March 8, 1966 B. A. DENTON 3,238,649

STEAM IRON BOILER CLEANING

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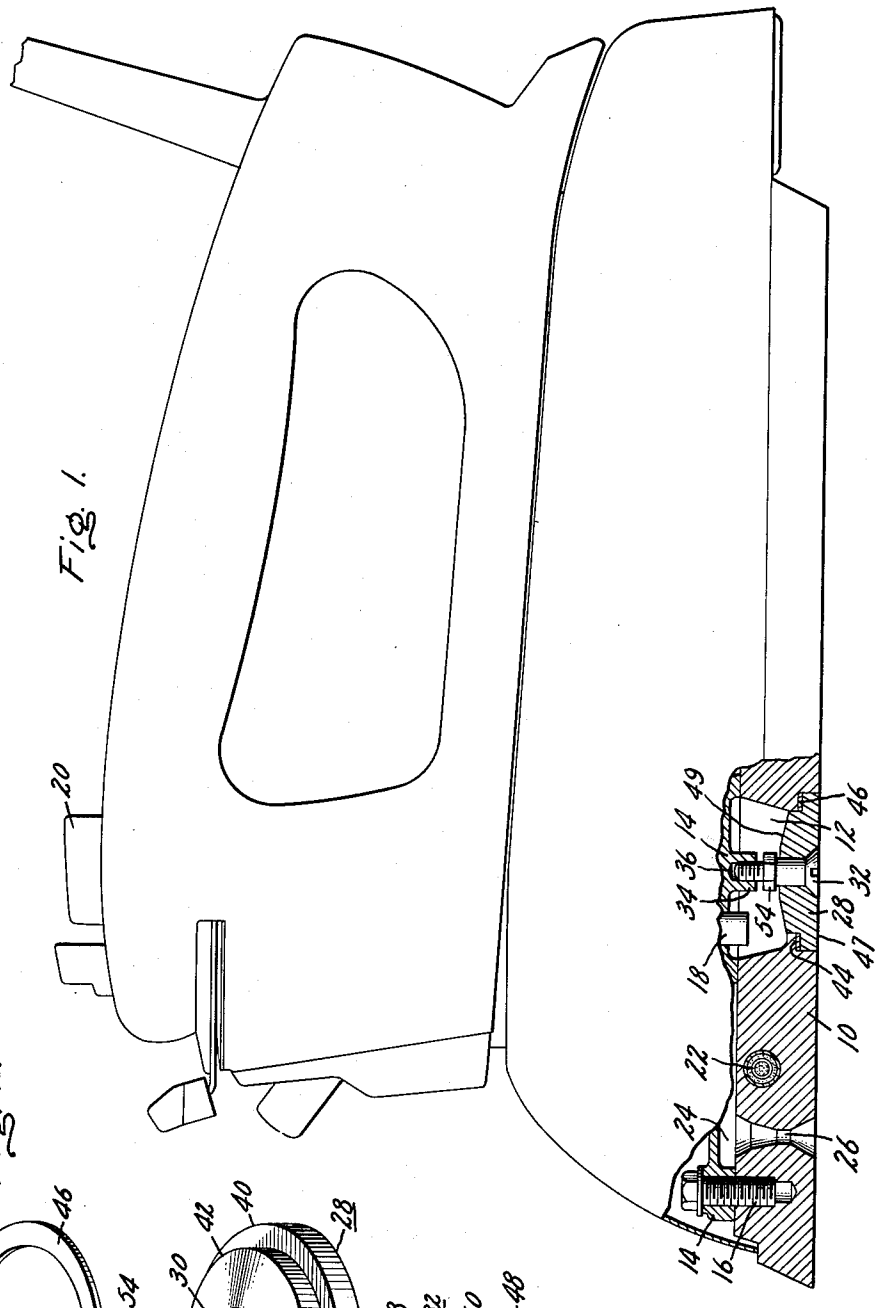


Fig. 1.

