

# ***The village steel-works***

***Concept for a  
small scale  
steel production unit  
for  
local development***

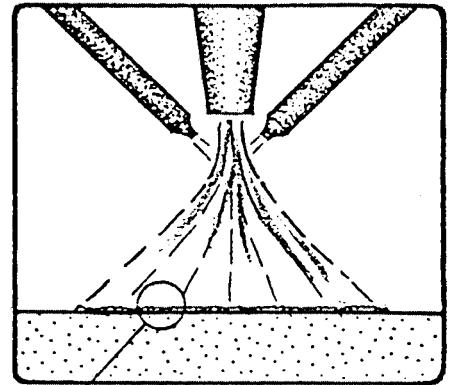
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# Small scale steel production

Steel is today generally produced in very large and very expensive industrial plants requiring heavy capital investments. The technology used is based on converting iron ore or scrap metal into molten steel. The molten steel is solidified into thick slabs which must be reworked several times over into thinner + thinner material. This requires heavy equipment, a long and complicated process chain, high capital costs, high energy consumption and experienced workers. Such plants are not suitable where steelmaking is to be introduced on a relatively small scale.

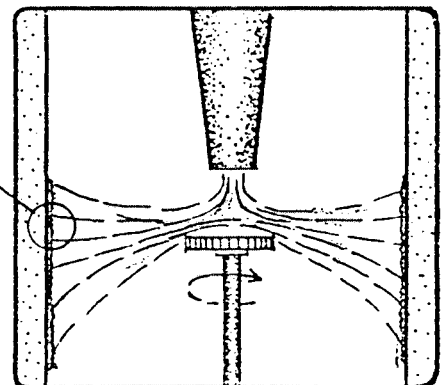
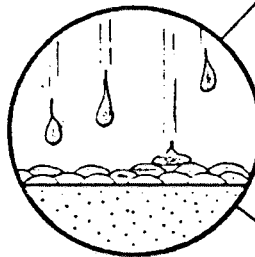
Spray casting uses a technique based on the principle of converting raw material into semifinished steel one drop at a time. The process requires melting equipment for raw material and a spray tank in which the steel body is built up. Other necessary equipment is for heat-treating and cutting the finished product to size.

Spray casting makes it possible to produce high quality steel on a very small scale. It also creates two other possibilities. Melting equipment can be designed so as to have a relatively low capacity, requiring therefore a much **lower power supply**. The handling process can be geared to more manual procedures with **less automatic equipment** since the raw steel plates to be processed are all of relatively low weight.



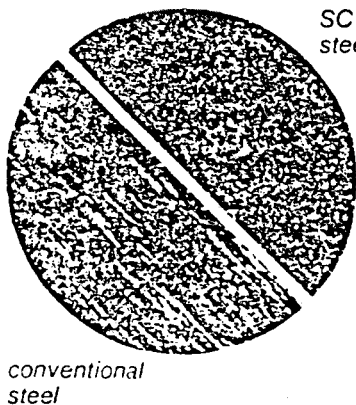
## SC steel

*By bombarding molten steel with gas or by mechanical means breaking up it's flow, it is possible to create droplets of steel.*

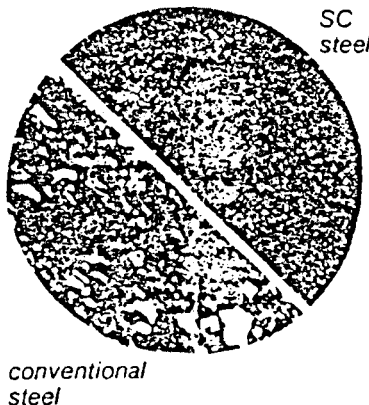


## SC steel is high quality steel

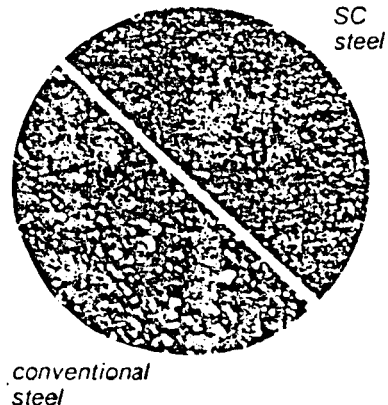
Carbide segregation in M35 high speed steel bar  
20mm diameter x 100

