

國立中央研究院鋼鐵試驗場  
工程研究所

其目的工作及服  
務社會情形

國立中央研究院  
工程研究所

# 鋼鐵試驗場

場址 上海白利南路兆豐公園對面

電話 二七九〇三

辦公處 上海霞飛路一三三七號工程研究所

電話 七〇三六三

# 國立中央研究院工程研究所鋼鐵試驗場

## 其目的工作及服務社會情形

### 一 創辦之目的

我國工業自歐戰以來進步較速。其最著者為紡織。其他如橡皮，搪瓷，水泥，製碱，電機等工業亦均有相當成績。惟於近代工業所資賴之機械所需要之材料之製作，即鋼鐵之鑄鍊，鮮有注意及之者。誠為一大缺點。查國內翻砂廠對於澆鑄鐵件，多仍沿用數十年前英人教授之陳法，至鑄鋼，特種生鐵等之製鍊則雖曾有數廠投資試辦，均已歸於失敗。本所自籌備以來，即深以研究此問題為重要。故以全力籌設鋼鐵試驗場於我國工業中心之上海。大部份之設備已於民國廿年春季裝置完竣。遂於是年五月間開始鑄鍊。雖以學理及應用上之研究為目的，然深感國內各機關及工廠應付其鑄鋼機件之困難，頗願予以援助，故對於其委託代製鋼鐵鑄件，合金鋼及研究熱處上之問題，亦盡量接受。一年以來此項服務社會之計劃，頗受各地工廠之贊同。此後與國內工業界之合作，當更有增進之趨勢焉。

## 二 設備

本場設備現已裝置完竣者有：

- (1) 五百公斤(基羅)「莫屋式」電爐一座
- (2) 烘模爐一座
- (3) 溫煉爐一座
- (4) 一公噸吊車一部
- (5) 鎔鐵爐一座
- (6) 拌砂機一部
- (7) 舊鋼去銹機一部
- (8) 六百公斤機動鋼澆筒一只并配備九十公厘方鋼錠模子十餘只
- (9) 養氣燒焊器一套
- (10) 造木模設備
- (11) 化學分析設備

(12) 金圖學研究設備

已經訂購尚未運到或本所正在設計圖樣預備增製者有：

(1) 七百七十公斤(四分之三英噸)汽錘一座

(2) 燃煤熱鋼胚爐一座

(3) 空氣壓機一部

(4) 高三十分公分寬六十分公分長九十公分電力熱處爐一座

(5) 六十分公分圓鋼鋸機一部

(6) 五公噸電吊車一部

鋼鐵試驗場之南設有金工場一所，內置一公尺又八十三公分(六英尺)及三公  
尺(十英尺)車床各一部；大小刨床各一部；鑽床一部；銑床一部及零星應用精細  
量器刀具等。此項機器大部份備本所研究工作之用，至各處工廠委託代鑄之件，大  
都以毛坯交貨；由各廠自行精製。

三 工作種類

(一) 鑄鋼：照目前設備最大機件能澆重三百六十公斤者（八百磅）\* 所用鋼汁依其性質約分為低炭鋼，中炭鋼，高炭鋼及各種合金鋼。鑄鋼之分析成分可由委託者指定之，否則本場當予以最適宜之成分。

(二) 低炭素鐵亦名鋼性鐵鑄件：此項鑄件<sup>註</sup>鑄鋼單單\* 亦以電爐鑄鍊，性質堅韌，適用於汽缸，汽缸彈簧，搪瓷鐵模及其他需要鐵質堅密之鑄件。

(三) 堅性鑄鐵 (High test cast Iron) 及特種鑄鐵：生鐵密化後，經過一定高熱度，則其澆成鑄件之強度增加。此種處理方法係近來鋼鐵研究之成績。本場即利用此法以製成所謂堅性鑄鐵。至生鐵內加入其他原素如錳，<sup>註</sup>等使其性質改善則稱為特種鑄鐵。本場亦已有相當研究。

(四) 工具鋼及合金鋼：本場電爐採用碱性法，故對於製鍊工具鋼及合金鋼最為適宜。因其可使燐硫兩原素減少也。現已製成者有炭素及合金工具鋼數種。惟汽錘尚未裝就，由鋼胚製成商品，尚須時日耳。

