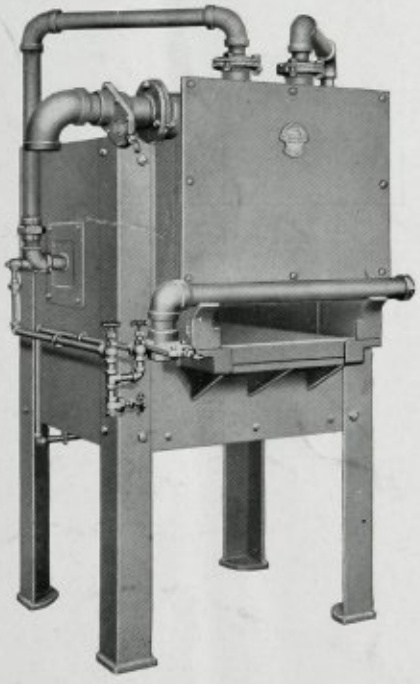
FORGING AND HEATING FURNACES

ECONOMIZER SHIELD TYPE



(Patented)

W. S. ROCKWELL COMPANY

FURNACE ENGINEERS AND CONTRACTORS

50 CHURCH STREET NEW YORK

(Hudson Terminal Building)

PRODUCTION COST IN FORGING

There are perhaps few industrial heating operations in which less real progress has been made, since the general introduction of liquid or gaseous fuels, than the heating of small and medium sized stock for drop forging, upsetting, bending and miscellaneous light hammer or press work.

Many of the furnaces now used for this work are extremely crude and inefficient and ofttimes entirely unsuited to the work. In some instances the application of the fuel and heat is poor; in others the construction of the furnace is at fault; and, in most cases, the furnace is so hot and uncomfortable to the operator that his output is curtailed, particularly in hot weather. Complete shutdowns, brought about by the sheer inability of the operator to stand up to the almost unbearable conditions, are not infrequent. Excessive heat in the shop is generally an indication of unnecessary waste of fuel. In many instances the loss in labor and fuel alone is greater than the cost of operating the machine that the furnace serves. The waste of time and limited production due to these faulty conditions result in a high forging cost and offset many of the advantages that liquid or gaseous fuels otherwise afford.

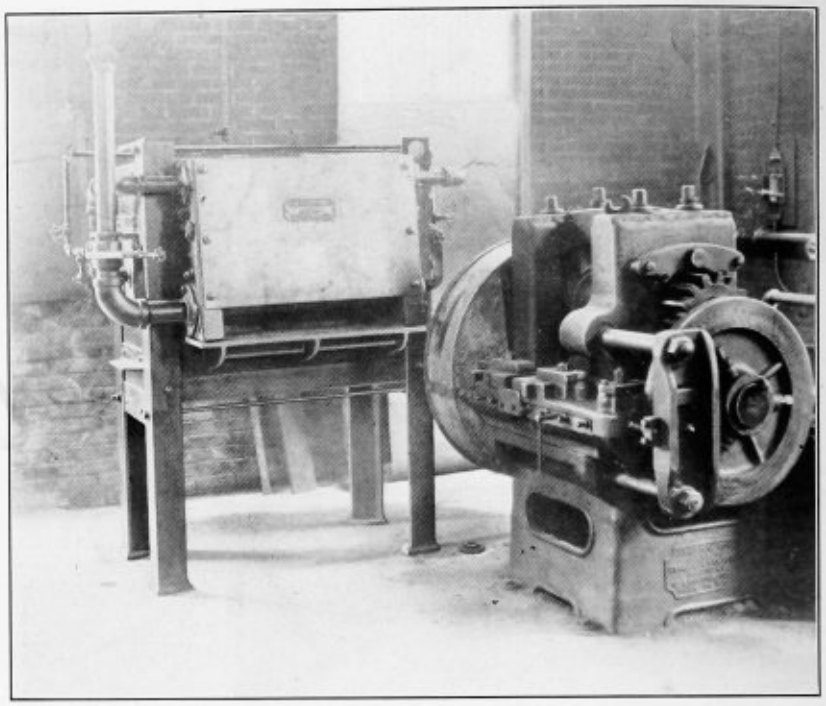


Fig. 2 Furnace and roll for tapering. The preheater shield protecting the operator from the heat makes it possible to locate the furnace very close to the machine.