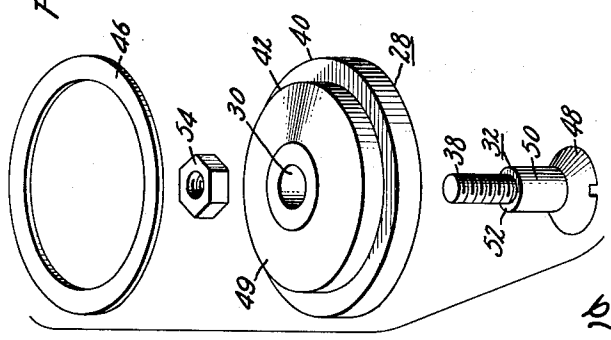


Fig. 2.

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Fig. 3.

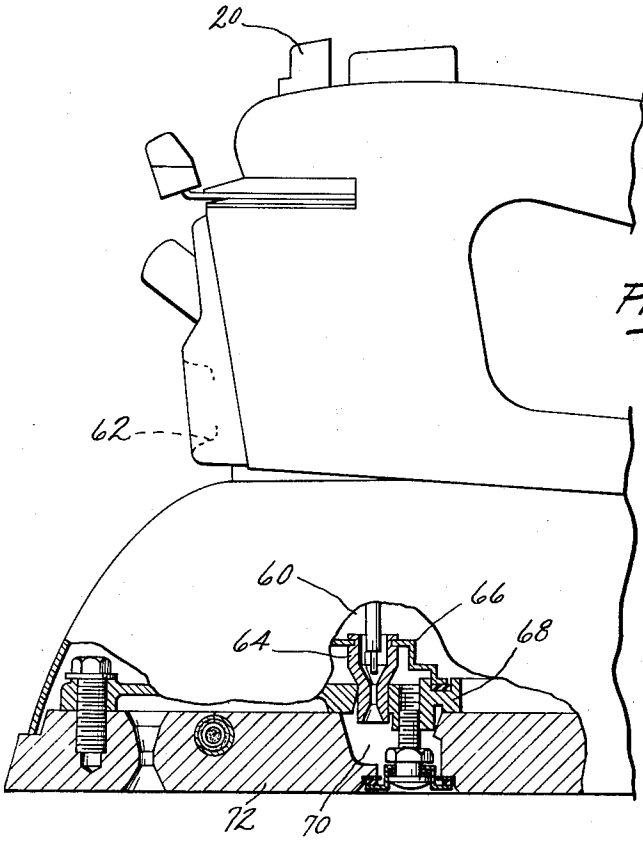


Fig. 5.

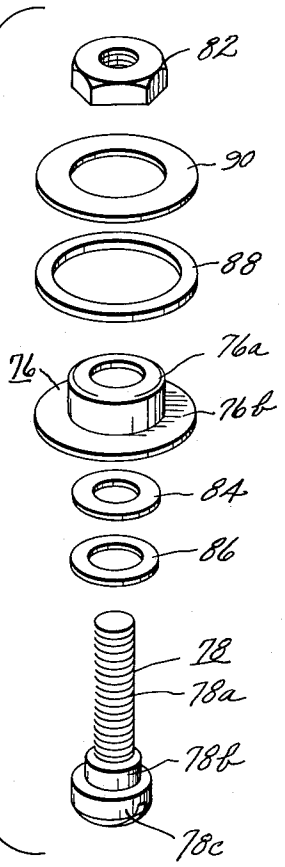
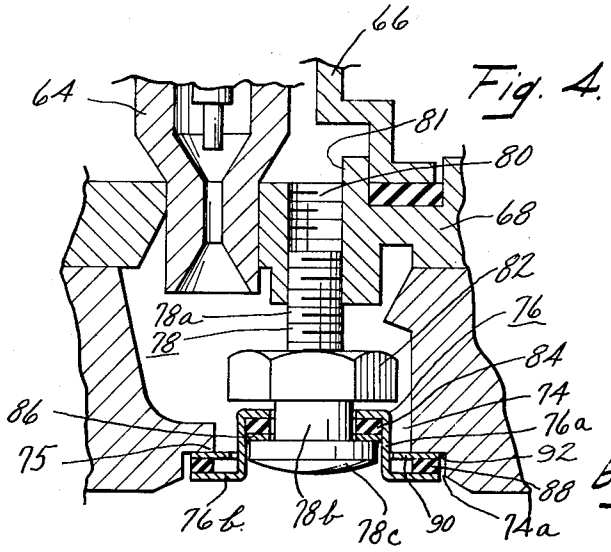


Fig. 4.