(五) 熱處及加硬：本場所鑄之鋼件均經溫煉（俗稱退火）後方始交貨。其需特種熱處或加硬者亦可代辦。本場置有高熱度計及金屬學設備，對於承做此

項工作甚有把握也。

#### 四 代製辦法

代製鑄件收費辦法：本場之目的原在研究鋼鐵上之種種問題，惟此項工作需要工料電力等費用頗鉅，若能以餘暇代製商品，則鑄鍊之量加多，電費單價減輕，而同時可以低價之鑄件，供各廠家之需要，實一舉而兩得焉。現在暫定收費辦法列舉如次：

(一) 普通鑄鋼：每公斤收費洋八角八分（每磅洋四角）其特別小巧及繁雜者視其需工之多少酌定價格。合金鑄鋼依所加其他原素之類別及重量而核計應增收之費用。

(二) 低炭素鐵鑄件及堅性鐵鑄件：每公斤收費洋四角四分。（每磅洋二角）其特別繁雜者另議。

(三) 工具鋼及合金鋼：俟有出品後再定價格。

(四) 熱處加硬等手續：依所費人工燃料等酌收費用。

(五) 代做木樣照所需工料核實計算。

## 五 本場出品及其用途之一般

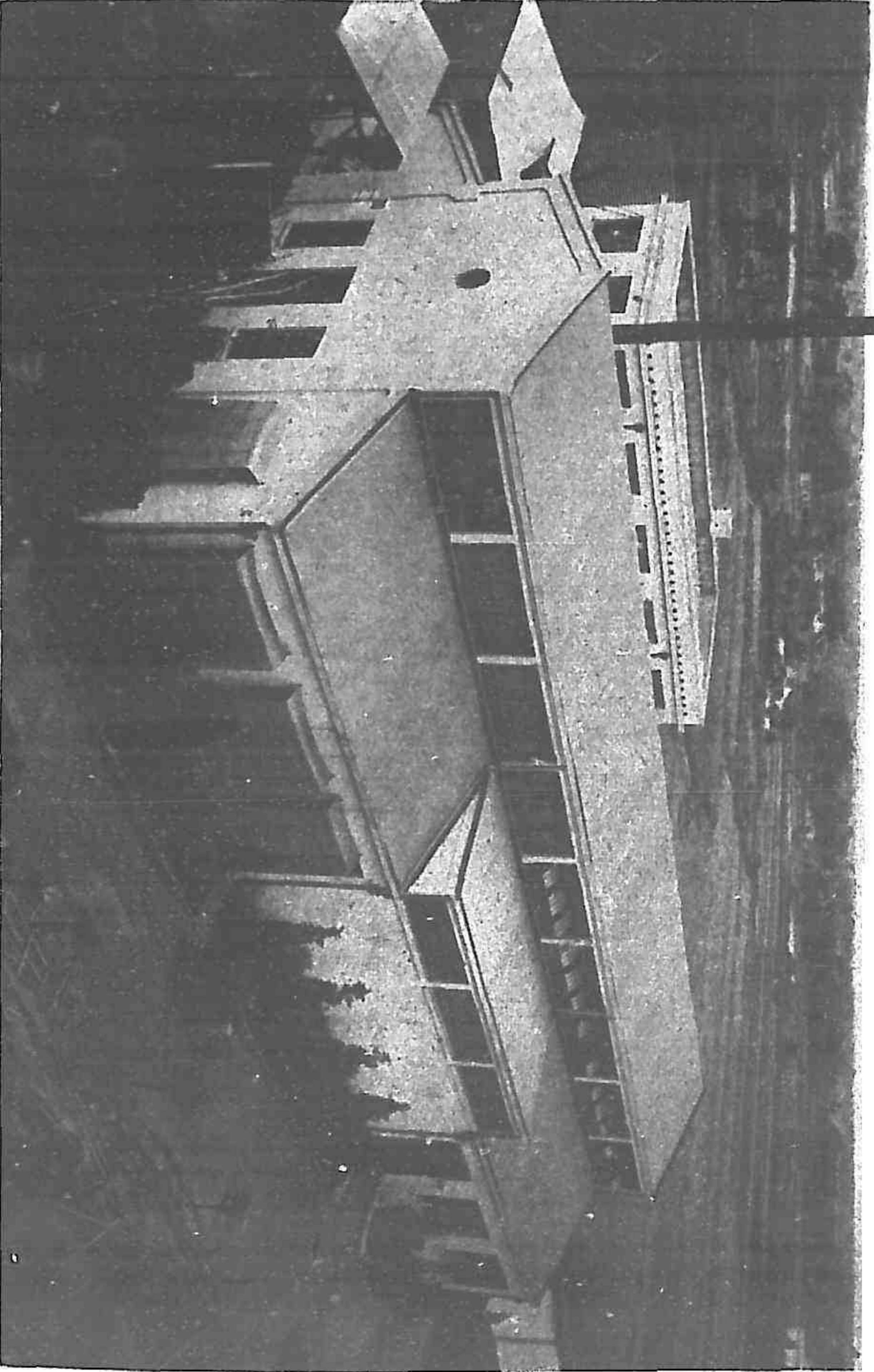
本場鋼鐵鑄件式類繁多，難於備載。茲特列舉若干種於左，以見其對於各項工業關係之一般。

