THE BURRY PAGE-PRINTING TELEGRAPH.

The development of the art of telegraphy has been marked by the production of some of the most ingenious machines to be found in the whole field of practical mechanics; and in no part of it has more well-applied inventive energy been displayed than in the direction of what might be broadly classified as telegraphic printing, or the automatic recording of messages by printing the same in the characters of the Roman alphabet.

Although the art of telegraphic printing had its beginning as long ago as the middle of the century, it is only during the past few years that successful attempts have been made to produce a true page-printing telegraph. The ingenious machine which forms the subject of the accompanying illustrations is a very successful attempt on the part of John Burry, of the New York News Bureau, 16 Broad Street, New York, the inventor and manufacturer both of this machine and of the well-known ticker which bears his name, to substitute a true page-printing telegraph in place of the old ticker with its messages written upon a continuous tape.

The objects aimed at in this invention may be broadly summed up under the following three heads:

First: To produce a machine that would receive a telegraphic message and print it in the Roman alphabet, not, as in the old "ticker," in a continuous line upon an endless strip of tape, but in presentable page form, suitable for commercial or domestic use.

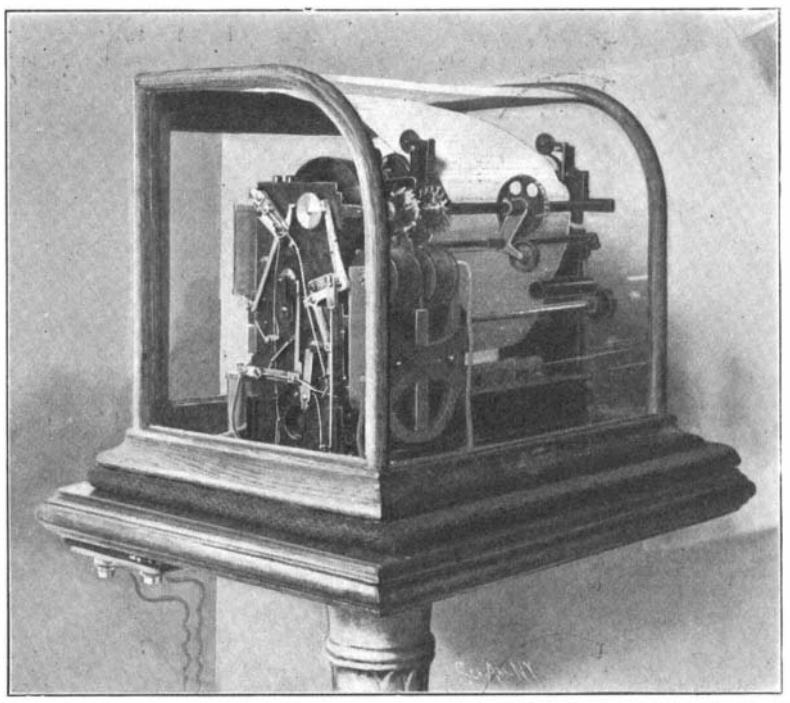
Second: To provide a machine which would be absolutely automatic, and, therefore, independent of both the sender and the receiver, thereby obviating all risk of clerical errors.

Third: To provide a system whereby a large number (several hundreds, if so desired) of these machines could be operated at one and the same time by a single sender at the central station.

Broadly stated, the system consists of a transmitting machine at the central station, from which, by the operating of a keyboard, certain electrical impulses are sent out, in the proper sequence and of the proper polarity, over two line wires, to any number of printing telegraphic machines. As each key of the transmitter is depressed at the transmitting station, electrical impulses are sent out through the circuits and act upon a series of magnets in each of the receiving instruments, the magnets serving to furnish the energy for the automatic movements of the machine.

The operation of the printing-telegraph, so far as its internal mechanical movements are concerned, is absolutely automatic, and hence, to all intents and purposes, the operator at the transmitting station, who may be some hundreds of miles distant from the printing telegraph, is able to print, without any possibility of error, a hundred different messages, in as many different and widely separated localities. We present a photographic view of the printing telegraph, as it appears when installed in a business office or any other place of use. It is mounted on an iron stand and inclosed in a glass case, as shown. As the roll of paper is printed it is delivered automatically at the back of the machine, and the printed matter may be cut off in pages of any desired length.

The relative position of the magnets in the electric circuit is shown clearly in the diagram (Fig. 2), and before entering into a detailed, consecutive description of the movements of the machine, it will be well to state briefly the particular operations which each magnet is designed to fulfill.



