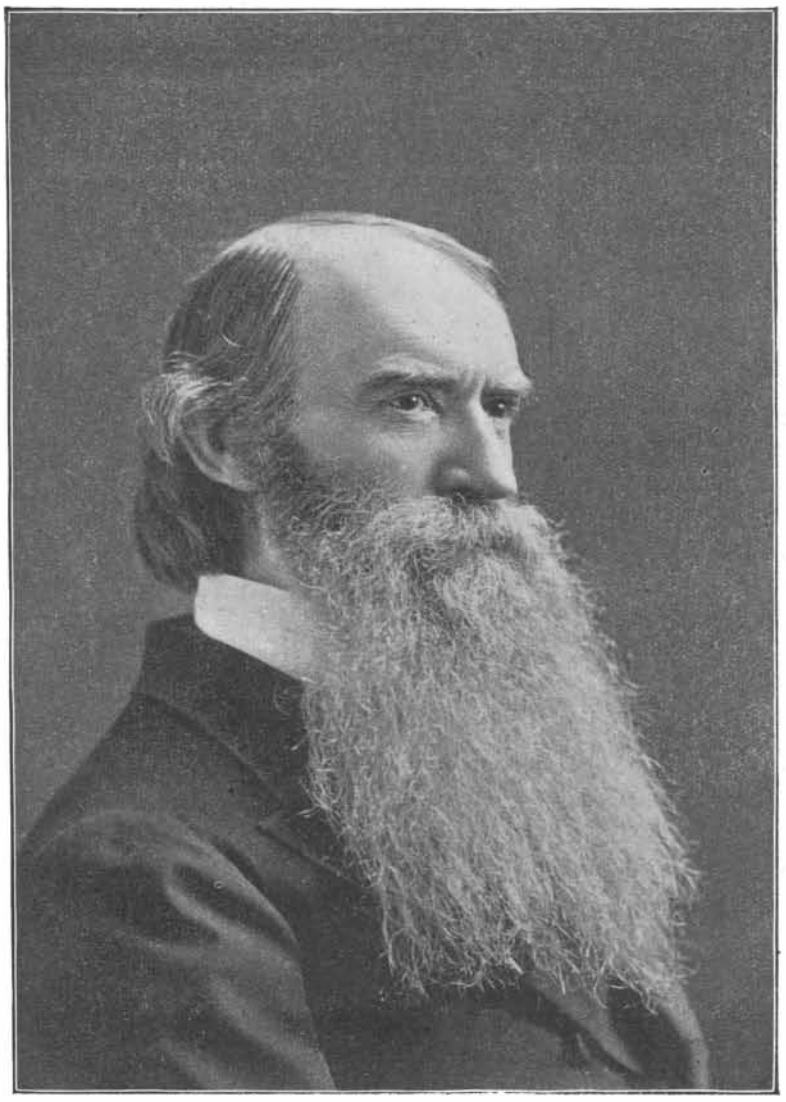
In the first test 15 shots were fired as a single loader in 54 seconds, followed by the 5 shots from the magazine in 15 seconds. Forty-five shots were then fired in two minutes, using the piece as a single loader. In testing the piece for two minutes as a magazine arm, six trials were made, on account of various mishaps, the last trial resulting in 50 shots being made; and in firing from the hip at short range, 30 shots were made and 5 cartridges introduced into the magazine in one minute. Throughout the 500-round endurance test the mechanism worked well, and also as a single loader for 100 rounds. The gun also worked well after both dust tests, with the magazine loaded and empty when exposed, and defective cartridges and excessive charges in no way affected the mechanism, which worked freely and well and to the satisfaction of the board. After rusting the bolt had to be opened with a mallet, and the firing pin was rusted fast, so the gun could not be fired.

The other American guns submitted to the board included one by John H. Blake, of New York City, in which the magazine, lying below the receiver, contains a revolving cylindrical packet holding seven cartridges; a gun by the Chaffee-Reece Arms Co., of Washington, D. C., with a tubular magazine carrying five cartridges in the butt stock; one by M. H. Durst, of Wheatlands, Cal., having a cylindrical ten-cartridge magazine lying directly below the receiver, the cartridges being loaded singly or stripped from a clip as with the Mauser gun; one by Ivert Larsen, of Chicago, with five-cartridge magazine and cut-off; one by J. W. Mullins, of Fariston, Ky., in which the magazine is designed to hold but three cartridges; one by Major W. R. Livermore and Captain A. H. Russell, of the United States army, very similar to the Lee-Speed gun of England; and one by Arthur Savage, of Brooklyn, N. Y., with a magazine adapted to carry nine cartridges.