### 鑄件名稱

### 致用之工廠

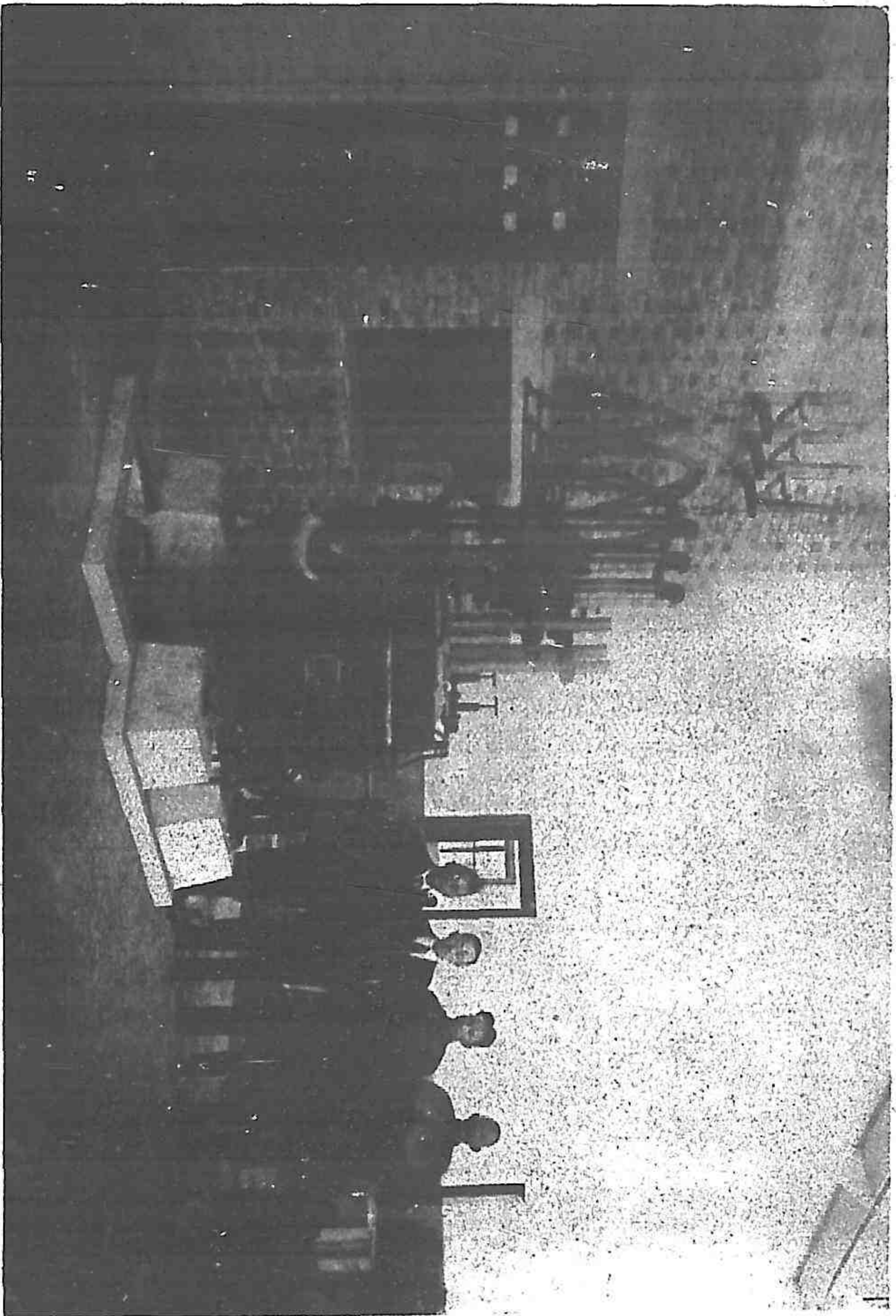
鑄鋼吊鈎	鐵路機車廠
鑄鋼輕便鐵道車輪	鑄廠
電車架部件	電車廠
鑄鋼齒輪	橡皮廠
鑄鋼大小齒輪胚	紡織廠及其他機器廠
鑄鋼軋煤球輪	煤球廠
鑄鋼鋼研碎筒襯板	水泥廠
低炭素鐵模	搪瓷廠
鑄鋼輪件	造船廠