PAGE-PRINTING TELEGRAPH MOUNTED ON STAND.

The escapement magnet, *A*, controls the position of the escapement wheel, 2, and the type-wheel, 3.

The power magnet, *B*, has six functions:

(1) It turns the type-wheel forward or backward 1-72 part of a revolution at each pulsation;

(2) Winds the main spring, 4 (Fig. 5);

(3) Winds the traversing spring, 5 (Fig. 5);

(4) Controls the unison device, 6;

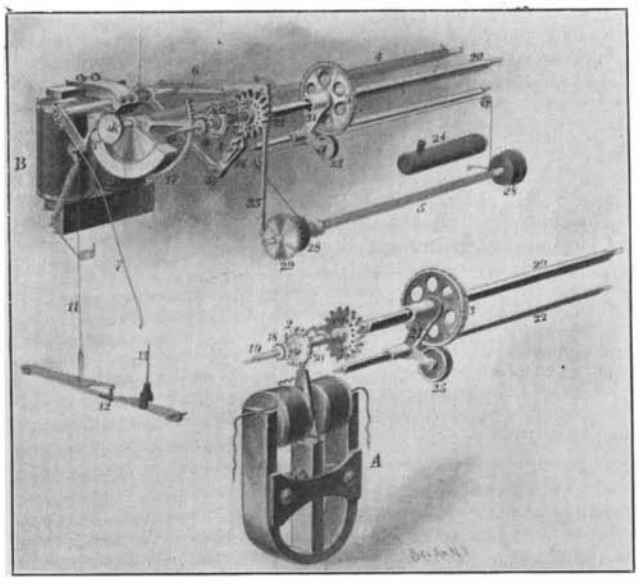


Fig. 5.—TYPEWHEEL POSITIONING MECHANISM AND ESCAPEMENT.

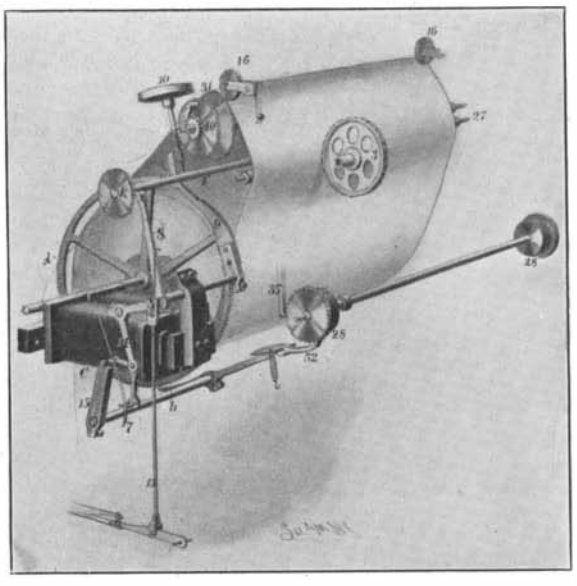


Fig. 3.—DETAILS OF PAPER FEED AND RELEASING GEAR.

(5) It gives oscillating movement to wire, 7 (Figs. 3 and 5), which throws pawl on arm 14 into engagement with arm 15 (Fig. 3);

(6) By means of a catgut, 11, it actuates one of the two contact points, 12; and acting in conjunction with the vertical rod, 13, operated by magnet, *C* (Fig. 3), it serves to cut in the current for magnet, *D*, whose duty it is to bring up the impression roller, 27 (Fig. 1), at the proper instant for printing a character.

The magnet, *C*, has four functions:

(1) By means of a pawl, 8, and ratchet wheel, *K*, it assists in winding up the main spring, 4 (Fig. 5).

(2) By means of arm, 9, it spins the shaft and flywheel, 10, and, through a worm on said shaft engaging a worm-wheel, 40, it winds up two helical feed-springs, which, acting on two toothed wheels, 31, one at each edge of the paper, serve to keep them under a constant tension.

(3) It operates the rod, 13, before referred to as assisting to cut in the current for magnet, *D*.

(4) It operates a lever, 14, whose lower end carries a pawl, which serves to engage the upper end of the arm, 15, for purposes later explained.

The purpose of the magnet, *D*, is to bring the impression roller, 27, forward at the proper instant for taking an impression from the type-wheel.

The quick-acting magnet, *E*, actuates a forked rod, 26, which forms part of a switching device, that throws the tooth, 24 (Fig. 1), to the right or left, and determines which of two adjacent letters on the type-wheel is to be thrown into the printing position.

