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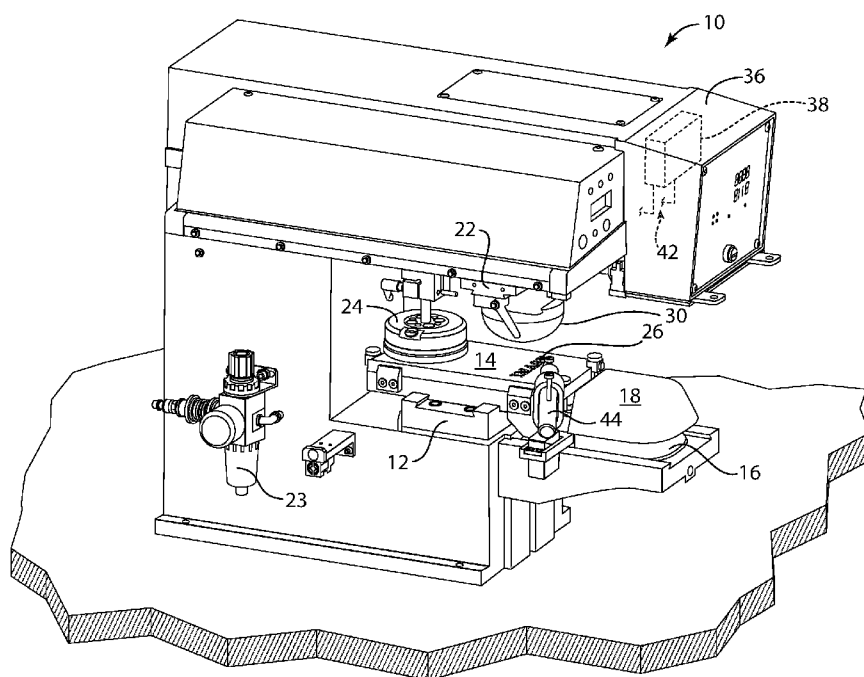


FIG. 1

(57) Abstract: A pad printing machine (10) is arranged for enabling the transfer and application of multiple layers of ink from an ink source (26) both into and onto an ink receiving member (14). The pad printing machine (10) comprises a depth enhanced ink well (26) (about .0015 to about .0035 inches deep) for peripherally enclosing an absorbable pattern of ink, a vertically and horizontally displaceable temperature controlled ink transfer print pad (30), and a temperature controlled printable item support print fixture (16) for supporting an ink receiving printable item member (18), to enable multiple layers of ink to be simultaneously transferred after pickup by the print pad (30) as one layer, and inversely and simultaneously applied as multiple layers into and onto the ink receiving printable item member (18) on the support print fixture (16).

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THERMALLY CONTROLLED PAD PRINT INK TRANSFER ARRANGEMENT**FIELD OF THE INVENTION**

This invention more particularly relates to an arrangement to generate transferrable
5 coatings (ink deposits) for application on absorbent, non-absorbent and porous surfaces
requiring decoration via the pad transfer printing process whereas more highly opaque
images are required than are achievable using conventional pad transfer printing
technology.

DISCUSSION OF THE PRIOR ART

Pad transfer printing technology has been in use for many years and is a common
form of printing utilized in the decoration and branding of flat and more importantly, three
dimensional products. A basic patent which represents the state-of-the-art may be seen in
US Patent 7,498,277 B2. The pad transfer printing process uses a combination of
15 components that allow the transfer of an image from an engraved print plate (cliché) to the
surface requiring decoration. These components: print plate, print pad and inks, work
together in an evaporative process which allows the ink to transfer from the plate, to the
print pad and finally from the print pad to the surface requiring decoration.

One prior art concept for print pad treatment includes blowing warm air on the print
20 pad between the ink pattern pickup at the inkwell and the deposition of that ink pattern from
the print pad onto the item to be printed. This blown air warmed the print pad but the inked
print pad's surface temperature however, was uneven and difficult to control. This process
of such blow treating of an ink laden print pad causes the evaporation of the wetted ink
resulting in a single ink layer, and it also creates a non-uniformity in the disposition of the
25 ink when the ink is applied to the printed item.

The current prior art systems are thus limited in their ability to create proper opaque
images on absorbent and porous surfaces. This limitation is relative to both the maximum
amount of pigment that can be contained in traditional plate etch depths and the wetted
characteristics of the ink at time of transfer onto and from an inkpad.

This is best explained by understanding the theoretical capacity of the print plate to contain a volume of pigment necessary to achieve an opaque image and the result achieved when transferring wetted inks to an absorbent surface.

Pad printing inks are a mixture of resins or binders (lacking colorant), pigments
5 (containing colorants) and solvents (lacking colorants) that comprise the ink formulation. Current art limits the maximum workable image etch depth to be in the .0015 - .0018 range. Depths of image etches greater than these will not support pick up and transfer of the ink by the prior art systems.

Further, wetted inks generated by current art restrictions, lack sufficient amounts of
10 pigment to generate opaque images. In addition, these wetted ink films reconstitute themselves into a totally wet formulation at the time of transfer to the print surface resulting in absorption of the pigments and loss of opacity, in particular when printing lighter colors on darker surfaces.

It is an object of the present invention therefore, to overcome the disadvantages of
15 the prior art.

It is a further object of the present invention to provide an ink pad transfer system which enables a multilayered or dual layered ink transfer arrangement from an etched inkwell to a printable item in a controllable manner and in a single operative step.

It is yet a further object of the present invention to provide that dual or multilayered
20 ink to have a display layer of high opacity.

It is yet another object of the present invention to apply that dual or multilayered ink to the print item with an attachable, printable-item high-absorbency layer.

It is yet another object of the present invention to manufacture a printed item which item has a one-step multilayer ink transfer arrangement thereon.

25 It is still another object of the present invention to manufacture a printed item with an item-absorbable layer and a contiguous, content-different, denser, commonly applied outwardly-displayed opaque layer.

It is still another object of the present invention to manufacture a printed item with a
30 single print-pad-delivery-motion of an item-absorbable layer and a contiguous, content-different, denser, commonly applied outwardly-displayed opaque layer.

It is still yet another object of the present invention to provide a method of manufacturing a single printed item having a multilayer ink transfer arrangement placed thereon by a single ink pad application thereagainst.

It is yet a further object of the present invention to provide a dual layer image ink transfer to an item wherein the applied dual layer images differ from one another in thermal characteristics.

It is yet a further object of the present invention to provide a dual layer image ink transfer to an item wherein the dual layer images differ from one another in opacity.

10 BRIEF SUMMARY OF THE INVENTION

The present invention comprises a print pad machine for the controlled transfer of layered ink from a deep well ink cliché or image to a printable item. The print pad machine includes a frame and support assembly for securing an etched image print plate and thereon. The frame support assembly includes a print fixture for supporting a printable item thereon. 15 The frame and support assembly also includes an overhead gantry to enable the slidable moving a support housing back and forth between the image print plate and the print fixture. The support housing supports the sliding lateral displacement of an ink supply cup back and forth over the image print plate. The support housing also supports the corresponding back and forth lateral displacement of a print pad between the image on the image print plate and a printable item supported on the print fixture. The printable item may be manually placed 20 on and removed seriatim from the print fixture, or mechanically placed and removed therefrom in a further embodiment. The support housing also permits and supports the controlled up-and-down movement of the print pad over the image and onto the image print plate, and subsequently, the up-and-down movement of the print pad against a printable 25 item supported on the print fixture to apply a particular image thereon.

The frame support assembly also includes an enclosure for a proper system control computer for operable control of the support housing and its associated mechanisms of the print pad machine by a machine operator at a first end of the print pad machine.

The frame support assembly includes heat control modules and pad position sensors 30 connected through a proper circuit to the system control computer within the first end of the

print pad machine. In a first preferred embodiment, an articulable heat sensor is arranged on the frame support assembly adjacent the print fixture at the first end of the print pad machine. The articulable heat sensor is connected through a proper circuit to the system control computer and the heat control module for monitoring the heat of the print pad as it
5 traverses the print pad machine from ink image pickup to ink image deposition on the printable item.

In a second preferred embodiment, the print pad has a uniform array of temperature sensors therewithin, to monitor and assist in the control and regulation of the array of heating elements within the print pad. Such temperature sensors would be connected to the
10 system control computer which regulates the temperature of the heating elements within the print pad.

