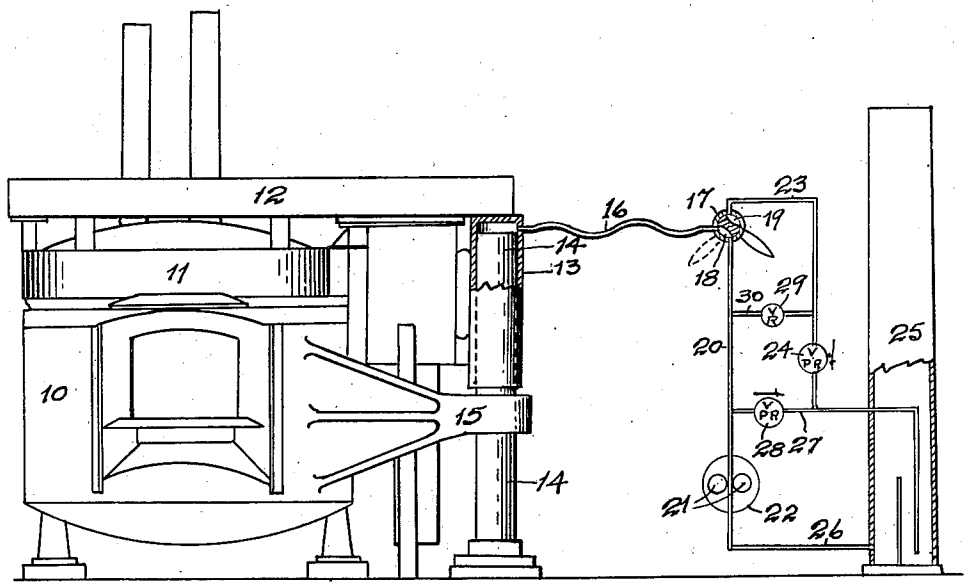
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FURNACE ROOF CONSTRUCTION

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FURNACE ROOF CONSTRUCTION

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9 Claims. (Cl. 266—31)

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The present invention relates to improvements in electric arc melting furnaces with particular respect to the top charge type of electric melting arc furnaces.

Present top charge designs use lift-roll-out roof mechanisms or roof lift swing-a-side designs. Some have separately located roof swing-a-side units from the shell proper and others have the roof lift swing-a-side mechanisms fastened directly to the electric furnace shells.

One of the troubles with these types of equipment in the past has been that in operation the entire weight load of the roof and its refractories and electrodes and arms and back plate mechanism, vertical extensions, and, in fact, all mechanism that goes with the top charge swing-a-side group is thrown on the side wall refractories of the electric furnace to be supported thereby inbetween times when the furnace is not being charged. As an example, in the case of a 6-ton furnace with an 11 ft. diameter shell, this swing-a-side mechanism weighs about 18,000 lbs. total. Practically 95% of the time an electric furnace is in operation. this entire weight is normally supported on the side wall refractories of the furnace shell. While these side wall refractories are thick and new, they will support this load fairly well, but toward the end of a refractory run, when the side walls get down to 3 inches or more in thickness, this tremendous mechanical load is a burden to such an extent that the refractories will be crushed and short refractory life is the result.

The present invention which is concerned with the problem of reducing this dead load weight on the side wall refractories to any desired percentage may be exemplified by the hydraulic mechanism disclosed in the accompanying drawing.

In the drawing 10 represents a furnace having a swing cover 11 carried by an arm 12, the outer end of which is rigidly secured to a vertically movable cylinder 13 enclosing the upper end of a fixed piston post 14 suitably supported and secured to the furnace wall by a brace 15. The construction is one which permits pressure to be admitted under the upper closed end of the movable cylinder to react against the piston post in lifting the arm which supports the cover so that the cover may be swung laterally upon the post as a pivot to open the top of the furnace for charging. After the charge is dropped into the furnace, the roof is again swung back over the furnace crucible, and lowered into place, being supported on the side wall refractories.

The above features are of standard construction and the present invention now to be described is directed to the means provided for easing the pressure of the cover upon the side walls by maintaining an upwardly directed pressure under the cylinder head which will in part counterbalance the weight of the cover.

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In lifting the cover, a liquid, preferably oil, under pressure is admitted to the cylinder through flexible pipe 16 controlled by two-way valve 17 having passages 18 and 19 which when turned as shown in full lines will establish communication through passage 18 with pressure line 20 which includes a pump 21 driven by a motor 22 which, for example, may have a capacity to maintain a pressure of 400 lbs. p. s. i.

