for use on the Canal Zone, in addition to the very large number in the offices in Washington. All the machines sent to the Canal Zone were of bronze, as such machines were much better adapted to the climatic conditions prevailing on the Isthmus, being entirely rust proof.

The machines were used for correspondence, for the preparation of data, contracts, etc., and for filling in blank forms of all widths and descriptions. That there might be no delays, no mistakes, no duplications of any part of the huge undertaking, daily reports were made from all, even the most insignificant branches of the work, and these reports were required to be copied for the information, not alone of those directly in charge of the whole undertaking but those in charge of each part of it. All this work of making the original reports and the copies was done by the use of mechanical writing machines. It could not have been done otherwise.

Every piece of mechanism used on the zone or in the construction of the canal had to be made with a view to meeting the climatic conditions. This fact added very largely to the labors of those having direction of the work, in seeing that all equipment met such requirements. The ordinary mechanical writing machines, or those made to meet the requirements of the temperate zone, or for use in a dry climate, would have soon failed on the Isthmus; hence the wisdom in purchasing those made of bronze. The Underwood, being constructed for work of varying widths, for preparing tables, filling in specifications, etc., met all requirements of the commission.

For handling accounting and other records in connection with the system of keeping track of the canal work, a number of standard writing-adding machines manufactured by the Elliott-Fisher Company, of Harrisburg, Pa., were furnished to the Canal Commission. The wide scope of work that could be advantageously handled on these machines, and their superior durability led to their selection. The machine is manufactured from parts produced from the finest grade of machinery and tools in the Elliott-Fisher factory, and the fact that the writing machine with the adding machine combined can be placed over any number of columns, permitted its use in many ways that made for economy and accuracy in keeping the canal accounts and records.

Enormous quantities of stationery of various descriptions were consumed at Panama. The bulk of this was furnished by the Tower Manufacturing and Novelty Company, of New York, and during the period of construction hardly a steamer left New York for Panama without carrying a consignment of stationery and miscellaneous office supplies from the company to the canal authorities. The company carried such a large and complete stock on hand that it was able at any time to meet the wants of the commission, and this was a factor in the continuous business awarded to the company.

A great American concern which figured indirectly in the canal work was the Interlaken Mills, of Providence, R. I., the largest manufacturer of book cloths in the United States. For many years this company has supplied nearly all the cloth for the government printing office at Washington, where, in addition to other publications, it was used in binding the *Canal Record*, the official publication of the Isthmian Canal Commission.

Cable and Telegraph Facilities

The officials at Panama Canal were kept in instant communication with the Washington government, and other points in the United States, through the extensively equipped cable and overland telegraph system of the Central and South American Telegraph Company. The lines of communication to Mexico and Central and South America available through this system are graphically shown in the accompanying plate.

J. H. Bunnell & Co. Inc., manufacturers, importers, and dealers in telegraph, telephone, railway, and electric lighting

supplies, with headquarters in New York, one of the oldest and best known electric houses in the world, had the distinction of furnishing the instruments and equipment in its line that were used to facilitate the construction work of the Panama Canal. This company has a reputation for manufacturing high grade apparatus, and its product met the high standards of efficiency called for on the Canal Zone.

Building Material and Equipment

In 1904 and 1905, in the early rush of the canal work, many portable houses were set up by the Canal Commission along the zone of construction. These buildings were supplied by the Ducker Company, of New York, the pioneer in this line of manufacture in the United States. The Ducker sectional portable house has been manufactured by the company for the past thirty years, and this long experience, combined with excellent manufacturing facilities, has brought about the production of a system of sectional portable construction that is acknowledged by the engineers and experts to have reached perfection.

Although these houses are erected without the use of nail or screw, they have all the attributes of the best permanent construction, while at the same time they are adapted to speedy demolition and quick reërection. There is nothing unusual in the appearance of these buildings, and in fact they are architecturally correct. They are turned out by machines, assuring mechanical accuracy of parts, perfect fit, and ready interchangeability. These sections are made at the Ducker factory in sections two feet and nine inches wide and any desired height, including windows and doors. The construction is patented, and was adopted by the United States government as a standard of excellence after a rigid inspection by the government engineers. The buildings erected at the canal were for offices and wireless telegraph houses. They are in general use for all kinds of government buildings, schools, churches, bungalows, railway stations, cottages, garages, and emergency buildings of various kinds.

In the evolution of the building methods at the Isthmus, following the beginning of the canal, from the primitive structures of Spanish-Indian character down to the latest types of finished and sanitary construction, such as are now to be found throughout the entire zone, the National Fire Proofing Company, of Pittsburgh, played no inconsiderable part.

The main product of this company used in building construction at Panama was its "Natco" hollow tile, an article that had commended itself throughout the building world. At the time the National Fire Proofing Company was called upon by the Isthmian Canal Commission to furnish supplies no information was given regarding the buildings in which the tile was to be used. It was subsequently ascertained, however, that such mention was not necessary, as the tile was used in the construction of practically all prominent buildings erected in the Canal Zone. Foremost among these are the government cold storage plant, the administration building, the Washington hotel, and the new station for the Panama Railroad at Panama City, all of which are fireproof throughout.

The government cold storage plant, located in Colon, is one of the largest and most completely equipped plants in the world. The capacity of the plant is such that from it 50,000 people can be supplied daily with fresh foodstuffs. The extraordinary climatic conditions under which this plant is maintained, with the excessive tropical temperature and humidity the year round, necessitated its construction throughout with an absolute non-conductor of heat. Such a non-conductor was found in "Natco" tile, serving at the same time as fireproof protection for the vast amount of perishable products.

The administration building at Ancon is one of the most beautiful architectural structures on the Isthmus, and was designed as a permanent and practically indestructible home for the executive and

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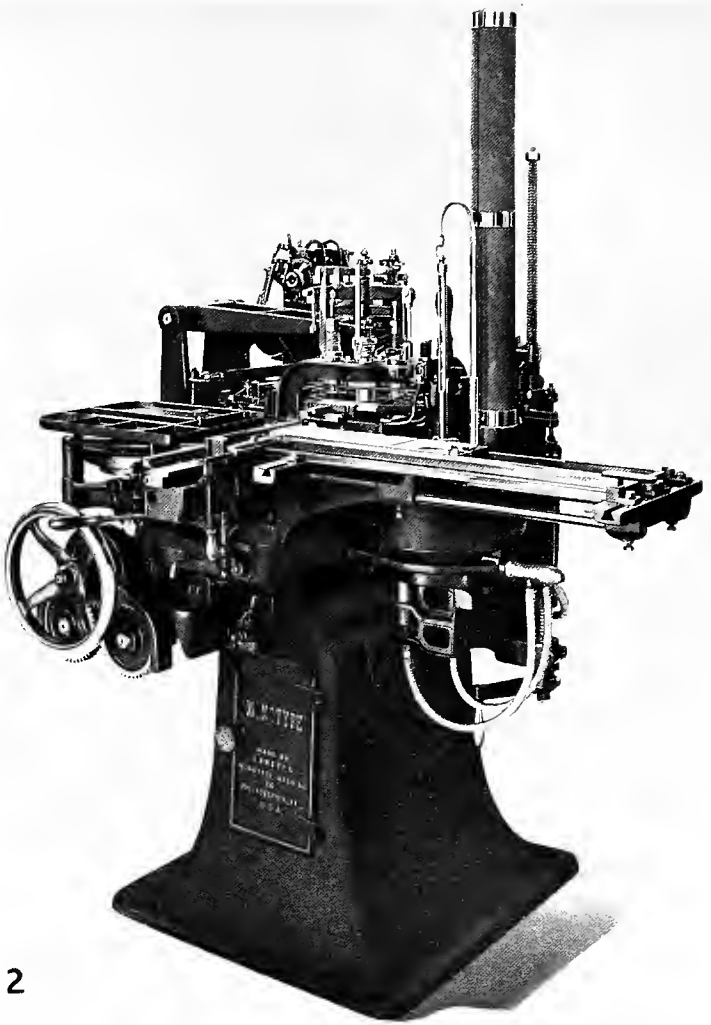
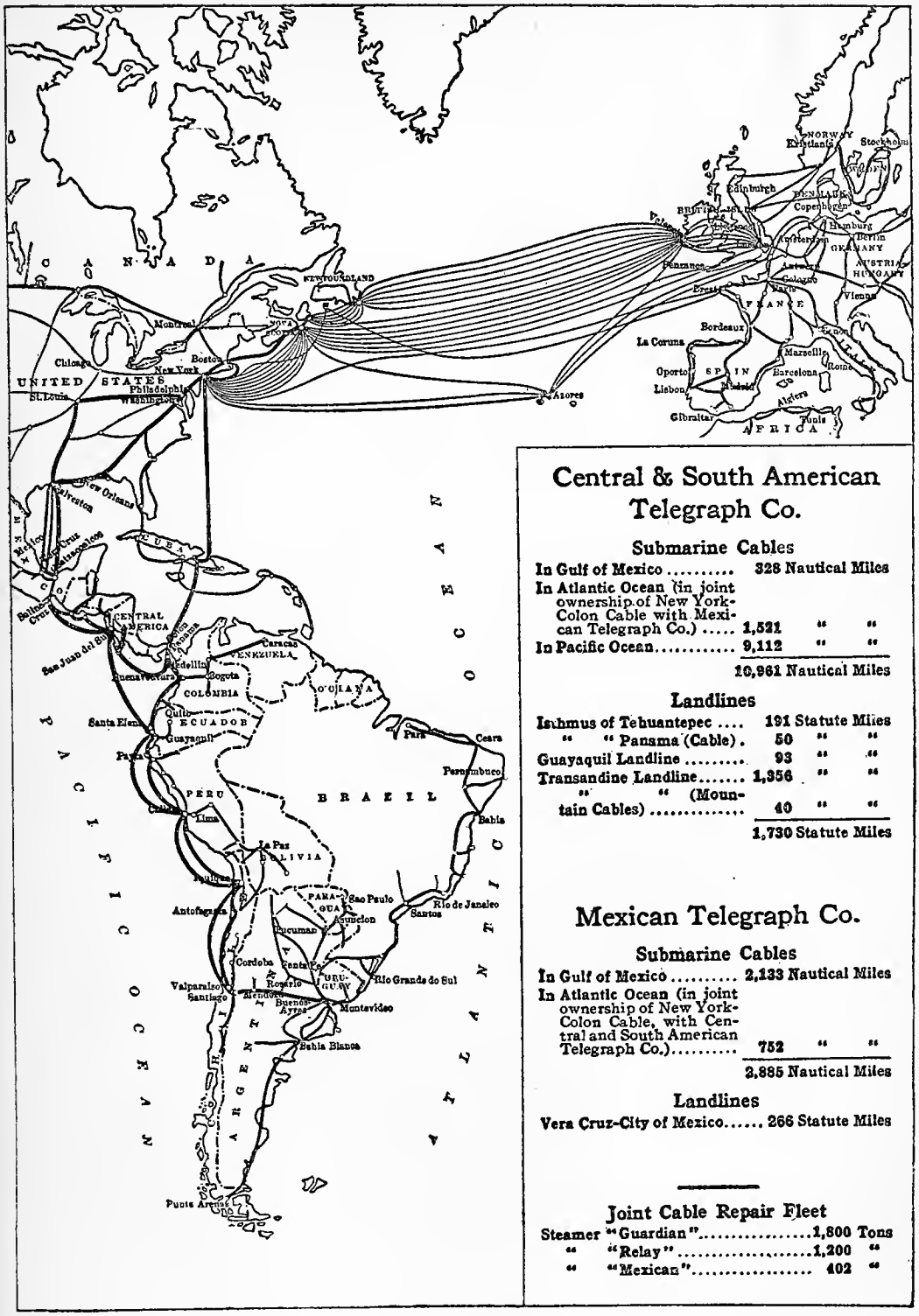


2

1. Keyboard of the Lanston Monotype Machine used by the Canal Commission.
2. Lanston Monotype Casting Machine used on the Canal.
(Lanston Monotype Machine Company, Philadelphia, Pa.)