The print plate or cliché contains the etched inkwell which forms the image to be transferred to the printed item. The preferred depth of the etched inkwell image in the print plate or cliché is critically between about .0015 to .0035 inches. The etched image-bearing
15 print plate is supported on a mounting plate and may in one embodiment have a system computer controlled arrangement for heating (or chilling) the ink therewithin. The print pad has its system computer controlled arrangement of heating elements therewithin. In another preferred embodiment, the print fixture which supports the printable item has a system computer controlled heating (or chilling) element therewithin as well. The respective
20 heating elements within the support plate, the print pad, and the print fixture are all controlled by the system central control computer in conjunction with the heat/chilling temperature control module within the frame assembly of the print pad machine.

The articulable heat sensor embodiment and the embodiment of the implanted array of heat sensors within the print pad are controlled through a proper circuit in conjunction
25 with the system control computer and pad position sensors to monitor and regulate those respective temperatures, particularly the temperature of the print pad so as to control and treat the thermally printed ink before and upon its deposition on an item being printed.

The articulable heat sensor tracks the movement of the laterally and vertically displaceable print pad during its transition from picking up ink on the image bearing print
30 plate through to the deposition of ink layers upon the upwardly facing surface of the to-be

printed printable item. Regulation of the temperature with respect to either the articulable heat sensor or the implanted heat sensors within the print pad, and with respect to the print fixture are critical to the development of the dual or multiple contiguous layers simultaneously deposited both in and on the structure of the printable item. The system control computer tracks the time and the temperature so as to ensure compatibility and efficacy of the specific type of ink being utilized for a particular application.

The invention thus comprises a pad printing arrangement for enabling the transfer and application of multiple layers of ink from an ink source into and onto an ink receiving member, comprising: a depth enhanced, image-constrained ink well for peripherally enclosing an absorbable pattern of ink; a vertically and horizontally displaceable temperature controlled ink transfer print pad; and a temperature controlled printable item support print fixture for supporting an ink receiving printable item member, to enable multiple layers of ink to be simultaneously transferred after pickup by the print pad as one layer, and inversely and simultaneously applied as multiple layers into and onto the ink receiving printable item member on the support print fixture.

A dual layer of ink, picked up and carried by the temperature controlled print pad to a printable item supported on the print fixture in a single step. The depth enhanced ink well has a depth of at least about .0015 to about .0035 inches. The depth enhanced ink well may be heated above ambient temperature. The temperature of the print pad and the print fixture is governed by a system control computer member. The print pad has a temperature sensor monitor either within the print pad or a sensor temperature monitor trackably following any vertical and horizontal displacement of the print pad. The temperature sensor monitor regulates the temperature of the print pad through communication with the system control computer member. The print pad carries a first layer of dense opaque ink immediately on a surface thereof and a second peripherally contiguous layer of wetted printable-item absorbable ink, for absorption in and attachment on the printable item.

The invention also comprises a process for a single step for printing multiple layers of ink from a single ink source to an ink receiving member comprising providing a pre-configured, etched enhanced depth ink source, engaging a heated print pad onto and into the temperature controlled ink source to coat the curvilinear pickup surface of the

temperature controlled heated print pad with a pre-configured layer of ink, dissipating volatiles from an outer surface of the pre-configured layer of ink forming a second or wetted-surface layer of pre-configured ink and a first or dense/opaque sub-surface layer of pre-configured ink on the heated print pad during movement of the print pad from ink pick up to ink deposition, applying the sub-surface layer of pre-configured ink into the ink receiving member arranged on a printable item on the support print fixture. The process includes one or more of the following steps of simultaneously applying the first dense/opaque layer of pre-configured ink on top of the second surface of ink applied into an ink receiving printable item, heating the printable item support print fixture, monitoring the temperature of the print pad during a displacement thereof from ink pickup at an ink source to ink disposition on a printable item, controlling the temperature of the heat pad through a computer connected therewith, to maintain ink temperature and volatile displacement prior to application of the ink to a printed item, following displacement of the print pad with internal heat sensors built therewithin or an articulable temperature sensor, tracking the print pad from ink pickup to ink deposit onto a printable item, thus maintaining a uniform temperature of the ink pick-up surface print pad to a range of preferably about 230 to 270 degrees F.

The invention also includes a system for applying an enhanced opaque multi-layer applique of pre-configured ink onto a receiving surface, wherein the system effects the transition of a single layer of pre-configured ink into a multiple pre-configured layer arrangement of ink, the system may comprise: a heat controlled pre-configuration of ink engaged by a temperature controlled articulable curvilinear surfaced print pad which dissipates ink volatiles in the transition from an ink pickup location to inversely applied ink deposition location as a multiple-layer or dual layer, pre-configured ink pattern on the receiving member supported on a print fixture, wherein a print pad-outer-ink layer, which is a volatile (wetted) layer, and a print pad-dense-inner-layer inversely become respectively, the dense, opaque receiving-member outer-layer and the innermost wetted layer when they both are applied to the surface of the receiving member at a ink deposition location. The temperature of the print pad is maintained at a preferred range of about 230 to about 270 degrees F. The system may include an articulable temperature sensing monitor which

follows the print pad from its ink pick up location to the print pad's ink deposition location. The system may alternatively include a print pad ink-surface sensor built into the sub surface of the curvilinear print pad. The sensing monitor arrangements provide temperature feedback to a system computer at adjust the temperature of the print pad within the desired range. The print fixture supporting an item to be printed, may also be heated by a heating arrangement therewith. The system computer controls the temperature of the print fixture within the desired range. The invention also includes a textile garment receiving material with a multiple-layer concomitantly-applied ink display pattern therewith, the multiple layer ink display pattern arranged so as to provide an opaque product indicia, the multiple-layer concomitantly-applied display pattern comprised of: a wetted layer of a pre-configured pattern of ink absorbed into the textile garment receiving material; and an opaque, concomitantly applied dense layer of ink corresponding to the pre-configured pattern of ink, overlaying the wetted layer absorbed into the textile garment receiving material. The applied multiple-layer pattern of ink is applied to the garment at a temperature of about 220 to 270 degrees F. The applied multiple-layer of ink is about .0022 to about .0030 inches thick. The textile garment as recited in claim 24, wherein the applied multiple-layer pattern of ink is applied to the garment at a temperature of about 220 to 260 degrees F. The applied multiple-layer of ink is about .0022 to about .0030 inches thick. The applied multiple-layers of ink are of different consistencies from one another. The textile garment may be supported on a heated printable item support which is heated to a temperature of about 220 to 260 degrees F. The opaque layer of ink is applied to the garment is a surface layer.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the present invention will become more apparent, when viewed in conjunction with the following drawings, in which:

Figure 1 is a perspective view of a print pad machine constructed according to the principles of the present invention;

Figure 2 is a side elevational view of the print pad machine shown in figure 1, with its ink cup ink supply mechanism shown slideably disposed over the image bearing print plate for deposition of a quantity of ink within the etched image thereon, with the tandem movable print pad awaiting further motion of the support housing to enable the next step in the operational sequence;

Figure 3 is a side elevational view similar to that shown in figure 2 showing the ink cup ink supply mechanism slideably disposed over the rear portion of the image bearing print plate and its correspondingly moved print pad shown supported above the ink laden etched image of the print plate;

Figure 4 is a side elevational view similar to that shown in figure 3, now showing the print pad displaced vertically from the support housing thereabove, to enable the print pad to pick up its quota of ink from the etched inkwell image;

Figure 5 is a side elevational view similar to that shown in figure 4, now showing the ink image laden print pad displaced vertically towards the support housing thereabove, awaiting its next transition in the operational sequence;

Figure 6 is a side elevational view similar to that shown in figure 2, now showing the ink-image-laden print pad disposed vertically above the to be printed item supported on the print fixture at the 1st end of the print pad machine;

Figure 7 is a side elevational view similar to that shown in figure 6, now showing the ink image laden print pad displaced downwardly from the support housing and against a printable item supported on the print fixture;

Figure 8 is a side elevational view similar to that shown in figure 6, now representing an ink image free print pad displaced upwardly towards its support housing after having applied multiple layers onto the now printed item supported on the print fixture at the 1st end of the print pad machine;

Figures 9A, 9B and 9C are schematic representations of the sequence of operation involved between the print pad, the ink-laden etched image on the print plate and ultimately the printable item supported on the print fixture ending as a multilayered image shown on and absorbed into the printable item; and

5 Figure 10 shows a printed item constructed according to the principles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in detail and particularly to figure 1, there is shown
10 the present invention which comprises a print pad machine 10 for the controlled serial transfer of a developing-arrangement of multi-layered ink initially drawn from a proportionately deep well ink cliché or etched image in an image print plate and then onto a printable item. The print pad machine 10 includes an elongated frame and support assembly
12 for securement and as-needed replacement of an etched ink-containing image-displaying
15 print plate 14 thereon. The elongated frame support assembly 12 includes a print fixture 16 for fixedly supporting a preferably ink absorbing printable item 18 thereon. Such printable item 18 may be any absorbable curvilinear or linear item such as a piece of cloth or fabric as for example, an item of clothing such as a T-shirt, underwear, pants or hat, an insole or upper of a footwear member, or a sheet of material for advertising purposes or the like,
20 represented in figures 1, 7, 8 and 9C.

