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SCRAP METAL PREHEATER

Filed May 31, 1966

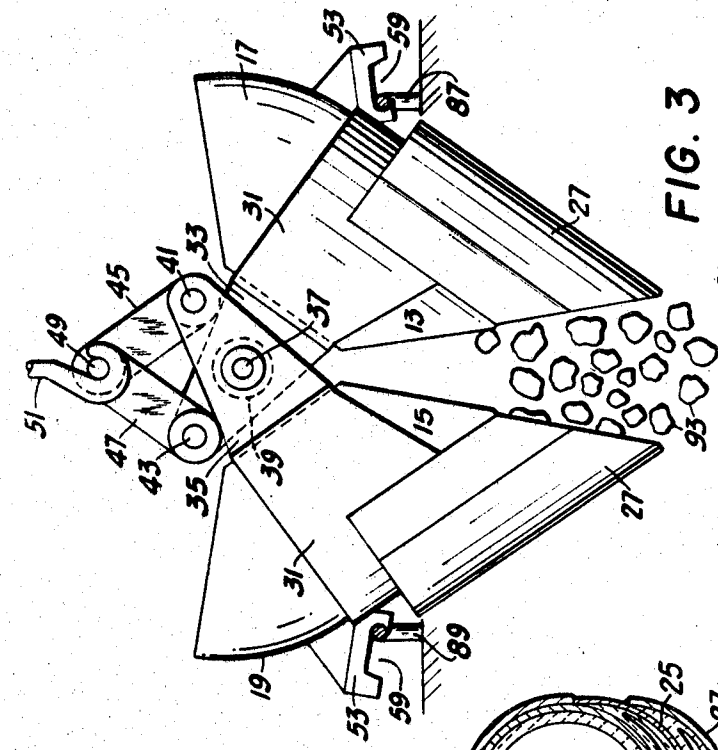


FIG. 3

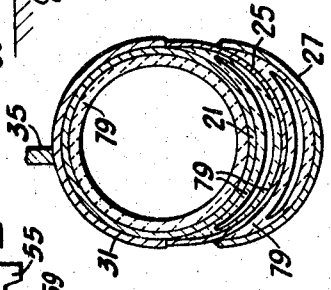


FIG. 4

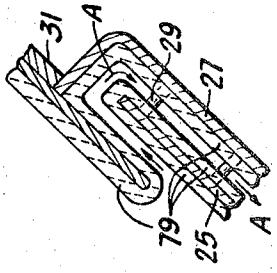


FIG. 2

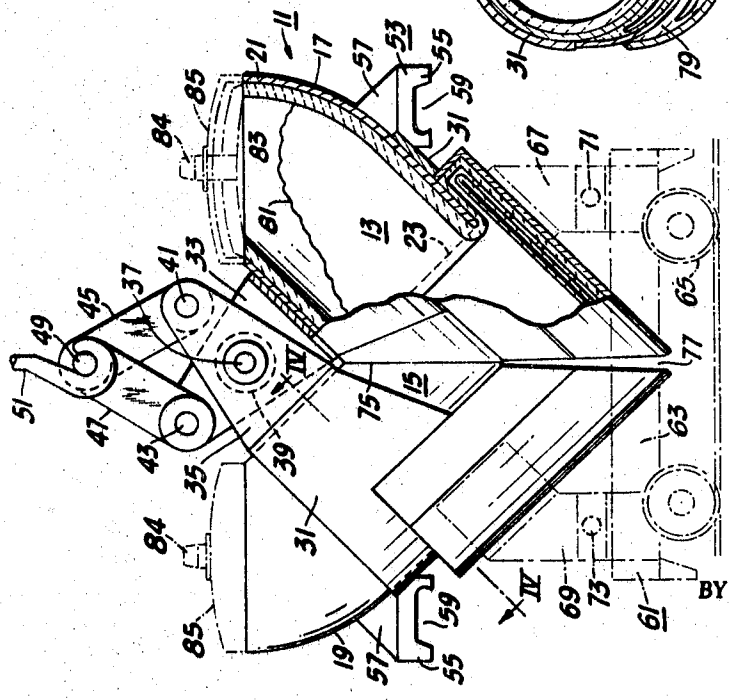


FIG. 1

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SCRAP METAL PREHEATER

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This invention relates to steel making and, more particularly, to improve apparatus for preheating scrap metal and other additives used in making steel.