Central & South American Telegraph Co.

Submarine Cables

In Gulf of Mexico	328	Nautical	Miles
In Atlantic Ocean (in joint ownership of New York-Colon Cable with Mexican Telegraph Co.)	1,521	"	"
In Pacific Ocean.....	9,112	"	"
	10,961	Nautical	Miles

Landlines

Isthmus of Tehuantepec	191	Statute	Miles
" " Panama (Cable).	50	"	"
Guayaquil Landline	93	"	"
Transandine Landline.....	1,356	"	"
" " (Mountain Cables)	40	"	"
	1,730	Statute	Miles

Mexican Telegraph Co.

Submarine Cables

In Gulf of Mexico	2,133	Nautical	Miles
In Atlantic Ocean (in joint ownership of New York-Colon Cable, with Central and South American Telegraph Co.).....	752	"	"
	2,885	Nautical	Miles

Landlines

Vera Cruz-City of Mexico..... 266 Statute Miles

Joint Cable Repair Fleet

Steamer "Guardian".....	1,800	Tons
" "Relay"	1,200	"
" "Mexican".....	402	"

Cable Connections with the Isthmus.

administrative affairs of the canal and the United States government.

The new Washington hotel's a three-story structure, the only wood being that used in door and window frames and the ball-room floor. All other floors are of Natco hollow tile, furnished by the National Fire Proofing Company, while the walls are of steel and reinforced concrete frame work, with hollow tile curtain walls. In the $85,000 station at Panama, hollow tile was utilized to the fullest extent, finding a place not only in wall construction but in the circular pillars and arches of a building of classic design.

With characteristic official policy, the representatives of the government refused to commit themselves on the subject of materials to be used in all the permanent buildings without making experiments with cement blocks, as in the fire department headquarters at Cristobal, and with reinforced concrete, each of which defeats the devouring ant, and offers resistance to the sun and fire, whatever may be said against their value in a climate of excessive dampness. But with all the materials of the United States to draw from, and with no restrictions beyond those imposed by conditions at the Isthmus, the government selected for its first permanent buildings, inside and out, terra cotta hollow tile. "Will hollow tile make good in the tropics?" was asked of the man on the ground representing the Central American Construction Company. "It's the ideal building material for this country," was his answer. "It's cooler than any other. It is impervious to moisture, which counts in a land where it rains nine months out of the year. The ants can't harm it, and it is proof against fire."

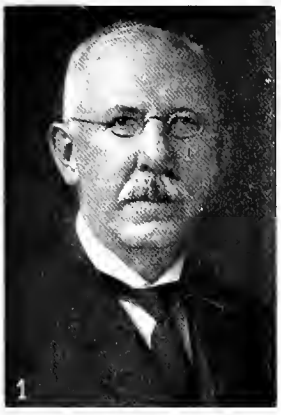
What is true of its use in the tropics is applicable, of course, to the conditions experienced in the temperate zone. The hollow tile block of the National Fire Proofing Company is the outcome of many years of experimenting. Its dead air space makes it warmer in winter and cooler in summer in houses or other buildings where it forms part of the construction work. Other advantages are its minimum weight, its sound proof qualities, its imperviousness to moisture, the possibilities of rapid construction where it is used, and the fact that it may be laid at any time of year, without reference to weather, temperature, rain, or snow.

Thousands of buildings in the United States have used hollow tile, including trust and bank buildings, apartment houses, art galleries, sky scrapers, bungalows, and costly private residences, as well as silos in the agricultural districts. It is also adapted for use in the construction of less pretentious residences, as it gives to them all the stability and strength that is to be found in the structural work of the sky-scraper order of architecture.

The National Fire Proofing Company was organized in 1889. It is engaged in the manufacture and installation of fire-proofing material of every description, hollow building blocks, conduits, sewer pipes, drain tile, and other forms of clay products. The raw material used is clay, which is mined from properties owned by the company in proximity to the markets, thus providing for the transportation of the finished ware with economy.

The factories of the company, twenty-six in all, have a total annual capacity of about 1,000,000 tons of finished product. The company has engineering, constructing, and draughting organizations in connection with its offices in Pittsburgh, New York, and Chicago, and maintains a completely equipped testing laboratory in Chicago. It has offices in several of the more important cities of the United States, from New England to the Pacific Coast.

With the introduction of modern building construction at the Isthmus, consequent upon the beginning of work at the canal and the housing of government employees, calls were made on manufacturers of all sorts of building material combining elements of ornament and attractiveness, as well as durability and protection. In this connection there was brought into the canal



TYPES OF AMERICAN BUSINESS MEN WHO CO-OPERATED ALONG VARIOUS LINES IN AMERICA'S GREAT WORK AT PANAMA

1. George E. Earnshaw, Pres., Earn Line S. S. Co., Phila., Pa.
2. S. W. Whitmore, Whitmore Mfg. Co., Cleveland, O.
3. L. E. Johnson, Pres., Norfolk & Western Ry.
4. John Kolb, Pres., Theobald & Oppenheimer Co., Phila., Pa.
5. Gustav Dalen, American Gasaccumulator Co., Phila., Pa.
6. Thos. E. Coale, Pres., T. E. Coale Lumber Co., Phila., Pa.
7. F. C. Austin, Pres., Municipal Engineering and Contracting Co., Chicago, Ill.

work the firm of David Lupton's Sons Company, of Philadelphia, which, in 1911, furnished to the Canal Commission 110 Lupton hollow metal windows for the government buildings at Colon.

These windows were glazed with wire glass, and were used to protect from fire the buildings in which they were installed. The material used was keystone metal, a copper-bearing open hearth steel, which offers a particularly successful resistance to corrosion and to the action of all gases and fumes.

The Lupton Company, which was one of the earliest manufacturers of this type of fireproof windows, has had over forty years' experience in roof lighting and metal windows. Among its specialties in construction are roof formations to aid in the quick removal of gases and fumes, as in foundries and laboratories; arrangement of roof levels in power houses for the conduct of heat; special adaptation of material and construction to the needs of forge shops, machine shops, and weave sheds, and the arrangement of sash panels and lighting and ventilating areas in multiple-story buildings. The Lupton Company furnishes and installs the latest developments in steel sash, steel partitions and doors, rolled steel sky-lights, hollow metal windows, louvers and operating devices for the effective control of all types of windows.

The main office and works of the David Lupton's Sons Company are at Allegheny Avenue and Tulip Street, Philadelphia, Pa. The works are given over exclusively to the special construction of material for light and ventilation in fireproof buildings. The company also has offices in New York, Pittsburgh, and Chicago. Its leading officers are: Edward Lupton, president; David D. Lupton, treasurer; and E. T. Wilkinson, secretary.

The prominent part played by the Thomas E. Coale Lumber Company in construction work at the canal is shown by its record of lumber shipments, which in two years reached nearly 4,000,000 feet of lumber and piling, with nearly half a million feet of orders for lumber to be filled.

It was not until the latter part of 1911 that the company entered into business relations with the Canal Commission. At that time its New Orleans agent took the first order for a quick shipment from that port. This was followed by large bids for piling and lumber, resulting in many awards, all of which were filled promptly and some under unusual conditions calling for the highest order of business enterprise. One instance of this character was of especial interest. At the height of the task of filling its contracts, the failure of one of its sub-contractors left the company without the supply of piling necessary to fill its order. Realizing its responsibility to the government, the company at once chartered a steamer at Gulfport, at a freight rate of $250 a day, before it had secured a single foot of lumber to go on the boat. It then took up the business which its sub-contractor had failed to handle successfully, and within ten days the boat was loaded and on its way to the Isthmus.

Thus began the relations of the Thomas E. Coale Lumber Company with the canal. It first utilized the steamers of the United Fruit Company in transporting its materials. Later the company chartered the *Haakon VII* and the *Thelma* through its Jacksonville agent, and after August, 1912, kept those vessels in constant commission carrying lumber and piling from the Atlantic coast to Colon.

In the construction work large quantities of heavy timbers were used, practically all shipped to the Canal Zone from the United States. The heavy timbers were mainly used as dipper handles and spuds for dredges, and were chiefly of Douglas spruce shipped from Seattle and Tacoma, Wash. Four of these timbers were twenty-four by twenty-four inches and sixty-five feet long. Four other pieces of the same length were twenty-eight inches in diameter, dressed round. Firm white oak and yellow pine were used in the construction of the spill-

ways, repairs of cars, and for car stakes. The oak and pine were shipped from Baltimore. George R. Johnson, of Baltimore, was the contracting party for furnishing much of the lumber and heavy timber used.

J. K. Joice, of Chicago, had the distinction of receiving the Canal Commission's first order for lumber, and he continued with additional shipments from time to time, his total consignments running in value to about $750,000. The lumber supplied was used throughout the Canal Zone in various ways, much of it going into buildings, and the remainder being used in the construction of the canal works.

The D. L. Gillespie Company, of Pittsburgh, a large firm widely known throughout the country, was prominent in the canal work through shipments of lumber and building material in great quantities.

Early in the history of canal operations the Gold Metal Camp Furniture Manufacturing Company, of Racine, Wis., received orders from the Isthmian officials for supplies of its Gold Medal camp cots for the use of the employees at the canal. In all between 30,000 and 40,000 cots manufactured by this company were ordered. Of this number nearly 15,000 were contracted for by direct order, and thousands more were supplied through dealers at Panama. The orders filled from the Racine headquarters aggregated $38,000 in total cost.