Before the question of selecting the best breech mechanism was submitted to the board, the War Department had fixed upon 0·30 of an inch as the caliber of the new rifle, instead of 0·45 of an inch, the old standard. It had also settled upon the length of the barrel, the twist of the rifling, the number and form of grooves, and the dimensions of the chamber corresponding to the new cartridge, which will have a bottle-necked shell, and will, when loaded, be 3·09 inches long. The bullet will be 0·309 inch in diameter and weigh 230 grains; it is made of hardened lead incased in a jacket of copper. A charge of 36 grains of smokeless powder is to be used, giving an extreme range of 4,000 yards, or a range of some 1,500 yards with a very flat trajectory. The smokeless powder used on the trials came from Wetteren, Belgium, but we already have a smokeless powder, perfected by officers in the service, which has many superior points, and is thought to be fully equal to any of the smokeless powders heretofore made in Europe.

The report of the board, forwarded to the War Department in September last, approved by the chief of ordnance and the Major-General commanding, has also received the approval of the department, and in November orders were issued for the commencement of work upon this new United States magazine rifle at the gun shop of the Springfield Armory. A great amount of preparation is necessary before it will be possible to turn out the guns rapidly in quantities sufficient to supply the army, much of the present machinery having to be materially changed and considerable new machinery having to be supplied, but this work of preparation is now well under way. It is being energetically pushed under the immediate direction of Captain S. E. Blunt, of the ordnance department of the army, who was the recorder of the board, and who has a national reputation as being one of the most competent officers in the service in all matters pertaining to the manufacture, handling, and use of small arms. It is expected that deliveries of the new arm to the army will commence about June or July, 1893.

* An illustrated description of the manner in which these tests were carried out was published in the SCIENTIFIC AMERICAN of August 22, 1891.



PROF. NEWBERRY.

JOHN STRONG NEWBERRY.

The present year will be long remembered in the history of the National Academy of Sciences by the large number of deaths among its distinguished members. Scarcely had 1892 been ushered into existence when the loss of the venerable Quartermaster-General Montgomery C. Meigs was made known. In quick succession came the announcements that the physicist Lovering and the chemist Sterry Hunt were no more. The botanist Watson and the astronomer Rutherfurd died before the year had reached its fullness. In the early autumn the engineer Trowbridge died, and now, as the year is fast drawing to a close, death claims as its victim one whose genius placed him easily among the very first of our geologists.

John Strong Newberry was born in Windsor, Conn., on December 22, 1822. His ancestry was thoroughly American and his grandfather served with distinction in the revolutionary war, attaining a high rank in the army. At an early age the boy accompanied his parents to Ohio, and, as he grew up, determined to study medicine. Accordingly he entered the Western Reserve College, where he was graduated in 1846, and two years later received his medical diploma at the Cleveland Medical College. This education he supplemented by two years in Europe, where, besides pursuing special studies, he visited the great capitals.

Few men at that period were able to begin a professional career so well equipped in every respect as young Dr. Newberry. The city of Cleveland was, even in those early days, a large place and was beginning to feel the prosperity that came to it in consequence of the building of Western railroads. Perhaps more than any other city in Ohio it was a social center, and in 1851 Dr. Newberry settled there in the practice of medicine. For four years he was active in his profession, but his scientific researches were steadily leading into those branches which subsequently became his life work.

Soon after the discovery of gold in California, the desirability of a transcontinental railway was agitated, and the selection of a suitable route was one of great importance. The national government took an active interest in the matter, and during the years 1853–6 no less than five separate lines of geological reconnoissance were in active operation in different sections of the country west of the Mississippi River. To a young and enthusiastic student of natural history, here was a new and great field to be studied. James D. Dana and Philip T. Tyson had made brief reports on the geology of California, but otherwise it was a *terra incognita*.

Accordingly, in 1855, Dr. Newberry joined the United States army as an assistant surgeon, and in that capacity, but with charge of the geology, he was assigned to the exploring party sent out under command of Lieut. Robert S. Williamson, to examine the country between San Francisco and the Columbia River. He gathered information on the botany, geology, and zoology of the territory visited, and his reports appear in the sixth volume of the "Reports of Explorations and Surveys to ascertain the most Practical and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, made in 1853–6," which was published in Washington in 1857.

The work proved congenial, and, promptly on finishing his report, he joined the expedition under Lieut. Joseph C. Ives, assigned to the exploration and navigation of the Colorado River. With this party he entered the river at its mouth and ascended the turbulent stream by steamer some five hundred miles, until the entrance of the Grand Cañon was reached, where he spent nearly a year in making researches in the geology and natural history of that territory. His observations formed the most interesting material that was gathered by the expedition, and more than one-half of the "Report upon the Colorado River of the West, explored in 1857–8," issued by the government in 1861, was written by him. It was doubtless the interest aroused by this account that ten years later led Major John W. Powell, now director of the United