In accordance with the invention, the apparatus for preheating scrap material includes a pair of coplanar tubular charging legs pivotally connected together and disposed in end abutting relation. The internal surfaces of the tubular charging legs are refractory lined to protect and insulate the steel leg structure from heat generated in each leg to raise the temperature of the scrap metal. The lower portion of each tubular charging leg is fitted with spaced apart outer cylindrical surfaces that surround the lower portion of the tubular charging leg in a spaced relation and form passages of a labyrinth for the exit of hot gases of combustion after they have passed through scrap metal in the unit and raised the temperature of the scrap metal.

Each charging leg is provided with a fixed saddle support that is adapted to engage and coact with a pair of fixed supports, adjacent a discharge area, in such a manner that when the preheater unit is disposed between the fixed supports and is lowered relative to the supports, the saddles engage the supports and the charging legs pivot relative to the fixed supports and to each other to open the preheater unit and discharge the preheated scrap metal therefrom.

For a further understanding of the present invention and for advantages and features thereof, reference may be made to the following description taken in conjunction with the accompaying drawing which shows, for the purpose of exemplification, a preferred embodiment of the invention.

In the drawing:

FIG. 1 is a schematic elevational view, partly in section, of a preferred embodiment of the invention in one operative position;

FIG. 2 is a sectional view, at an enlarged scale, of a portion of the preheater of FIG. 1;

FIG. 3 is a schematic view of the preheater of FIG. 1 in another operative position; and

FIG. 4 is a sectional view along line IV—IV of FIG. 1.

Referring to FIG. 1, the scrap preheater **11** of the invention includes a pair of right hand **13** and left hand **15** tubular charging legs of generally circular cross-section that are disposed in substantially coplanar, converging end abutting relation. The upper end of each charging leg **13, 15** is integrally formed to an elbow portion **17, 19** respectively, and both charging legs **13, 15** and elbow portions **17, 19** are fashioned preferably from steel plate, such as is indicated at **21**.

As shown in FIG. 1, the lower half portion of the shell plate **21** of each charging leg **13, 15** terminates along a radial line **23**. Surrounding the shell plate **21** in this area, and in spaced relation thereto, inner and outer cylinder shell portions **25, 27** are welded to the shell plate **21** and are themselves maintained in spaced apart relation by suitable spacer pieces **29** (FIG. 2).

Adjacent the upper portion of each charging leg **13, 15**, and in the vicinity of the elbow **17, 19**, a girth plate **31** overlies the shell plate **21**, but is shaped so as not to overlie the outer cylindrical plate **27** and is welded to the outer surface of the shell **21**. However, between the upper end of outer plate **27** and the elbow **17, 19**, the girth plate **31** entirely surrounds the shell plate **21**. The girth plate **31** supports upwardly projecting juxtaposed arms **33, 35** that are pivotally connected together by a pivot pin **37**. Preferably, a washer **39** or other suitable member is disposed around the pivot pin **37** and between opposed surfaces of the juxtaposed arms **33, 35** to maintain them in spaced apart relation.

The arms **33, 35** are also pivotally connected, as at **41, 43**, to a pair of links **45, 47** that are themselves pivotally connected together, as at **49**. The pivot pin **49** also serves as a connection to a lifting device, such as a powered crane hook **51**.

Adjacent the upper edge of the girth plate **31**, a saddle support structure **53** comprised of a horizontal rectangular body portion **55** and a triangular bracket portion **57** is welded, preferably, to each shell plate **21** at a location opposite a plane passing through the pivot pins **37, 49**, or about where shown in FIG. 1. The rectangular body portion **55** has in the lower surface a groove **59** that has, preferably, the cross sectional form and shape shown in FIG. 1 for a purpose that will be described hereinafter.