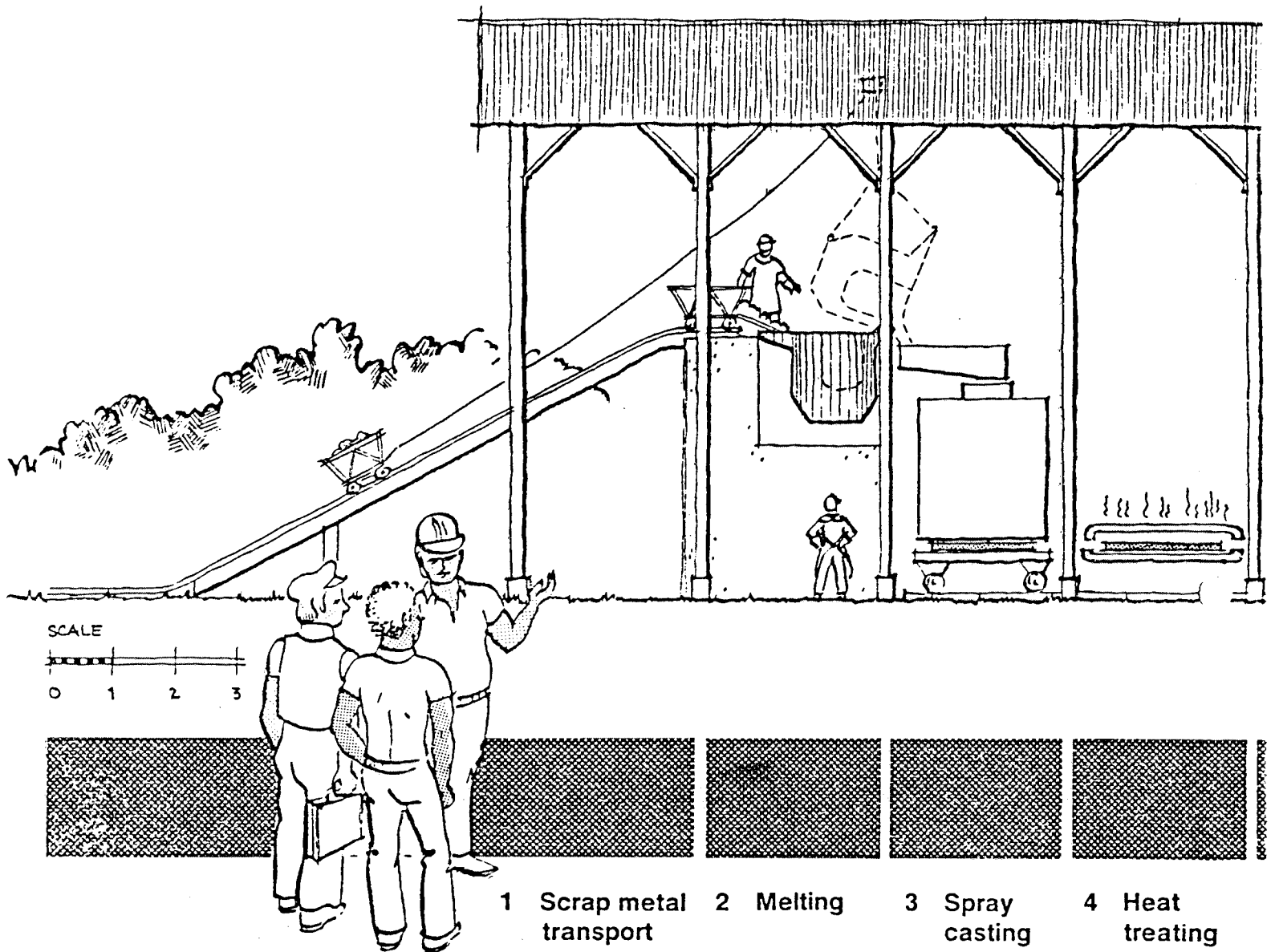


Carbide structure in SC M15 sheet  
6mm thick x 400



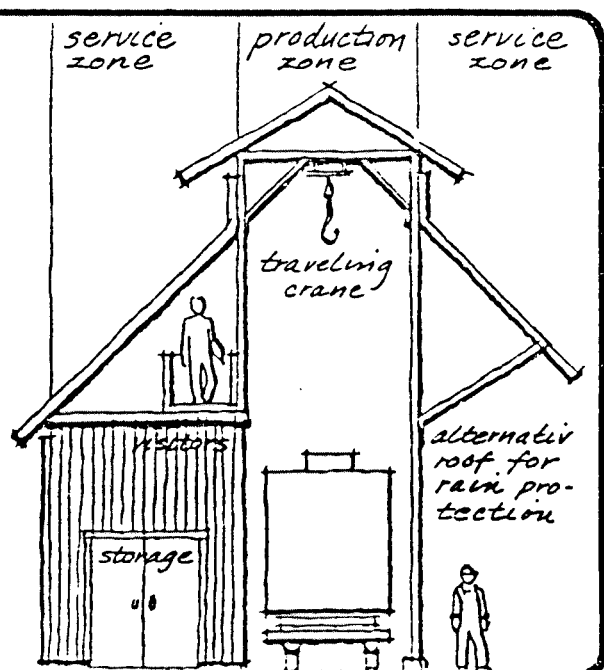
Carbide structure in SC A7 sheet  
4mm thick x 400

