

BRANDS.



PRIZE MEDALS.

LONDON, 1851, CLASS I.
PARIS, 1855, GOLD.
LONDON, 1862, CLASS I.
STOCKHOLM, 1866, CLASS I.

PRIZE MEDALS.

STOCKHOLM, 1866, SILVER.
PARIS, 1867, GOLD, SILVER, BRONZE.
MOSCOW, 1872, GOLD, SILVER, BRONZE.
VIENNA, 1873, FORTSCHRITTS-MEDAL.

CATALOGUE
OF
PRODUCTS EXHIBITED
AT THE
INTERNATIONAL EXHIBITION,
IN
PHILADELPHIA, 1876,
BY THE

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of Sweden

POST ADDRESS,
Motala Werkstad, Sweden.

TELEGRAPH ADDRESS,
Motala Works, Sweden.

PRESS OF
J. B. LIPPINCOTT & CO., PHILADELPHIA.
1876.

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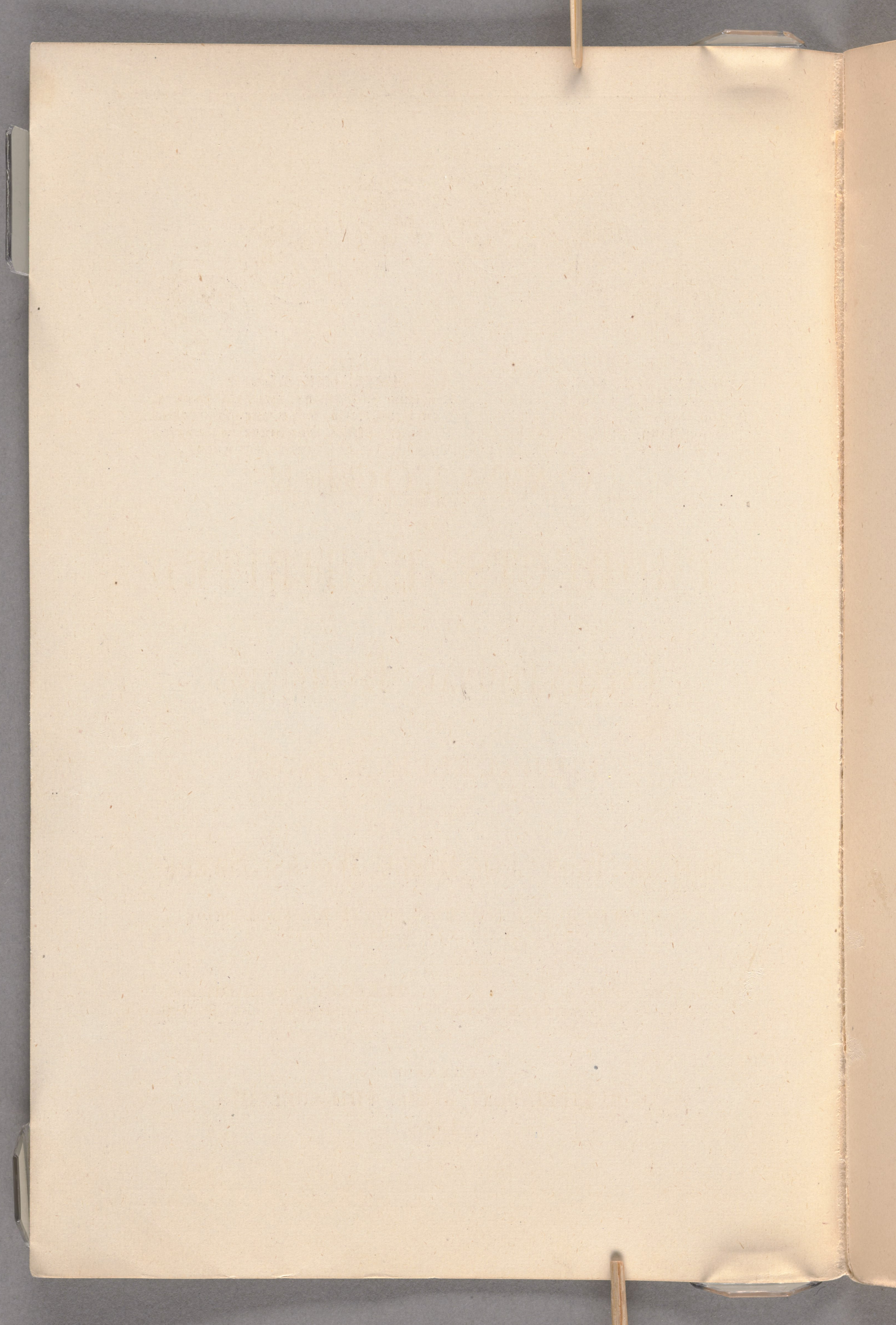
CATALOGUE
OF
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BY THE
MOTALA IRON AND STEEL WORKS, SWEDEN,

FOLLOWED BY A DESCRIPTION OF THE WORKS, A PRICE
LIST, AND A MAP.

