Sept. 21, 1971 W. E. DAVIDSON ET AL 3,606,691

STEAM-POWERED SPRAY IRON

Filed June 18, 1970

Fig. 1.

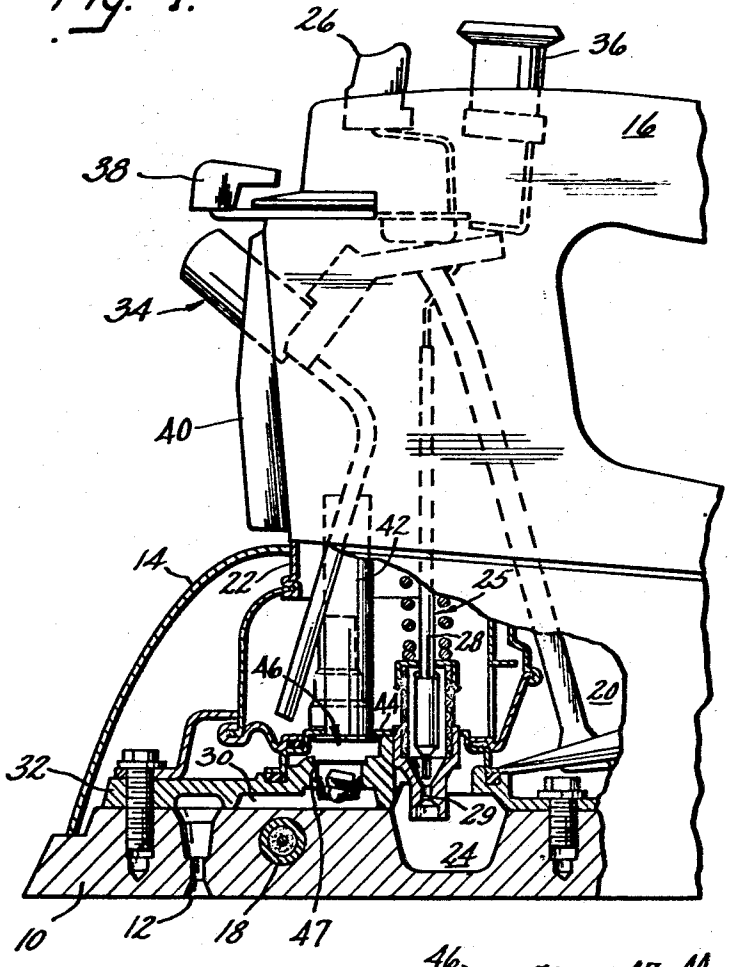


Fig. 4.

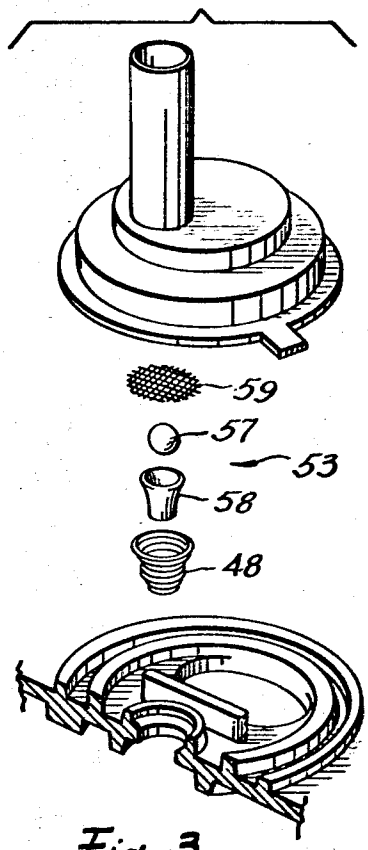


Fig. 3.

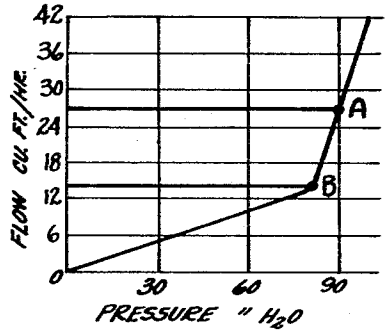


Fig. 5.