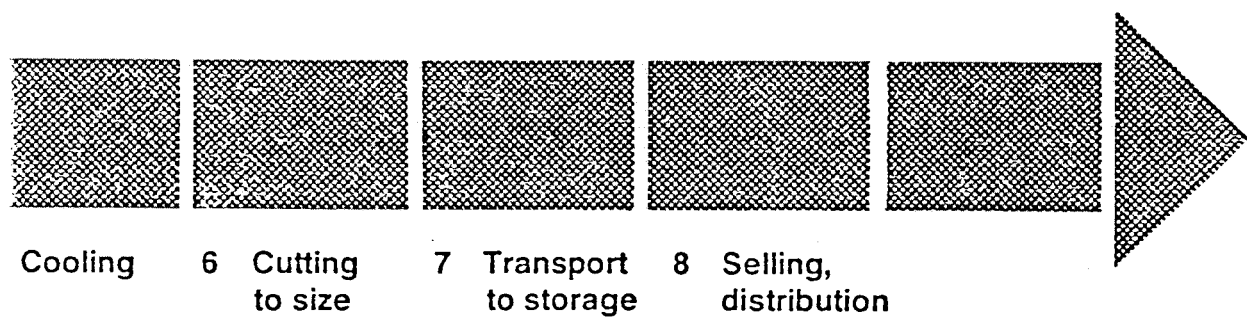
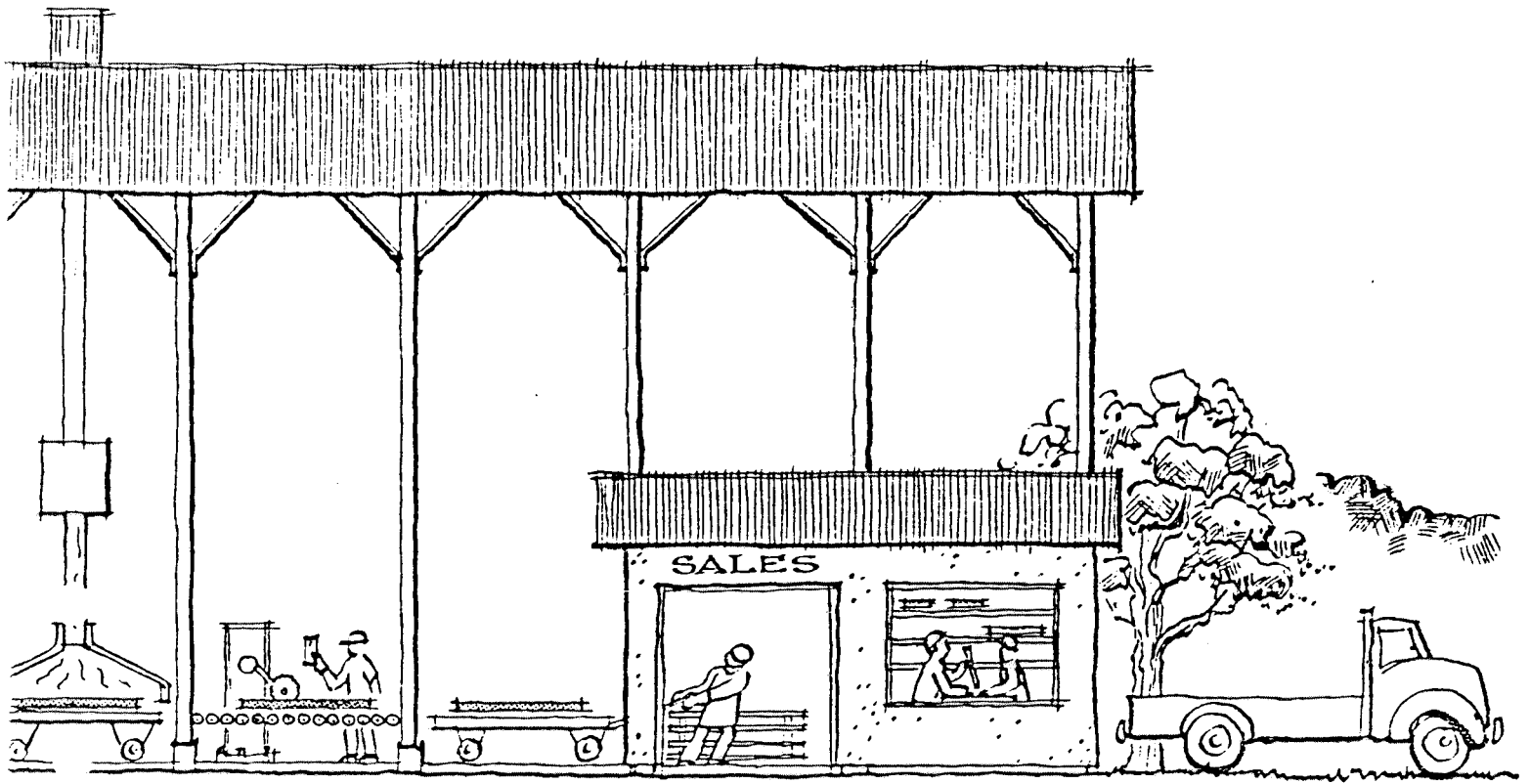




### A SC steel plant

Production of SC steel requires lifting equipment which need not be especially complicated. The building structure can be designed to carry an overhead crane as well as protective roofing. Side walls can be added for complete enclosure or can remain partially open depending on local weather conditions and storage needs.