The Gold Medal Camp Furniture Manufacturing Company received its orders as the result of competitive bidding. Its bids were not only the lowest for the quality of cots called for, but the cots were recognized as best adapted to use in tropical climates, being constructed of wood, steel and canvas, in accordance with the United States army specifications. The company's highly developed manufacturing plant also gave it exceptional facilities for the immediate filling of large orders. The cots were mainly used as beds for laborers, and in the hospital wards. In addition to the direct shipments and those supplied through local dealers, it is understood that the War Department furnished many more cots from its stock of these goods, of which it usually has a large quantity on hand.

The high estimate in which these cots are held is attested to by their general use in the government departments. Immediately after the close of the Spanish-American war the War Department advertised for 67,000 cots, and after thoroughly testing the different kinds offered, of which there were more than twenty samples submitted, the product of this company was selected as the best suited for war purposes, and especially for service in the insular possessions of the United States, as well as for the soldiers then still stationed in Cuba. The Medical Department of the United States army and also of the navy have adopted this cot as their standard.

Some of the stools, chairs, and portable bath tubs of this company have likewise been adapted as standards in the army and navy, to which large quantities have been furnished from time to time. Another product of the Racine concern which has been purchased in large numbers by both the army and navy is the United States army standard litter. These are also manufactured for various railroads and other corporations throughout the United States. The company's products are found in every civilized country.

For a number of the permanent government shop and other buildings on the Canal Zone, as well as for several of the temporary buildings, rolling shutter doors, manufactured by the Jas. G. Wilson Company of New York were furnished from the company's factories at Norfolk, Va.

These doors were of the interlocking slat type, made of No. 20 gauge steel, galvanized and operated by electric motors. They were equipped with the Wilson Company's patent anchor device to prevent their being blown out of the grooves in high winds.

Thirty-nine of the Wilson shutters were installed in the permanent shop buildings at Balboa, and at Panama thirty-nine doors were furnished for the Panama Rail-

road freight house. In addition, the Wilson doors were used in the temporary forge, boiler, and erecting shops at Balboa during the canal construction period.

John Lucas & Company, of Philadelphia, with factories at Gibbsboro, N. J., and Chicago, and branch offices in all the large cities of the United States, furnished great quantities of paint and varnishes for the buildings and machinery at the canal. Under the trying climatic conditions on the Isthmus, this paint and varnish was found completely up to standard.

The oldest mercantile house in America is that of F. W. Devoe & C. T. Raynolds Company, manufacturer of paints, varnishes and painters' supplies, of New York. This house was founded in 1754, when George II reigned over England, and ruled America. Not only is it the oldest mercantile house in the United States, but it is the largest concern in the world devoted to the manufacture of paints, varnishes, brushes, and artist's materials.

It was originally founded by William Post, and has continued in an unbroken line of succession for 160 years. The watchword with which William Post began business in a little way in 1754, was "high quality of product," and that has continued to be the watchword of his various successors, and is still on their banner. The name "Devoe" on a package, can, or brush, is its guarantee as to quality of material used, and of the workmanship in producing it.

The trade of this firm reaches every part of the continent. It operates offices and salesrooms in every large city of the country, and has factories in New York, Chicago, Brooklyn, and Newark, N. J. The firm was an important factor in furnishing supplies for the construction for the great waterway connecting the two oceans. The climate of the Isthmus renders almost everything subject to rapid decay, especially iron and steel, and the best protection is afforded by paints and varnishes. These necessary articles were supplied in large quantities and from one end of the canal to the other Devoe's paint is seen.

The word "hammock" is derived from the hamack tree of Brazil, the fibrous rind of which has been used by the natives for centuries for the manufacture of *hamacas* or nets in which they sleep.

The German word "Hang-matte," meaning hanging mat, has been supposed by some persons to be the origin of the word, but it seems certain that the hammock itself is of American origin.

Columbus, in his account of the earliest voyage to America, speaks of the Indians coming down to the sea to barter their cotton and *hamacas*, or sleeping nets, for the baubles the mariners offered.

In tropic climes, with the long rainy season, the necessity becomes apparent for some cool, elevated sleeping arrangement which places the sleeper out of reach of pests and reptiles. The natives of "Brasill," as it was then termed, must have led in the early manufacture of hammocks, and the name "Brasill beds" has been given to the hammocks of their making.

Down through the years since the discovery of America we find the hammock, with its "soothing seductiveness," referred to in song and story, until today the *hamaca* or sleeping net of the aborigine has, by various stages, been developed to the perfection found in the product used by the canal army, which was furnished by the Hohlfeld Manufacturing Company, of Philadelphia.

It is the natural sequence of the development of American lines of industry from ideas furnished by the aborigines to find that surprising numbers of Hohlfeld hammocks were used on the Isthmus. The hammocks furnished by this company, if placed end to end, would reach a distance of about four miles. In the varied assortment of this company can be found hammocks for the poorest native of even the countries in which the hammock originated, as well as couch hammocks or hanging divans fit to grace the arbor of a prince. Hammocks for the dweller in the country where out-door space is abundant, folding hammocks for the city dweller, where space is limited, collapsible couch hammocks for

the camping or prospecting party, or for the sailor, are all manufactured by this company.

The Ludowici-Celadon Company, of Chicago, manufacturers of terra-cotta roofing tiles, entered into several contracts with the Canal Commission for promenade tile, cove-base, and angles for the floors of the Colon hotel. The material included in three contracts shipped in 1912 comprised 101,000 square feet of six by nine promenade tile, 10,650 feet of cove-base tile, and 3,900 feet of cove angles. These were a vitreous shale tile adaptable to any climate, and could be used either for floors, or flat roofing. This particular shipment of tiles was manufactured at New Lexington. This is one of the Ludowici-Celadon Company's factories, three others being located at Coffeyville, Kan., Chicago Heights, Ill., and Ludowici, Ga. In addition to the floor tile supplied to the hotel at Colon, the company shipped large quantities of roofing tiles for use on the Isthmus. These were found well adapted to the tropical climatic conditions of Panama, and gave general satisfaction.

In keeping with the rest of the canal's equipment, the glass which entered into the construction of the buildings at the canal was manufactured in the United States. Swindell Brothers, of Baltimore, manufacturers of druggists', chemists' and perfumers' glassware and window glass of all kinds, were heavy shippers of window glass to the canal, their shipments in the period between April, 1910, and July, 1912, running to 40,000 square feet of the best quality, double thickness window glass and 700 square feet of rolled glass. Superior quality, reasonable price, and prompt delivery secured the business for this company.

Practically all the fire brick for the power plants on the Isthmus was furnished by the Chas. Taylor Sons Company, of Cincinnati. The commission specifications for this article were the severest ever exacted, and the company maintained a continuous laboratory check on the product as it came from the factory, thus fully keeping up with the specifications.

The Hydrex Felt and Engine Company, of New York, specialists in structural water-proofing, and manufacturers of Hydrex waterproof felt, Pluvinox reinforced roofings, Saniflor deadening felt, Novento building paper, waterproofed papers and burlaps, compounds, asphalts, paints, etc., furnished large quantities of their product for the buildings on the Canal Zone.

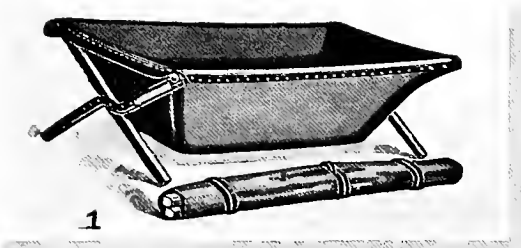
In all the administrative buildings and homes on the Isthmus, special attention was given to lounge and chair equipment as an offset to the enervating climate. In supplying chairs and lounges, which added greatly to the comfort of the canal workers and their families, the firm of Thonet Bros., of New York, was prominent.

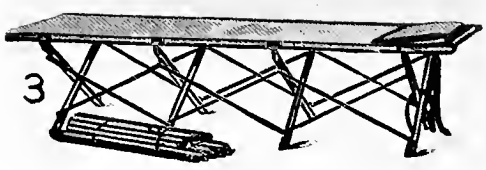
The Panama Canal was above all a utilitarian project, but one American firm is distinguished by having furnished material for the beautification of the Canal Zone. This was Peter Henderson & Co., of New York, who over a series of several years furnished the canal authorities with quantities of flower seeds. The firm also supplied vegetable seeds, and many varieties of flowers and vegetables from these flourished on the Isthmus, giving an added interest to the homes of the canal workers.

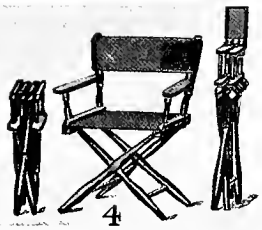
Marine Equipment

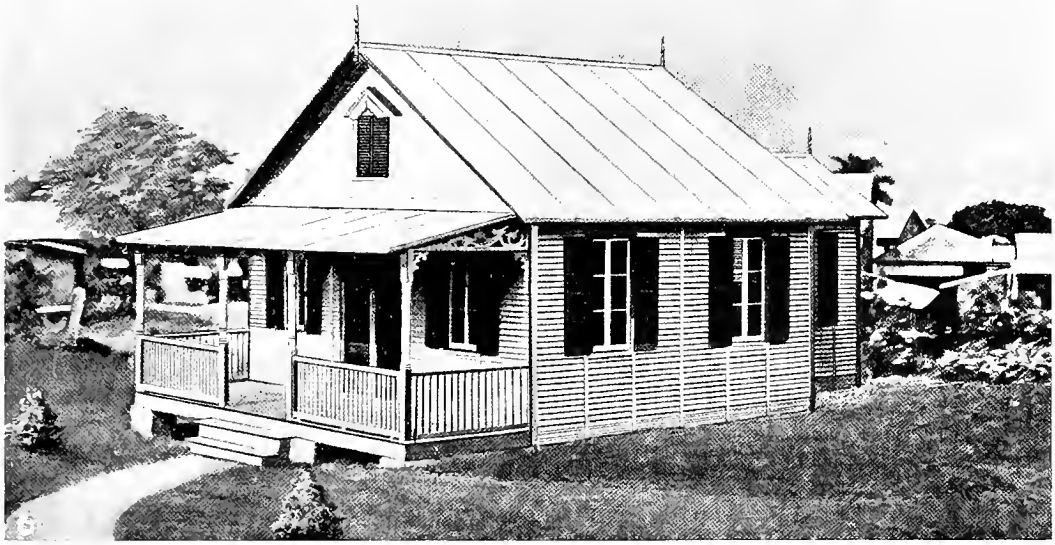
During the construction period a number of vessels needed for the Pacific side of the work gave a practical demonstration of the need of the completed canal by having to travel around South America in order to reach their place of work. One of these was the tug *Cocoli*, formerly the tug *Catherine Moran*, built for the Moran Towing and Transportation Company, of New York, in 1904, and sold by that company to the Isthmian Canal Commission in 1907.