The frame and support assembly 12 also includes an overhead gantry 20, best represented in figures 2 – 8, is utilized for slideably moving a support housing 22 back and forth between the image print plate 14 and the print fixture 16. The gantry 20 supports the pneumatically empowered longitudinal sliding of the support housing 22, through an air
25 regulator connector arrangement 23, thereby facilitating the lateral displacement of an ink supply cup 24 back and forth, as represented by an arrow B in figure 2, over the cliché or etched image inkwell 26 (ink reservoir, which may be held above or below ambient temperature in a further embodiments) in the image print plate 14, as represented by the word “image” shown in figure 1. The support housing 22 also supports the corresponding
30 back and forth lateral displacement of a print pad 30 between the image (inkwell) 26 on the

image print plate 14 and a printable item 18 supported on the print fixture 16, as represented in figures 2 and 3. The print pad 30 has a resilient, somewhat flexible, convex, downwardly-facing, curvilinearly shaped pick-up/ink deposition surface 31, as may be seen in figures 3 and 5. The support housing 22 also permits and supports the controlled
5 up-and-down movement of the print pad 30 over the etched ink-filled image 26 and onto the image print plate 14 as represented in figures 4 and 5, and subsequently, the up-and-down movement, as represented by arrow "D" in figure 7, and pressurized application of the print pad 30 against a printable item 18 supported on the print fixture 16 to apply a particular image 26A thereon, as represented in figures 6, 7, 8 and 9C.

10 In a further embodiment of the print pad 30 itself, which includes the convex ink receiving portion 31 being formed of a thermochromic silicon material which changes color according to the temperature of the print pad 30. For example, that convex ink receiving portion 31 of the print pad 30 may turn from a dark blue color to a beige color to visually indicate that the desired temperature of the ink bearing surface has been reached.

15 The frame support assembly 12 also includes an enclosure 36 for a proper system control computer 38 for operable control of the support housing 22 and its associated mechanisms of the print pad machine 10 by a machine operator (not shown), typically operating at a first end of the print pad machine 10, represented primarily in figures 1 and 2.

The frame support assembly 12 includes temperature (heating or chilling) control
20 modules 39 and pad position sensors 40 connected through a proper circuit 42 to the system control computer within the first end of the print pad machine, as shown in figure 2. In a first preferred embodiment, an articulable print-pad-following heat sensor 44 is arranged on the frame support assembly 22 adjacent the print fixture 16 at the first end of the print pad machine 10, as represented in figures 2 - 8. The articulable temperature (heat or chill) sensor
25 44 is connected through the proper circuit 42 to the system control computer 38 and the heat control module 39, as represented in figures 1 and 2, for continuously monitoring and controlling the heat of the print pad 30 as it traverses the print pad machine 10 from ink image pickup, represented in figure 4, to ink image deposition on the printable item, as represented in figure 7.

30 In a second preferred embodiment, the print pad 30 has a uniform array of

temperature sensors 33 within the surface 31 of the print pad 30, to monitor and assist in the control and regulation of an array of heating elements 60 within the print pad 30, as represented in figures 9A-9c. Such temperature sensors 44 or 33 would be properly connected to the system control computer 38 which regulates the temperature of the heating elements 60 within the print pad 30. Heating of the print pad 30 to required temperatures, for example, to a range of about 200 to about 350 degrees F. preferably about 230 to about 270 degrees F. depending upon the of the type of ink 47 being utilized effects the driving off of volatiles within the depth of attached ink not in direct contact with the surface 31 of the print pad 30, creating a "wetted" or second layer 50, as represented in figure 9B, and a more dense and more opaque, peripherally contiguous first layer 52, sandwiched between the surface of the print pad 30 again as represented in figures 9B and 9c. When the resilient curvilinear print pad 30 is pressed against a printable item 18, the (now outer) wetted layer 50, free of certain driven-off solvents is absorbed into the printable item 18, leaving the attached contiguous (inner) first layer 52 exposed on top thereof, as a now highly visible display on the surface of the printed item 18, not in it, which dual layer with different ink consistency configuration is represented in the right hand portion "X" of figure 9C.

The print plate or cliché represented in figure 9A, contains the etched inkwell 80, shown as member 26 in a perspective view in figure 1, and more definitively in figure 9, which etched inkwell 80 forms the image 26 to be transferred by a corresponding ink now pad-attached pattern 26A, transferable to the printed item 18. The preferred depth "M" of the etched inkwell image in the print plate 14 is critically depth-enhanced to between about .0015 to .0035 inches, as represented diagrammatically in figure 9A. The etched inkwell 80 bearing the image to be transferred contains the ink 47, such as for example: Inkcups Now Corp. ink identified as *SB Brite Series Ink*. The etched image-bearing print plate 14 is supported on a mounting plate 52 and may in one preferred embodiment, have a system computer controlled heating (or chilling) element 55 therewithin, as represented in figures 9A-9C. In another preferred embodiment, the print pad 14 is not heated, and the ink 47 in this embodiment, is at ambient temperature.

The print pad 30 has its system computer temperature-controlled heating element 60

therewithin, as represented in figure 9. The print fixture 16 which supports the printable item 18, preferably has the system computer controlled heating (or chilling) element 55 therewithin as well, again, as represented in figures 9A - 9C. The print pad 30 may be heated to and maintained at temperatures of about 230 to about 270 degrees F., preferably about 250 degrees F. Such temperature range varies somewhat depending on the ink being utilized, such as identified hereinabove. The respective heating elements within the support plate 52 (with that particular embodiment), the print pad 30, and the print fixture 16 are all controlled by the system central control computer 38 in conjunction with the heat control module 39 within the frame assembly 12 of the print pad machine 10 in response to the detection and monitoring of the pad 30 temperature by the articuable pad tracking heat sensor 44 or the print pad array of implanted temperature sensors 33 as represented in figure 9A.

The articuable heat sensor 44 embodiment and the embodiment of the inner implanted array of heat sensors 33 is within the print pad 30 is controlled through a proper circuit 42 in conjunction with the system control computer 38 and pad position sensors 40 represented in figures 1 and 2, to monitor and regulate those respective temperatures, particularly the temperature of the print pad 30 so as to induce and control the thermally differentiated separate dual ink layers 50 and 52 upon their deposition into and onto the printable item 18. The thin evaporated "wetted" layer 50 being absorbed first into the item 18, and the contiguous denser layer 52 being then contiguously and simultaneously applied onto the being-printed item 18.

The articuable heat sensor 44 is controllably programmed to track the transitory movement of the laterally and vertically displaceable print pad 30 during its transition from the picking up of ink 47 from the etched image bearing print plate 14 through to the concomitant deposition of multiple ink layers 50 and 52 upon the upwardly facing surface of the to-be-printed, being printable item 18, as represented in figure 7. Regulation of the temperature with respect to either the articuable heat sensor 44 or to the implanted array of heat sensors 33 embedded within the print pad 30, and with respect to the print pad 30, the image bearing print plate 14 (if heat utilized there) and to the print fixture 18 are critical to the development of the dual layers 50 and 52 deposited both in and on the structure of the

printable item 18. The system control computer 38 tracks the time of movement and the temperature of the print pad 30 so as to ensure compatibility and efficacy in conformance to the temperature and evaporation characteristics of the specific type of ink 47 being utilized for a particular print item application.

- 5 Figure 10 shows an article of clothing 70, made by the inventive process/system as for example, a T-shirt displaying a label which has an opaque “on the surface” layer 52 and an absorbed “wetted” layer 50, similar to that identified at location “X” still on the print fixture shown in figure 9.