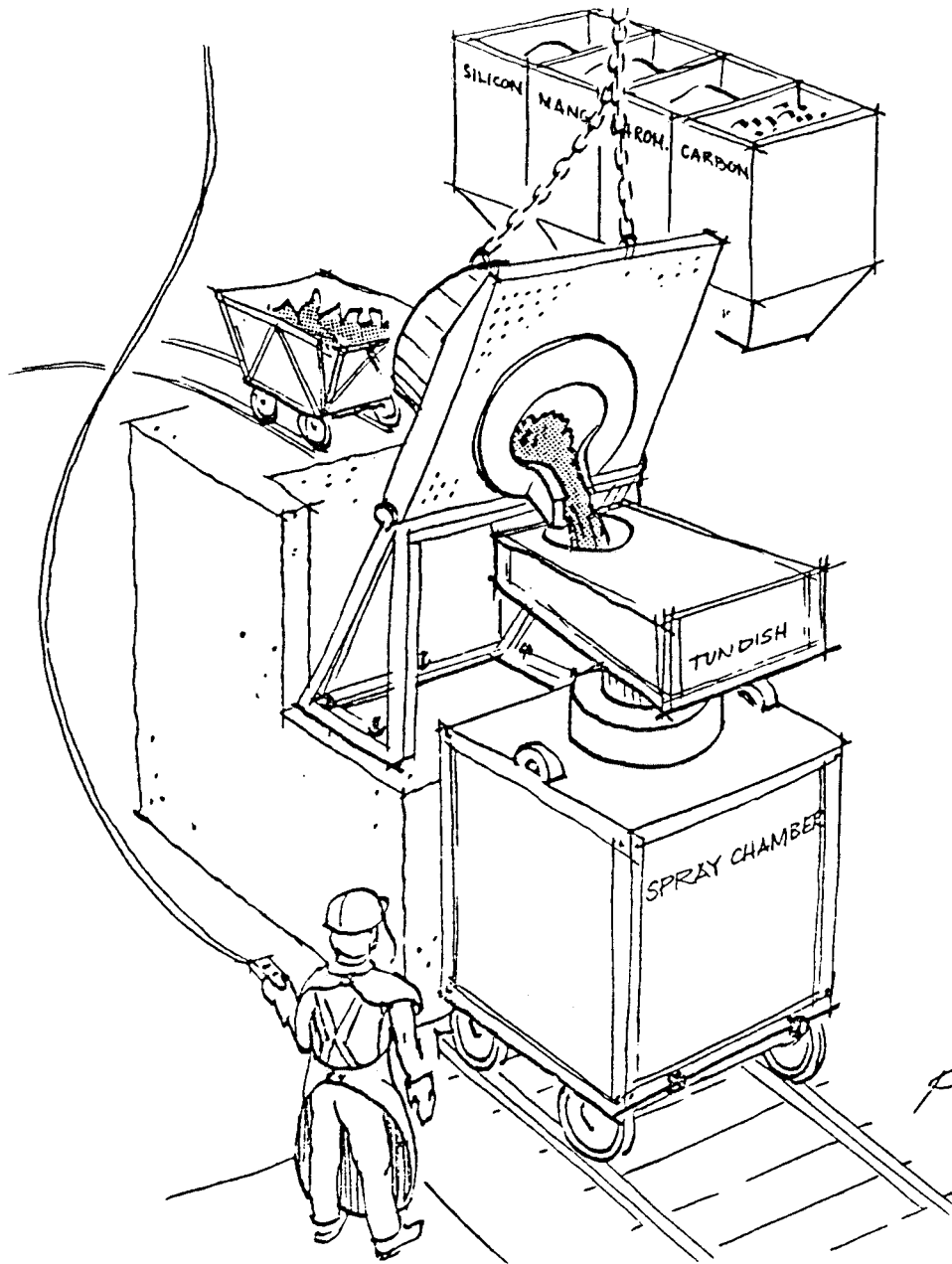
## ***Production stations***

### **1 Scrap metal transport**

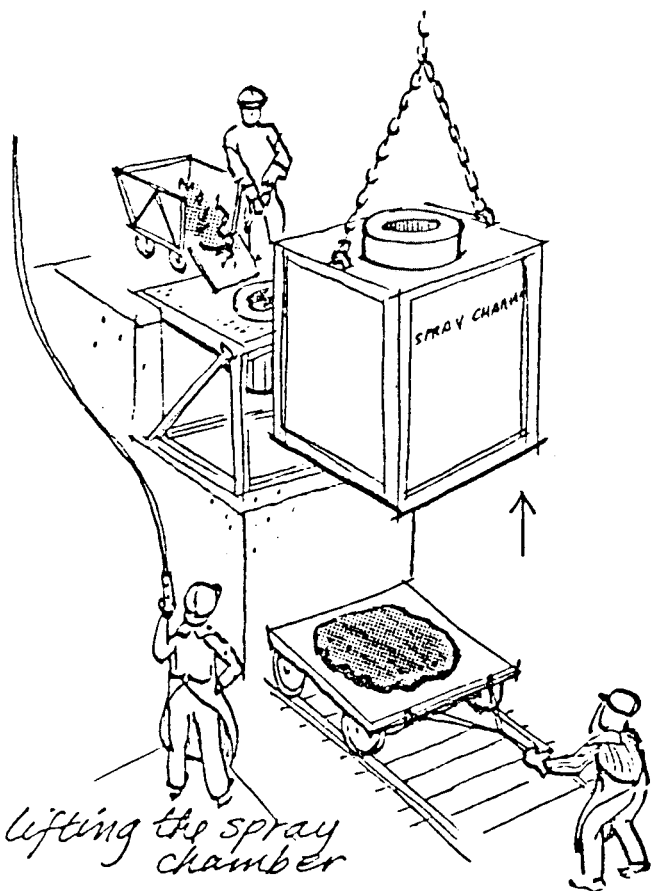
Raw material in the form of scrap metal is transported to the SC plant and loaded into small, rail mounted wagons. The wagons are lifted up to about three meters above floor level.