The *Cocoli* is constructed of steel, with steel deck house, and has a length of 105 feet, and beam of twenty-three feet. She was fitted out for the trip to La Boca, on









1, 2, 3 and 4. Canal living equipment supplied by the Gold Medal Camp Furniture Manufacturing Company, Racine, Wis.
5. Portable wireless station building at Colon.
6. Portable cottages for the canal engineers.
(Portable buildings supplied by the Ducker Company, New York.)

the Pacific side of the Isthmus, at the pier of the Panama Steamship Company in New York, and on October 25th, 1907, left New York in charge of Captain Phillips, and Chief Engineer John Sperr, both of whom were employed by the Moran Company on the tug before she was sold to the commission. Passing through the Straits of Magellan during the middle of December, the *Cocoli* reached La Boca on January 9th, 1908. Her trip was very successful, as she made no stops other than those necessary to secure supplies, and arrived ready for duty.

The manufacturing center of Buffalo, N. Y., which had such a large part in supplying equipment for the canal work, scored again through the Buffalo Gasoline Motor Company, which supplied gasoline marine engines for the canal motor boats *Manzanillo*, *San Blas*, *Toro Point*, and others. The company also supplied a number of seven and one-half, ten, and fifteen horsepower gasoline engines for use at various points on the canal.

Two floating hoists, the largest ever constructed, were built for the Canal Commission by Neumeyer & Dimond, of New York, manufacturers of all kinds of cranes, loading and conveying plants, and shipyard, mining, milling and other equipment.

The Canal and the Camera

There are interesting features about the canal other than the great work of construction. Among these may be classed the story of the building of the canal as told by photography. The canal is the first great engineering enterprise occurring in the history of the kodak, or, it might be said, in the history of amateur photography. The complete photographic records of the canal construction suggest the part the kodak is destined to play in the future in recording historical events.

The story of the building of the great Egyptian pyramids is buried deep in the sands of the desert, and the world has not even a tradition as to when, how, and under what sacrifices they were erected. The story of the building of the Panama Canal is pictured in millions of permanent films, and will be carried to succeeding generations.

From the moment it was announced to the world that the United States had acquired sovereignty over a strip of territory running from ocean to ocean, and through that narrow strip would dig a canal connecting the waters of the Atlantic and Pacific, the Canal Zone became a favorite field for amateur photographers. Kodaks were to be seen everywhere. Camera-armed tourists went to the Isthmus in troops, snapping every foot of the great ditch from Panama to Colon. Officially and unofficially they covered every detail of the work, from the steam shovels which scooped up earth and stone by the ton, to the little donkey engines that hauled the dirt to the dumping grounds. Every incident connected with the work is somewhere on photographic records.

Through the work of the kodakers the public in this country and in Europe was able to trace from day to day every step in the work of building the canal. Through them the Gatun dam and Culebra Cut are as familiar to the public as are the Capitol at Washington or Niagara Falls. These pictures have also brought to the comprehension of the public the difficult and complex engineering problems connected with the work. In addition to their immediate educational value they have furnished a valuable historical record.

Picture taking on the scale followed at Panama, and under the conditions existing in the tropics, would have been impossible but for the kodak system. The combination of heat and moisture incidental to tropical climates tends to melt the photographic emulsion, and, consequently, is fatal to the photographic image. This difficulty is only avoided by developing the films as soon as exposed. The means of doing this in a simple, practical way is supplied by the kodak system.

The kodak system enables the amateur

to go forth on a picture-taking tour with no other equipment than a handful of film cartridges, a kodak, and a daylight developing outfit, which he can tuck under his arm. With this system he can take and develop his pictures anywhere. He is independent alike of climate or dark room. It is the freedom from the ordinary impedimenta of the photographer that makes the system so necessary in these fast-moving modern days.

Canal Army's Recreations

If it be true that those who originate and devise the pastimes of a people are counted among the benefactors of mankind, then those who devoted themselves to the task of providing the means for rational relaxation and amusement for the army of men engaged in the construction work of the Isthmian Canal deserve recognition as having, in no small degree, contributed to the final successful completion of that undertaking.

Among the various forms of amusement provided by the Isthmian Canal Commission for recreation and the promotion of the moral and mental well being of the workers were the two most popular indoor pastimes, billiards and bowling.

During the work there were introduced into the canal territory in the various Y. M. C. A. club houses, gymnasiums and amusement places, under the supervision of A. B. Dickson, forty-two carom and six pocket billiard tables and eighteen bowling alleys.

From time to time all-Isthmian carom and six pocket billiard tournaments, as well as many local tournaments, were held, participated in by from 30 to 100 members. Bowling tournaments were held continually, and often as many as 150 men entered in these contests, from 20 to 30 in each town where alleys were located.

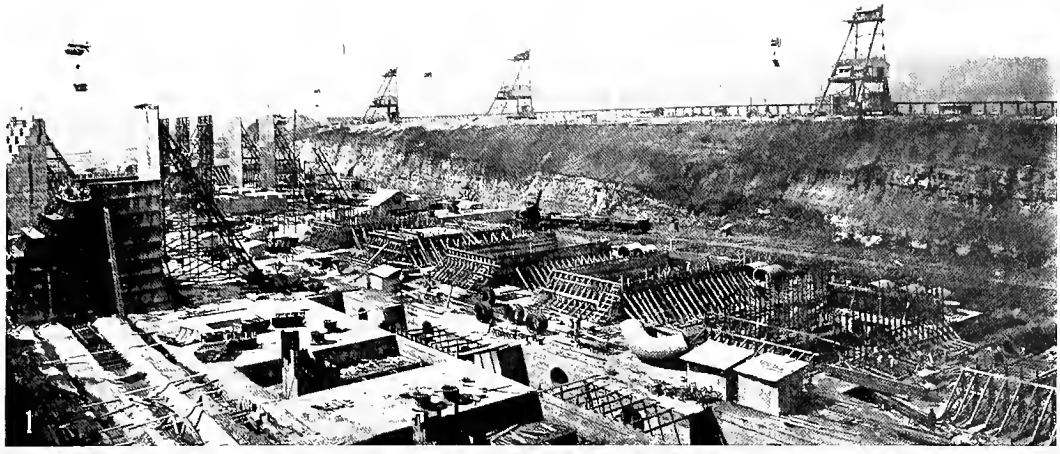
Bowling, especially, was very popular on the zone, helping to keep the men contented and furnishing a light form of exercise greatly appreciated by them.

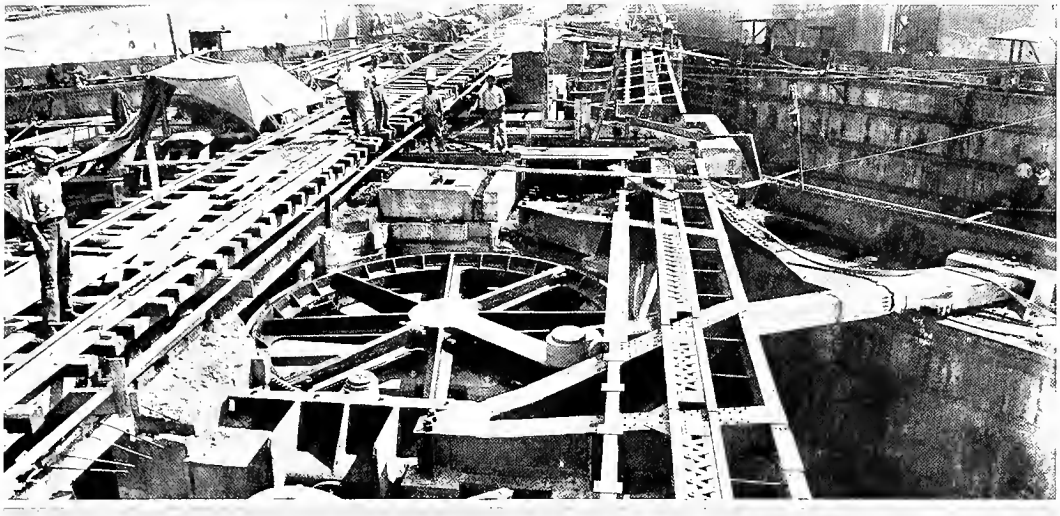
This line of amusement equipment was furnished from the factories of the Brunswick-Balke-Collender Company, the products of whose shops are well known and whose business activities are world-wide.

In spite of the tropical climate, all forms of athletic recreation were in vogue, exactly as in the States. The base ball nine, picked from the best players among the young Americans, played some remarkably sharp games, and the tennis courts were often thronged. Bathing was, of course, a favorite amusement, and prizes for fancy swimming, diving, etc., were offered. With uniforms and outfits furnished by A. G. Spalding & Bros., the athletes of the Isthmus were as well equipped and up-to-date as those in the United States, and the scenes at the base ball, handball, tennis, and other contests were exactly like those at home.

Featured prominently among the provisions made for the amusement and entertainment of the canal officials and employees was the continuous presentation under government auspices of the magnificent spectacles known for many years in the States in connection with the name of "Pain." For more than a quarter of a century, the Pain Fireworks Display Company has given its exhibitions of pyrotechnics in every part of this country, as well as abroad, while in Mexico it is even in greater favor among the pleasure-loving people whose counterpart is to be found in the native population of the Isthmus.

The president and principal owner of the Pain Fireworks Display Company, Harry Bishop Thearle, was for twenty-five years manager of the old company, while its destinies were in the hands of the founder. When the old company failed and Mr. Pain returned to England, Mr. Thearle bought out the business and proceeded to build it up into a strong and durable institution. Under his control its reproductions of historical events have become famous the world over. Among the more notable are, "The Battle in the Clouds," "The Last Days of Pompeii," "Mount Vesuvius," and "Pioneer Days,"





1. Beginning of concrete construction, Gatun Locks, showing cableways for handling concrete.
2. Master wheel and arm for opening and closing gate.
3. Gate beyond vessel is closed, water has reached level of lock in foreground, and vessel is passing through.

as well as at least ten others equally well-known, and as popular today as when they were first produced.

The Pain Fireworks Display Company has factories in New York, Chicago, and San Francisco. During the past few years its expansion has been such that scarcely a celebration of any importance in the United States or Canada is without one of its exhibits.

A firm which contributed to the peace of mind and comfort of the men on the Canal Zone was the Theobald & Oppenheimer Company, of Philadelphia. This firm was the pioneer, and now stands at the head of the field as manufacturers of fine domestic cigars of national reputation.

The success of this company is due to John J. Kolb, a native of the quaint old village of Sandhausen, Baden, Germany, where he made a special study of tobacco and its attributes. On coming to this country he began his career as a cigar maker, becoming identified with his present firm as superintendent in 1896. The firm at that time was a small concern employing some forty or fifty hands.

From the inception of this connection, Mr. Kolb introduced methods in manipulation and handling of tobacco thereto unknown in this country, thereby revolutionizing the cigar industry, increasing the character and style of manufacture, and bringing to the fore the finest product to that time seen on this country's market.