The valve 17 when turned to the position indicated in dotted lines establishes communication between flexible pipe 16 and return line 23 including relief valve 24 set to maintain a pressure of, for example, 100 lbs. p. s. i. The return line leads to the base of an oil storage tank 25 from which oil is supplied to the pump through pipe 26.

The supply pipe 16 connects with return line 23 through cross pipe 27 including relief valve 28 which may be set to open at a pressure slightly in excess of the pump pressure as, for instance, 450 lbs. p. s. i. A reducing valve 29 in connection 30 between the supply and return lines is provided for a purpose to be presently explained.

With the two-way valve turned to the dotted line position, communication will be established between the upper leg of the supply pipe and the return line, and in these circumstances a pressure of say 100 lbs. p. s. i. will be maintained beneath the head of the movable cylinder, so that the lowering of the furnace cover will be cushioned and its weight partially counter-balanced and the none-too-strong refractory furnace walls relieved in part from the pressure of the cover. This minimum pressure will be maintained and renewed in the return line by the pressure admitted through the reducing valve 29 which is a standard piece of equipment which is in connection with the superior pressure constantly maintained in the supply pipe 16 by the action of the pump or by air under pressure acting against the oil supply or by any other equivalent agency.

Others have attempted to attain a similar result by the use of adjustable screws and wedges on the top of the furnace shell which, however, require frequent adjustment and attention on the part of the operator as the roof refractories expand and contract in order to take the load off the refractories. Such expedients are unsatis-

factory, while the employment of pressure as a counter-balancing agent serves at all times to reduce the pressure on the walls in sufficient degree to prevent fracture or disintegration.

In the event the lifting pressure continues to act on the head of the movable cylinder after the same has reached the limit of its movement, the relief valve 28 will open to recirculate the oil or other liquid so that the column of oil will not act as a solid abutment to suddenly stall the motor.

The invention as a whole is extremely simple in construction and certain in operation and is of a nature which readily permits adjustments in the degree of pressure to be employed for lifting and counter-balancing purposes to best meet the ends in view.

I claim:

1. In mechanism of the class described, the combination of a furnace, a roof adapted to rest upon the furnace walls, and mountings therefor adapted to permit the roof to be lifted to open the top of the furnace, said mountings including a vertically movable cylinder closed at its upper end, and a fixed piston post entered thereinto and adapted to afford resistance to a medium under pressure admitted between the piston post and the closed upper end of the cylinder, means for enclosing a column of liquid and communicating with the space between the cylinder and the piston post, a liquid column enclosed within said means, an agency for applying to said liquid column a degree of pressure in excess of the weight of the cover and parts movable therewith to lift the cover from the furnace, and means effective to relieve the pressure to lower the cover and thereafter automatically maintain a constant substantially uniform reduced pressure on said column adapted to act as a partial counter-balance for reducing the weight of the load supported by the walls of the furnace.

2. In mechanism of the class described, the combination of a furnace, a roof adapted to rest upon the furnace walls, and mountings therefor adapted to permit the roof to be lifted and swung laterally to open the top of the furnace, said mountings including a vertically movable cylinder closed at its upper end, and a fixed piston post entered thereinto and adapted to afford resistance to a medium under pressure admitted between the piston post and the closed upper end of the cylinder, means for enclosing a column of liquid and communicating with the space between the cylinder and the piston post, a liquid column enclosed within said means, an agency for applying to said liquid column a degree of pressure in excess of the weight of the cover and parts movable therewith to lift the cover from the furnace, and means effective to relieve the pressure thereafter automatically lower the cover and to maintain a constant substantially uniform reduced pressure on said column adapted to act as a partial counter-balance for reducing the weight of the load supported by the walls of the furnace.

3. In mechanism of the class described, the combination of a furnace, a roof adapted to rest upon the furnace walls, and mountings therefor adapted to permit the roof to be lifted to open the top of the furnace, said mountings including a cylinder and piston movable vertically relatively to one another, the movable element being effective to lift the cover when a medium under adequate pressure is admitted between the cylinder and piston, means for enclosing a column of liquid and communicating with the space between the cylinder and the piston, a liquid column enclosed within said means, an agency for applying to said liquid column a degree of pressure in excess of the weight of the cover and parts movable therewith to lift the cover from the furnace, and means effective to relieve the pressure to lower the cover and thereafter automatically maintain a constant substantially uniform reduced pressure on said column adapted to act as a partial counter-balance for reducing the weight of the load supported by the walls of the furnace.