Claims:

1. A pad printing arrangement for enabling the transfer and simultaneous application of multiple layers of ink from a common ink source into and onto an ink receiving member, comprising:
 - 5 a depth-enhanced image source ink well for peripherally enclosing an absorbable pattern of ink;
 - a vertically and horizontally displaceable temperature controlled ink transfer print pad; and
 - a printable-item support print fixture for supporting an ink receiving printable item
- 10 member, to enable multiple layers of ink to be simultaneously transferred after pickup by the print pad as one layer, and inversely and simultaneously applied as multiple layers both into and onto the ink receiving printable item member on the support print fixture.
2. The pad printing arrangement as recited in claim 1 wherein a dual layer of picked up
- 15 ink is carried by the temperature controlled print pad to a printable item supported on the print fixture.
3. The pad printing arrangement as recited in claim 1 wherein the depth enhanced image source ink well has a depth of at least about .0015 to about .0035 inches.
- 20 4. The pad printing arrangement as recited in claim 1 wherein the printable item support print fixture is temperature controlled.
5. The pad printing arrangement as recited in claim 3, wherein the depth enhanced ink
- 25 well is temperature controlled.
6. The pad printing arrangement as recited in claim 5, wherein the depth enhanced inkwell is heated above ambient temperature.

7. The pad printing arrangement as recited in claim 1, wherein the temperature of the print pad and the print fixture is governed by a system control computer member.

8. The pad printing arrangement as recited in claim 1, wherein the print pad has a
5 temperature sensor which tracks the temperature thereof.

9. The pad printing arrangement as recited in claim 8, wherein the temperature sensor is an articulable temperature sensing device to monitor the surface of the print pad by following any vertical and horizontal displacement thereof.
10

10. The pad printing arrangement as recited in claim 8, wherein the temperature sensor is an array of thermocouples implanted within the print pad so as to monitor and provide feedback control for the surface of the print pad.

11. The pad printing arrangement as recited in claim 7, wherein the temperature sensor monitor regulates the temperature of the print pad through communication with the system control computer member.
15

12. The pad printing arrangement as recited in claim 1, wherein the print pad carries a
20 first layer of dense opaque ink immediately on a surface thereof and a second peripherally contiguous layer of wetted printable-item absorbable ink, for absorption in and attachment on the printable item.

13. A process for simultaneously printing multiple layers of ink from a single ink source to an ink receiving member comprising:
- providing a pre-configured, etched enhanced depth ink source;
 - 5 engaging a heated print pad onto the ink source to coat the heated print pad with a pre-configured layer of ink;
 - heating the print pad to warm the ink evenly across its surface;
 - dissipating volatiles from an outer surface of the pre-configured layer of ink forming a second or wetted surface layer of pre-configured ink while maintaining a first or
 - 10 dense/opaque sub-surface layer of pre-configured ink on the heated print pad during movement of the print pad from ink pick up to ink deposition;
 - applying the wetted sub-surface layer of pre-configured ink into the ink receiving member arranged on a printable item on the support print fixture.
- 15 14. The process for printing multiple layers of ink from a single ink source to an ink receiving member as recited in claim 13, including:
- applying the first dense/opaque layer of pre-configured ink on top of the second surface of ink applied into an ink receiving printable item.
- 20 15. The process for printing multiple layers of ink from a single ink source to an ink receiving member as recited in claim 14, including:
- heating the printable item support print fixture.
16. The process for printing multiple layers of ink from a single ink source to an ink
- 25 receiving member as recited in claim 14, including:
- monitoring the temperature of the print pad during a displacement thereof from ink pickup at an ink source to ink disposition on a printable item.
17. The process for printing multiple layers of ink from a single ink source to an ink
- 30 receiving member as recited in claim 14, including:

controlling the temperature of the heat pad through a computer connected therewith, to maintain ink temperature and volatile displacement of the wetted layer prior to application of the ink to a printed item.

5 18. The process for printing multiple layers of ink from a single ink source to an ink receiving member as recited in claim 17, including:

following displacement of the print pad with an articulable temperature sensor from ink pickup to ink deposit onto a printable item.

10 19. The process for printing multiple layers of ink from a single ink source to an ink receiving member as recited in claim 18, including:

maintaining the temperature of the print pad to a range of about 230 to 270 degrees F.

15 20. A system for applying an enhanced opaque multi-layer applique of pre-configured ink onto a receiving surface, wherein the system effects the transition of a single layer of pre-configured ink into a multiple pre-configured layer arrangement of different ink consistencies, the system comprising:

a heat controlled pre-configuration of ink engaged by a temperature controlled
20 articulable print pad which dissipates ink volatiles in the transition from an ink pickup location to inversely applied ink deposition as a multiple-layer, pre-configured ink pattern on the receiving member supported on a print fixture, wherein a pad-outer-ink layer, which is a volatile-free layer, and a pad-dense-inner-layer inversely become respectively, the dense, opaque receiving-member outer-layer and the innermost wetted layer when they both
25 are simultaneously applied to the surface of the receiving member at a ink deposition location.

21. The system as recited in claim 20, wherein the temperature of the print pad is maintained at a desired range of about 230 to 270 degrees F.

22. The system as recited in claim 21, including an articulable temperature sensing monitor which follows the print pad from its ink pick up location to the print pad's ink deposition location.

5 23. The system as recited in claim 22 wherein the sensing monitor provides temperature feedback to a system computer to adjust the temperature of the print pad within the desired range.

24. The system as recited in claim 20, wherein the print fixture supporting an item to
10 be printed, is heated by a heating arrangement therewith.

25. The system as recited in claim 24, wherein the system computer controls the temperature of the print fixture within the desired range.

15 26. A textile garment receiving material with a multiple-layer concomitantly-applied ink display pattern therewith, the multiple layer ink display pattern arranged so as to provide an opaque product indicia, the multiple-layer concomitantly-applied display pattern comprised of:

a wetted layer of a pre-configured pattern of ink absorbed into the textile garment
20 receiving material; and

an opaque, concomitantly applied dense layer of ink corresponding to the pre-configured pattern of ink, overlaying the wetted layer absorbed into the textile garment receiving material.

25 27. The textile garment as recited in claim 26, wherein the applied multiple-layer pattern of ink is applied to the garment at a temperature of about 220 to 260 degrees F.

28. The textile garment as recited in claim 26, wherein the applied multiple-layer of ink is about .0022 to about .0030 inches thick.

29. The textile garment as recited in claim 26, wherein the applied multiple-layers of ink are of different consistencies from one another.

30. The textile garment as recited in claim 26, wherein the applied multiple-layer
5 pattern of ink is applied to the garment having a temperature of about 220 to 260 degrees F.

31. The textile garment as recited in claim 30, wherein the garment is supported
on a heated printable item support which is heated to a temperature of about 220 to 260
degrees F.

10

32. The textile garment as recited in claim 26, wherein the opaque layer of ink is
applied to the garment is a surface layer.