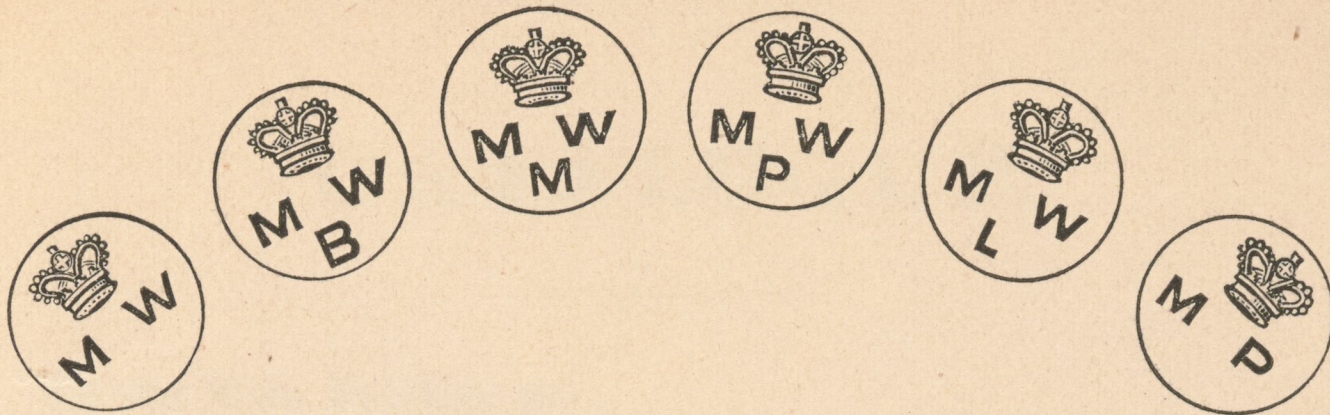
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THE
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1873-1874

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CATALOGUE.

IN the Main Building are :

A. (a.) Iron Ores employed in the Charcoal Blast Furnaces at Bångbro for making Bessemer Steel.

(b.) Charcoal used in the Blast Furnaces.

(c.) Coals used in some of the Puddling and Reheating Furnaces at Motala.

(d.) Peat Fuel used in the Generative Gas Furnaces at Motala Works for smelting Steel, Welding and Puddling Iron.

(e.) Blast Furnace Slag.

(f.) Fettling Slag, for the Puddling Furnaces.

(g.) Fire Bricks used.

(h.) Pig Iron, for Iron-puddling and Steel-making.

B. (a.) Bessemer Steel Ingots.

(b.) Siemens-Martin's Steel Ingots.

(c.) Iron puddled in Regenerative Furnace, fractured.

(d.) Puddled Steel, fractured.

(e.) Hard and Soft Bessemer Steel, fractured.

(f.) Hard and Soft Siemens-Martin's Steel, fractured.

(g.) Bar Iron, Flat, Round, Square, Angle, and other forms, made of Hard and Soft Bessemer, Siemens-Martin's Steel, and Puddled Iron and Steel.

(h.) Rails made of Bessemer Steel for the Swedish Government Railroads, also for Private Railroads.

(i.) Sections of Bar Iron and Shape Iron.

(k.) Railway Axles of Soft Bessemer and Siemens-Martin's Steel, bent cold ; also Rails bent cold.

C. (a.) Soft Bessemer and Siemens-Martin's Steel Plates.

(b.) Soft Bessemer Steel Plate, for a Steam Boiler, flanged.

(c.) Soft Siemens-Martin's Steel Plate, for a Steam Boiler, flanged.

(d.) Puddled Iron Plate, for a Steam Boiler, flanged.

(e.) Soft Bessemer and Siemens-Martin's Steel Plates, folded four times under Steam Hammer, when cold.