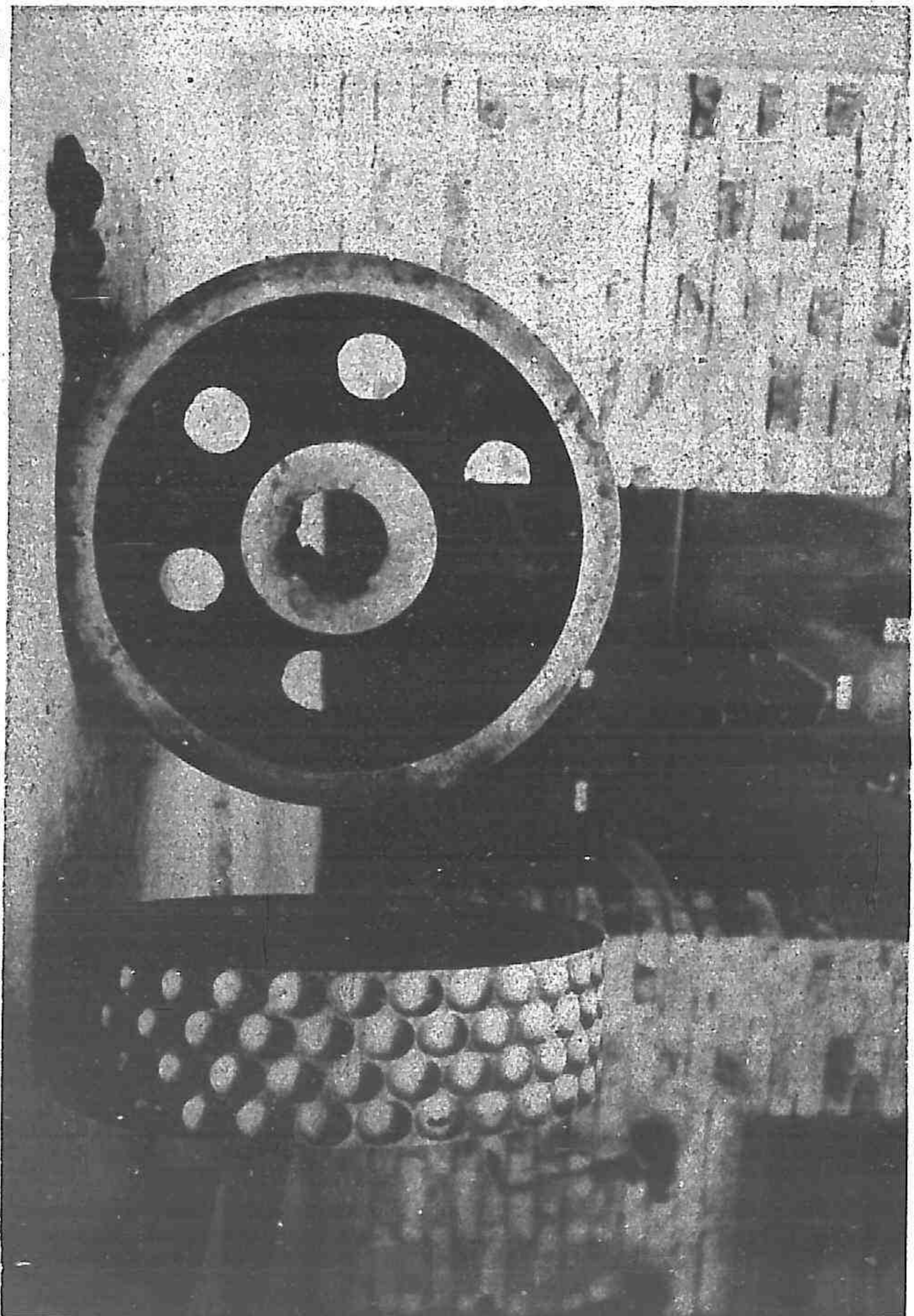
General View of The Iron and Steel Laboratory