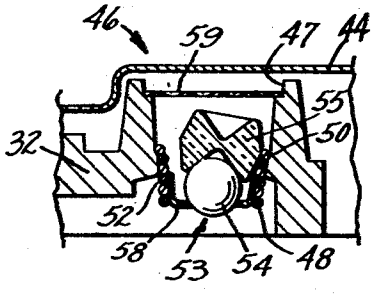
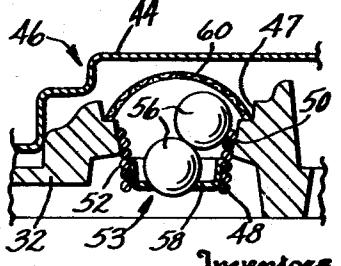


Fig. 2.



Inventors
William E. Davidson,
Kaj Toft

by James F. Cullen
Attorney

United States Patent Office 3,606,691
Patented Sept. 21, 1971

3,606,691

STEAM-POWERED SPRAY IRON

William E. Davidson, Ontario, and Kaj Toft, Upland, Calif., assignors to General Electric Company

Continuation-in-part of application Ser. No. 23,884, Mar. 30, 1970. This application June 18, 1970, Ser. No. 47,229

Int. Cl. D06f *75/06*

U.S. Cl. 38—77.5 9 Claims

ABSTRACT OF THE DISCLOSURE

The invention discloses a steam-powered spray iron which uses a pressure regulating valve between the water tank and steam generator for maintaining a substantially uniform steam pressure in the generator for operating the spray. The pressure regulating valve is improved to increased reliability, to reduce the number of parts, the overall height, and the cost of the iron.

BACKGROUND OF THE INVENTION

(1) Field of the invention

The invention herein pertains to a steam-powered spray iron and, more particularly, to a spray/steam iron which employs a novel pressure regulating valve to control the steam pressure for reliably operating the spray and reduce the number of parts and overall height of the structure to improve operation and reduce the cost of the iron.

This application is a continuation-in-part of my application Ser. No. 23,884, filed Mar. 30, 1970, assigned to the same assignee and now abandoned.

(2) Description of the prior art

With the advent of irons using water for either steam or spray purposes or both, it is customary to provide a water tank in the iron above the soleplate and to use water valve structures to provide controlled water drippage into a steam boiler or generator where it is evaporated and directed out apertures in the soleplate to steam the article. Additionally, powered spray attachments, either steam or manual, have been added to such irons to supply a fine spray from the water tank to spray onto the garment. The powered spray form uses continuous steam pressure to assist in expelling an atomized mixture of water and steam from the sprayer. In such a spray, a single depression of the operating button provides a continuous spray. In steam-powered spray irons it is necessary to have a pressure control or regulating valve to maintain a specific pressure within the steam generating system to generate and power the spray. Some irons have a closed steam system which generates steam at a relatively constant rate so in order to maintain a constant pressure in the closed system it is necessary to bleed excess steam through a control valve. When the iron is used for spraying, most of the steam generated is used thus the amount of steam bleed through the pressure control or regulating valve is relatively low. On the other hand, when the iron is being used as a steam iron, the amount of steam bleed is identical to the amount produced thus it is necessary to have a pressure control device which will regulate or bleed various amounts of steam at a near constant pressure. This generally has involved a valve to maintain the pressure in the closed system substantially constant. A typical power spray is shown in U.S. Pat. 3,041,757 of common assignment. As seen there, the pressure regulating valve has generally involved a valve stem that extends up into the iron and is spring biased to closed position in a known manner.

Such structure has generally used about seven elements in order to adequately control the pressure as necessary in a steam-powered spray iron of the type shown. Various functions of springs are of course well-known. For example, it is known to use springs to gradually increase an opening to act as a variable orifice and control pressure. While prior art constructions of spray-powered irons have provided the use of a spring to bias a stem-type valve, none have shown the unique spring used alone as the primary regulating member itself.