15

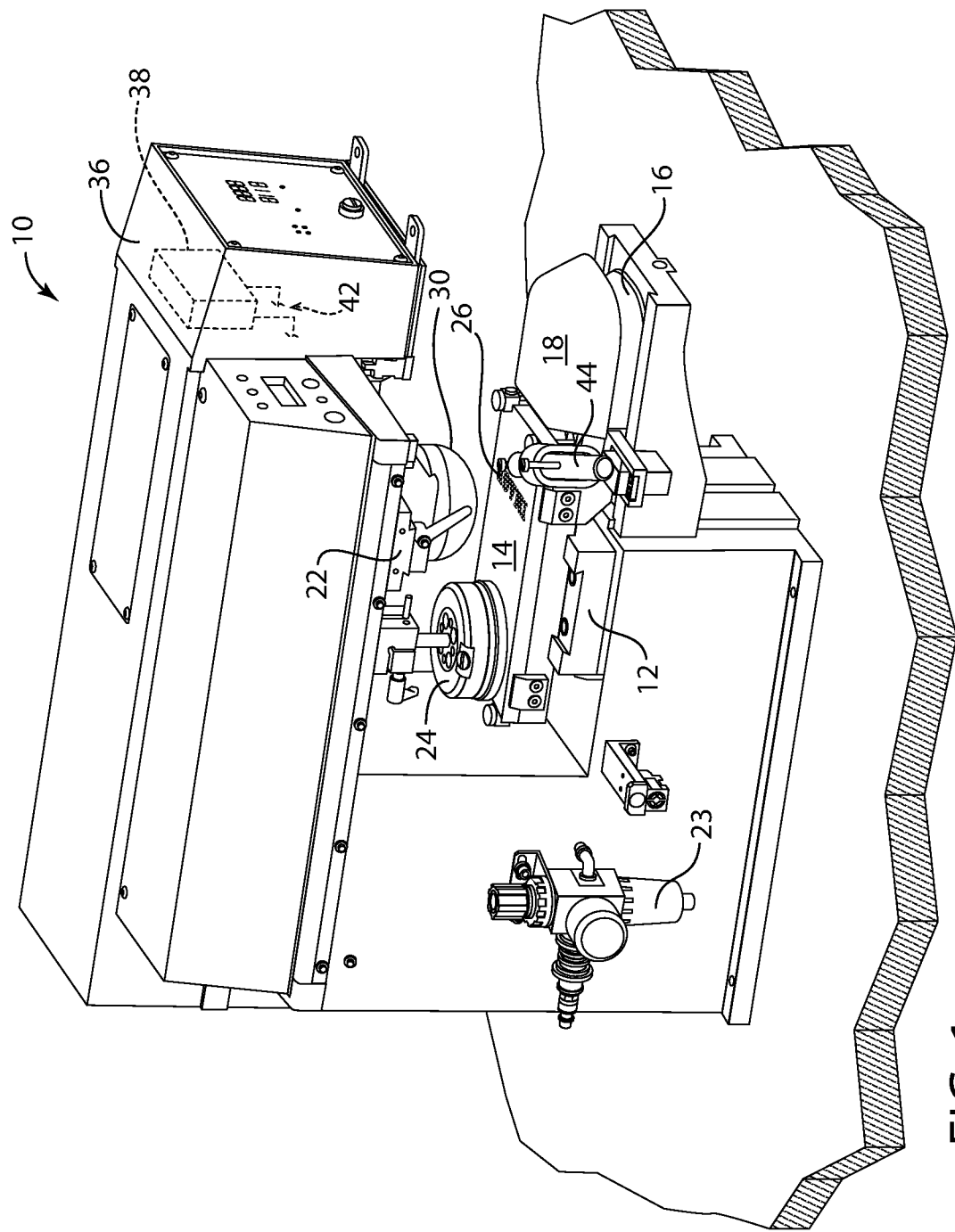
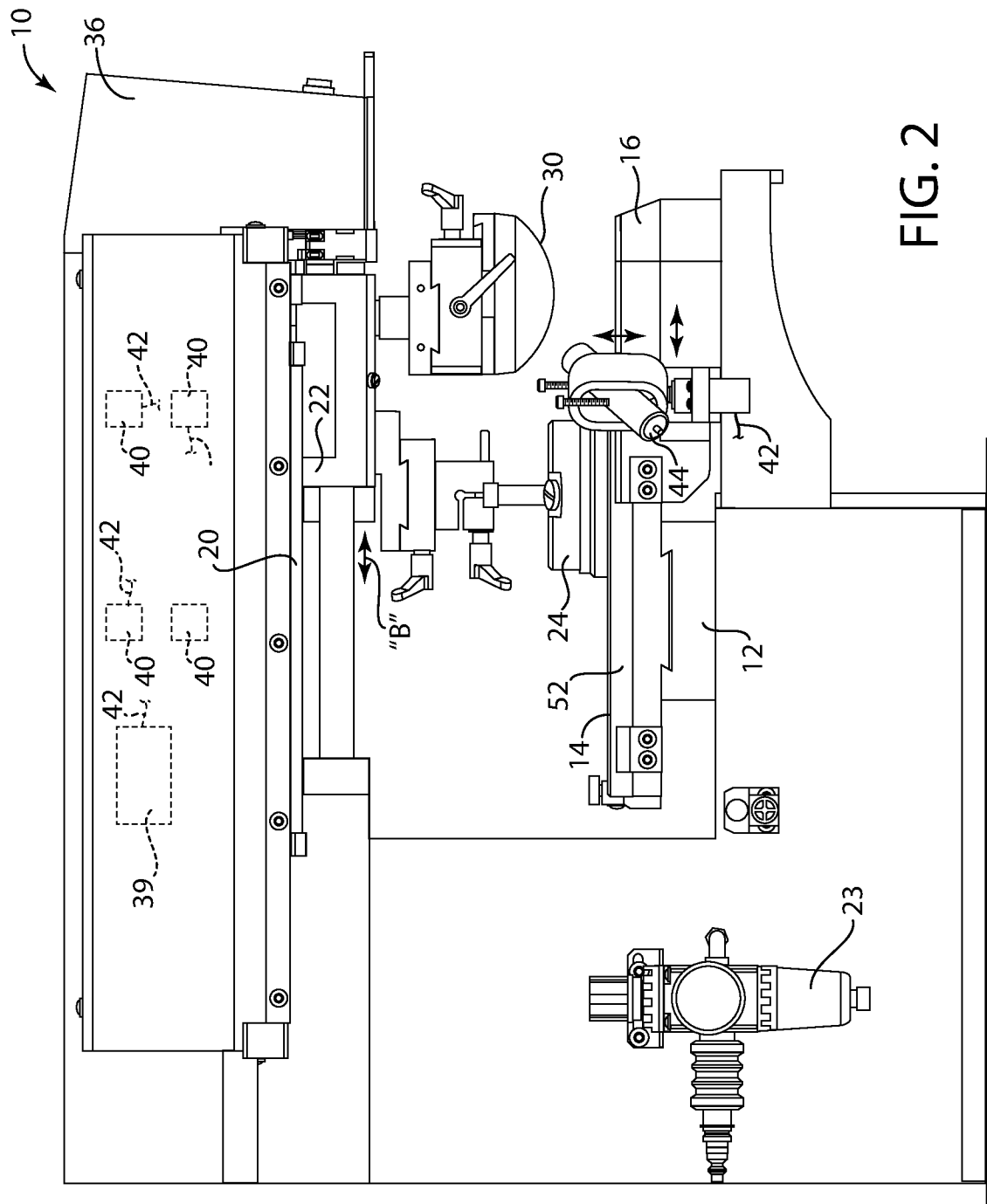
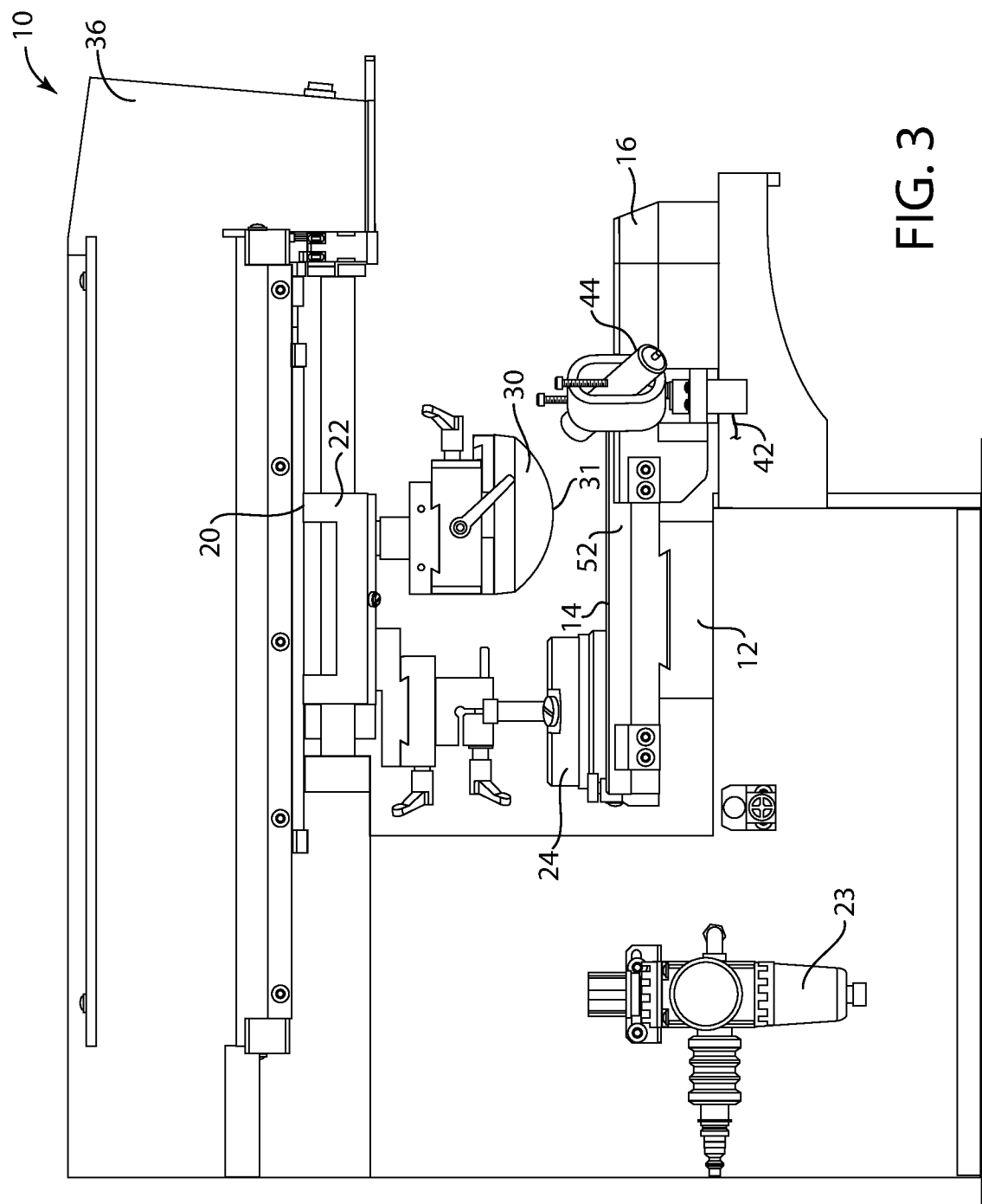