鋼鐵試驗場之外景



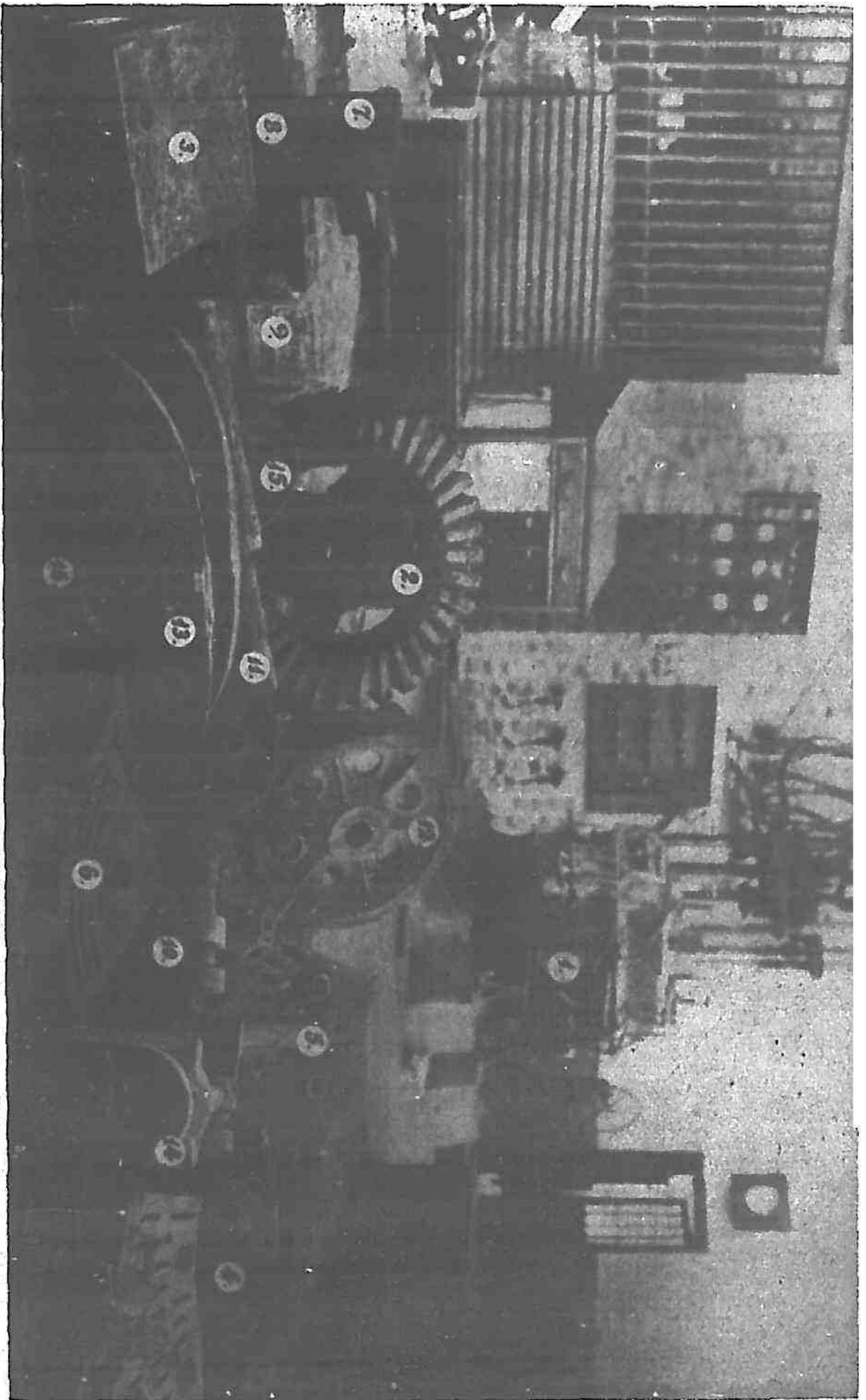
The Electric Furnace

電力鍊鋼爐



Hardened Rolls for Coal Briquetting

製煤球硬鋼模輪



Some of The Products of The Laboratory

- 1. 2. 3. 4. 5. 6. 7. 8.
- 本水水水水水水水水水水
- 場泥泥泥泥泥泥泥泥泥泥
- 電廠廠廠廠廠廠廠廠廠廠
- 力用用用用用用用用用用
- 鍊齒鋸隔隔隔隔隔隔隔隔
- 鋼輪鋼板板板板板板板板
- 爐板

- 9. 10. 11. 12. 13. 14. 15. 16.
- 鍊鋼場場場場場場場場場場
- 棍棍棍棍棍棍棍棍棍棍棍棍
- 煤煤煤煤煤煤煤煤煤煤煤煤
- 電電電電電電電電電電電電
- 引引引引引引引引引引引引
- 礦礦礦礦礦礦礦礦礦礦礦礦
- 火火火火火火火火火火火火
- 皮皮皮皮皮皮皮皮皮皮皮皮
- 球球球球球球球球球球球球
- 車車車車車車車車車車車車
- 上上上上上上上上上上上上
- 頭頭頭頭頭頭頭頭頭頭頭頭
- 用用用用用用用用用用用用
- 車車車車車車車車車車車車
- 上上上上上上上上上上上上
- 凡凡凡凡凡凡凡凡凡凡凡凡
- 輪輪輪輪輪輪輪輪輪輪輪輪
- 而而而而而而而而而而而而
- 托托托托托托托托托托托托
- 領領領領領領領領領領領領
- 而而而而而而而而而而而而
- 子子子子子子子子子子子子
- 架架架架架架架架架架架架

低炭素鐵汽缸及汽缸彈簧圈	機器廠
轆路機前輪鑄鋼架	同上
硬質鋼碎粉機件	石粉廠
鑄鋼轆筒	軋銅廠
玻璃器低炭素鑄鐵模	玻璃廠

## PRODUCTS FOR VARIOUS PURPOSES

The following list gives some of the products supplied to various lines of industry :

- (1) Ordinary steel castings (carbon steel):
  - Railway waggon couplers;
  - Mine car wheels;
  - Crane wheels;
  - Chain gear wheels;
  - Toothed gear wheels;
  - Blank disc for cut gear wheels;
  - Impellers of pulp pumps;
  - Rolls for coal briquette making;
  - Parts of frame for tramway cars;
  - Diaphragms of cement mill;
  - Impeller frames of centrifugal blowers;
  - Parts of foot valves for pumps;
  - Bearing blocks for heavy duty engines;
  - Piston of steam engines.
- (2) Chrome steel castings:
  - Jaw plates of stone crusher;
  - Grinding plates of cement mill;
  - Rolls for coal briquette making.