The machine consists essentially of a base and two end frames, in which latter are journaled the various shafts and spindles, and upon which are carried the five magnets and the numerous pawls and levers, by which the various movements in the machine are performed. A roll of blank paper, 5½ inches in width, is carried upon a roller, with a steel center, journaled at about the midheight of the frame. It is maintained under a constant and even tension by means of two toothed wheels, 31 (Fig. 3), one at each edge of the paper, the paper being pressed down upon the serrated periphery of the wheels by two small pressure rollers, 16. The toothed wheels, 31, are maintained under constant tension by means of a winding gear, which is operated by the magnet, *C*, acting through arm, 9. As this arm oscillates, a knife edge on its upper end strikes a small pinion at the foot of the shaft, 10, on which is a flywheel, and causes it to spin, a worm above the pinion on said shaft engaging the worm wheel, 40, and winding up the shaft on which this worm-wheel is journaled. Upon the shaft, between the toothed wheels, 31, are two helical springs, which are wound upon the shaft with sufficient friction to cause the rotation of said shaft to exert a rotational effect upon said toothed wheels, 31, thus preserving a constant tension upon the paper. This tension is resisted by two pawls, *a* and *b* (Fig. 4), which engage a toothed wheel, *d*, keyed firmly upon the steel shaft that carries the roll of paper. The pawls, *a* and *b*, are operated by the pulsations of the magnet, *C*, and are brought into play whenever a new line is to be commenced, the releasing of the wheels allowing the paper to be unwound a quarter of an inch, which is the space between two successive lines. This escapement is provided with ingenious mechanism to compensate for the decreasing diameter of the roll of paper; for it is obviously necessary that the escapement wheel, *d*, should rotate through a larger arc, when the roll is nearly exhausted, than it does when the roll is full; otherwise an even feed of a quarter of an inch could not

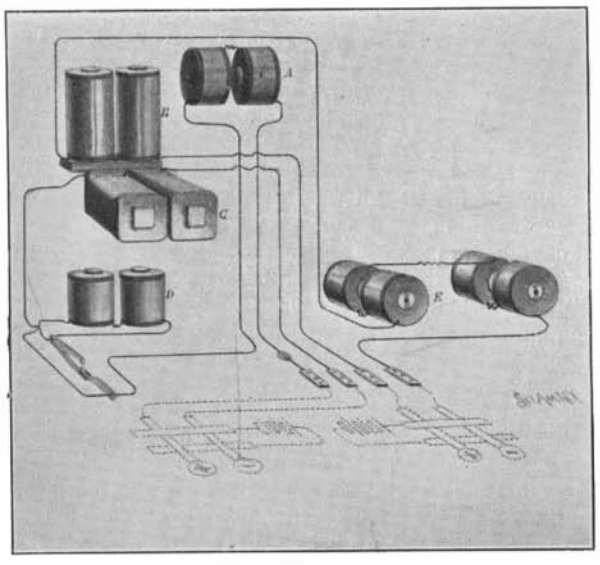


Fig. 2.—DIAGRAM OF ELECTRIC CIRCUIT.

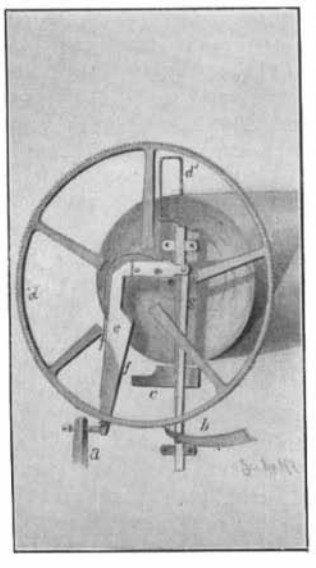


Fig. 4.—PAPER FEED.

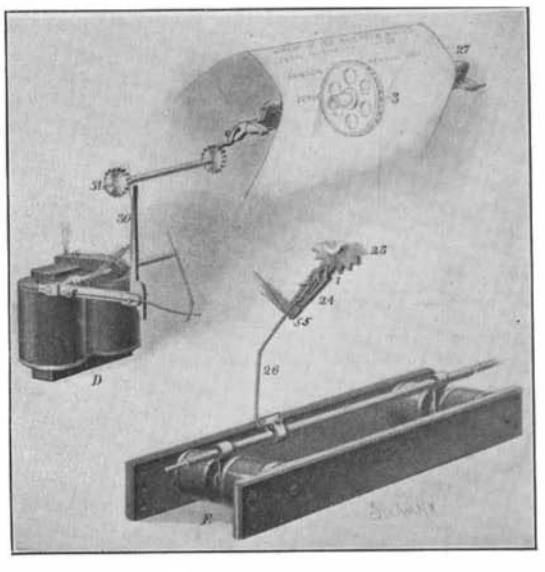


Fig. 1.—PRINTING MECHANISM AND OSCILLATING MOVEMENT.