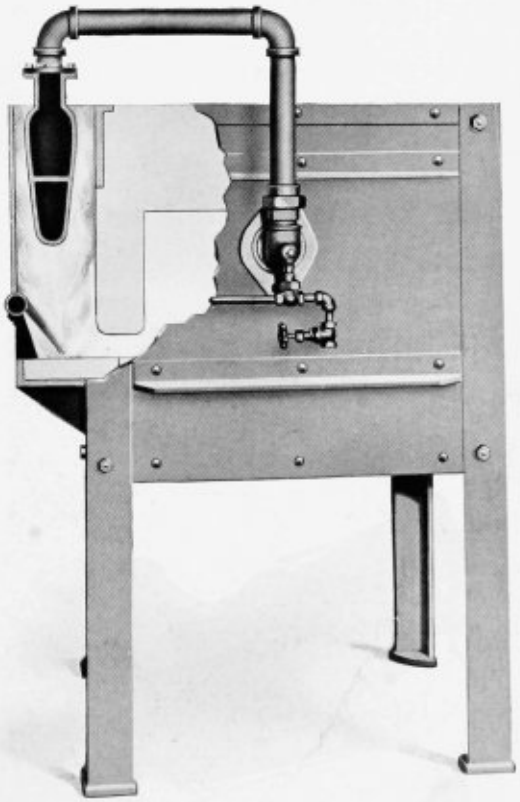


Fig. 1. Section showing deflection of spent gases and utilization of heat in preheating air for combustion, the working opening being the only vent.

Production cost is not determined alone by the machine, the furnace, the fuel, or the man, but by the proper combination of all these. In order to produce the greatest all-around efficiency, it is necessary to bring the furnace up to the standard of the machine and make it possible for the man to keep up with both. The ability of the man to keep up with the machine is greatly influenced by the working conditions around the furnace and the facility with which he can heat and handle his material. The output of the machine is usually less than it should be, due to the inability of the operator to serve it. The heat from the ordinary furnace is so uncomfortable that it is generally necessary to place the furnace a considerable distance from the machine or hammer in order to make it physically possible for the man to work and protect him not only from the heat but the spent gases, which investigation has proved to be more fatiguing and detrimental to health than the heat itself. This distance partially relieves the condition, but it automatically involves a loss of production through an unnecessary burden upon the man, due to the time required to travel between the