SUMMARY OF THE INVENTION

Briefly described, the present invention is directed to a steam-powered spray iron that has a steam generator and a closed water tank above the generator with means to pass water from the tank to the generator. Means is also provided to ensure pressure communication between the generator and the tank. A steam discharge passage provides a sole outlet for steam from the generator during normal ironing operation. In this environment, the invention discloses an improvement in the pressure regulating valve located in the steam discharge passage and used to maintain a substantially uniform operating pressure in the generator and tank. The improved valve provides a helical-coiled spring that is seated in a sealing relation in a cover over the steam generating cavity. The spring is prestressed into a closed or unstretched position and is preferably tapered or coned in a downstream direction away from the tank. A check valve such as ball means is disposed within the spring and is operative to permit unrestricted flow through the spring upstream towards the generator when the pressure in the generator is equal to or lower than ambient and the check valve means blocks reverse flow to thus unstress the spring to stretch it and permit flow through the passage and the spring convolutions in a downstream direction to then be distributed when the generator pressure is equal to or greater than ambient plus the prestressed value. Suitable screen means may be secured over the top of the spring in the cover. Thus, the main object of the invention is to provide a powered spray iron with an improved pressure regulator that uses fewer parts, reduces the valve height, simplifies construction, and reduces the cost of the iron.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view, partially in section and broken away, showing general parts of an iron and illustrating a preferred form of the invention;

FIG. 2 is an enlarged partial sectional view of the detailed pressure regulating valve shown in FIG. 1;

FIG. 3 is a modified form of valve;

FIG. 4 is a perspective exploded view of the parts of pressure regulating valve showing another modification; and

FIG. 5 is a graph of the operating characteristics of the valve as used in an iron.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, there is shown an electric steam-powered spray iron which includes a soleplate **10** having a plurality of steam ports or apertures **12** and an outer shell **14** connected in any suitable manner to handle **16** all in known fashion. In accordance with conventional practice, soleplate **10** may be cast from a suitable material, such as aluminum, with an electrical heating element **18** cast in position. This heating element preferably is of the sheathed type and, with the electrical resistance element, extends through an outer tubular protective sheath and is separated from the outer sheath by an insulating compound resistant to heat such as granulated and com-

pressed magnesium oxide. The heating element generally extends in a loop beginning at the rear of the iron and along one side to the forward end then rearwardly along the other side. Thus, substantially uniform heat distribution is provided when the iron is plugged in and activated.

The iron includes means for generating steam by providing water tank **20** which may have a vertical outer tube means **22** in the forward portion for housing various operating mechanisms. For steam, soleplate **10** has a steam boiler or generator cavity **24** that is under control of a water valve structure generally indicated at **25** and including a button **26** with connected spring-biased vertical stem **28** which is preferably located in tube **22**. Water may be dripped through orifice **29** from tank **20** onto the heated soleplate, the resulting steam being eventually distributed through passages **30** under chamber cover **32** and out ports **12** onto the fabric being ironed. The steam-powered spray attachment generally indicated at **34** may be operated by control button **36** through connected linkage as is well-known. A typical power spray is shown in U.S. Pat. 3,041,757 of common assignment. Temperature control **38** operates to thermostatically control the heat generated in the soleplate in a known manner. For supplying water to the tank **20** for steam and spray power, fill opening **40** is provided with direct communication to the tank.

In order for the water in tank **20** to be able to drip through orifice **29** and through the chamber cover into steam generator **24** when water valve **25** is in the up or on-position, it is necessary, in the closed system, to equalize the steam pressure in generator **24** and water tank **20** and, to this end, it is customary to provide a pressure balancing means in the form of a vertical balance tube **42** that is open at its upper end to the upper portion of tank **20** and open at its bottom end to generator **24** as shown in FIG. 1. Thus, the steam pressure is equalized on both sides of water valve **25** so water will drip at a constant rate for steam generation. The balance tube may be mounted on a steam dome **44** that has open access to generator **24** and is secured to cover **32**. For controlling steam pressure in the closed system, a suitable steam regulating valve of generally known construction per se is provided as shown in FIG. 3 of the referenced 3,041,757 patent. This has generally included a relatively high separate open-ended tube means that has been mounted on the steam dome **44** adjacent balance tube **42**. Thus, steam from generator **24** passes directly down through the cover onto the soleplate when the steam pressure opens the regulating valve, generally indicated at **46**, and which is located in discharge passage **47** as the sole outlet from the iron for steam during normal ironing operation. The steam may also pass directly up balance tube **42** where it subsequently powers spray **34** in a known manner.