be maintained at all times. The compensating gear consists of a curved wire, *d'*, one end of which rests upon the roll of paper, while the other is attached to a vertical sliding bar, at the center of which is carried a horizontal stop-piece, *c*. When the paper is to be drawn forward, the stop, *b*, is released and the stop, *a*, engaged, the amount of rotation of the escapement wheel, *d*, being determined by the distance between the inclined face, *f*, of the arm, *e*, which carries the escapement pin, *a*, and the opposing face of the stop-piece, *c*. By this arrangement it will be seen that as the roll decreases, there is an equivalent increase in the amount of rotation of the escapement wheel, *d*, at each release.

Type-Wheel: The type-wheel is a small disk of brass with the alphabet cast in soft rubber around its periphery. This wheel is capable of rotation, oscillation and lateral or transverse motion, these movements being secured in the following manner: In the first place, there is a helical mainspring, 4, extending entirely across the machine, which is kept under tension by two pawls, *T* and 8, operated respectively by magnets, *B* and *C*, as already described. This mainspring is in frictional contact with the shaft on which the ratchet wheel, *K*, is keyed, and one end of it is attached to and actuates a gear wheel, 17 (Fig. 5), which in turn rotates the pinion, 18, and shaft, 19. The shaft, 19, is clutch-connected by coiled springs, 50, with a triangular shaft, 20, on which the type-wheels, 3, and carriage, 21, slide, and by which the type-wheel, 3, is rotated. The smaller triangular shaft, 22, just below serves as a guide, and is engaged by the lower elbow of the carriage. The ink roller, 23, is carried on an arm of the carriage, and is inked every time it passes the ink-brush of the ink tank, 24 (Fig. 5). Under the constant tension of the mainspring, 4, operating as described, the type-wheel tends to rotate in a constant direction, but is controlled by the escapement wheel, 2, which is operated by the magnet, *A*. The escapement is so arranged that a single pulsation of the magnet causes the type-wheel to rotate through the space of two letters. Thus, if the type-wheel is to be rotated through the space of six letters, there will be three pulsations of the magnet, *A*, three teeth of the escapement being allowed to pass. When this has occurred, the wheel is brought up in its *approximate* position, or midway between any two letters, and it is now necessary to move the type-wheel to the right or left just half a space, or 1-72 of a revolution, in order to bring the desired letter to the exact position for printing. This small movement is accomplished by means of the V-shaped, reciprocating, tooth, 24 (Fig. 1), which is controlled by a magnet, *E*. This tooth is pivoted at 55 (Fig. 5) on a rocking arm, whose movement is derived from the magnet, *B*, as shown in Fig. 5. The V-shaped tooth engages a star wheel, 25, which is carried on the same triangular shaft, 20, as the type-wheel. After the escapement has brought the type-wheel to the mid-position between two letters, the magnet, *E*, by means of the forked arm, 26, throws a small tongue, 1, to the right or left of a guide pin, placing it in such a position that, as the tooth, 24, comes up, its right or left-hand face will engage the star wheel, turning it 1-72 of a revolution to the right or left, according as the right or left-hand letter is to be brought into the printing position. The movements involved in these operations, acting by means of catgut, 11, and vertical rod, 13, on the contact points, 12 (Fig. 5), cut in the current for magnet, *D* (Fig. 1), which, by means of a pawl, 30, and ratchet wheel, 51, brings the impression roller, 27, forward and prints the letter on the paper.

The transverse motion of the type-wheel across the machine is accomplished by means of a cord (Fig. 5) which is attached at its center to the type-wheel carriage, 21, and extends parallel with the guide bar, 22, passes over two small pulleys at the end of this bar, and is wound at each end on two drums, 28. The drums are rotated by means of the ratchet wheel, 29, and the pawl, 35, at every pulsation of the magnet, *B*, each movement of the ratchet causing the type-wheel to travel transversely the space of one letter. The ratchet also winds up the helical spring, 5, on the shaft that carries the ratchet wheel and drums, and when it is desired to return the type-wheel for the commencement of a new line the pawl is automatically released, and the tension of the helical spring, 5, draws the type-wheel sharply back to the starting point, ready to commence the next line.