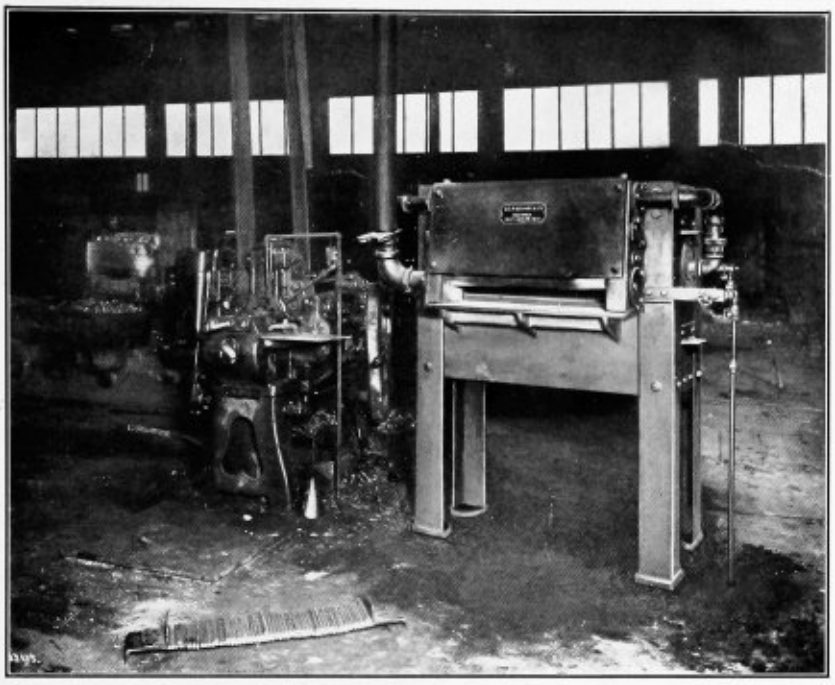


Fig. 3. Furnace and heading machine for light stock.

furnace and machine. It is an attempt to deal with the effect but not the cause of the condition, and the waste of fuel reflected in the amount of heat thrown off from the furnace still exists.

To relieve these conditions, we supply a new type of furnace which not only makes it possible for the operator to work to better advantage and keep up with his machine under more comfortable working conditions, but, at the same time, affords other advantages in the way of decreased operating cost and better quality of product.

DESIGN

The design of the furnace, as illustrated by Fig. 1, involves among other features a special economizer over the working opening which recovers a large percentage of the heat ordinarily wasted; and also a novel arrangement of air blast and shield which acts as a barrier between the operator and the escaping heat, enabling him to work closer to the furnace and handle his material quickly, easily and in comfort.

OPERATION

In the operation of the furnace, the spent gases discharged from the working opening are deflected by the air blast away from the operator and against the economizer, through which the air for combustion is circulated, with the result that the air, taking up heat in its passage, is delivered hot into the furnace. The fuel is also preheated, with the result that there is quicker ignition and better combustion, particularly with oil, which is gasified before entering the heating chamber. The spent gases are discharged vertically from the top of the economizer and above the head of the operator, which serves to protect the arms and face of the operator from the heat and eliminate the weakening effect of the spent gases. Any heat in front of the working opening is radiant heat free from gas. Under this condition the operator can stand up closer to the furnace and employ shorter tongs.

The air blast is employed not merely to retard the escape of heat and gases, but to form a curtain of cool air under pressure through which the operator works. The full mechanical effect of this cool air blast is always maintained, whether the stock be partly without or entirely within the furnace chamber, or whether the chamber be entirely or partially filled or empty. This is accomplished by applying the blast above the stock instead of below, which is ineffective when the material to be heated projects beyond the working opening and over a blast pipe.

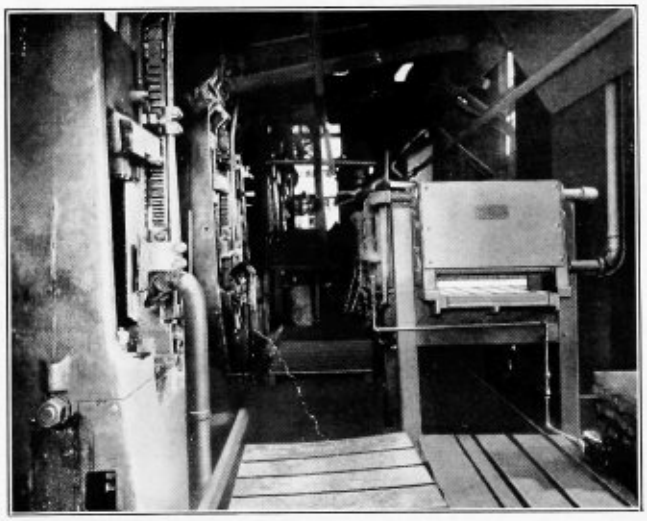


Fig. 4. Section of a row of furnaces and drop hammers.

REGULATION

The operating valves for fuel and air are controlled from the working end of the furnace, so that the operator is not required to change his position nor interrupt his productive work in order to adjust the fire.