(f.) Soft Bessemer and Siemens-Martin's Steel Plates; also Puddled Iron Plates, pressed into Caps.

(g.) Two Ventilators, made of Siemens-Martin's soft Steel Plates.

(h.) Plate taken from the wrecked steamer "Thorer Helsing," showing the toughness of the Motala Iron.

D. (a.) Coils of Puddled Steel, for making Gun-hoops.

(b.) Hoops made of Coils for four-, ten-, and eleven-inch Guns, finished.

(c.) Two Breech-loading Apparatus of Siemens-Martin's Steel, for ten- and eleven-inch Guns.

(d.) Puddled Steel Hoops, shrunk on a cast iron block, showing how they are fitted on the gun. On the same block is also fitted the Breech-loading Apparatus.

(e.) Several Steel Turnings of Soft Siemens-Martin's Steel; one about a mile long.

(f.) One Double Crank Axle, of Soft Siemens-Martin's Steel, not finished; weight, about six tons.

(g.) Two Armor Plates of Soft Siemens-Martin's Steel; weight, respectively, three and a half and eight tons.

In the Machinery Hall is:

E. (a.) Marine Engine of 35 nominal, or 100 indicated horse power.

MOTALA IRON AND STEEL WORKS, SWEDEN.

When, in the beginning of this century, they began to build the canal system which, in the middle of Sweden, runs from the Baltic to the North Sea, it was found imperatively necessary, for the execution of this great enterprise, to have a shop where the necessary engines and tools could be made. Such a one was established for this purpose, in 1822, at Motala, on the east line of Göta Canal, during the chief directorship of the great Canal Engineer, Count Baltzar Bogislaus von Platen. The expenses were paid by the Göta Canal Company. Mr. Daniel Fraser, Engineer, was elected builder; later he was appointed manager of the completed works. At this time the Swedish industries began to develop more rapidly; partly because the means of communication, in a great part of the country, were better on account of this canal system, and partly because the use of the steam engine became more and more common in navigation; therefore it was almost a necessity to get an engineering works where steam vessels and engines could be built. In order to supply these wants, the Göta Canal Company resolved to extend their works, and as early as 1824 they obtained a Government's concession for making every kind of engines and vessels. After that the establishment increased in size from year to year. In 1840 a separate company was constituted, that bought this establishment of the Canal Company, and also a piece of ground on the Baltic, on which to build a shipyard for constructing larger ships. In 1855 this was completed, with a dry dock close by. This Company soon considered it necessary to get a complete shipyard on the North Sea, and therefore, in 1858, it purchased such a one,—Lindholmen, near Gothenburg.

In 1868, the Iron Works of Nyköping, consisting of machine-

shop, shipyard, and rolling mills, were purchased by the Company; and, in 1875, the Bångbro Iron and Steel Works, with accompanying iron mines, were also acquired by purchase.

The Company was, in 1867, changed into a limited company, having six hundred shares of stock, the par value of which was £277 per share. When, in 1875, the works of Bångbro were purchased, two hundred shares were added, thus making the present number eight hundred.

The Directors of this Company are, at present:

P. VON EHRENHEIM, f. Counsellor of State, K. N. O.,

Chairman.

E. UNGE, f. Captain, R. N. O., R. W. O.,

Managing Director.

A. DICKSON, Esq., R. N. O.

E. CEDERLUND, Esq., R. N. O.

N. FOSSE, Esq.

Besides these Directors, there are, at present, in the Company, fifty-one share-holders.

The books of the Company are examined every year by two or three Revisors, who are elected at the Stockholders' meeting.

By this brief history of the origin and development of these works, it may be seen that they now consist of five principal divisions, whose relative situations appear on the map at the end of this pamphlet.

I.—WORKS AT MOTALA.

These are situated in one of the most densely populated and fertile parts of the country, and at the crossing of two great lines of communication, the Göta Canal, which, in combination with Trollhätte Canal, connects the North Sea with the Baltic, Gothenburg, and Stockholm; and the Halsberg-Motala-Mjölby Railroad, which joins the north and south systems of railroads in Sweden. The works are in large part supplied with power from the outlet of Lake Wetteren (Motala Ström), which passes the works in a series of falls, of a total height of fifty feet.

To the country's central port, Carlsborg, the water communica-

tion is direct and short. The situation is consequently good in industrial and commercial, as well as in strategical respects.