As manager and president of the concern, the guidance of which has been his care and study, he has seen one factory of a few hands grow by leaps and bounds, until he wields the reins over a vast enterprise of his own building, operating numerous factories and employing twenty-five hundred hands.

Philip Morris cigarettes, the world's oldest high grade of Turkish cigarettes, made by Philip Morris & Company, Ltd., of New York City, were used in enormous quantities by the canal army, natives of all the countries represented on the Canal Zone using them constantly. The "Brown Box" in which this tobacco was packed was a familiar object along the route of the canal.

Pay Roll Equipment

For use as advance payment of wages, payable in merchandise from the commissaries or in board at the hotels, commissary coupons were issued to Isthmian Canal and Panama Railroad employees, and meal slips, good for one day's board, to silver employees. All coupon books were charged to the employee receiving them, the charge being made directly in the pay-roll book for deduction from his wages on the next pay day.

Orders for books and meal slips were placed by the commission from time to time from 1907 onward with the Allison Coupon Company, of Indianapolis, Ind., which furnished 5,000,000 books for commissary use in denominations ranging from $2.50 to $15.00, with the separate coupons ranging from one cent to fifty cents. This firm also furnished 500,000 Isthmian Canal Commission hotel books, each containing fifty coupons separately valued at thirty cents. In addition, it furnished 8,000,000 daily meal tickets for silver employees.

These coupons and slips not only simplified bookkeeping and merchandise charges, but actually served as a circulating medium for citizens of all the countries employed at the Canal Zone. The coupons were manufactured at the company's plant at Indianapolis, on special water-marked paper to guard against imitation or counterfeiting, and on special machinery that provided for accuracy in counting and assembling, rapid printing, and prompt shipments.

In 1909, the officials in charge of the sanitary and commissary supply departments, that their transactions might be more accurately and quickly recorded, ordered from the National Cash Register Company, of Dayton, O., sixty-one of its machines.

The machines were built to order on special construction specifications. They were used in the stores for the employees

of the commission and were beautifully nickel-plated to withstand the climate of the Isthmus. Cash registers have long been considered an absolute necessity in stores, even in those doing a small business, for they keep a correct record of all transactions, give a correct total for each of the various classifications, and save a great deal of time in balancing books. The appearance of numerous cash registers on the Isthmus was certain to follow the policy of speed, accuracy and completeness that characterized the canal work, and these machines had no small part in the sum total of equipment that carried the work to an early completion.

In the selection of safes for use in the various offices throughout the Canal Zone, the Isthmian Canal Commission used the same care that prevailed throughout their administration of the entire work, and the purchase of the celebrated York safe, manufactured by the York Safe & Lock Company, of York, Pa., may be regarded as a strong endorsement of their high quality and efficiency.

This company has been a prominent factor in safeguarding the riches of the government in every department. Not only has it provided safes for use along the Panama Canal, but hundreds of them are in use on the battleships of the United States navy and by army paymasters, wherever Uncle Sam's domains extend. It installed the great bond vaults in the United States Treasury Department at Washington, where hundreds of millions in money are stored; also the treasurers' vaults, cash vaults, stamp vaults, and plate vaults in the new bureau of engraving and printing, where ponderous fifty-ton doors protect more riches than the average mind can conceive. It recently constructed similar vaults for the United States Sub-Treasury at San Francisco, Cal.

Natives Discover the Sewing Machine

The sales of machines for domestic or household use from the beginning of the active construction work are hints as to what the opening of the canal will mean to American manufacturers. Before the advent of the American builder probably not a family on what is now the Canal Zone owned a modern American-made sewing machine. The statistics gathered and compiled for the information of the American business public disclose that since the beginning of the active construction work more than 1,500 sewing machines manufactured by the New Home Sewing Machine Company, of New York, have been sold by one representative of the company in Panama City. These were used by natives as well as white residents, and from the Isthmus knowledge of the usefulness of the sewing machine has spread through Central America.

The manufacture of the New Home sewing machine dates back to 1862, in a little factory employing about forty persons. Now the works of the company cover about eleven acres of floor space, and about 1,000 persons are in its employ. It manufactures annually about 150,000 sewing machines, and 12,000,000 sewing machine needles.

Sanitation and Health Appliances

When the United States started on the work of building the canal it was confronted with its greatest problem—the saving of human life—for the experience of the French Company had shown that unless new and more effective methods were introduced to safeguard the lives of those connected with the construction work, thousands of persons would be sacrificed. So strong was the feeling in the United States that to go to the Isthmus was only to encounter disease, if not death, that it was difficult to secure the services of those fitted to make the canal a success.

Investigation developed that two species of mosquito infected the Isthmus, one carrying malarial germs and the other the bacillus of yellow fever. In addition to the question of health the government was also desirous to secure the personal

comfort of those it sent to the Isthmus. So it was that when the Secretary of War sent Gen. George W. Davis to investigate the possibility of constructing the Isthmian Canal, to protect him from the danger of yellow fever germs carried by the mosquito, he contracted with Wickwire Bros., of Cortland, N. Y., to screen the cottage intended for the use of Gen. Davis with their wire cloth made of copper and spelter wire. This was the introduction of wire screens in the canal work. This wire cloth was later adopted by the engineers and government officers for screening all buildings.

The wire cloth used on the Isthmus was especially designed by Wickwire Bros. for use where the ordinary wire cloth would deteriorate because of climatic conditions. The government has used the cloth very extensively in screening lighthouses. The enforced screening of houses on the Canal Zone was one of the effective elements in stamping out yellow fever, thereby saving thousands of lives.

As a part of the warfare against disease on the Canal Zone, the spraying pumps manufactured by F. E. Myers & Bro., of Ashland, O., were early brought into requisition. Following inquiries made by Major Boggs, of the purchasing department, for a pump easily transported and capable of developing a good pressure for applying oils and disinfectants, for use by the sanitary department, this firm submitted its catalogue of pumps, and recommended the use of the Myers Knapsack Pump. Shortly after submitting the proposal, notification was received from Major Boggs that the equipment recommended had been adopted by the commission as being better suited to the needs at the Canal Zone than any other of the various kinds that were offered.

That those pumps gave complete satisfaction is fully evidenced by the orders that followed. The first shipment was made in June, 1905, and consisted of six pumps. This was followed at more or less regular intervals and in increasing numbers, up to July, 1911, by which date a total shipment of 474 pumps had been made.

These knapsacks pumps were used at the canal for spraying low marshy places, swamps, small streams, creeks, and other similar places where the mosquitoes have their breeding places. The pumps are made of galvanized iron and copper, the "knapsack" being carried on the back of the operator in such manner that he can pump and direct the spray at the same time. The copper can or receptacle does not rust or corrode, making it particularly adapted for use in tropical climates. With each pump was supplied an extra length of hose, and additional nozzles and other parts. The commission was careful to specify a pump that was characterized by more than ordinary strength and durability, since those furnished were to be used largely by the natives. The numerous repeated orders indicate that the goods furnished by this firm were especially adapted for the work.

In the battle against the canal mosquito, to prove the efficiency of Phinotas Oil as a destroyer of the mosquito pests, the Phinotas Chemical Company, of New York, sent one barrel of its oil to the Department of Sanitation on the Isthmus, during August, 1907. In September a trial order for 500 gallons was given the company, and in December another order was given, this time for 1,000 barrels. This order so quickly following the test of ten barrels amply testified to the value of the oil. That yellow fever has not been epidemic in the Canal Zone is largely attributed to the efficiency of Phinotas Oil in destroying mosquitoes.

One of the potent agents used by those in charge of the sanitation of the Canal Zone was Chloro-Naptholeum, from the laboratories of the West Disinfecting Company, of New York. It is in fact a germ killer, from five to six times as strong as pure carbolic acid. Used in the hospitals and quarters of the canal workmen, as a cleansing solution it was unexcelled. It cleared away dirt and filth, dissolved grease and fat, and

got to the bottom of cracks and crevices in the floors and walls where germs thrive. Cleanliness was the order of the day on the Isthmus, and to secure this Chloro-Naptholeum was freely used.

The Canal Commission not only drained off all stagnant pools of water, but it put into operation a system by which all objectionable refuse of the different camps, towns, and colonies along the canal reservation was collected and burned in suitable garbage destructor furnaces, of a type furnished by the Morse-Boulger Destructor Company of New York.

Nine furnaces of this kind were located at different points along the canal route. Each destructor consumed ten tons of miscellaneous garbage and refuse every twenty-four hours.

The United States within recent years has had a large part in spreading the lesson of sanitation to tropical countries. Its example at Panama led to emulation in nearly every port city in South America where disease had not already been conquered by modern methods. At Manila, shortly after the American occupation, the United States issued specifications and called for bids for a 130-ton daily capacity destructor for the city of Manila, and here the Morse-Boulger Destructor Company was again successful.

The city of Guatemala was one of the first to take advantage of the lesson taught at Panama. It completed in 1908 a large garbage and waste destructor, and celebrated the event with parades, decorations, and a general three-day holiday, the people rejoicing in the knowledge that from that time on disease and deaths in the city would never rise above the normal rate.

Keeping pace with the development of medical hygiene, the evolution of sanitation and household hygiene in the United States as well as throughout the world during the last thirty years presents a most interesting study. Just as at Panama was developed the last word in medical science in successfully fighting the dreaded yellow fever, so in the buildings of the canal may be seen the last word in modern sanitary equipment.

It is not many years ago that bath tubs and other household sanitation equipment were made chiefly of wood, lined with zinc or copper sheeting, or other material. As late as the '70s, bathroom and lavatory fixtures, however expensive, were entirely encased in wood, and open plumbing was unknown.

For the rapid development of better household sanitation in the United States, the Standard Sanitary Manufacturing Company, of Pittsburgh, Pa., is largely responsible. The first "Standard" porcelain enameled bath was made in 1875, at the plant of the Standard Manufacturing Company, at Alleghany, Pa., now a part of Pittsburgh. At that time the company's capacity and capital was small. It could turn out two baths a day, and the manufacture and sale of baths at this rate was considered remarkable.

From this small organization, with the awakening of public appreciation of sanitation, the company has grown to be the largest in the world in the line in which it is engaged, with its product reaching into every corner of the earth. The present company was incorporated in 1900, with a capital of $5,000,000, which was later doubled. The number of employees is now 5,500, and the combined daily capacity of its factories is 2,000 bath tubs, 2,000 sinks, and 2,000 lavatories, in addition to a large output of miscellaneous fixtures, plumber's brass, and woodwork. Twenty branch stores, showrooms, warehouses and offices are maintained by the company. During its existence it has manufactured and sold over 3,000,000 of its standard bath tubs, 3,000,000 standard lavatories, and more than 10,000,000 miscellaneous fixtures, and while the quality of output has constantly improved, the cost has steadily decreased, so that proper household and building sanitation is now within the reach of all.