All air entering the furnace is under control and must pass through the economizer and become heated, so that the operator can positively regulate the supply of heated air not only to maintain the temperature but to fix the composition of the gases surrounding the stock. The pressure of the air blast may be regulated to suit the operating condition desired.

CHARACTER OF HEAT

The provision made for combustion is such that there can be no ill effects through direct blast or cutting action of flame or unburned fuel against the stock, which is really heated under a blanket of hot gases. The heat is applied uniformly on all sides and the ill effects of the varying temperature and composition of so-called "flame" when applied direct to the stock are eliminated. There is a thorough mixture of the gases, which, with the help of the heated air, makes it possible to maintain good combustion, without smoke or carbon deposits, even with low pressure air. The heat may be brought up promptly and in every way is in marked contrast to that obtained with the common type of furnace, in which the fuel is merely burned and very little, if any, attempt made to properly utilize or apply it.

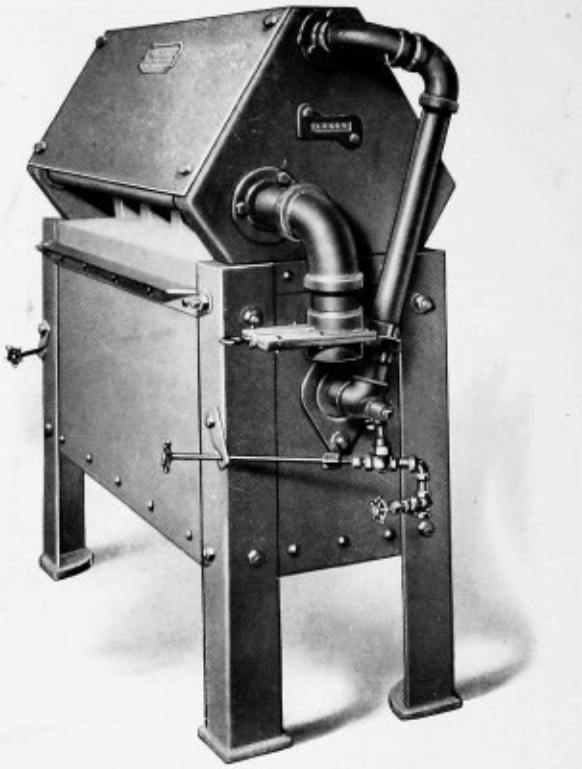


Fig. 6. Furnace for center or short end heats to be worked from one or both ends.

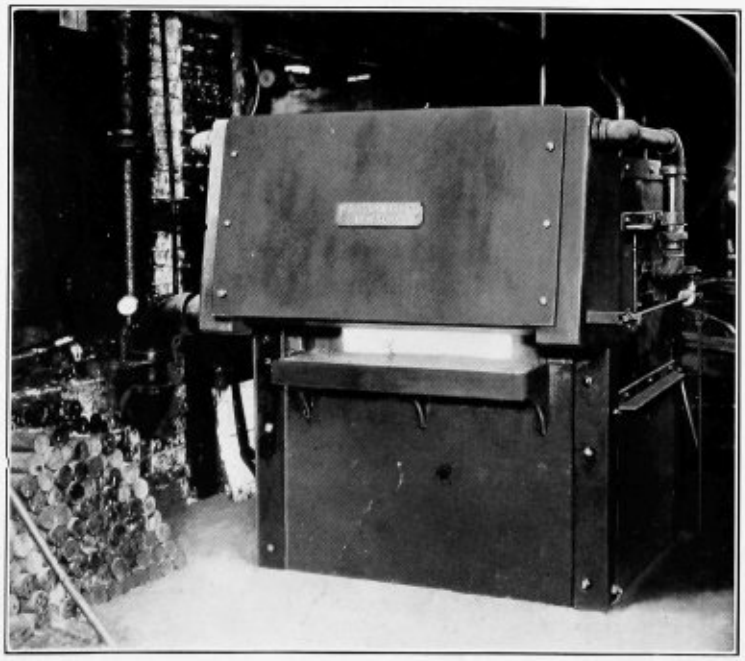


Fig. 5. Furnace for heating medium heavy stock.