FIG. 1





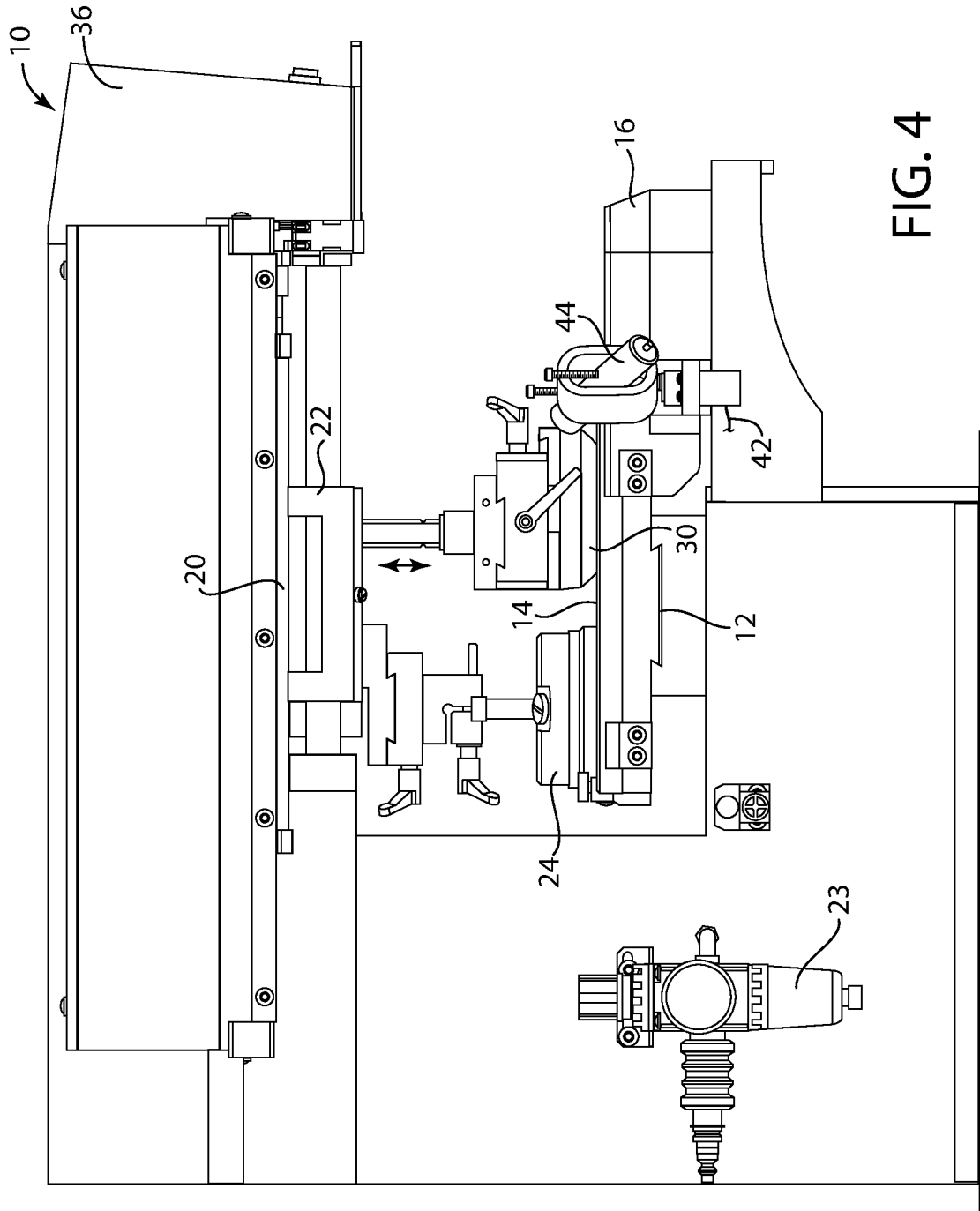


FIG. 4

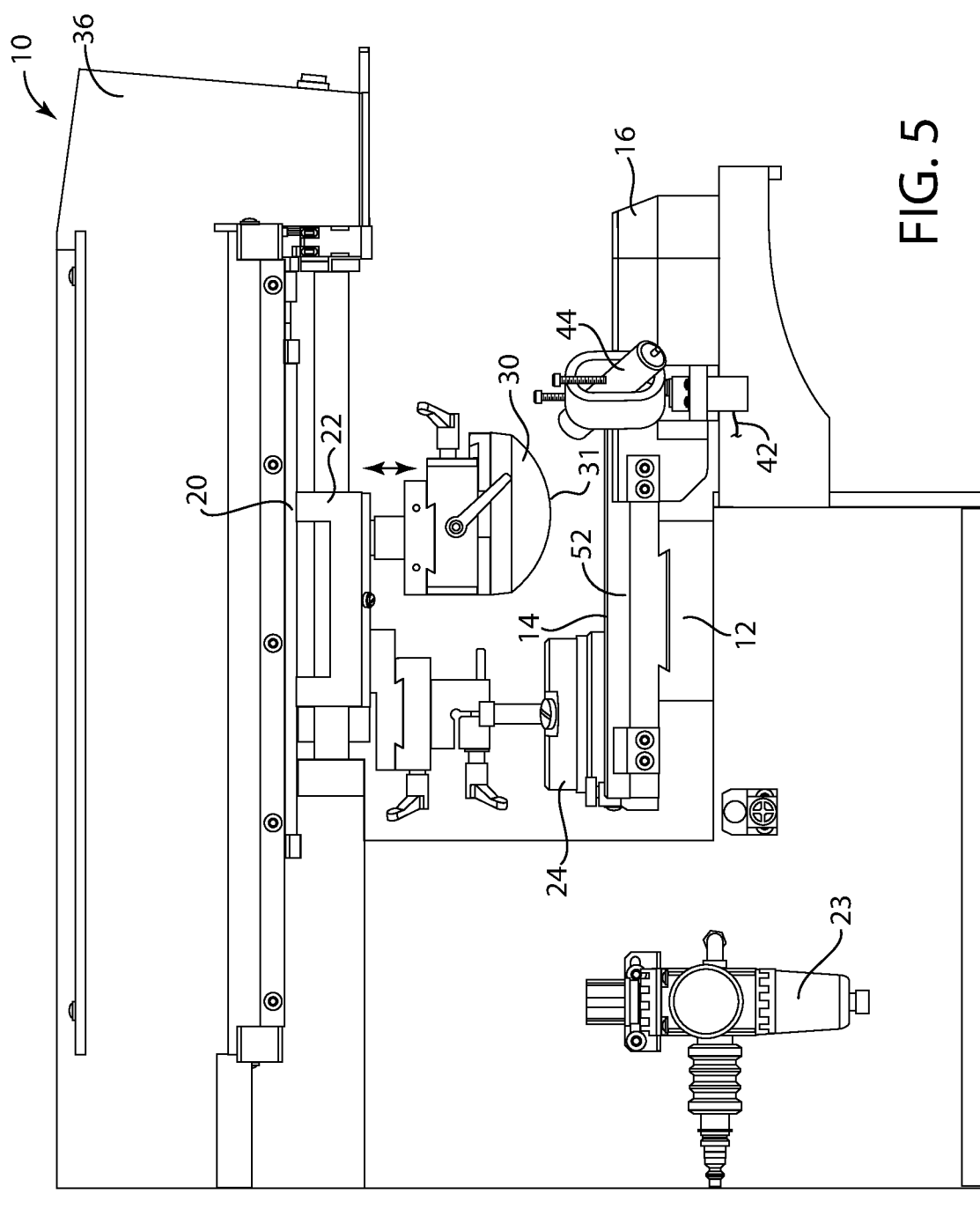
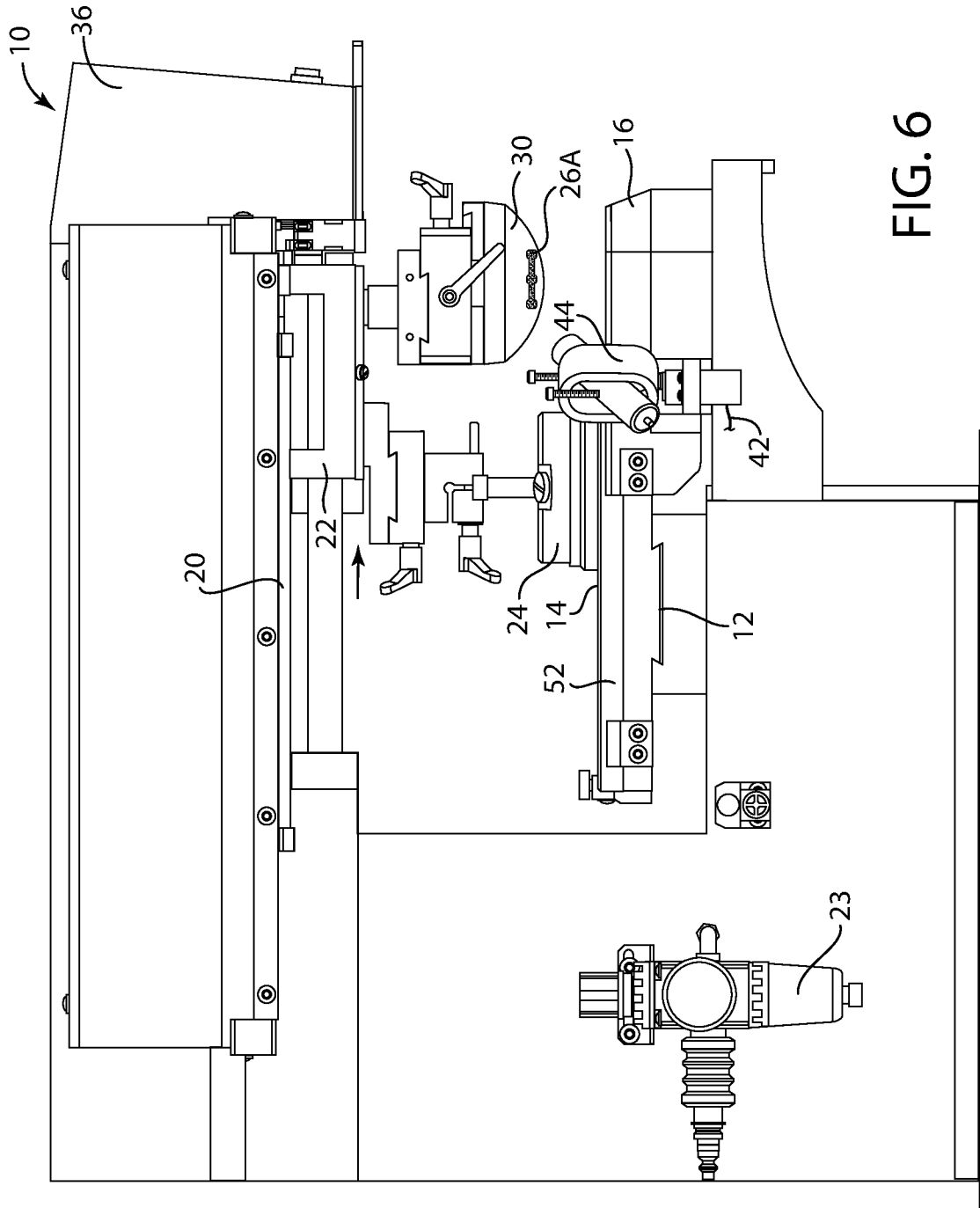