The operation of the preheater apparatus **11** may be understood readily by describing a typical cycle of operational steps. It may be assumed that the preheater unit **11** has just discharged a load of preheated scrap metal and is ready for reloading. The unit **11** has been returned to a scrap loading station and is supported on a transfer car **61** (FIG. 1), or other suitable mobile apparatus. The transfer car **61**, shown schematically in FIG. 1, has an open center type body portion **63**, comprised of interconnected side and end rails respectively, that is supported on conventional railroad type trucks **65**. At each end of the transfer car there are cradle supports **67, 69** that are preferably pivoted at **71, 73** to suitable mountings on the transfer car.

In the embodiment of the invention shown in FIG. 1, the preheater unit **11** has been placed in the cradle supports **67, 69**, and the upper half of the lower ends of the charging legs **13, 15** are in the closed end abutting position; the edges of the respective legs **13, 15** abutting along a line **75** that lies in a plane passing through the pivot pins **37, 49**. It will be noted that the juxtaposed edges of the inner and outer spaced apart cylindrical plates **25, 27** do not abut, but are spaced apart so as to form a slightly divergent gap **77** at the bottom of the preheater unit **11**.

It will be understood that, at the scrap metal loading station, the upper ends of the elbows **17, 19** are open and are not closed. Scrap material may be loaded into the charging legs **13, 15**, using conventional equipment such as electro-magnets, grab buckets, or the like apparatus. Scrap material will tend to gravitate toward the bottom of the unit **11** because of the sloping charging legs **13, 15**, and such scrap will not tend to bridge or become wedged in the charging legs. Preferably, the inner surface of the shell **21**, both surfaces of the shell **25**, and the inner surface of the shell **27** are lined with suitable refractory material **79** that serves to protect and insulate the steel plate from the heat generated within the charging legs to raise the temperature of the scrap metal placed therein.

The scrap metal should, preferably, be loaded no higher than the level suggested at **81** in FIG. 1; that is to say, there should be a space **83** or volume within each leg **13, 15**, between the top level **81** of the scrap and the top of the elbow **17, 19**. The space **83** is necessary to accommodate the flame generated by a burner **84** in a removable cover, such as the cover **85**, that may be placed over the elbow **17, 19** at heating station.

As soon as the unit **11** is loaded with scrap material, the transfer car **61** and the unit **11** may then be moved in any suitable manner to a heating station. At the heating station, the unit **11** will be picked up by the powered crane hook **51** and set upon a suitable support structure that is preferably fixed in place at the heating station, and that is provided with suitable exhaust ducts located beneath the unit to exhaust the hot gases after they have permeated the scrap metal in the unit and emerged from the gap **77**. After placing the unit **11** on the fixed heating station support structure, the covers **85**, each having therein a fuel burner **84**, are placed over the upper ends of the elbows **17, 19** and the joint therebetween is sealed in any suitable manner such as, for example, by a sand seal or a refractory lute type seal. Thereafter, the burners may be fired with any suitable fuel and the scrap metal heated by the hot gases of combustion.

The hot gases generated by the burning fuel are prevented from escaping at the covers because of the luting seal and so the gases are urged to permeate down through the scrap metal and exhaust from the unit at the gap **77**. Some of the hot gases, however, exit the charging legs **13, 15** through the passages of a labyrinth formed between the spaced apart shells **25, 27**. These gases flow generally in the direction of the arrows A as shown in FIG. 2. As mentioned herein, suitable exhaust ducts (not shown) are provided at the heating station to remove the emerging hot gases from the environment and also to urge the gases to permeate the scrap metal in the unit **11**.

After the scrap metal has attained a desired mean temperature, in the range of say about 1550° F., the burners **84** may be shut off and the covers **85** removed. Thereupon, the powered crane hook **51** may be used to pick up the unit **11** by engaging the pivot pin **49** and transporting the unit to the furnace area.

Referring to FIG. 3, two fixed spaced apart support bars **87, 89** are provided adjacent a discharge area, such discharge area being above a conventional type of furnace opening **91**. It will be understood that the furnace opening **91** may be in either an open hearth furnace, an electric arc furnace, or a basic oxygen furnace or other type of furnace. The horizontal distance between the support bars **87, 89** is about equal to the distance between the outer edges of the groove **59** in the saddle supports **53**. Also, the supports **87, 89** are located above the furnace **91** a convenient distance for purpose to be presently explained.