The Washington Hotel at Colon, and all

the buildings at Panama which required sanitary equipment are fitted up with Standard supplies, and from the Canal Zone as a starting point, the lesson of household sanitation is spreading throughout the Latin-American countries as part of the result of the battle against sickness and disease won by the Americans on the Isthmus.

Among the other things introduced in the zone for the comfort and convenience of those engaged in the construction work, and of their families, were soap and toilet articles. This may sound like a little thing, but when the human-interest side of it is considered it was one of the important things.

In all probability there is not a household in the United States where the name of Colgate is not known. The firm of Colgate & Company had been in existence a little more than one hundred years when the Commissary Department connected with the canal work purchased for the use of the department its first supply of soaps and toilet articles. In this connection it may not be out of place to say something of the magnitude to which the business of this firm has grown. It was originally established by William Colgate, and his largest soap pan (and it was the largest then in this country) contained but 43,000 pounds. Now the company has twelve kettles, each containing nearly a million pounds, and more than a score of others with a capacity of half a million pounds each.

For the comfort of those on the zone the Commissary Department purchased from the Colgate Company many thousand dollars' worth of their toilet preparations, and many thousands' worth additional were purchased by individual consumers. More than this, the canal has already opened up a large section of the commercial world to this great American industry, and its completion brings all the Pacific States of South America and Mexico into the immediate range of future possibilities.

Mutilations or deaths appear to be an unavoidable penalty for progressive operations of any great magnitude. It can safely be said that not an ocean steamer, locomotive, or great structure, either building, bridge, or railway, has ever been carried to its completion without one or more of those employed in the work being mangled or otherwise injured. It was so with the Panama Canal. The great steam shovels, derricks, drills, and trains used in constructive work brought about accidents to many of their operators, and amputations resulted in several cases.

It was the purpose of the Isthmian Canal Commission to supply their dismembered employees, irrespective of color, nationality, or character of work engaged in, with the best substitutes procurable, and for this A. A. Marks, 701 Broadway, New York City, probably the largest and best-known artificial limb-maker in the world, was given requisitions by the commission for artificial limbs for the canal employees, beginning January, 1908. Over 200 requisitions were issued up to 1912, and more were needed before the completion of the work.

Most of the legs and arms were built from measurements furnished by the canal hospital surgeons, the patients remaining on the Isthmus. As the limbs arrived from New York they were applied, and the patients were permitted to either go to their homes in retirement, or to return to the work on the canal. A large number of them were able to return to work.

Commissary Equipment

In view of the climatic conditions on the zone, and the general policy of using high-class equipment in all cases, special attention was given the bins and shelving for the stores in the commissary department.

A very extensive equipment for steel bins and shelving was furnished by the Berger Manufacturing Company, of Canton, O. The equipment from this company for the stores at Colon and Balboa alone filled four carloads. An equal amount of

similar equipment was supplied by the company to other parts of the Canal Zone.

The type of construction used was the company's standard closed type of bins and shelving, consisting of solid uprights, backs, and shelves. It is a ledge construction, in which the units which hold the ledge are thirty inches deep, twenty-four and thirty inches wide, and thirty-six inches high. Above the ledge are units of the same width, and fifty-four inches high, making the total height of the complete assembly seven feet and six inches. The load carried on this shelving is approximately 200 pounds per square foot. These bins, as well as being used in the temporary store houses, were installed in the general store house of the permanent building at Balboa. Here there are 108 assemblies of the bins, each approximately sixteen feet long, or about a quarter of a mile of bins seven and one-half feet high. The uprights and backs of these bins are punched for a three-inch vertical adjustment of the shelves, and the shelves are all punched for an approximate horizontal adjustment of dividers. This construction gives the greatest possible flexibility, so that practically any arrangement desired can readily be made. In addition the construction is arranged so that the bin fronts can be added at any time in the future, and thus the shelving construction can at any time be transformed into bins of any depth.

For refrigerating the cold storage department of the canal commissary making ice and ice cream, and for all uses required for ice and refrigeration, refrigerating machinery was supplied by the Ice and Cold Machine Company, of St. Louis, Mo. In one shipment in May, 1910, this company sent six carloads of refrigerating machinery, weighing 24,000 pounds to a car. The refrigerating machines were the Cross compound duplex, with engine of the Corliss type, and compressors of the horizontal double-acting type. They had a capacity of 300 tons of refrigeration daily. These refrigerating machines were of the type used by the large packers of this and foreign countries, and were especially adapted to continuous operation during the entire year, and particularly adaptable to any climate where continuous operation is necessary. The machines furnished the canal commissary were of an especially high grade, designed for the trying climatic conditions of the Isthmus, and using a minimum of steam. The refrigerators were manufactured by American labor in the company's machine shops.

In insulating the cold storage plant at Cristobal, against the exterior walls of concrete eight inches of Nonpareil cork board was laid up in Portland cement, and the exposed surface finished off with marble cement. The interior partitions consisted of two layers of two-inch Nonpareil cork board erected in Portland cement and finished on each side with marble cement. The bottom of the ice freezing tanks was insulated with six inches of Nonpareil cork board laid down in asphalt; the sides and ends with four inches of granulated cork and four inches of Nonpareil cork board. The exposed surfaces of the cork board around the tank were finished off with marble cement. This insulating material was furnished by the Armstrong Cork Company, of Pittsburgh, Pa. In addition, the company furnished for the Canal Commission large numbers of cork life-preservers and ring buoys, and other cork material. Nonpareil cork board has been for a number of years the standard type of cold storage insulation employed by the United States government. It consists of pure granulated cork compressed in board form and baked at a moderate temperature. The natural gum or resin in the cork itself joins the whole mass firmly together. This is the distinctive feature of this material. The advantages that led to its selection for Panama were its remarkable low heat conductivity; the fact that it will not absorb moisture, and hence excludes offensive odors; the ease with which it may be installed; the fact that it occupies a very small space as com-

pared with insulating materials of lower efficiency; and that it is slow burning and fire-retarding.

W. M. Duncan, of New York, whose specialty is the building of high class refrigerators, had a large part in fitting the government's line of ships to Panama with the refrigerators for storing perishable supplies for use on the Canal Zone. He also furnished refrigeration equipment for some of the commissary department buildings on the zone.

Immediately on the beginning of the American régime at the Isthmus, Hutchinson Bros., of Baltimore, manufacturers of furnaces, ranges, and hotel kitchen apparatus, filled an order for ten large ranges. Their construction and wearing qualities secured many duplicate orders as the army on the Canal Zone increased. The shipments continued for more than six years, the equipment growing as the size of the working army grew. The ranges were of steel, varying from four and one-half to twelve foot sizes, and were used at the Isthmus camps, hotels, and hospitals. All were turned out at the Hutchinson factory.

Flour in great quantities was supplied the canal workers by Holt & Company of New York, an old firm which has been a pioneer in American and South American fields of trade, and which therefore naturally had a great share in the business at the canal.

Enormous quantities of coffee were shipped for the use of the men on the Isthmus. In the period between 1908 and 1912 the William B. Harris Company, of New York, dealer in coffees, teas, spices, and cocoa, shipped 827,903 pounds of green coffee, 99,295 pounds of roasted coffee, 99,295 pounds of cocoa, 1,315 pounds of tea, and 31,891 pounds of spices. This firm continued its shipments until the completion of the canal. These supplies were selected for their quality under competitive bids, and were afterward demanded on account of their popularity with the canal army. To meet the climatic conditions on the Zone the tea, spices, and cocoa were supplied in tins, with each tin wrapped in parchment paper and sealed.

In supplying the cooking equipment for the canal army, the city of Baltimore appears to have been the chief resource of the commissary officials. The S. B. Sexton Stove and Manufacturing Company, of Baltimore, furnished for the Canal Zone about 600 cast iron ranges of various sizes, which were used not only in the construction camps, but in the "bachelor" quarters and family housekeeping quarters as well. Many of this company's ranges were shipped through other concerns under separate contracts, all being manufactured in the company's Baltimore shops.

Among the commissary supplies furnished for the canal were the wares manufactured by the Gorham Manufacturing Company, of Providence, R. I. The rise of this company from insignificant beginnings is typical of the American thrift and inventive genius which have helped so greatly to place this country in the front rank of commercial and manufacturing nations.

Its founder was Jabez Gorham, whose itinerant tradings for eighteen years from his small shop in Providence ended in 1831 in a partnership then formed for the manufacture of silver spoons and other small ware. From this partnership Jabez withdrew in 1847 to interest himself in the Eagle Screw Company, which he lived to see built up into a large establishment. His son, John Gorham, who succeeded him, immediately enlarged his father's plant, and in 1850 conceived the idea of entering into the general manufacture of silverware. The process of spoon making had already advanced from crude hand work at a common blacksmith's forge, but, in order to look into its further development, John Gorham made a trip to Europe to investigate methods in England and on the continent. The shops of Sheffield and Birmingham were visited, where his declared intent to make American goods equal to any of England was greeted as a char-

acteristic Yankee boast. John paved the way to the fulfilment of his boast, however, by beginning as a workman in a London establishment, and when he had mastered the details he returned to this country, bringing other skilled workmen with him.

From that time to the present, the progress of the company has been one of uninterrupted success. In addition to its line of silverware, the company has been engaged in the production of plated ware of the highest grade. In 1889 its plant was greatly enlarged through the purchase of thirty acres of land, where buildings were erected for existing needs and with plenty of room for expansion. The present president of the company, Edward Holbrook, has advanced through all its branches from the minor position which he occupied when he came into its employment in 1870, to complete control.

The wares made by the Gorham Company are not confined to silver and electroplate. It has a special department for the designing and manufacturing of metal work of all descriptions, including statuary work, bas-reliefs, tablets, etc. A notable example of this work was the life size statue of Columbus, modeled by the noted French sculptor, Bartholdi, and cast by the Gorham Company and exhibited at the Columbian Exposition at Chicago.

Not the least interesting feature of the history of this company is the consideration that it has paid to the welfare of its employees. In its "Casino," so called, erected at a cost of $40,000, are lunch rooms, sitting rooms, and a library, the administration of which is controlled by committees composed partly of employees and partly of members of the company. The privileges of these quarters are available to the employees at a nominal cost, whatever deficit that may ensue being borne by the company. A "Workman's Loan Association" has also been formed for the benefit of the employees in temporary emergencies, and a pension system having favorable features is carried on by the company, at its own expense, in the interest of the several thousand men and women in its employ.

The Paris Exposition of 1900 awarded the Grand Prix to the Gorham Mfg. Company, and gave the president of the company (Edward Holbrook) the decoration of the Legion of Honor. Awards have also been received by the company as follows: Centennial Exposition at Philadelphia, 1876; International Exposition, Paris, 1889; Columbian Exposition, Chicago, 1893; International Exposition, Buffalo, 1901; International Exposition, St. Louis, 1904.