The furnace holds its heat well. It is common practice in many shops to light the furnace in the morning by the heat retained in the chamber from the previous day's operation, without using a torch. This saves time, fuel and power and makes possible a clean, quick start, and tends to decrease the loss following the destruction of the brickwork due to severe contraction under quick cooling.

The utilization of waste gases to preheat the air and fuel to support combustion not only effects economy in fuel, air and power, but makes it possible to maintain clean, soft, soaking heats, which in practice have been found to materially reduce the quantity of oxide or scale on the stock. In a number of instances the reduction in scale has resulted in an increase in life of dies to double that of previous practice.

CONSTRUCTION

The construction is heavy throughout and involves a liberal amount of heavy section ironwork with extra thick lining, practically all of which is made up of standard fire brick and insulating material. All the ironwork is accessible and may be easily dismantled for inspection or repairs. The work of relining is simple, involving mostly common fire brick and the services of an average bricklayer. When oil is used there is no drip from the burners, no carbon deposits, nor any special provision in the way of baffles or complicated burners to secure proper combustion, which is accomplished without these undesirable features.

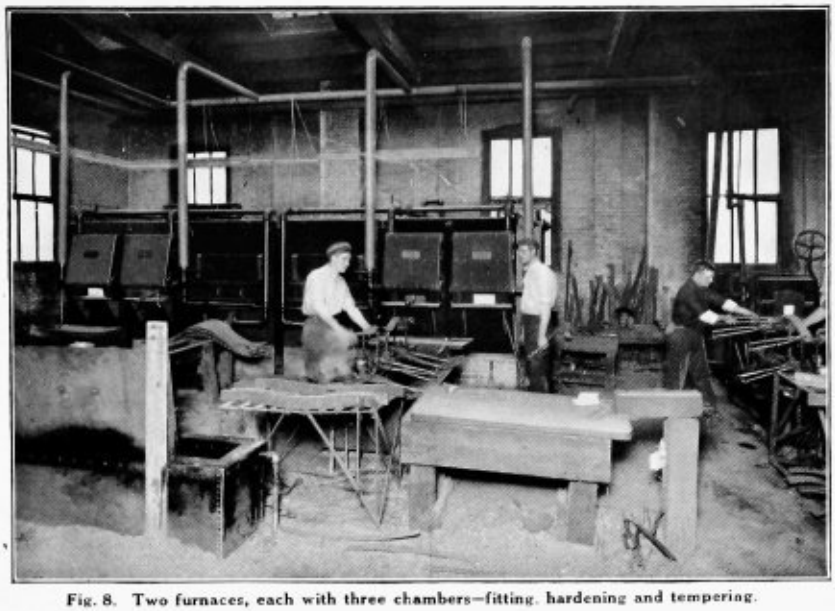


Fig. 8. Two furnaces, each with three chambers—fitting, hardening and tempering.

The furnaces may be built on legs (Fig. 3) or with solid body (Fig. 5), depending upon the size and whether or not it is desired to have them portable.