In accordance with the invention, discharge passage **47** houses pressure regulating valve **46** that has been greatly simplified and reduced in overall height to completely dispense with the extra tube adjacent balance tube **42** thus simplifying the manufacture of components **42** and **44**. To this end, as seen in FIG. 2, the conventional pressure regulating valve structure is replaced with a spring **48** that is disposed entirely in cover **32** and is substantially flush with the top surface thereof. Spring **48** is formed as a helical-coiled spring having longitudinal convolutions with one end that is seated in sealing relation at **50** directly to the cover and is carried completely by the cover **32**. It is possible to use a helical conventional spring, but a tapered spring of the type shown is preferred as will become apparent. In the manufacture of small tension springs it is extremely difficult to provide consistency so that each spring coil will begin to stretch uniformly under a given load and, as a result some turns or convolutions of the spring open and some do not open. In an iron it is undesirable to allow a slow build-up in steam pressure because of the resulting slow spray start up. With the unique structure shown these normal drawbacks can be used to provide mutual advantages by using a prestressed spring. By tightly winding and prestressing the spring in a closed or unstretched position and heat treating the spring it is possible to prevent any stretching until a desired prestressed force is slightly exceeded when the spring will suddenly open. Thus, the consistency requirement is obviated and a pressure build-up in the iron system for spray operation is provided. By proper spring design then, the steam may be bled for steaming through apertures **12**.

During spraying, a large amount of steam is used, thus the amount that is bled through regulating valve **46** is low while, during periods when the user is just steam ironing in normal position, the amount of bleed is identical to the amount produced. The regulating valve and spring are thus designed to bleed the steam from time to time to maintain substantially constant pressure in the system.

Referring to FIG. 5, the desired flow-pressure relationship is illustrated. In this figure, the pressure regulating valve bleeds at high flow condition A while the iron is steaming and bleeds at low flow condition B while the spray is being used. Consequently, as an example, it is desired to have an operating steam pressure range between 60–120 inches of water. In such an iron, if operated continuously, the iron would produce a maximum of around 45 surface cubic feet of steam per hour at 500° F. steam and .025 lb./min. steam rates. Thus, it is desired to produce a curve of the type shown in FIG. 5 with a knee at B so that no flow takes place and pressure builds up until the knee is reached and the pressure regulator must then control the pressure in the noted range. As indicated, it is extremely difficult to provide consistent helical springs in large quantities. A vertically disposed spring that is coned or tapered in the downstream direction is preferred because, in such a spring, it is possible to get a larger deflection in a shorter vertical space whereby the spring can be sealed at its top portion and carried in a small support e.g. substantially entirely within the chamber cover. Also, in tapered springs, the largest diameter free coil is the first to operate i.e. it deflects first in response to pressure. Thus, it is easier and more exact to design to a single coil than a plurality so a tapered spring is preferred. It is thus possible to reproduce the spring in quantity where, in effect, only one coil need be designed. In the FIG. 2 modification, where steam dome **44** is shown closer because of space limitations, this first free coil is top coil **52** immediately below seal **50**. Consequently, the spring is prestressed in a closed or unstretched position and, as shown, is tapered in the downstream direction away from the tank. In order to open the spring, check valve means that, conveniently, may be in the form of ball check means generally indicated at **53** is provided. Any check means acting in conjunction with the particular prestressed spring will suffice and a ball check is a straight forward solution. Similarly, several modifications of ball check valves are suggested as will become apparent. It has been noted that, on occasion, as when steam escapes with the iron in a heel rest position, there can occur a resonant condition of the spring that may result in a buzzing sound. This can be alleviated in a preferred form as shown in FIGS. 1 and 2 wherein ball **54** seats in the tapered portion of the spring and, in normal position, nests under a shaped insert **55**. The ball and insert thus rest against each other with the insert being shaped to provide a relatively large rubbing surface against the spring to damp any vibrations. It has been found effective to make the insert a light weight ceramic for the desired coefficient of friction and low cost solution. A modification that uses two balls **56** as shown in FIG. 3, where dome **44** is moved in, may also be used but the former is preferred. Similarly, a modification using a single ball **57** as shown in FIG. 4 may be used. Both FIG. 3 and 4 versions operate satisfactorily albeit with occasional buzzing which is eliminated in the preferred form. The ball means may rest in the lower tapered portion of the spring on the bottom coil directly or through a seat member **58** resting in the spring. Thus,