Food for the Army

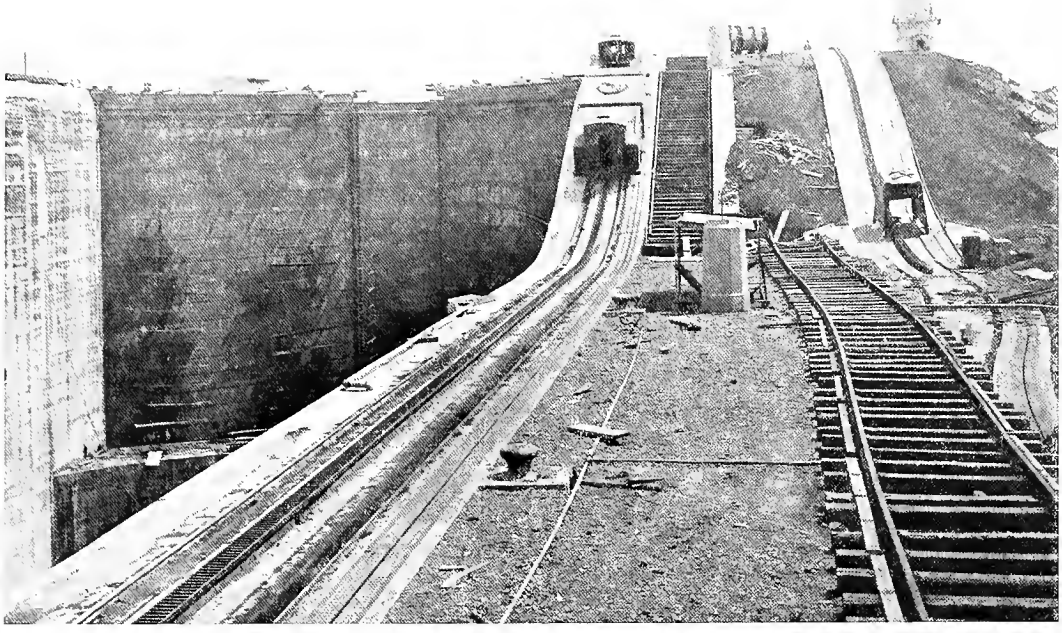
Visitors to the canal who were privileged to get a glimpse of the routine inner life will recall a familiar picture of workmen going to their places of labor carrying round yellow tins. Often, as they went, they munched a food poured from the tin into the hand. This food, which played no inconsiderable part in "building" the canal, was the well-known article of diet "Grape-Nuts."

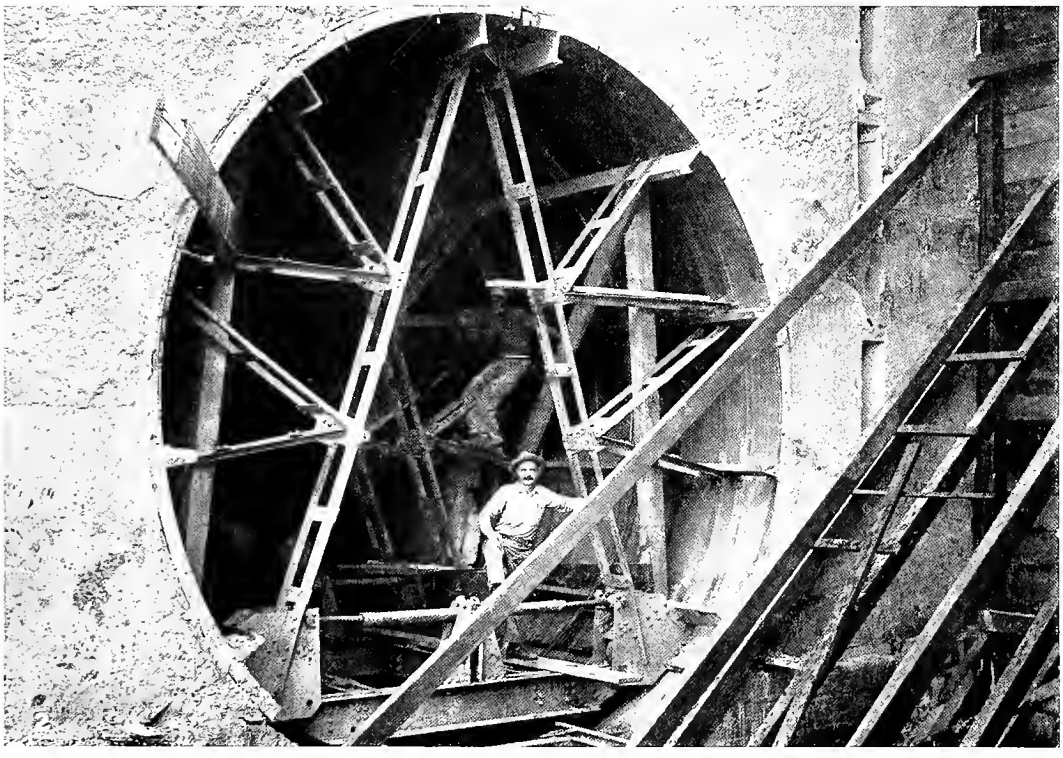
The mention of Grape-Nuts in this connection is peculiarly pertinent. Not merely because Grape-Nuts is a food—for of course proper food was an integral part of the big enterprise—but because it is a cereal food which successfully withstood the effects of a tropical climate. This characteristic of Grape-Nuts was pretty well known, and constituted a cogent reason for its selection for use in the Canal Zone.

An intimate history of the food problem in the early operations at Panama would make fascinating reading. One of the very first considerations in any such project is the commissary. Indeed, in an enterprise like this, involving the transportation of supplies thousands of miles from the home base, and the feeding of a host, the problem assumes the magnitude of provisioning an invading army.

The purely technical side of the building of the canal was one of the most complex of undertakings. The strenuous efforts of America's foremost engineers were

1. Disrupting effects of the slides in Culebra Cut.
2. Wreck caused by slides.





1. Electric towing locomotives passing from one level to the next one above on the lock walls.
2. View showing size of the wall culverts through which the water is let into or out of a lock chamber to lift a ship up or drop it down.

applied to the gigantic task of overcoming almost insuperable obstacles. But intermixed with the main problem was the seemingly never-ending and quite as important problem of sanitation and diet in their manifold aspects.

The subject of food is intimately related to that of sanitation. It is virtually a part of it, for naturally the problem of supply hinges in great degree on what to supply. As to the deteriorating effects of tropical climates upon foodstuffs, every traveler—especially one who finds it desirable or necessary to remain for a time in such climates—knows well the peculiar obstacles encountered in obtaining foods to which he has been accustomed. Very few of the "home" foods can be had in fresh condition, because of the extreme rapidity with which fresh or exposed food spoils in the tropics.

Particularly is this true of flour and ordinary breadstuffs. The rule, however, finds an exception in Grape-Nuts. This food is so thoroughly baked that it keeps almost indefinitely in any climate, as has been demonstrated again and again. Polar explorers have taken Grape-Nuts with them in their dashes into the Arctic, and travelers have carried the food with them in slow caravan journeys across deserts. One finds Grape-Nuts on transoceanic steamships, in the islands of the seas, in Alaska, South America, Japan, along the China Coast, in Manila, Australia, South Africa, and on highways of travel and the byways of the jungle—in short, wherever minimum of bulk and maximum of nourishment are requisite in food which has to be transported long distances, and often under extreme difficulties. The very enviable reputation which Grape-Nuts has attained in these respects caused it to be chosen as one of the foods for the Canal Zone.

A word as to the nature and processing of this food: Grape-Nuts is made from prime wheat and malted barley, with a bit of yeast and salt. The barley is first malted in order to develop the diastase ferment—a ferment which converts starch into sugar. The malted barley is ground and combined in proper proportions with flour made from whole wheat. A dough is then made, formed into large loaves and baked in highly heated ovens.

These loaves are cooled and afterward baked a second time in slow heat for some twenty hours. From this second baking the loaves come almost rock hard. They are then crushed into the toothsome granules so familiar in the commercial package.

The long, slow baking produces a partially predigested food, for a large percentage of the starch of the grain is thus mechanically converted into grape-sugar (dextrose), in a manner very similar to the change which such food undergoes during natural digestion. The balance of the starchy portions of the grain is thus also thoroughly broken down or dextrinized. Grape-Nuts digests very quickly, usually in about one hour.

This thorough processing prepares Grape-Nuts for long keeping, even under unfavorable conditions, and it has been particularly noted that it is practically never contaminated by proximity to other food products, even if such products should be in a decaying condition. This is in marked contrast to most cereal package goods. For foreign shipment Grape-Nuts is packed in air-tight sanitary tin packages that keep the food fresh and crisp.

Grape-Nuts is ready to eat from the package, and represents probably more concentrated and perfect nourishment than any other prepared cereal. All the valuable phosphates and other minerals of the grain are retained in this food. This cannot be said of most cereal preparations. And yet these minerals, such as phosphorus, sulphur, iron, etc., are regarded by modern science as all-essential for health and for proper building and rebuilding of body, brain, and nerves.

It goes without argument that better and more work can be done on a food of this nature than on foods lacking the vital phosphates. It is also obvious that a food as easily digested as Grape-Nuts is ideal

to 1850 practically every part of shoemaking was a hand process, while to-day a machine performs each of the early processes with greater accuracy, rapidity, and economy, and many new processes. In a large and up-to-date factory as many as sixty different machines are used to make the best shoes for men and women by the Goodyear welt process, and 300 different machines are used in the manufacture of the many kinds of footwear.

That this is an age of machinery, speed, service and system, for the saving of time and expense and the multiplying of product, is shown in no direction more emphatically than in shoe manufacture. The wonderful growth of this industry in the United States, and especially the success and prosperity of the small manufacturer, has been made possible very largely through the machinery and service to be obtained from the United Shoe Machinery Company. And there is a very interesting and valuable example here for all South and Central American countries.

Manufacturers, large or small, obtain machinery on equal and equitable terms. Through its products and expert service the United Shoe Machinery Company lowers the cost of manufacture, simplifies the problems, and facilitates the business of every shoe manufacturer and retailer and helps to bring the best shoes within the reach of all the people.

The United Shoe Machinery Company equips factories with the best shoe machinery in the world, both by direct sale and by leasing or rental. The leasing system in connection with shoe machinery was inaugurated by Gordon McKay in 1861, at the time of the Civil War, when great difficulty was encountered in getting manufacturers to purchase outright machines for sewing the uppers to the soles. This practice of paying for the use of machines, by which the manufacturer was enabled to use his capital in other directions, because of its value and advantages, quickly became an established and permanent feature of the shoe manufacturing industry, and has been so recognized by the 1,200 or more American shoe manufacturers ever since. The application of this system by the United Shoe Machinery Company in Latin-America will prove of similar value to all concerned, and will be the means of stimulating the small shoe manufacturer throughout Central America along the Canal Zone, and in South America.