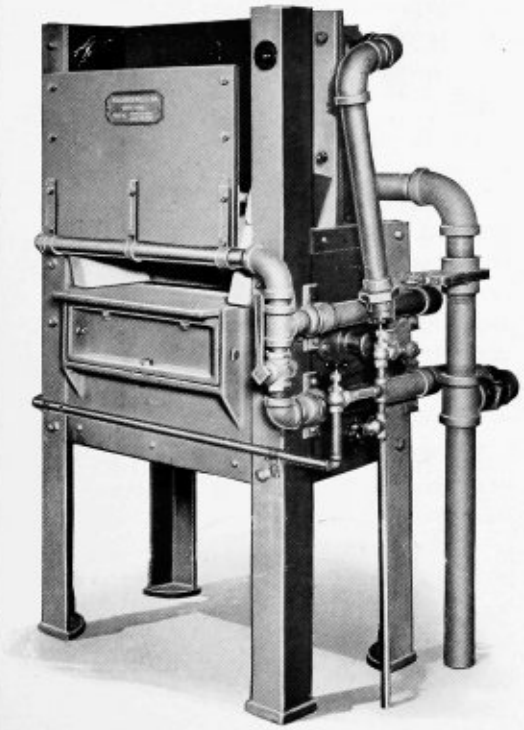


Fig. 7. Furnace with adjustable shield on front and economizer in rear. For short end heats on light stock to be stacked in magazine above sill plate.

FUEL

The furnaces are designed for the use of oil, gas or powdered coal and low pressure air—the latter lessening the noise and power attending the use of the higher pressures, which are neither necessary nor desirable. They can also be employed in connection with coal or coke.

The furnaces have been successfully operated with oil and air blast of but a few ounces pressure with clear fires, free from smoke and carbon deposits. However, the proper pressure to be employed depends upon the nature of the operation, size of furnace, temperature, etc. When air blast is used to blow scale from the dies, it is desirable to adapt the furnaces to the same pressure, if possible, so that but one blowing system is required. The best all-around results are secured within the limits of 4 oz. and 1 lb. per sq. in., which may be easily secured without a piston type air compressor. The saving in power resulting from such low air pressure is an important factor in production cost, and the use of one system of piping for all the air required is an important factor in the installation cost.

SIZES

The furnaces are built with chamber widths of 9 in., 14 in., 18 in., 22 in., 27 in., 30 in., 36 in., 42 in., and 48 in., and with chamber depths ranging from 6 in. to 30 ft. The widths of working openings may be varied within these limits without affecting the general construction of the furnace. The furnaces may be built in single or multi-chamber form, with one or more openings at either or both ends of the chamber as desired.