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STEAM IRON BOILER CLEANING

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6 Claims. (Cl. 38—77)

This invention relates to electric steam irons and to improved means for cleaning the boiler or steam generator in such an iron. This application is a continuation-in-part of my application, Serial No. 183,239, filed March 28, 1962, and now abandoned.

A typical steam flatiron includes a steam generator or boiler area and an inlet valve for liquid supply to the steam generator. Preferably, such steam irons should operate satisfactorily with tap water, which often contains such materials as calcium salts, silica and other impurities typical of hard water. When the water is evaporated in the iron, many of these impurities are deposited on the boiler, the valve, and other exposed surfaces. After continued use of such hard water, the valve and other passage may eventually become clogged. In addition, the coating or deposit material in the boiler acts as an insulator and reduces the rate at which steam can be generated.

The usual manner of coping with this problem in the past has been to completely disassemble the iron and scrape off the hard water scale when possible. Badly encrusted components must be replaced in some instances. This, of course, requires a considerable amount of labor, both in disassembly and reassembly, resulting in high repair costs for the housewife. Another approach which has been attempted is to provide a relatively large removable clean-out plug in the wall of the boiler adjacent the soleplate so that the interior of the boiler may be made accessible for mechanical cleaning without completely disassembling the steam iron. However, this approach has not been completely successful due to the difficulty of removing the plug, in that the impurities deposited on the walls of the boiler act as a cement to secure the plug in the wall opening.

It has also been known that there are various solvents which can be introduced to an iron to dissolve deposits on the boiler walls. However, although there are deposits or scale which can be dissolved by safe, inexpensive solutions, there are others, such as silica, which cannot be dissolved by chemicals that are safely stored or used in a household. Also, any chemical which will dissolve silica will also damage the iron in other respects. The result is that that while the deposits can be loosened from the boiler walls, much of the material exists in the form of flakes or particles which are too large to pass through available openings or passages. Thus, the problem remains of removal of the particles from the boiler.

It is a primary object of my invention to provide improved methods and means for the removal of scale or other deposits from the boiler walls and associated surfaces in a steam iron.

Another object of the invention is to provide a simple and inexpensive clean-out plug in the wall of a steam iron boiler which may be easily and readily removed.

In accordance with one aspect of my invention, there is provided an iron having a clean-out plug in the area of the soleplate forming the lower wall of the boiler. A screw extends through the plug and threads in to a tapped hole on the opposite side of the boiler. An abutting means, such as a locknut, is positioned on the screw shank intermediate the inner face of the plug and the threaded end of the screw. When the plug is to be removed, the screw may be backed off from the tapped opening, causing the abutting means to engage the inner face of the plug and force the plug outwardly. To minimize the temperature differential between the plug and surrounding soleplate, the inner face of the plug extends inwardly beyond the surrounding boiler walls so that the water dripping into the boiler is directed away from the plug. If the plug is of large enough diameter, there is sufficient room so that the walls of the boiler may be mechanically scraped to remove the collected deposits.

As another aspect of the invention, the boiler may be chemically cleaned by a suitable solvent and the clean-out plug opening used to permit loosened particles or deposits to drain from the boiler. Such an arrangement enables the clean-out plug to be of restricted size relaitve to the soleplate area. A smaller plug simplifies removal problems and minimizes the effect of the temperature differential between the plug and the surrounding area.

Further features, objects and advantages will be apparent with reference to the following drawings in which:

FIG. 1 is a side elevational, partially sectionalized view of a steam flatiron incorporating the plug and removal means of the invention.

FIG. 2 is an exploded perspective view of the plug assembly components;

FIG. 3 is a side elevational, partially sectionalized view of a steam iron incorporating another embodiment of a clean-out plug;

FIG. 4 is an enlarged sectional elevation of the plug arrangement of FIG. 3; and

FIG. 5 is an exploded perspective view of the plug assembly components of FIG. 3.