The printing done by this most ingenious little machine is remarkably even, and in its spacing and general typographical excellence it compares favorably with the best work that is turned out on the typewriter. We are informed that during the past six months over one hundred and fifty of these printing telegraphs have been put in operation in New York and Chicago, the number being limited by the capacity of the shop in which the machines are constructed.

In 1900 applications for patents in the United Kingdom amounted to 23,909. In the previous year the number was 25,775, showing a decrease.

TRANSPORT SERVICE TO THE PHILIPPINES.—I.

It is unfortunate that a certain branch of the War Department, whose duties are in many respects more perplexing, arduous, and, at times, heartbreaking, than those of any other branch, should be the least in the public eye, and be apt to receive the smallest amount of credit for its services. We refer to what is known as the Quartermaster's Department. The efficiency of an army has, in every age, been measured largely by the effectiveness of its methods of transportation; and the modern developments in the art of war have been such as to render the work of the Quartermaster's Department of greater importance than at any previous period. Never, surely, have armies depended more absolutely for their success upon an efficient system of transport than those which, during the past two years, have been engaged in the mountains and swamps of the Philippines and on the broad veldt and among the rugged kopjes of South Africa.

The Quartermaster's Department is not merely charged with the duty of providing means of transportation of every character, either under contract or in kind, which may be needed in the movement of troops and material of war, but it has a great variety of other duties, incidental to the equipment, housing and supplying of an army. It furnishes all public animals employed in the service of the army, the forage consumed by them, wagons and all articles necessary for their use, except the equipment of cavalry and artillery. It furnishes clothing, camp and garrison equipage, barracks, storehouses and other buildings; constructs and repairs roads, railways and bridges; builds and charters ships, boats, docks and wharves needed for military purposes; and attends to all matters connected with military operations which are not expressly assigned to some other bureau of the War Department.

Beyond being aware of the fact that we have a considerable army in the Philippines, which is recruited and furnished with supplies from this country, the general public has but little knowledge of the vast amount of labor and expense entailed in the mere transportation of troops and supplies to those far-off islands of the Pacific. It is a fact that at one period of the war the fleet of army transports numbered no less than seventy large ocean-going ships, this being the number engaged at the time when the volunteers were being brought home and the regular army carried out to Manila. As this work was completed the transports were gradually discharged from service, until, at the present time, the fleet consists of twenty-six transports owned by the department, and eleven vessels which are employed under charter, making a total of thirty-seven vessels. The magnitude of the operations of the Quartermaster's Department may be judged from the fact that during the past fiscal year transportation was furnished by rail, water, wagon and stage, exclusive of the Army Transport Service, for 747,399 persons, 18,455 animals, and 328,801 tons of freight; while the army transports carried 104,422 passengers, 13,397 animals, 310,683 tons of freight, and 2,523,836 packages.

The army transports range in size from the "Ingalls" of 1,147 tons, and a carrying capacity of 26 officers and 260 men, up to the "Grant" of 5,658 tons, and the "Sheridan" of 5,673 tons, the former with accommodation for 68 officers and 1,836 men, and the latter accommodating 93 officers and 1,843 men. Six of the transports are of from 5,000 to 6,000 tons, these being the "Grant," "Hancock," "Logan," "Meade," "Sheridan" and "Sherman;" three, the "Crook," "Sedgwick" and the "Warren," are of between 4,000 and 5,000 tons burden; six vessels, the "Buford," "Kilpatrick," "Lawton," "Relief," "Sumner" and "McPherson," measure from 3,000 to 4,000 tons burden; while five vessels, the "Burnside," "Egbert," "McClellan," "Rawlins" and "Rosecrans," are of from 2,000 to 3,000 tons. Of the chartered ships, two, the "Indiana" of 2,484 tons, and the "Pennsylvania" of 3,166 tons, are used as troop ships, while the other nine, which are vessels of from 3,500 to 5,000 tons displacement, are used for the transportation of horses and mules, and live stock. The chartered vessels cost from $650 to $700 per day for charter alone.