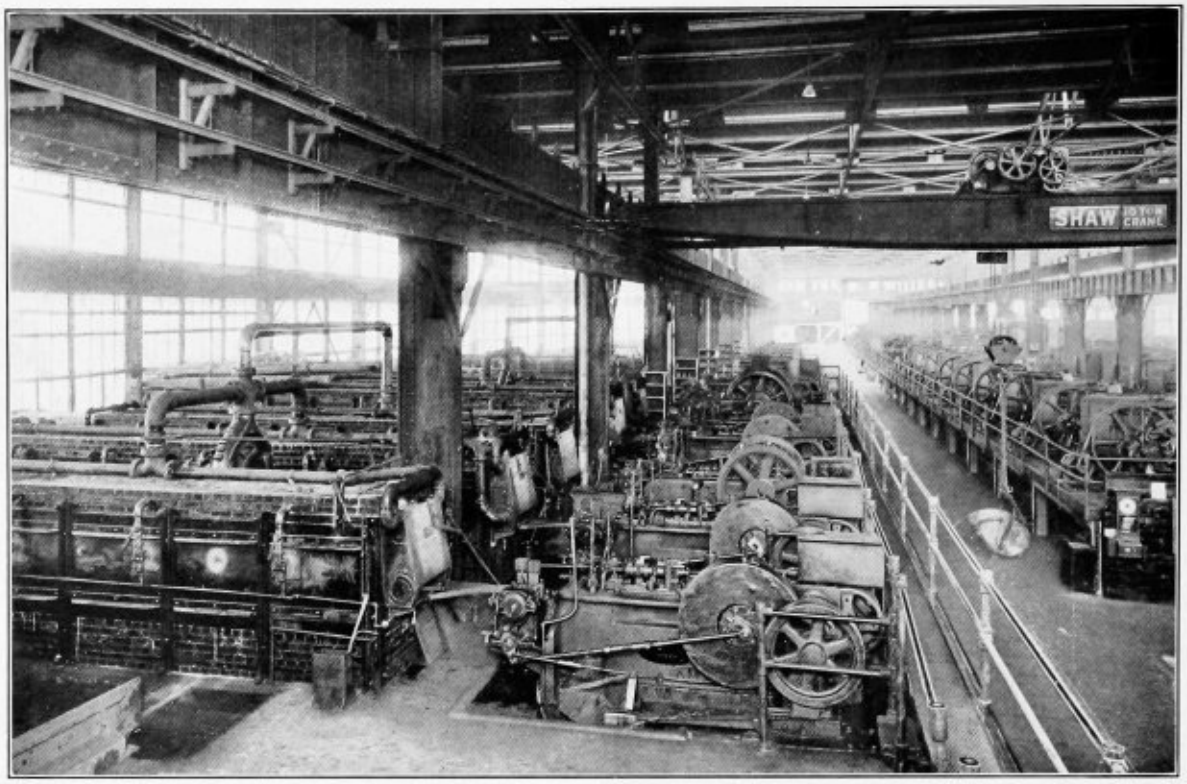


Fig. 9. Continuous rod heating furnaces with upsetting machines and smaller bar heating furnaces and nut machines on platform on the right.

ADVANTAGES

In practice, under actual working conditions in connection with the manufacture of nuts, bolts, rivets, axles, springs, automobile parts, etc., as well as for miscellaneous forging and upsetting operations, it has been found that this principle of operation materially reduces the cost of production by the advantages it offers, which have been found to include:

Reduction in fuel consumption through utilization of heat in spent gases to preheat the air and fuel.

Saving in fuel resulting from the use of low pressure air.

Protection of the operator from the heat and gases of the furnace, enabling him to work to better advantage.

Greater output due to more comfortable working conditions.

Use of one system of piping to operate the furnaces, protect the operator and blow scale from the dies.

Less heating area for same output by reason of better heating conditions.

Reduction in quantity of scale and increase in die life due to the effect of soft, slow, soaking heats.

Cleaner shops and more healthful conditions for the men, with less smoke, heat, gas, noise and dirt.

Economy of fuel and power resulting from the saving in time required to bring the furnace up to heat.

The principle is applicable to a great variety in size and arrangement of chambers for different classes of work, and the economizer hood and attachments may be applied to existing furnaces irrespective of the fuel employed.

The furnaces are not offered alone as furnaces but also as part of a manufacturing equipment, and it is the purpose to adapt their size and construction to the nature of the operation and the local shop conditions, which govern the results accomplished from the combination of the man, the furnace and the machine. It is preferred to consider each case separately on its merits in order that the furnace may be properly adapted to the local conditions, looking toward the end of securing the greatest all-

around efficiency from all the elements involved in the operation as a whole.

The purpose for which the furnace is to be used, with full information as to sizes of stock, lengths of heat, number of pieces to be heated per hour, and time of heating each piece, should be stated with inquiry; also the fuel and air pressures available, together with any other data in the nature of details of the operation or shop conditions that will make us acquainted with all phases of the problem in order to properly determine the size and type of furnace best suited to the purpose.