FIG. 5



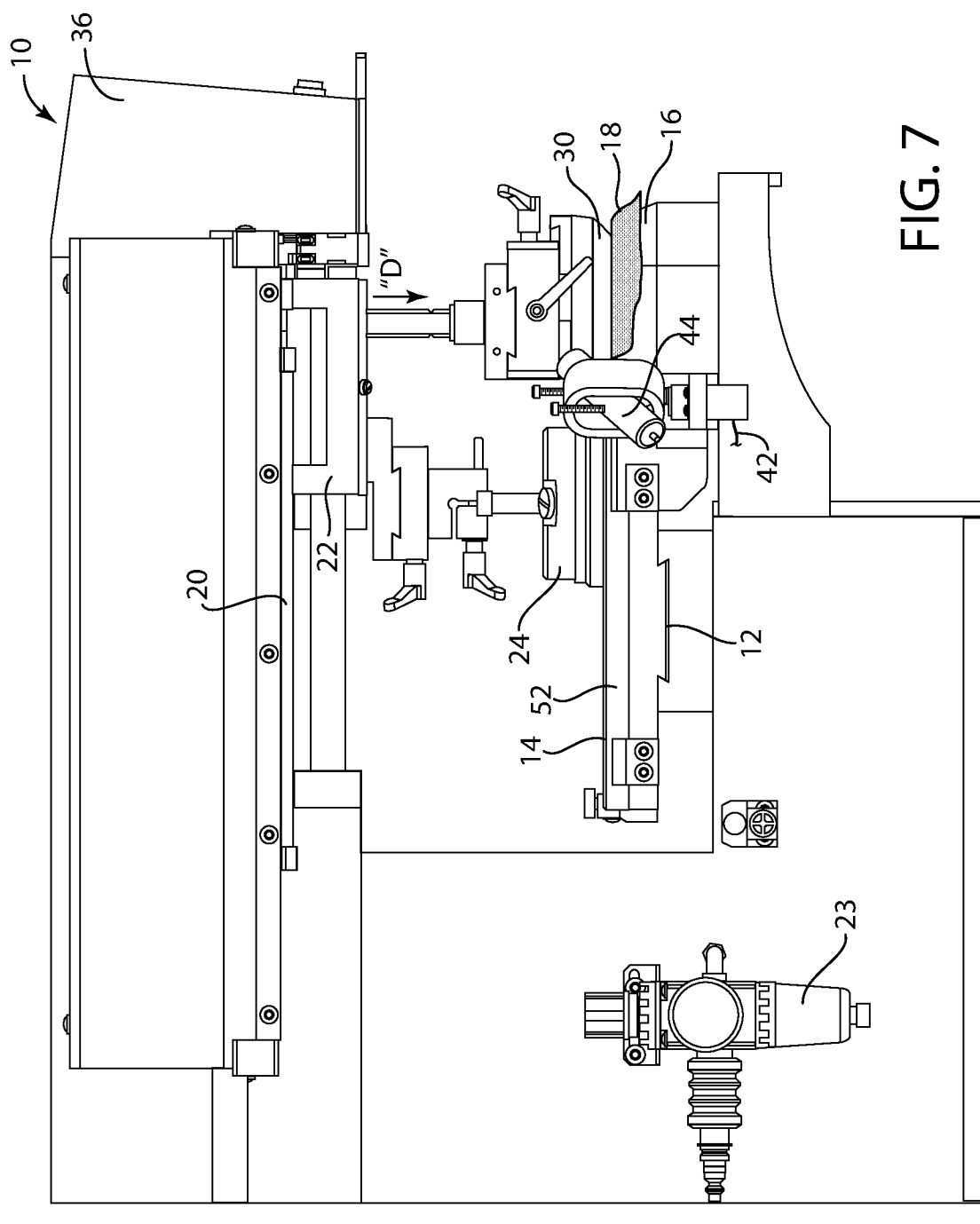


FIG. 7

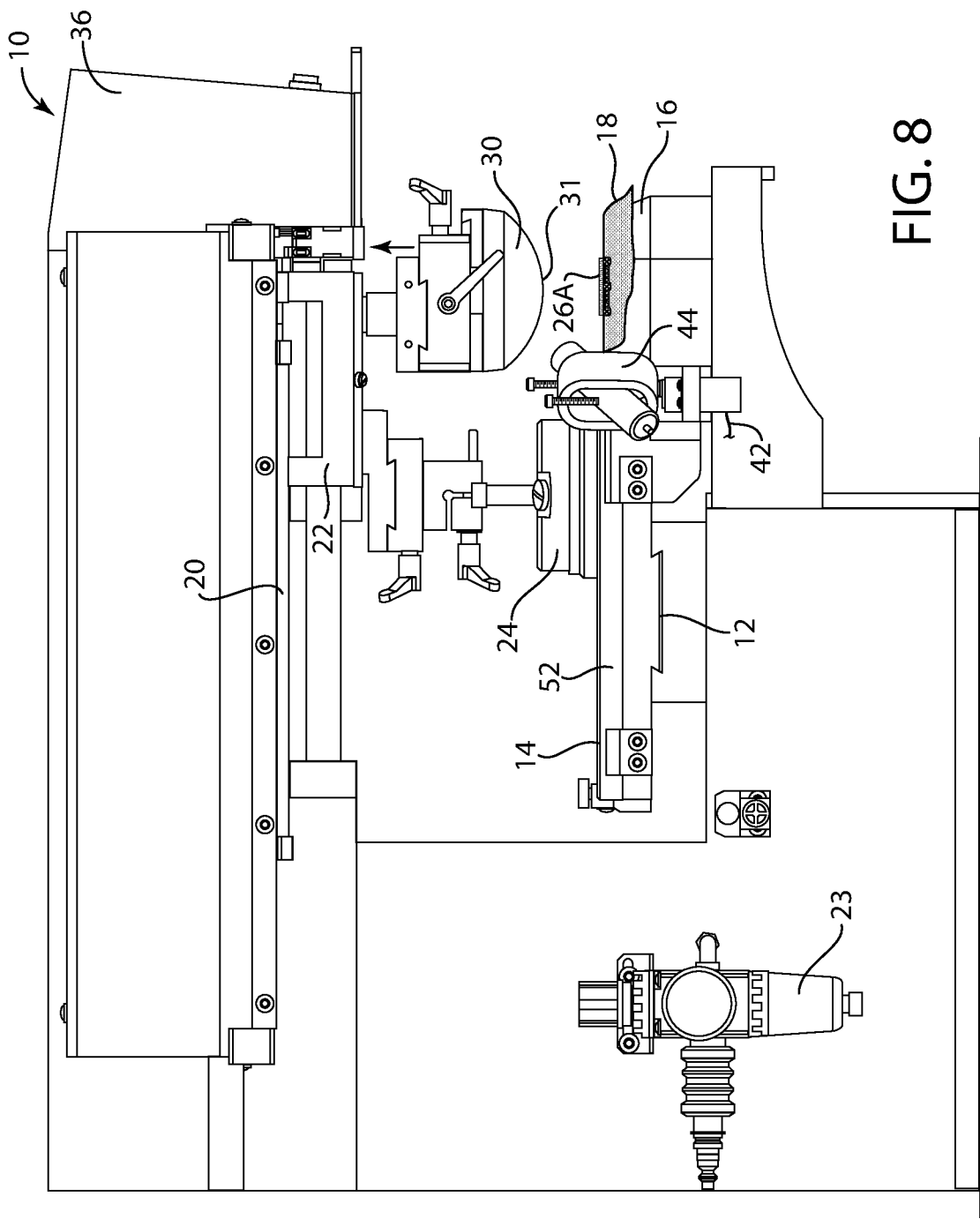


FIG. 8

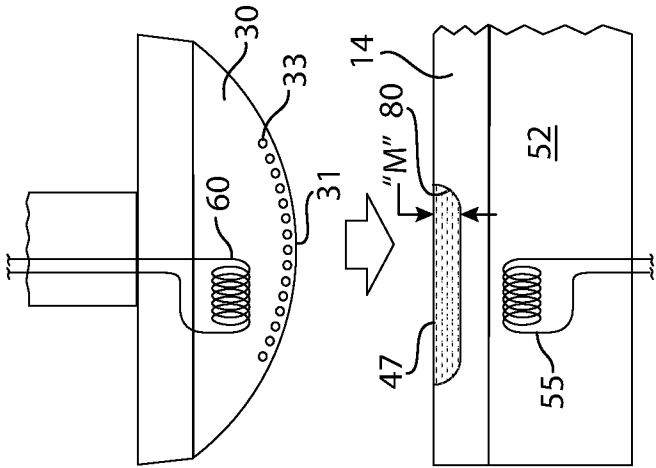


FIG. 9A

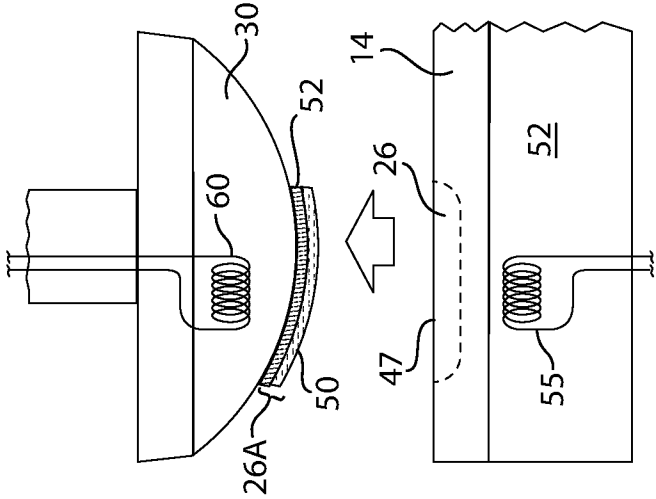


FIG. 9B

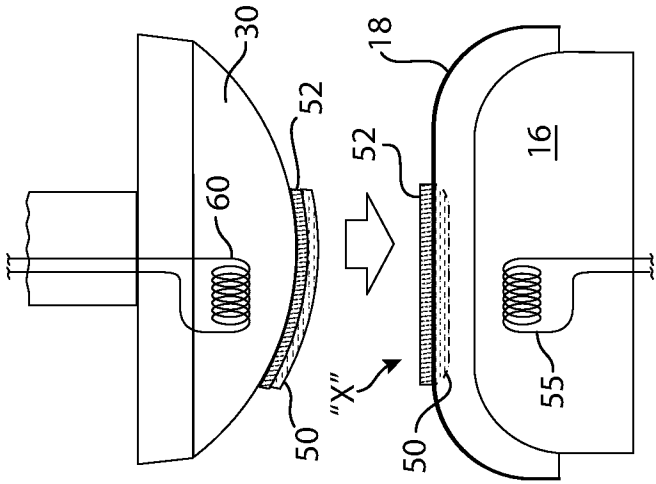


FIG. 9C