The army transports are fine, seaworthy vessels, many of which like the "Meade," which was formerly the "City of Berlin," had previous to their purchase done duty for a considerable number of years in the transatlantic passenger trade. Others of the transports were vessels that, although they were built primarily as freighters, were furnished with a considerable amount of accommodation carried on superstructure decks amidships. When a transport is purchased she is sent to a shipyard where she is carefully surveyed and a very comprehensive specification is drawn up for her refitting and renovation. The special requirements of the transport service necessitate a large amount of structural refitting, which, together with the furnishings and accommodations for officers and men, bring the cost of reconstruction to a very high figure. In the first place, the hold of the vessel must be adapted to carry the class of cargo required for army purposes, the hatches and holds being so rearranged that the stores necessary for the subsistence of from 1,000 to 1,500 officers and men, for seventy days, may be at all times accessible. This necessitates that about 175 tons of provisions be placed so that they can be drawn upon daily as required. Provision must be made for keeping a large amount of meat in storage; vegetables must be stored in special gratings under lock and key; and various other special fittings must be put in place. A complete system of ventilation has to be installed; for where such large numbers of men have to be confined between decks, much of the time in tropical climates, special appliances are necessary for drawing off the polluted air and supplying large volumes of fresh air. The ventilation usually consists of four fans carried on deck, which are capable of supplying from 75,000 to 100,000 cubic feet of air per minute. The air is delivered to fore and aft lines of galvanized iron conduits, which extend the whole length of each of the living spaces. From these mains, numerous branch lines extend athwartship. The foul air is carried off either by exhausting fans or by means of uptakes and ventilators. Steam coils are provided in the conduits by which the air can be warmed, as required, in the winter.

The distribution of officers and men and supplies in two of the latest and best of the transports, the "Kilpatrick" and the "Buford," is as follows: The hold is devoted entirely to freight; the orlop deck above the hold contains the refrigerators and storerooms; the between deck is given up entirely to sleeping accommodation; the main deck contains two separate lavatories, two separate mess decks, and sleeping accommodation. The spar deck contains the hospital, officers' staterooms amidships, and spaces for the promenading and recreation of the troops; while the promenade deck contains other staterooms and is reserved entirely for the use of the officers.

One of our illustrations shows the sleeping accommodation on the between decks. The bunks are arranged in tiers of three. They are of a type which has been designed with a special view to ventilation and cleanliness. It was found that it was absolutely impossible to use the old mattress bunk, and at the same time keep the sleeping accommodations free from vermin. Moreover, in the hot and muggy atmosphere of the tropics the mattresses were stuffy and uncomfortable. The standard type of bunk herewith illustrated is known as the Lane-Irwine. It is carried on four standees of 1½-inch gas-pipe. The bed proper consists of a stout piece of canvas laced into a gas-pipe frame, the frame being in turn laced to the sides of the bunk. These bunks have been found cool and comfortable in the tropics, and they have the great advantage that the canvas bottom can be unlaced and washed. In the hospital the beds are, of course, provided with mattresses, and they are arranged only two deep. The floor, moreover, is carpeted with linoleum, and other measures are taken to provide special comfort. The mess deck is provided with tables and benches with folding legs, which are so constructed that they can be folded into a very small space and stacked away in racks at the side of the deck, leaving, as shown in our illustration, a large open space for promenading and recreation. The refitting of the transports necessitates the thorough overhauling of the plumbing and piping, and the provision of many thousands of feet of new lines. Much of this new piping is of copper and brass, and the lavatory fittings are of solid porcelain instead of porcelain-lined ware, which is found to give only indifferent service. By the time the transport has been thoroughly renovated and refitted the cost has run up to a pretty high figure, not far short, indeed, in the largest vessels, of half a million dollars, the actual cost of refitting the "Buford" at Newport News being $397,637, while the cost of refitting the "Kilpatrick" at the docks of the J. N. Robins Shipbuilding Company, of New York, was $408,000.

It is the aim of the Quartermaster's Department to run transports, if possible, with a full load of freight. Some of the larger vessels carry as much as 2,000 tons of cargo, in addition to a complement of 1,900 officers and men. It has been found that if the ship has a full complement and full cargo, transportation can be carried on very much cheaper by the Quartermaster's Department than it can be by shipping troops and supplies by the various steamship companies. Thus, one voyage of the "Crook" from New York to San Juan and return cost $9,761.39, whereas the cost estimated at the current rates of civil lines of steamships would have been $19,907, a saving of $10,145.61. Another voyage of the "Crook" from New York to San Juan and back would have cost $26,419.29 had the men and supplies been carried upon regular lines, whereas the actual cost by the transport was $14,062.94, a saving of $12,356.35. It is the opinion of Major Carroll A. Devol, the general superintendent of the Army Transport Service, to whom we are indebted for our illustrations and particulars, that although good results, as shown by these figures, are being obtained under the present system of purchase and reconstruction of ships, even better economy could be realized if the department