As the powered crane hook **51** lowers the preheater unit **11** between the support bars **87, 89**, the link mechanism, that supports the preheater unit **11** and that connects to the arms **33, 35**, maintains the charging legs **13, 15** in the closed or edge abutting condition. But, after the saddle supports **53** contact the support bars **87, 89**, a further lowering of the unit causes the unit **11** to slide on the fixed support bars **87, 89** until the bars engage the curved inner wall of the groove **59**. Further lowering of the unit causes the charging legs **13, 15** to pivot relative to themselves about the pivot pins **37**, and also relative to each other about the fixed support bars **87, 89**. Under these circumstances, the charging legs **13, 15** move to the open position (FIG. 3) and the preheated scrap material **93** discharges from the preheater unit into the furnace opening **91**.

As soon as the scrap metal **93** has discharged from the unit **11**, the unit may then be raised by elevating the powered crane hook **51**, and the charging legs **13, 15** will pivot again to the closed end abutting relation after the unit **11** has been raised above the level of the fixed support bars **87, 89**. Thereafter, the empty preheater unit **11** may be returned to the transfer car **61**, which remained at the heating station, and then both the transfer car and heating unit may be moved to the scrap loading station from which they started initially.

A feature of the present invention is that the sloped arrangemnet of the charging legs **13, 15** prevents a bridging or a wedging of the scrap bundles within the unit **11**. Scrap metal that is loaded into the top end of each charging leg **13, 15** gravitates naturally toward the bottom zone of the unit, but cannot force open the legs **13, 15** of the unit because of the linkage arrangement connected to the arms **33, 35**. Further, the unit is supported in the cradle structure **67, 69**, and the unit cannot be forced open for this reason also.

Another feature of the invention is that the scrap material may be of conventional size and shape (medium or heavy scrap in some cases), and it is not necessary that a cushion load of light scrap be loaded into the bottom of the unit first as is done in other conventional scrap preheater units. A feature of the invention is that the hot gases generated by the burners are forced downwardly through the scrap load and thence outwardly to the exhaust ducts mentioned hereinbefore. The gases must permeate practically all of the scrap loaded into each charging leg.

Although the invention has been described herein with a certain degree of particularity, it is understood that the present disclosure has been made only as an example, and that various modifications and changes may be made within the scope of the invention as defined by the appended claims.

What is claimed is:

1. Apparatus for use in preheating scrap metal comprising:

(a) first and second cylindrical tubular members;

(b) arms mounted to and extending from said first and second tubular members, said arms being pivotally connected together at a first point intermediate their length;

(c) links pivotally connected together at a second point and pivotally connected to each arm at third and fourth pivot points, said second point pivot being adapted to be engaged by a lifting mechanism whereby when a lifting force is applied to said second point pivot, said first and second tubular members pivot into end abutting relation along a plane passing through said first and second pivot points;

(d) refractory means applied to the inner surface of each said tubular member;

(e) refractory lined spaced apart third and fourth cylindrical members surrounding the lower portion of each said first and second tubular members in spaced relation thereto, said third and fourth spaced apart cylindrical members defining ducts of a labyrinth passage for hot gases of combustion generated in the end portion of each said first and second tubular member remote from said abutting plane;

(f) saddle supporting means mounted to each first and second tubular member at a level below said first point pivot and on the side of each tubular member opposite said plane of abutment whereby, when said apparatus is suspended from said second pivot point and is disposed between fixed supports engaging said saddle supports, and said apparatus is lowered relative to said fixed supports, said first and second tubular members pivot relative to each other about said first pivot and each tubular member pivots relative to a respective engaging fixed support, said first and second tubular members pivot in opposite directions and scrap material in said apparatus is discharged therefrom.

2. The invention of claim 1 wherein:
(a) said first and second cylindrical tubular members are disposed in a substantially coplanar relation.

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