Referring first to the embodiment of the invention in FIGS. 1 and 2, an iron soleplate **10** is shown having in its upper surface a boiler cavity **12** which forms the bottom wall and side walls of a flash boiler. The upper wall of the boiler is formed by a cover member **14**, which may be secured to the upper surface of the soleplate **10** by suitable fastening means such as a plurality of screws or bolts, one of which is shown at **16**. A valve, indicated schematically at **18** in the wall of the cover member **14**, controls the flow of water from a water supply tank (not shown) to the boiler cavity. The valve **18** may be controlled by the iron operator by means of a suitable external push button **20**.

When the valve **18** is opened, water flows into the boiler cavity **12** and is vaporized by heat provided from a heater **22** embedded in the soleplate **10**. The steam is ducted by means of suitable passages, one of which is partially shown at **24** to a plurality of apertures, one of which is shown at **26**, leading to the ironing surface of the soleplate **10**.

Since the water frequently employed in steam irons is tap water which usually contains a considerable amount of salts or other impurities, a problem arises due to the fact that the impurities tend to deposit on the walls of the boiler cavity and on the surface of the valve **18** as the water is evaporated. If the deposits are not periodically removed, the boiler passages and the valve may become clogged, thus rendering the steaming provision inoperative. Additionally, the deposits on the walls of the boiler act as insulation and retard the transfer of heat from the surrounding soleplate **10** to the water in the boiler, resulting in a decreased efficiency of the flatiron. Consequently, it is essential that the boiler wall surfaces, the valve, and other surfaces exposed to water or steam be periodically cleaned.

In accordance with the invention, an access opening is provided in the lower wall of the soleplate **10** leading from the interior of the boiler cavity **12** to the ironing surface of the soleplate. The opening is closed by a suitable plug **28**, which may be seen in FIG. 2 as having a centrally aligned aperture **30** adapted to receive a screw **32**. The cover member **14** is provided with a

depending lug 34 having a tapped opening 36 aligned with the aperture 30 of plug 28 and adapted to receive the threaded end 38 of screw 32, to thereby secure the plug in position.

To provide the proper sealing, the plug 28 may be provided with an outer flange portion 40 and an inner reduced portion 42 which is adapted to be received within an annular flange 44 surrounding the opening in the soleplate. A suitable gasket 46 may be placed between the plug flange 40 and the soleplate flange 44 to further insure a tight seal. With the plug completely installed as shown in FIG. 1, the outer face 47 of the plug is approximately flush with the ironing surface of the soleplate 10 so as not to interfere with the ironing operation. For the same reason, the outer face may be countersunk around the aperture 30 to receive the head 48 of the screw 32.

It will be appreciated that as the iron is operated, scales, sediment, and other deposits will adhere to the inner face 49 of the plug 28 and the surrounding boiler wall surface, thus tending to cement the plug in position and making removal difficult. In accordance with the invention, this problem has been solved by providing an arrangement by which the plug may be mechanically forced out of the soleplate. For this purpose, the screw 32 is provided with a non-threaded enlarged portion 50, adjacent the screw head 48, which fits snugly within the aperture 30 in the plug. The enlarged portion 50 extends beyond the inner face 49 of the plug 28 when the screw is installed and forms a shoulder 52 between the enlarged portion and the threaded portion 38, which is of a reduced diameter. After the screw 32 has been inserted into the plug aperture 30, but before the screw has been threaded into the cap opening 36, a lock nut 54 is threaded onto the screw and jammed against the shoulder 52. As shown in FIG. 1, the relationship between the various parts is such that when the plug is secured in position, the lock nut 54 does not interfere with the lug 34 on the cover 14. When the plug is to be removed in order to obtain access to the boiler cavity 12 and the valve 18, the screw 32 is merely backed out of the tapped opening 36. The rotational movement of the screw forces the screw in an axial direction, causing the nut 54 to engage the inner face 49 of plug 28 and thereby force the plug outwardly from the opening in the soleplate 10. It has been found that with this arrangement the plug may be easily removed even when the walls of the boiler are heavily coated with deposits.