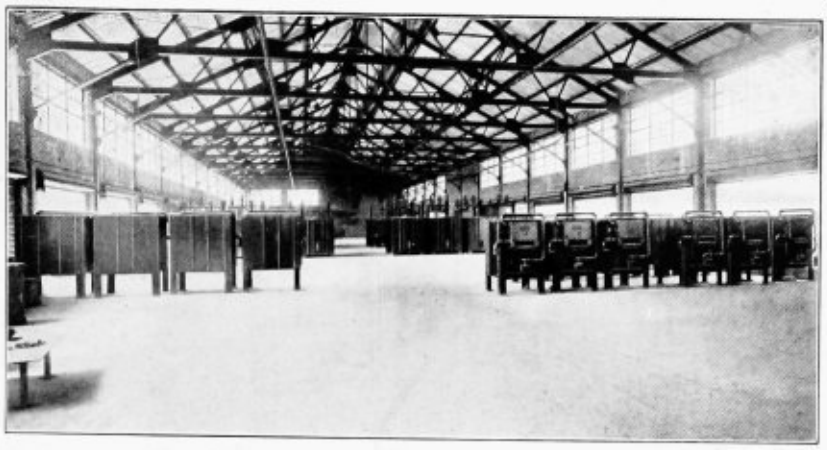


Fig. 11. Furnaces with economizer hoods for miscellaneous heating operations on small light stock.

GENERAL

The statements made relative to the merits of this type of furnace are based upon observations taken from actual operation under a variety of working conditions from the operation of hundreds of these furnaces. The results secured are such as lead us to offer them in competition with any existing installation or type of furnace used for the same work.

The principles of operation and application in a variety of forms are protected by patents granted and others pending in the United States and foreign countries.

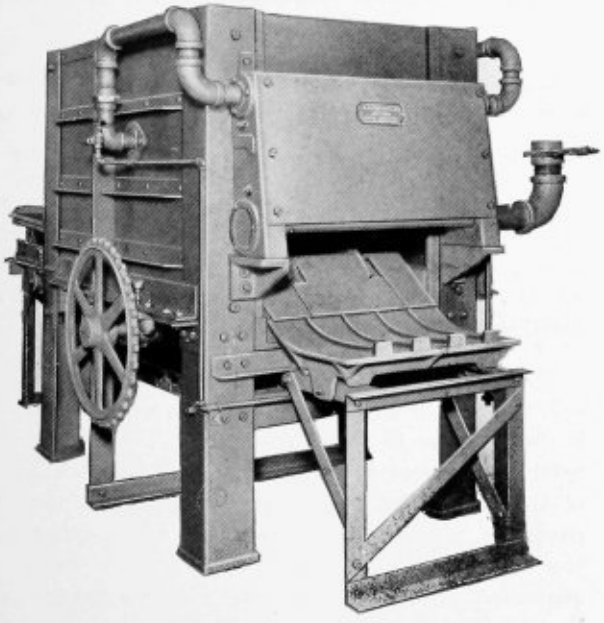


Fig. 10. Automatic furnace with conveyor to heat light stock for bending.

MODERN FORGING PRACTICE

The best modern practice requires the forging of steel under conditions similar to those herein outlined, and a subsequent heat-treatment of the steel to relieve the strains set up in the forging operation and to facilitate machining. In fact, a large percentage of the high grade drop forgings made today are purchased under specifications that require this heat-treatment operation.

Development of this practice has shown the economy effected by decreasing the percentage of rejections, the cost of machining and improvement in quality of the finished forging, which much more than offset the cost of the heat-treating operation.

An up-to-date forging shop should have the best facilities for forging the stock and for the comfort of the workmen in order to keep up production; and, in addition, the best type of furnace equipment for the subsequent heat-treating operations, which in time will be considered as necessary for the production of good forgings as the forge furnaces themselves.

Fig. 12. Four rows of furnaces and nut machines.

We make a specialty of forge shop work and solicit inquiries for better heating methods irrespective of equipment or fuel.

"ROCKWELL SERVICE" SOLVES HEATING PROBLEMS

"FURNACE AND FUEL TO SUIT THE WORK"—is the rule governing our consideration of a new or the improvement of existing furnace equipment to suit **your** needs under **your** plant conditions. Our purpose is to deal with each case on its individual merits and to recommend changes in methods or equipment only when it is apparent that these will be productive of better results.

We do not merely sell furnaces but rather means for efficiently producing results in industrial heating operations, which involves a great deal more than combining brick and iron or the burning of fuel.

We make inspection of plant, devise methods and means of working, prepare plans, furnish complete industrial furnace equipment and guarantee results, using coal, coke, gas or oil, as the best interests of our patrons require.

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