upon an increase in pressure in the generator, the check valve prevents or blocks flow to the soleplate and allows a pressure build-up until the pressure is equal to or greater than ambient plus the prestressed value at which time the pressure on the check valve unstresses the spring to stretch it to suddenly open and bleed steam through the discharge passage and through the spring convolutions to the steam distributing means downstream below the cover. When the pressure in the generator is equal to or lower than ambient, the check valve permits ready flow upstream. This is important for venting the iron during emptying and when filling in the heel rest position where the spring **48** is then horizontally aligned so that ball means **53** rolls away from the seat. The ball of the ball means cannot completely roll out of position because of a screen **59** of the FIGS. 1–2 and 4 modifications or a domed screen **60** of the FIG. 3 modification. The screen limits the movement of the check means and also screens the steam. The screen may be fastened substantially flush with the upper surface of the cover as shown by means such as a press fit or staking or overlapping ears or any other suitable means to secure the screen in the coverplate.

The construction thus uses, as seen in FIG. 4, four or five simple elements for regulating the pressure and these replace more than double the number of parts in conventional structure. Additionally, the entire pressure regulating valve is located substantially entirely in the cover **32** to reduce the height of the valve. The extremely simple, reliable structure is cheaper to manufacture and assemble resulting in a lower cost iron.

While there have been described preferred forms of the invention, obvious equivalent variations are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practised, otherwise than as specifically described, and the claims are intended to cover such equivalent variations.

We claim:

1. In a steam-powered spray iron having a steam generator, a closed water tank above said generator, means to pass water from said tank to said generator, means providing pressure communication between said generator and tank, a steam discharge passage providing the sole outlet for steam from said generator during normal operation, the improvement in a pressure regulating valve in said passage for maintaining a substantially uniform operating pressure in said generator and tank, said valve comprising:

a helical-coiled spring disposed in and sealed to said passage,

said spring being prestressed in a closed unstretched position,

means cooperating with said spring and operative to permit flow through said spring upstream toward said generator when pressure in said generator is equal to or lower than ambient and to permit flow from said generator downstream through said passage when generator pressure is equal to or greater than ambient plus the prestressed value, and

steam distributing means downstream of said valve and connected to said passage.

2. Apparatus as described in claim **1** wherein said spring is formed of longitudinal convolutions and one end is sealed directly to said passage.

3. Apparatus as described in claim **2** wherein said spring is vertically disposed in said passage and is seated in sealing relation at the top portion of said spring.

4. Apparatus as described in claim **3** having a screen member disposed over said top spring portion, and

means securing said screen thereover.

5. In a steam-powered spray iron having a steam generator, a closed water tank above said generator and a chamber cover therebetween, means to pass water through the cover from said tank to said generator, means providing pressure communication between said generator and tank, a steam discharge passage through said cover providing the sole outlet for steam from said generator during normal operation, the improvement in a pressure regulating valve in said passage for maintaining a substantially uniform operating pressure in said generator and tank, said valve comprising;

a helical-coiled spring seated in sealing relation with and carried by said cover,

said spring being prestressed in a closed unstretched position and being tapered in the downstream direction away from said tank,

check valve means disposed within said spring and operative to permit flow through said spring upstream toward said generator when pressure in said generator is equal to or lower than ambient and to block reverse flow,

whereby said check valve unstresses said spring to stretch it and permit flow through the passage and spring convolutions downstream when said generator pressure is equal to or greater than ambient plus the prestressed value, and

steam distributing means downstream below said cover and connected to said passage.

6. Apparatus as described in claim **5** wherein said spring is formed of longitudinal convolutions and the upper end is sealed directly to said cover.

7. Apparatus as described in claim **6** wherein said spring is vertically disposed in said passage, and

said check valve is a ball check means seated in the lower tapered portion to unseat in heel rest position when said spring is horizontally aligned.

8. Apparatus as described in claim **7** wherein a shaped insert rests on said ball check means and is formed to provide a rubbing surface against said spring to dampen vibrations therein.

9. Apparatus as described in claim **8** having a screen member disposed over the top of said spring, and

means securing said screen thereover in said cover substantially flush with the upper surface thereof.

References Cited

UNITED STATES PATENTS

181,288	8/1876	Shaw	38—77.5X
2,125,435	8/1938	Erling	38—77.5X
3,041,757	7/1962	Swenson et al.	38—77.5
3,045,370	7/1962	Foster	38—77.5
3,403,556	10/1968	Koester	38—77.5X

PATRICK D. LAWSON, Primary Examiner