Since the heater 22 is positioned in the soleplate 10, the temperature of the soleplate surrounding the plug 28 will be slightly hotter than the plug itself when the heater is energized. Consequently, it is desirable that water introduced in the boiler cavity 12 be directed away from the plug towards the surrounding soleplate material to insure quick evaporation of the water and to keep the temperature differential between the plug and the soleplate at a minimum. To accomplish this purpose, the plug inner face 49 may be formed with a protruding shape as may be seen in FIG. 1. Thus, when the iron is in the ironing position, the inner face 49 is higher than the surrounding boiler wall.

When the plug is removed, the walls of the boiler cavity 12 and the valve 18 may be mechanically scraped to remove the scales and sediment, and cleaning solutions may be introduced to perform further cleaning functions of all of the steam and water passages. Thus, it should be appreciated that a simple inexpensive arrangement has been provided which facilitates inspection and maintenance.

In the embodiment of the invention shown in FIGS. 3–5, there is illustrated a modified form of clean-out plug which is of limited or restricted area with respect to the area of the boiler and soleplate, and is considerably smaller than the plug shown in FIGS. 1 and 2. The steam iron shown is otherwise similar to that of

FIG. 1 including a water tank 60, a water fill opening 62, valve means 64 carried by steam dome 66 mounted on boiler cover 68, and a boiler cavity 70 formed within soleplate 72. Clean-out plug 76 includes a centrally located portion 76*a* having a recessed outer surface and a protruding inner surface. As can be seen, portion 76*a* extends loosely within opening 74. A flange 76*b* fits within the countersunk portion 74*a* of opening 74.

As an example of the restricted size of the opening, the dimensions of a successful version of the arrangement will be given. Opening 74 is approximately one-half inch in diameter with portion 74*a* being approximately .675 inch in diameter. The portion 76*a* of the plug has an outer diameter of about .380 inch and the flange outer diameter is approximately .666 inch.

The shank 78*a* of screw 78 extends through the aperture in plug 76 and threads into tapped hole 80 formed in lug 81 depending from boiler cover 68. After the screw is inserted into the plug but before it is threaded into hole 80, nut 82 is jammed against shoulder 78*b* on the screw so that it will engage the inner face of plug 76 when the screw is backed out of hole 80. Note that shoulder 78*b* extends beyond the inner face of the plug.

It is desirable that screw 78 be made of stainless steel. A brass screw is too weak and will ultimately shear; a nickel plated cold rolled screw, because of the difference in coefficient of expansion as compared to the aluminum soleplate, causes the plug to become loose and therefore to leak. Any leakage builds up water deposits which may make removal of the plug exceedingly difficult. In addition any breakdown of the plating may result in the screw rusting and ultimately failing.

To form a liquid and vapor tight joint, there is provided a seal 84 made of silicone rubber or similar material and a back-up washer 86 surrounding shoulder 78*b* adjacent the head 78*c* of the screw. As shown in FIG. 4, seal 84 and washer 86, are sandwiched between the outer face of plug 76 and the inner face of head 78*c* of the screw with seal 84 being positioned between the washer and plug 76. Similarly, there is provided a gasket 88 and a washer 90 sandwiched between the plug flange 76*b* and the recessed annular surface 92 surrounding cleanout opening 74, with the gasket located between washer 90 and flange 76*b*.

One advantage of utilizing the smaller plug is that there is a smaller area which can be cemented to the surrounding boiler by deposits from evaporated water. Accordingly, it takes considerably less force to remove a smaller diameter plug and a plug of thin cross-section can be used. The plug shown is .015 inch thick and preferably made of stainless steel. More importantly, since there is a temperature differential between the plug surface and the surrounding soleplate, this effect is minimized by reducing the diameter of the plug.