These works, which are the central ones, are composed of the following subdivisions:

A. Rolling mills, consisting of:

(1.) One rolling mill for puddled bars, 1 squeezer, 1 steam hammer, 6 single and 6 double puddling furnaces, and 1 Danks' puddling furnace, and also 6 steam boilers.

(2.) One rolling mill for heavy bar iron, 1 rail mill, 1 merchant bar mill, 2 machines for cutting, 2 shearing machines, and 6 reheating furnaces, 1 rod rolling mill with 1 accompanying shearing machine, 1 cutting machine, and a reheating furnace.

(3.) One mill for rolling heavy and 1 for rolling thin plates, 4 shearing machines, and 10 reheating furnaces.

(4.) One rolling mill for tires and gun-bands, with 2 reheating furnaces.

B. Steam forge, with 1 steam hammer of about 9 and 1 of about 3 tons, 4 lifting cranes, 3 welding furnaces, and 5 steam boilers.

C. Steel work, with 3 Siemens-Martin's furnaces.

D. Blowing engines, with 15 cylinders of 35 to 50 inches diameter.

E. Foundry, with 4 cupolas for iron and 1 for making brass and bronze castings, 2 drying furnaces, 3 large casting pits, 4 lifting cranes, and 1 Root's rotatory blower.

F. Machine shop, with 58 turning lathes, 20 boring machines, 7 smoothing, finishing, and gear-cutting machines, 17 shaping machines, etc., etc.

G. Shop for making railway wheels, axles, and wheels for locomotive engines; there are here 3 steam hammers of medium size, 26 blacksmith's fires and welding furnaces, 13 lifting cranes, 6 turning lathes for wheels and axles, 5 slotting and boring machines, 1 Root's rotatory blower.

H. Shop for making boilers and other plate iron work. Here are 3 plate-bending machines for thin and thick plates, 1 hydraulic

riveting machine, 2 shaping machines, 13 boring and screw-making machines, 2 turning lathes, 4 machines for making rivets, 3 small steam hammers, 4 furnaces for heating plates and angle iron before bending, 38 fires for blacksmith's work, and 2 steam boilers. Finally, there are 1 shipyard and a dry dock.

I. Pattern and carpenter's shop, containing 12 machines for working wood.

K. Gas works with gas tank.

All the above-named machines are moved by the following motors: 4 water wheels which together have 428 horse power, 8 turbine water wheels of 356 horse power, 6 steam engines, of 100 horse power.

As fuel, coal, coke, and peat are used, the last is only used in the Siemens-Lundin's furnaces, which have gas generators and surface condensers, for purification of the gas from hygroscopic water, ashes, and tar. These furnaces are used for puddling, welding, and steel smelting (Siemens-Martin's process). The peat is got from the Company's own peat bogs, lying at the west shore of the Lake Wetteren. These peat bogs occupy a space of about two hundred and forty-six acres, and a depth varying between six and sixteen feet. The peat is of a good quality, its amount of ash being about six to seven per cent. The peat bogs are located at a distance from the works of about twenty miles.

Raw materials and finished products are transported partly on the railroads and partly on steamers and sailing vessels. At present the Company possesses four steamers, whose combined tonnage is six hundred and fifty tons, and four sailing vessels. The Company owns about half the shares in the Halsberg-Motala-Mjölby Railroad (about fifty-four miles long), which passes the works.

The hands employed all the year round are twelve hundred in number. In summer two hundred are added, who work in the peat beds. The working time is from 7 A.M. to 7 P.M., with rest of one hour at noon. The hands get their wages every other Friday night, and do not work the following Saturday after 12 at noon.

To the best workmen the Company supplies dwellings for a very

small rent; besides, it lends money without interest to those workmen who wish to build houses at their own risk. This money is paid back in small sums at every pay-day. When the house is thus paid for, it is, of course, the workman's property.

By its own Board of Guardians, the Company takes care of weak and aged artisans, as well as of their smaller children.

The officers and the workmen of the Company have, if sick, free medical attendance. The Company has engaged a physician, who, besides the medical attendance to the workmen, also has to manage a hospital, built and maintained by the Company. This hospital is open gratis for those sick operatives who cannot get attendance in their own homes, or otherwise.