### **2 Melting**

The scrap is filled manually into the melting furnace which has a capacity of 500 to 2000 kg of molten metal. The quality of the metal is tested and adjusted by the addition of alloys such as carbon, silicon, manganese, chromium, etc.



*pouring the melt*



*lifting the spray chamber*

### 3 Spray casting

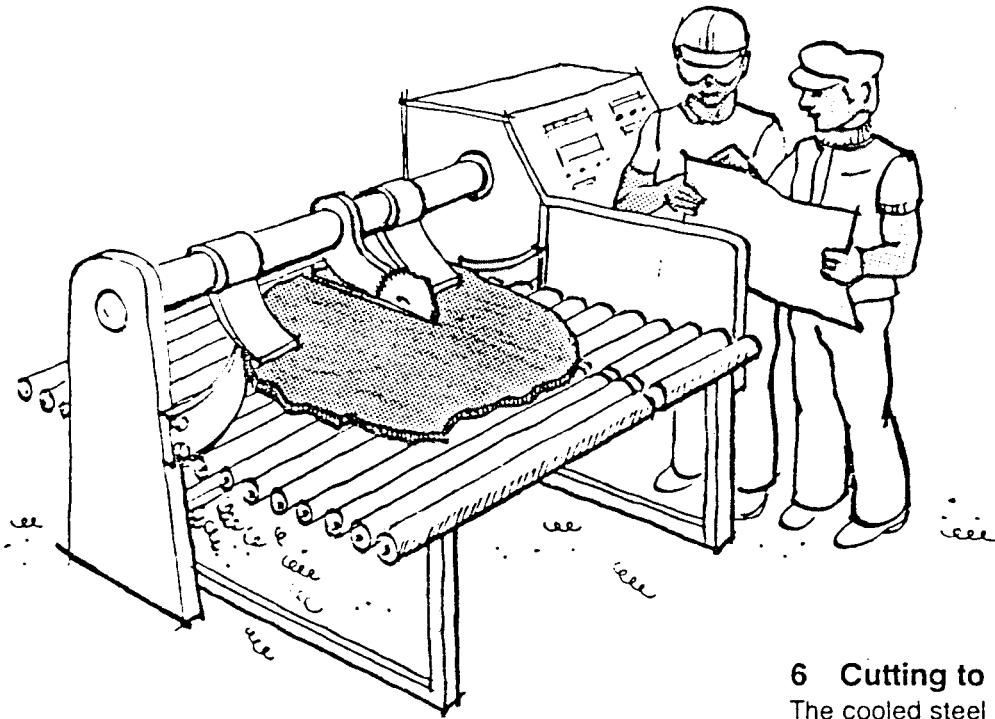
When the melt reaches the proper analysis and temperature, it is poured into the tundish and fed into the spray chamber. The stream of metal falling into the chamber is broken into very small droplets. The droplets are thrown on top of each other with great force and form a solid steel body. Due to the rapid solidification rate the resulting steel structure is fine grained and uniform and thus has good hot working properties.

### 4 Heat treating (Annealing)

The new steel is heat treated in order to produce the right structure.