With such a restricted opening, it is not conveniently possible to scrape mechanically or otherwise forcibly remove deposits from the boiler walls. Therefore, in accordance with the invention, chemical means are used to loosen the deposits, and the clean-out opening is used to remove the loosened particles. As previously mentioned, in some localities the water available has an appreciable amount of silica or silicon dioxide which is not soluble in any chemical that can be safely stored or used in the household. These silica particles are held in place by other materials, such as calicum carbonate, much like gravel is held in concrete by the cement mortar. The materials which hold the silica particles in place can be dissolved by any of several mild chemicals thus freeing the silica so it can be washed from the boiler by proper rinsing.

The stronger acids have been eliminated as suitable materials in that although some would certainly loosen the deposits, they would be dangerous to use in a household. Also such acids have adverse affects on the metal surfaces

which would be contacted. Liquids which have been investigated and found suitable are sulfamic acid, tartaric acid, gluconic acid, phosphoric acid, acetic acid, hydroxy acetic acid, trifluoroacetic acid, oxalic acid, thiourea, citric acid, and citric acid with versene. A three percent solution of citric acid has been found to be particularly well suited. Such a solution cleans the parts quite thoroughly in a relatively short period of time (one-half to one hour) with no visible attack of the flatiron parts and no redeposition of metals as might occur with some materials. This solution is also desirable from the standpoint that it is quite safe to use and it is inexpensive and readily available as a powder which can be easily packaged and shipped.

From the foregoing, the improved method of cleaning the boiler should be readily apparent. The citric acid solution is introduced to the boiler through the water fill opening, the water reservoir and the inlet valve means. The solvent is allowed to remain in the boiler for at least one-half hour or long enough to adequately loosen the deposits on the boiler walls. The clean-out plug is then removed and the loosened deposits and the solvent are allowed to drain from the boiler through the clean-out opening. It should be understood that the deposits are generally too large to pass through the small water inlet valve or the steam outlet passages. The boiler is then rinsed or flushed and the plug is replaced to complete the cleaning operation.

It should be understood that the particular structure and method described herein are examples of the invention, and it will be obvious to those skilled in the art that various changes and modifications may be made without departing from the invention in its broader aspects. Therefore, it is intended in the appended claims to cover all such uses and modifications that fall within the true spirit and scope of this invention.

What is claimed is:

1. In a steam flatiron: a soleplate with a boiler therein having a bottom wall on which liquid is transformed into steam; means defining an opening through said bottom wall of restricted size relative to the area of the boiler and the soleplate for removal of loosened mineral deposits and scale; a removable plug positioned in said opening with its inner face forming a portion of said boiler bottom wall and having an aperture extending therethrough; a cover plate secured over said soleplate to form the top wall of said boiler having a tapped hole in the bottom thereof; sealing means positioned adjacent the periphery of said plug between the plug and the surrounding boiler wall; a screw extending through said aperture and threaded into said tapped hole in the bottom of said cover plate to secure the plug in liquid and steam tight relation with said wall opening; and abutting means securely fixed on said screw at a position intermediate said plug and the free end of the screw, whereby the unthreading of said screw from said tapped hole moves said abutting means into engagement with said inner face to force said plug from said wall opening.

2. In a steam flatiron: a soleplate with a boiler therein having a bottom wall on which liquid is transferred into steam; means defining an opening through said bottom wall of restricted size for removal of loosened mineral deposits and scale; a removable plug having a portion positioned in said opening and thereby forming a portion of said boiler bottom wall and having an outwardly extending flange positioned adjacent the soleplate area surrounding said opening; gasket means sandwiched between said flange and said soleplate area; said plug having an aperture extending therethrough; a cover plate secured over said soleplate to form the top wall of said boiler having a tapped hole in the bottom thereof; a screw extending through said aperture and threaded into said tapped hole in the bottom of said cover plate to secure the plug and the screw in liquid and steam tight relation with said wall opening; sealing means sandwiched between the head of said screw and said plug; and abutting means securely fixed on said screw at a position intermediate said plug and the free end of the screw, whereby the unthreading of said screw from said tapped hole moves said abutting means into engagement with said inner face to force said plug from said wall opening.