The varying climatic and topographical conditions existing in the different countries of Central and South America make the shoe problem to a considerable extent a special one for each country, but American invention and mechanical skill have already provided machines adapted to the manufacture of every kind of footwear. The shoe industry is more advanced in some of these countries than in others. To-day, here and there are factories which manufacture light Goodyear welt shoes, turn shoes, and McKays. Under the stimulus of the new conditions it is inevitable that the future will bring a demand for the improved machines and expert attention which have assisted so much in giving American-made footwear its world-wide superiority. The countries which have shoe factories already started will progress further, and those where the industry has not started will take it up. This is as inevitable in Latin America as in those other parts of the world, where a few years ago the making of shoes was limited to native hand processes and methods. The American shoe is growing in favor because of its style, fit, and finish, and American-made machinery will be called into use for local production in order to make a good shoe at a low cost. The native and small manufacturer producing handmade footwear will gradually give way before the factory equipped with American machinery and with American methods of manufacture. The situation is much the same as it was in the United States forty years ago. Since then, and especially in the last twenty years, the growth of the shoe manufacturing industry has been an industrial marvel, impelled by improved machinery and

efficient service. What has been done in the United States is not impossible of repetition in Latin-America.

The commission bought a sample case of boots of the Rubberhide Company, Boston, Mass., in 1908. Then bids were regularly issued for similar merchandise "equal to Rubberhide."

In merchandise of this nature for long, hard, tearing wear in water, the quality of material, workmanship, and peculiarity of construction are the standards of comparison. The judgment of the commission, based upon careful, thorough tests, was given in accordance with the facts.

The Rubberhide Company received all orders on which it submitted prices for the special make of boots demanded by the commission, the specifications being that they should be of "long wear, absolutely watertight, and easy to resole."

The boots furnished by the Rubberhide Company were used by the men employed in concrete construction and other work of a like nature, in which they had to stand in water. The unique feature of the Rubberhide boot consisted in the manner of fastening the leather sole to the upper, by sewing, thus producing a water-tight leather-soled rubber boot that was impervious to water, and which could be resoled without losing its watertight qualities.

The shipping of hats to Panama—supposedly the birthplace and home of the Panama hat—would seem at first thought as unlikely and unprofitable as carrying coals to Newcastle, or exporting Toledo blades to sunny Spain. Nevertheless, there was a demand for hats that all Panama could not supply, and in meeting it American goods scored another, even though unexpected, triumph at the canal.

The succcessful firm in entering and holding the hat market at the Isthmus was Blum & Koch, of New York, hat manufacturer and maker of the only straw hats sold in this country under a recognized trademark. The Panama orders came to the firm entirely unsolicited. There arose a demand at the Zone for Blum & Koch straw hats, which the commissary met at once, and for the last four years of construction the firm made large shipments repeatedly to supply the workers in the tropics with the particular kind of headgear they required.

The John B. Stetson Company, of Philadelphia, received orders for nearly $100,000 worth of fine fur felt hats for workers at Panama.

Felt hats of the high grade produced by this company are recognized as being better adapted for white men who work in the tropics than any other kind of head covering. This is evidenced not only by the heavy orders received from Panama, but by the continual orders from South and Central America generally, Australia, and the Hawaiian and Philippine Islands. Stetson hats have established a reputation the world over as the finest quality that can be made, giving the best service under severe climatic conditions and hard usage.

The Eagle shirts, manufactured by Jacob Miller, Sons & Company, of Philadelphia, Pa., were already well known to the army officers at the canal, and the first order for that necessary article of wearing apparel came to the company from the Isthmus without solicitation. The business carried on by Jacob Miller, Sons & Company is unique in its particular line, as it is the only firm engaged in the shirt industry that both weaves and manufactures its own materials, in verification of its favorite phrase, "From Loom to Wearer." Every shirt sent by the firm to the Isthmus contained a guarantee slip for satisfactory workmanship and durability.

As an indication of the size and needs of the canal army, it is interesting to note that in a single year Isaac Lehmann, export broker and manufacturers' agent, of New York, shipped to the Canal Zone wearing material totaling a quarter million dollars in value. These shipments included overalls, working shirts, and other material for the men, and under the requirements were what is known as the

standard make in the United States. Under this requirement the canal workers received the very best material at manufacturers' prices.

The question of underwear might be thought insignificant as a factor in the canal building, yet taking into consideration that the bodily comfort of a man to a great degree controls his efficiency as a workman, it can readily be seen it is an important factor. The B. V. D. Company, of New York, furnished thousands of suits for the workmen in the Canal Zone, and its product was found especially adapted to the climatic conditions on the Isthmus.

Among the American firms that contributed their part to the comfort of the thousands of workers on the Panama Canal there is one which congratulates itself upon the fact that its most important manufactured product is trodden under foot all over the world. Nor is it at all strange that it should take pride in this unusual condition, since its main article of manufacture is hosiery—an article which, whether considered from the standpoint of style, attractiveness, durability, or comfort, properly engrosses no little thought on the part of its wearers.

This firm is that of Lord & Taylor, whose "Onyx" hosiery is known in every city and hamlet of the land. Its center of manufacture and wholesale distribution is in New York City, but it also has offices in Boston, Chicago, Philadelphia, and San Francisco, as well as old-world branches in Manchester, Paris, and Chemnitz.

The firm of Lord & Taylor was established in 1826. Lord & Taylor occupy the largest building in America or the world devoted to hosiery, and house the largest supply kept on hand by any firm engaged in a similar business. There is no class of hosiery that is not manufactured by this firm, and the style and make are suited to every climate, adapted to meet every taste, and equal to every occasion, at all prices. This variety in make and cost, together with its unchallenged record for comfort and durability, accounts for its wide use in the Canal Zone, where thousands of pairs were sold to the busy laborers as well as to the clerical and executive forces. Lord & Taylor are also manufacturers of hand made underwear, which line of supplies was likewise largely sold in the Isthmus. Their goods are in demand throughout all of South America—throughout all the world, for that matter, seeing that the inhabitants of England, France, Germany, Russia, Italy, Canada, Africa, and India are numbered among its patrons—its entire output reaching the enormous figure of $10,000,000 a year.

Every device that promised utility was used to make comfortable the condition of the employees engaged in the work of construction. The rays of the tropical sun and the torrential rains were things to be provided against. As an instance of this care and foresight, hundreds of dozens of small and large umbrellas were purchased from the Hulse Bros. & Daniel Company, of New York. This firm supplied from 100 to 300 dozens of these umbrellas each year during the continuance of the construction work. The umbrellas were specially constructed for the Canal Zone, with a view to the best service in tropical countries. Copper wire was used instead of steel, and the handles were riveted on, because in the climate of the Isthmus, the ordinary method of gluing would not have been efficient. Large quantities of umbrellas were of an extra large size, especially desirable during the rainy seasons. In the construction of these umbrellas natural wood rods and bamboo handles were used, owing to their light construction and large spread. Supplying these umbrellas for the comfort of the employees was but a part of the great sanitary measures adopted for the comfort and health of those engaged in the active work, and may be regarded as one of the measures which aided to cut down the rate of mortality to a very low figure for a tropical country.

Other American firms which had part in the canal work were the American Brass

Company, of Waterbury, Conn., supplying brass and other metal appliances; American Railway Supply Company, of New York City, railway equipment; American Metal Company, New York City, metals; American Hay Company, New York City, forage; American Negligee Company, New York City, clothing; Atlantic, Gulf and Pacific Company, New York City, mechanical equipment; the C. H. Alden Company, Abington, Mass., footwear; the R. P. Andrews Paper Company, Washington, D. C., stationery; the G. S. Baxter Company, of New York City, railroad ties; F. A. Branda & Company, New York City, general supplies; A. F. Brombacher & Company, New York City, hardware; Best & Company, Chicago, Ill., white duck material; the Baltimore Hub, Wheel and Manufacturing Company, Baltimore, Md., hubs; Bruce and Cook, New York City, iron pipe; the Buda Company, Chicago, motor engines; the Cleveland Pneumatic Tool Company, pneumatic and other tools; Columbian Facing Mills Company, foundry supplies; Herbert Crapster, New York City, general manufacturers' supplies; Callahan & Meyers, Allentown, Pa.; the H. B. Claflin Company, New York City, dry goods; George B. Carpenter & Company, of Chicago, cordage; the Carter Iron Company, of Pittsburgh, Pa., iron and steel; W. M. Duncan, New York City, refrigeration; the Detroit Hoist & Machine Company, Detroit, Mich., hoisting machinery; John H. Dialogue & Sons, Camden, N. J., propellers; Eimer & Amend, New York City, chemical apparatus; the Electric Controller & Manufacturing Company, Cleveland, O., electrical apparatus; the Barrett Manufacturing Company of Philadelphia, chemicals; the Interstate Iron & Steel Company, Chicago, iron and steel; the Jacobs Candy Company, New Orleans, La., candies; the Kay & Ess Company, Dayton, O., ochre; the Lead Products Company, St. Louis, Mo., lead chemicals; J. H. Leonard & Company, New York City; the Manicure Novelty Manufacturing Company, New York City, manicure supplies; Edgar A. Murray & Company, Detroit, Mich., chemicals; the Magor Car Company, New York City, cars; the W. J. Oliver Manufacturing Company, Knoxville, Tenn., machinery; the Phoenix Knitting Works, Milwaukee, Wis., knit goods; the Ransome Concrete Machine Company, Dunellen, N. J., concrete mixing and other machinery; Stevenson Brothers & Company, Philadelphia, oils; the Monarch Steel Castings Company, Detroit, Mich., steel castings; the Stonega Coke & Coal Company, Philadelphia, coke; Sudeman & Dolson, Galveston, Tex., construction supplies; the United States Metal Products Company, College Point, L. I., metal materials; R. C. Williams & Company, New York City, groceries; the Whelock Reinforced Cork Boat Company, New York City, boats; the Western Railway Equipment Company, St. Louis, Mo., railway supplies; J. H. Weil & Company, Philadelphia, lifting jacks; Union Tool Company, Torrance, Cal., tools.

The foregoing chapter gives a general outline of the character and quality of the manufacturing products and industrial efforts which entered into canal construction. More than 3,000 American firms, a comprehensive list of which follows, had the privilege of participating to some degree in the crowning feat of human enterprise. All of them may be justly proud of their share and ready coöperation in contributing to prompt construction, and to the comfort of the canal army of employees; and of them the American business world may also be proud, as exemplifying in high degree the best that American industry and commercial ability affords. Many monuments will arise in honor of the men who dug the canal; and there might appropriately be one to the American business men, who, often to their heavy financial loss, stood shoulder to shoulder with the workers at Panama in assisting the United States speedily and successfully to complete America's great donation to the commerce of the world.