4. In mechanism of the class described, the combination of a furnace, a roof adapted to rest upon the furnace walls, and mountings therefor adapted to permit the roof to be lifted and swung laterally to open the top of the furnace, said mountings including a cylinder and piston movable vertically relatively to one another, the movable element being effective to lift the cover when a medium under adequate pressure is admitted between the cylinder and piston, means for enclosing a column of liquid and communicating with the space between the cylinder and the piston, a liquid column enclosed within said means, an agency for applying to said liquid column a degree of pressure in excess of the weight of the cover and parts movable therewith to lift the cover from the furnace, and means effective to relieve the pressure to lower the cover and thereafter automatically maintain a constant substantially uniform reduced pressure on said column adapted to act as a partial counter-balance for reducing the weight of the load supported by the walls of the furnace.

5. In mechanism of the class described, the combination of a furnace, a roof, and mountings therefor adapted to permit the roof to be lifted to open the top of the furnace, said mountings including a cylinder and piston movable vertically relatively to one another, the movable element being effective to lift the cover when a medium under adequate pressure is admitted between the cylinder and piston, a supply pipe line for enclosing a column of liquid, said pipe line communicating with the space between the cylinder and piston, a liquid column enclosed within said pipe line, an agency for applying to said liquid column a degree of pressure in excess of the weight of the cover and parts movable therewith to lift the cover from the furnace, a return line and valve means for establishing communication between the cylinder and either the supply or the return line, a relief valve in the return line adapted to open under a degree of pressure less than that required to lift the cover and to close when pressure has been reduced to an intended degree to afford a partial counter-balancing pressure between the cylinder and piston.

6. In mechanism of the class described, the combination of a furnace, a roof, and mountings therefor adapted to permit the roof to be lifted and swung laterally to open the top of the furnace, said mountings including a cylinder and piston movable vertically relatively to one another, the movable element being effective to lift the cover when a medium under adequate pressure is admitted between the cylinder and piston, a supply pipe line for enclosing a column of liquid, said pipe line communicating with the space between the cylinder and piston, a liquid column enclosed within said pipe line, an agency for applying to said liquid column a degree of pressure in excess of the weight of the cover and

parts movable therewith to lift the cover from the furnace, a return line and valve means for establishing communication between the cylinder and either the supply or the return line, a relief valve in the return line adapted to open under a degree of pressure less than that required to lift the cover and to close when pressure has been reduced to an intended degree to afford a partial counter-balancing pressure between the cylinder and piston, and a reducing valve between the supply and return lines adapted to maintain the intended partial counter-balancing pressure.

7. In a mechanism of the class described, the combination of a furnace, a roof adapted to rest upon the furnace walls, and mountings therefor adapted to permit the roof to be lifted to open the top of the furnace, said mountings including a vertically disposed cylinder and a piston entered thereinto and forming an expansion chamber therewith, a source of higher pressure and a source of lower pressure and means for connecting the expansion chamber alternatively to the source of higher pressure and to the source of lower pressure; said higher pressure being sufficient to overcome the weight of the cover and parts movable therewith to lift the cover from the furnace, and said lower pressure being substantially uniform and acting as a partial counter-balance for reducing the weight of the load supported by the walls of the furnace.

8. In a mechanism of the class described, the

combination of a furnace, a roof adapted to rest upon the furnace walls, and mountings therefor adapted to relieve the walls of a substantial part of the load of the roof, said mountings including a cylinder and a piston entered therein to form an expansion chamber therewith, and means for supplying to the expansion chamber fluid under a pressure automatically maintained sufficient to relieve the walls of a substantial part of the load of the roof but insufficient to raise the roof therefrom.

9. In a mechanism of the class described, the combination of a furnace, a roof adapted to rest upon the furnace walls, and mountings therefor adapted to permit the roof to be lifted to open the top of the furnace, said mountings including a vertically disposed cylinder and a piston entered thereinto and forming an expansion chamber therewith, a source of higher pressure and a means for pressure relief to lower the pressure and means for connecting the expansion chamber alternatively to the source of higher pressure and to that of lower pressure; said higher pressure being sufficient to overcome the weight of the cover and parts movable therewith to lift the cover from the furnace, and means to maintain said lower pressure substantially uniform and acting as a partial counter-balance for reducing the weight of the load supported by the walls of the furnace.

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