3. In a steam flatiron; a soleplate with a boiler therein having a bottom wall on which liquid is transferred into steam with said bottom wall having an opening approximately one-half inch in diameter to provide access to the interior of the boiler for removal of loosened mineral deposits and scale; a removable plug positioned in said opening so that its inner face forms a portion of said boiler bottom wall and having an aperture extending therethrough; a cover plate secured over said soleplate to form the top wall of said boiler having a tapped hole in the bottom thereof; a screw extending through said aperture and threaded into said tapped hole in the bottom of said cover plate to secure the plug in liquid and steam tight relation with said wall opening; and abutting means securely fixed on said screw at a position intermediate said plug and the free end of the screw, whereby the unthreading of said screw from said tapped hole moves said abutting means into engagement with said inner face to force said plug from said wall opening.

4. A steam flatiron comprising: an electrically heated soleplate having a boiler cavity in which liquid is transformed into steam; steam discharge ports extending through said soleplate in spaced relation from said cavity; means supplying liquid to said boiler cavity; a cover plate extending over said boiler cavity and over portions of said soleplate to confine and direct steam from the boiler cavity to said steam discharge ports; wall means defining an enlarged opening through said soleplate in the boiler cavity area; a removable plug positioned in said enlarged opening to make sealed engagement with said soleplate and to define a substantial central portion of the bottom wall of said boiler cavity and provide an area on which liquid is deposited, said plug having a lower surface co-planar with said soleplate and an upper convex surface to direct deposited liquid outwardly into contact with adjacent soleplate areas, said plug further including a central opening; a threaded fastening device having a shank portion extending through said plug opening and a head engaging said lower surface of said plug in flush relationship; means defining a threaded socket in said cover plate to receive said fastening device, thereby to secure said plug tightly in position within said soleplate opening; and flange means secured to said fastening device intermediate said plug and said cover plate to force said plug out of engagement with said soleplate when said fastening device is rotated in a direction to withdraw the fastening device.

5. In a steam flatiron: a soleplate with a boiler therein having a bottom wall on which liquid is transformed into steam with said bottom wall having an enlarged opening to provide access to the interior of the boiler for removal of mineral deposits and scale; a removable plug positioned in said opening and thereby forming portion of said boiler bottom wall and having an aperture extending therethrough and a convex inner face which extends inwardly beyond the surrounding boiler bottom wall surface; a cover plate secured over said soleplate to form the top wall of said boiler and having a tapped hole in the bottom thereof; a screw extending through said aperture and threaded into said tapped hole in the bottom of said cover plate to secure the plug in liquid and steam tight relation with said wall opening; and abutting means securely fixed on said screw at a position intermediate said plug and the free end of the screw, whereby the unthreading of said screw from said tapped hole moves said abutting means into engagement with said inner face to force said plug from said wall opening.

6. In a stream flatiron: a soleplate having a cavity in its upper surface forming the side walls and bottom

wall of a boiler, a cover mating with said cavity to form the top wall of said boiler and including a tapped hole therein, the bottom wall of said boiler having an opening leading to the ironing surface of the soleplate to provide access to the interior of the boiler for removal of scale and mineral deposits from said boiler, a removable plug positioned in said opening in fluid tight relation and having an aperture extending therethrough and a convex inner surface extending inwardly beyond the surrounding boiler wall surface, a screw having a threaded portion threaded into said tapped hole in said boiler cover to secure the plug in said wall opening and an enlarged portion adjacent its head, said enlarged portion fitting within and extending slightly beyond said plug aperture, and a nut secured onto said screw and movable into engagement with said inner surface of said plug to force said plug from said opening upon the unthreading of said screw from said tapped hole.

References Cited by the Examiner

UNITED STATES PATENTS

3,095,862	7/1963	Berner	122—379

FOREIGN PATENTS

1,129,185	1/1957	France	38—77

OTHER REFERENCES

Ashton, W. F.: ASME Annual Meeting Highlights–II, Combustion Engineers, January 1961. Pages 46, 47, 51 and 52.

"Steam, Its Generation and Uses," N.Y., McKibbin and Son, 1955, chapter 21, pages 31 to 39, thirty-seventh edition.

JORDAN FRANKLIN, *Primary Examiner.*