The hands have formed a fund for support in sickness; to this fund the Company contributes some amount every year. Every member pays, at entrance, either 1s. 8d. or 3s. 4d. (sterling). Besides, he has to pay, annually, 2s. 3d. or 5s. 6d. If any one of the members is sick, he has a right to get from the fund 6d. or 1s. a day during his sickness, depending on which of the said annuities he has paid. Many of the hands pay both these mentioned annuities, and will then get 1s. 6d. a day during their sickness.

Should a man die, the fund will disburse either 11s. 6d. or £1 3s. to help pay the funeral expenses. If the sickness and mortality should be so great that the annuities and the reserve fund should not be sufficient for paying all claims, an extra duty is paid by every healthy member. The physician has to see that where sickness is simulated no support is given from the fund. In the year 1875 all the aid from this fund amounted to about £217.

The hands who like to deposit a fixed sum annually for their children in a life insurance institution, will get of the Company 6s. to pay the first year's premium. During the last two years two hundred and sixty-seven children have been registered on such life-rents.

In 1869 the Company donated a sum as a groundwork for the capital of a savings bank for the workmen. This bank, which was erected the same year, is managed by the artisans themselves,—i. e.,

the hands elect the Directors themselves. The bank is open on the days when the hands get their wages. It pays five per cent. interest. The last balance shows that about £7000 are deposited by four hundred and seventy-five workmen, and that at present there is a reserve fund of more than £222.

About fifteen years ago the hands formed a Working Men's Association, to which the Company granted a loan, without interest, for building a club house. This is large and elegant, and contains a meeting hall, a large theatre, two library rooms, containing a library of eight hundred volumes belonging to the Association, and three dwelling rooms for those members who are officers of the Association.

A number of the members have formed a band, which plays some evenings and on holidays, and is provided with new and good wind instruments.

Hitherto the works have had the same clergyman as the surrounding parish, but, from the beginning of next year, the Company will have a pastor of its own.

For the workmen's children the Company has erected five schools. They are arranged according to the new Swedish custom, with excellent equipments* and instructors. There are four gentlemen and six ladies teachers. One of these schools is exclusively designed for the instruction of the girls in needlework. The children have free school-books and free instruction. Going to school is strictly obligatory. That workman who has children and neglects to send them to school will be punished: the first time with suspension for a fixed time from his labor, the second time he will be discharged from the works. The school age is between seven and sixteen, but if the scholar during this time has not learned a fixed minimum of knowledge, he must continue to go to school even after his sixteenth year of age.

Five hundred children are daily instructed in these schools.

* See the Swedish school-house on the grounds of the International Exhibition.

II. THE SHIP-YARD AND MACHINE-SHOPS OF LINDHOLMEN.

As may be seen by the map, these works are situated on the west shore of Sweden, near Gothenburg; and, as this town is the principal seaport and trading town in Scandinavia, having an excellent harbor, which is closed by ice only one or two months a year, and which very deep-draught ships can enter, it is consequently an excellent place for a great shipyard with repair-shops.

The Company has, since the purchase in 1858, expended much money for the enlargement and completion of the works.

This shipyard is at present the largest in Scandinavia, and is composed of:

(a.) Foundry, with 2 cupolas for iron, and 1 for making brass and bronze castings, 2 cranes, and 1 fan.

(b.) Machine shop, with 3 slotting machines, 29 lathes, 11 planers, and 25 boring machines.

(c.) Boiler and sheet iron shop, with 3 bending machines for plates and angle iron, 11 shears and presses, 1 steam hammer, 2 furnaces for heating plates and angle iron before bending, and 51 fires for blacksmith's work.

(d.) Pattern and carpenter's shop, for fitting up woodwork of steam vessels.

(e.) Marine railway, for hauling ships on shore.

(f.) Dry dock, 330 feet long, 50 feet wide, and 20 feet deep, built in solid rock, with pumps for emptying.

All this machinery is moved by 4 steam engines of about 100 horse power. The hands employed are 750 in number.

Dwelling houses, charitable institutions, and assistance funds for laborers in case of sickness, as well as deposits in life insurance associations and free school for the children, are arranged similar to those at Motala; but as yet the Company has not been able to get these organizations in quite as good order as at Motala.

III. MOTALA SHIP-YARD AT NORRKÖPING.

In order to have a shipyard at the Baltic Sea, a place was

bought at Norrköping, as already mentioned, and a shipyard was erected there in 1844.