### 5 Cooling

The steel is cooled by air or gas which can be later used as a source of heat where there is need for space heating of office buildings, etc.



### 6 Cutting to size

The cooled steel is trimmed and cut to the desired size. Each plate can be specially cut to the buyers' requirements or cut to a standard size for storage.

### 7 Transport to storage

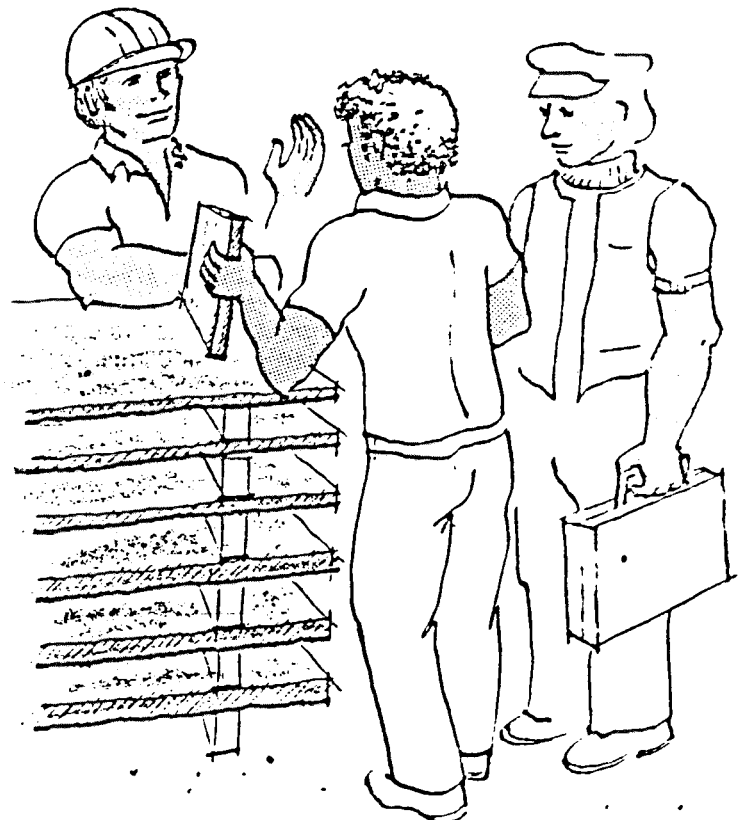
Storage can be combined with production or situated separately as a customer service unit.

## ***Local steel production and the industrial community***

### **The steel shop**

A special shop should be created to display SC steels. This type of production facility is especially interesting to two types of buyers; those looking for high quality steel and those with small orders who require special analysis and dimensions of steel. The SC process makes it possible to return excess material to the melting furnace, to produce special steels at a low price and to reach very short delivery terms.

When a local blacksmith visits the plant and the sales shop he will have every possibility for discussing steel qualities, hot working methods and even melting technique with the plant personnel. He can also sell his own scrap or other scrap that he has collected.



### **Combining high technology with craftsmanship**

The described SC technique is interesting in itself as a new development for the production of high quality steel in varying grades. For the developing country it is even more interesting as a technology which can be directly coupled to the production of handmade products by local artisans. The blacksmith will receive access to supergrade material which is easy to forge and hammer into finished products. The local factory producing parts for resale will be able to compete with the largest producers because of the good properties of SC steel.



## ***Power supply, manpower needs and yearly production***

An electrical power station is required with high voltage service of 10 000 volts. Converted power requirements 380 volts.

The plant shown here might employ 3 or 4 skilled workers and possibly 2 or 3 unskilled workers. Scrap metal suppliers not included.

Production per year depends on plant design and power supply. The production range can be between 20 and 500 tons of first-class steel per year.

Investment costs can be kept very low. It should be possible to purchase equipment (essentially for melting and spraying) for as little as 3,000,000 Swedish crowns for production of 500 tons of steel per year. This is the equivalent of 6,000 SK per annual ton of steel, a figure equal to the capital cost of steel from a large integrated steel mill. The small local facility will be able to offer short delivery times and low transportation costs.

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