- (3) Special iron castings:
  - Cylinders, pistons and piston rings of air compressors and oil engines;
  - Dies for stamping machines;
  - Rolls for coal briquette making.

(3) Heat treatments.

Annealing is done to all steel castings before delivery. Other kinds of heat treatments such as hardening, tempering, normalizing and case hardening can be performed at the buyers' request. All the heat treatment processes are closely controlled at their proper temperatures by pyrometer readings.

### CHARGES FOR THE SERVICES

Only reasonable charges are being made for services rendered by the Laboratory to the public in order to defray the expensive costs of electricity, graphite electrodes, refractory materials, ferro-alloys, etc. used in the manufacture of electrical steel.

The following scale is effective at the present:

1. Ordinary steel castings (carbon steel)—\$0.88 per kilogram (\$0.40 per pound). Extra is charged for intricate light castings.
2. Alloy steel castings—Quotation according to specifications.
3. Special iron castings—\$0.44 per kilogram (\$0.20 per pound) for castings each weighing not less than 20 kilograms.  
Extra is charged for intricate small castings. Alloy cast irons are quoted separately according to specifications.
4. Forgings and forging stocks—Quotations according to specifications.
5. Heat treatments—Charge for annealing is included in the price of the steel castings. Charges for other kinds of heat treatments are almost at cost.