Norrköping is the largest manufacturing city in Sweden. As the map shows, the shipyard is located at the mouth of the river Motala Ström, where it runs into the Bråwiken Sound, which is an excellent port on the Baltic Sea. The shipyard is composed of:

- (a.) Machine shop (small size).
- (b.) Pattern and carpenter's shop.
- (c.) Shipyard, with following machines: 1 plate-bending machine, 3 boring machines, 4 shears and presses, 1 planing machine, 1 steam hammer, 2 heating furnaces for heating plates before bending, 1 large lift crane, and 3 swing cranes.
- (d.) Dry dock, with pumps.

The hands employed are 275 in number. Their privileges are the same as those of the workmen at Lindholmen.

IV. NYKÖPING WORKS.

These works are, as seen by the map, located on the east coast of Sweden, in the city of Nyköping. The creek which flows close by the works furnishes a water power of about 1200 horses. In the neighborhood of Nyköping is a spacious and excellent harbor. The works are composed of:

- (a.) One rolling mill for plates, 1 rolling mill for heavy bars, 1 trip hammer for heavy forgings, 3 puddling furnaces, 3 reheating furnaces, 1 blowing machine.
- (b.) Foundry, with 3 cupolas and 2 cranes.
- (c.) Machine shop.
- (d.) Shipyard.
- (e.) Flour mill with 8 pairs of millstones.
- (f.) Saw mill.

Beside this, one-tenth of the city of Nyköping belongs to the Company. The shops of Nyköping have not been running for the last few years, but the Company has decided to put them in operation as soon as some legal disputes are settled.

V. BANGBRO IRON AND STEEL WORKS.

In order to be independent of other Swedish manufacturers of pig iron and Bessemer steel, the latter of which materials had formerly to be bought, the Company decided last year (1875) to buy the newly erected and excellently located Bångbro Works. These works are located in the neighborhood of some of the richest iron ore districts of Sweden, where almost inexhaustible beds of excellent ores are to be found. Abundance of charcoal is also to be had from the neighboring districts. The works are composed of:

(a.) Two charcoal blast furnaces of a capacity of 8400 tons pig iron a year (foundations for 2 more blast furnaces of same size are already laid).

(b.) Two Bessemer converters with crane.

(c.) Blowing engines for the Bessemer converters, blast furnaces, and roasting kilns.

(d.) Foundry, with cupolas and cranes.

(e.) Machine shop (of small size).

(f.) Saw mill.

(g.) Brickyard.

(i.) Laboratory, and

(k.) The following iron ore mines: Stållbergsgruftan, $\frac{3}{7}$ ths of Norra Ängesgruftan, and shares in Mossgruftan, Hellströmsgruftan, and Lejongruftan.

In order to make use of the water power of the creek which flows near by, a canal was dug of more than one mile in length. By this arrangement the water head is now raised to 107 feet. The machinery is moved by 5 turbine water wheels of 850 horse power, besides which, there are laid under ground water-pressure pipes for a rolling mill, requiring about 300 horse power.

In making the Bessemer metal, which here is the chief business, the iron is taken directly from the blast furnaces into the converters, without cooling and remelting in cupolas.

The fuel for the blast furnaces is invariably charcoal. The annual production of Bessemer ingots is about 6300 tons. The hands employed in the Bessemer Works and mines are about 300 in number.

Charitable institutions, savings bank, attendance of the physician, and the schools will be arranged in the same way as at the Company's other works.

As will be seen on the map, Motala is connected with Lindholmen, Nyköping and Motala shipyards by means of lakes and canals, besides which there are direct railroad connections between all the subdivisions. The distances by rail from Motala are: to Lindholmen, two hundred miles; to Nyköping, one hundred and twenty miles; to Bångbro, one hundred and six miles; and to Motala shipyard, forty-five miles.

The Company procures the ores, makes its own pig iron, Bessemer, Siemens-Martin's, and puddled steel or iron, and manufactures these products into finished articles, such as steam engines, steam vessels, locomotives, and railroad materials of every description, and ordnance materials, besides producing bar and shape iron, axles, pistons, railway tires, gun hoops, breech-loading apparatus, and armor plates. Everything is made of superior materials, either from Siemens-Martin's, Bessemer, puddled steel or iron, as customers may desire.

Besides a great many machines of all kinds, as well as steam boilers, plates, axles, bar and shape iron, which the Company has manufactured since it was established, it is worth mentioning that up to the end of 1875 it had delivered about four hundred large and small steamers, and, among these, ten monitors and small iron-clads, and about two hundred and eighty steam engines with boilers.

The amount of money paid for labor and materials during the year 1874 was, according to the books of the Company:

At Motala rolling mills and steam-forge works .	£131,722
“ “ machine shops	131,666
“ Lindholmen	102,232
“ Motala shipyard in Norrköping	34,101
Total	£399,721

Bångbro is not included in the above.

PRICE LIST

OF THE PRODUCTS MANUFACTURED AT THE MOTALA IRON AND
STEEL WORKS.

Only first-class Swedish charcoal iron and steel are used.

For brands, see the cover; and for testimonials of quality, see
report of testings made by Mr. David Kirkaldy, London.

Steamboats, of all descriptions and of any dimensions, as per agree-
ment.

Locomotives, of every size and description, as per agreement.

	s.	d.
<i>Bar Iron</i> , flat, round, and square, to $3\frac{1}{2}$ cwt., per cwt.	17	0
$3\frac{1}{2}$ to 5 cwt., per cwt.	18	0
5 cwt. and upwards, per cwt.	20	0
<i>Flats</i> , $1\frac{1}{4} \times \frac{3}{8}$, and upwards,	17	0
Under $\frac{3}{8}$ in. thick to $\frac{1}{4}$, "	18	0
" $\frac{1}{4}$ " " $\frac{1}{8}$, "	19	0
" $\frac{1}{8}$ " " "	22	0
For each $\frac{1}{8}$ in. less than $1\frac{1}{4}$ in. wide, extra 10s. per ton.		
<i>Squares</i> , $\frac{1}{2}$ in. and upwards, per cwt.	17	0
$\frac{7}{16}$ " "	19	0
$\frac{3}{8}$ and $\frac{5}{16}$ in., "	21	0
$\frac{1}{4}$ in., "	23	0
<i>Rounds</i> (rivet and chain iron), $\frac{5}{8}$ in. and upwards, per cwt.	17	0
$\frac{9}{16}$ and $\frac{1}{2}$ in., per cwt.	19	0
$\frac{7}{16}$ " $\frac{3}{8}$ " "	21	0
$\frac{5}{16}$ in., "	23	0
$\frac{1}{4}$ " "	25	0
<i>Boiler Plates</i> , to $2\frac{1}{2}$ cwt., "	22	0
From $2\frac{1}{2}$ to 3 cwt., per cwt.	23	0
" 3 " $3\frac{1}{2}$ " "	24	0
" $3\frac{1}{2}$ " 4 " "	25	0
" 4 " 5 " "	27	0
" 5 " 6 " "	29	0
" 6 " 7 " "	31	0
" 7 " 8 " "	33	0

From 8 cwt. and upwards, as per agreement.

All plates differing from a square form or regular taper,	s. d.
extra per cwt.	3 0
<i>Sheets</i> , 11 to 17 W. G., per cwt.	26 0
<i>Strips</i> , for welded tubes, from 1 to 10 W. G., per cwt.	26 0
11 to 14 W. G., "	27 0

Of about ten thousand steam boilers made of the celebrated Motala Plates, in Sweden and abroad, since the organization of the Company, none have resulted in explosion, injury, loss of life or property, nor accident of any kind.

FORGINGS.

	s. d.
<i>Double-Crank Axles</i> (for locomotives) from the forge	50 0
Rough turned, per cwt.	60 0
Webs cut out, "	75 0
Finished, "	105 0
<i>Railway Axles</i> , swaged with collars or to sketch, per cwt.	17 6
From 5 to 6 cwt., per cwt.	20 6
" 6 cwt. and upwards, per cwt.	23 6

Forgings of all descriptions, according to weight and workmanship. *Piston Rods*, swaged to any dimensions, according to weight. *Railway Tires*, of all dimensions; price as per agreement.

All sorts of gun-hoops as per agreement.

All the above-named products can be had, either of soft Bessemer steel, Siemens-Martin's steel, or of puddled iron and steel.