## SERVICES TO THE PUBLIC

The Laboratory, besides working on researches on its own account, is offering the public the following services:

- (1) Making iron and steel castings;
- (2) Making special steel forgings or forging stocks;
- (3) Various kinds of heat treatments.

(1) Iron and Steel Castings:

(a) Iron castings—Only iron castings of special quality are made here such as those possessing the qualities of high strength, great hardness, resistance to abrasion, resistance to chemical actions, etc.

(b) Steel castings—Ordinary steel castings are made of mild steel quality. Various requirements of strength, hardness, toughness, heat resistance, etc. can be met with by adjusting the chemical compositions. Chrome steel, nickel steel, chrome-nickel steel and manganese steel are used in special castings.

(2) Steel forgings and forging stocks.

These can be made of any kind of steel, plain carbon or alloyed. The Laboratory is ready to make alloy steels containing one or more of the alloying elements of nickel, chrome, tungsten, molybdenum and vanadium for various purposes. For the present only steel ingots are supplied to the customers. With the completion of the forging plant, finished bars (tool steel bars included), forgings and semi-finished forging stocks can be worked to order.



- (1) 1- Arc furnace of Moore type 500 kg. charge, complete with 200 K. V. A. transformer, automatic regulating panel and control panel.
- (2) 1- Mould drying oven
- (3) 1- Annealing furnace
- (4) 1- One-ton overhead travelling crane, hand operated.
- (5) 1- 500 kg. cupola
- (6) 1- Sand mixing mill
- (7) 1- Scrap steel tumbler
- (8) 1- 600 kg. bottom pour ladle with ingot moulds for 90mm x 90mm ingots
- (9) 1- Oxy-acetylene cutting and welding set
- (10) 1- Pattern shop
- (11) 1- Chemical laboratory
- (12) 1- Metallographical laboratory.

Additional equipments will be installed in course of time. They are as follows:

- (1) 1- Ingot heating furnace
- (2) 1- 770 kg. hammer of arch form stand, driven with compressed air.
- (3) 1- Air compressor, motor driven, capacity 13 cu. m. (460 cu. ft.) free air per min. to be delivered at 5 kg. per sq. cm. (71 lbs. per sq. in.)
- (4) 1- Electrically heated heat-treatment furnace, size 30cm x 60cm x 90cm
- (5) 1- Circular sawing machine for cutting risers and gates of castings
- (6) 1- 5-ton overhead travelling crane, electrically operated.

**THE IRON AND STEEL LABORATORY OF  
THE NATIONAL RESEARCH INSTITUTE OF  
ENGINEERING**

ACADEMIA SINICA

**ITS AIMS AND SERVICES TO  
THE PUBLIC**

In view of the importance of the metallurgy of iron and steel in relation to the various branches of engineering the National Research Institute of Engineering has undertaken since its organization in 1929 the establishment of a laboratory specially equipped for carrying on researches in this branch of engineering. This laboratory known as the Iron and Steel Laboratory is located in the Western district of Shanghai, the Industrial Metro-polis of China.

The building and principal equipments for the Laboratory were completed in the Spring of 1931 and experimental work was started in May of the same year.

Although the main aim of the Laboratory is for the carrying on of researches in the metallurgy of iron and steel, nevertheless services to the local industries are also considered as an important part of its work. During the past year cordial relations has established with many factories and Government Institutions by supplying them with steel and special iron castings and helping them to solve problems relating thereto. In order to secure still closer co-operation with the public, the following short account is given here for general information.

**EQUIPMENT**

The existing equipments in the Laboratory consist of the following:

THE IRON AND STEEL LABORATORY OF  
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ACADEMIA SINICA

ITS AIMS AND SERVICES TO  
THE PUBLIC

**THE IRON AND STEEL LABORATORY**

**WORKS: 37b BRENAN ROAD, SHANGHAI**

**TEL. 27903**

**OFFICE: 1337 AVENUE JOFFRE, SHANGHAI**

**TEL. 70363**

THE  
IRON AND STEEL LABORATORY  
OF  
THE NATIONAL RESEARCH INSTITUTE OF  
ENGINEERING  
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TO THE PUBLIC