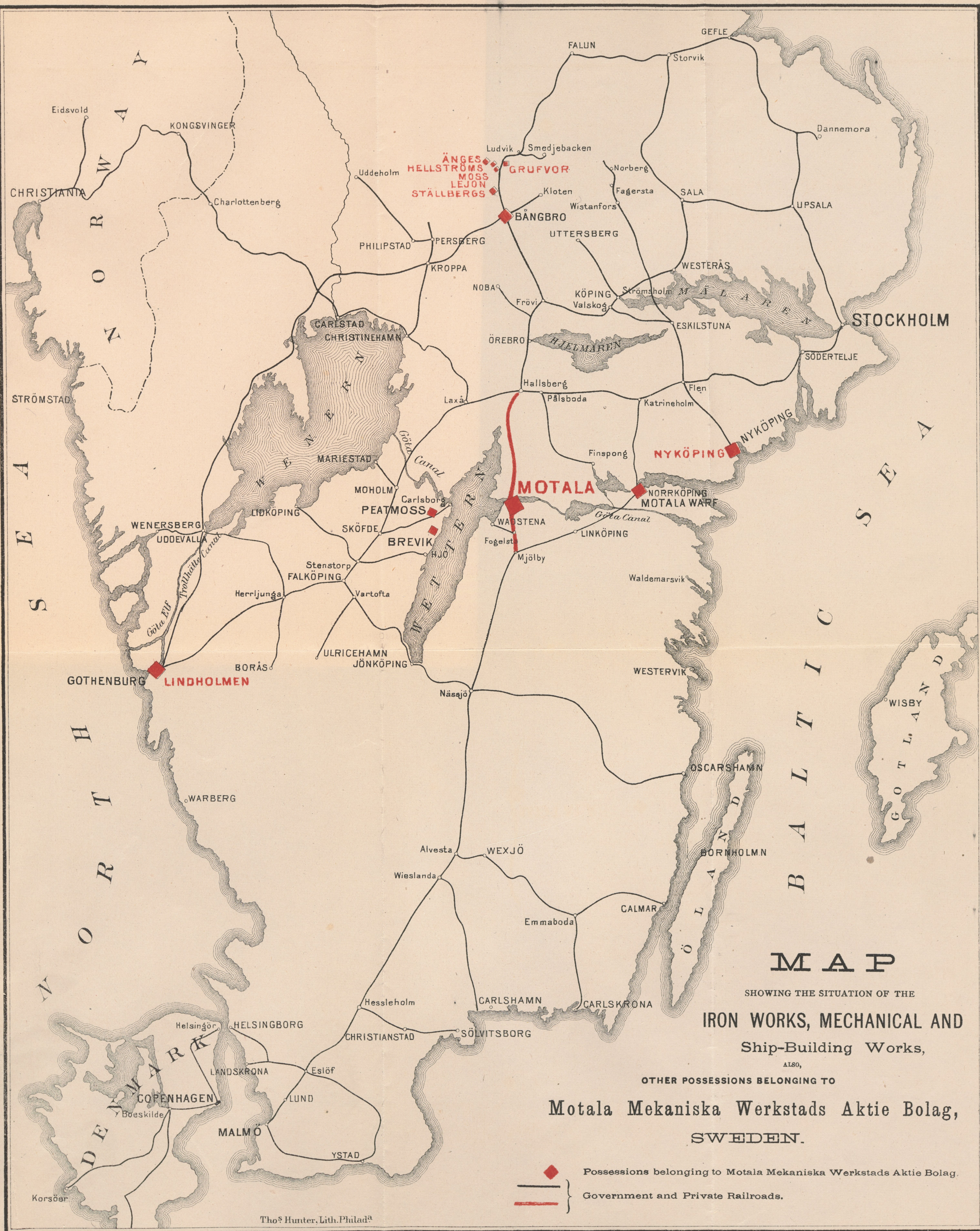
All sorts of hard Bessemer, and Siemens-Martin's steel, for tools, can also be had.

Terms: Three months' bills made out from date of invoice, or 2½ per cent. discount for cash.

The products will be delivered free, in trucks or on board, at London, Liverpool, Hull, Leith, Hamburg, Antwerp, Havre, etc. In American harbors as per agreement.

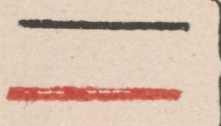
Agents,

MESSRS. JONSSON, STERNHAGEN & CO., GOTHENBURG.



MAP

SHOWING THE SITUATION OF THE
IRON WORKS, MECHANICAL AND
Ship-Building Works,
ALSO,
OTHER POSSESSIONS BELONGING TO
Motala Mekaniska Werkstads Aktie Bolag,
SWEDEN.

 Possessions belonging to Motala Mekaniska Werkstads Aktie Bolag.
 Government and Private Railroads.