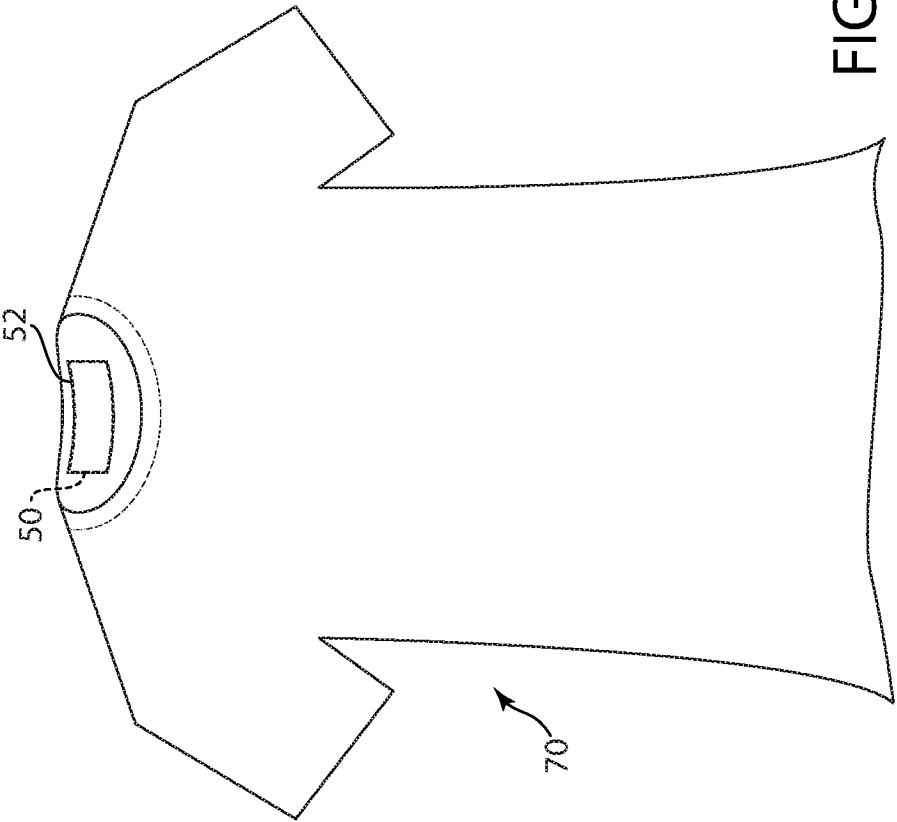


FIG. 10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/030409

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B41F 17/00; B41F 16/00; B41F 16/02; B41F 17/38 (2017.01)

CPC - B41F 17/001; B41F 16/00; B41F 16/02; B41F 17/00; B41F 17/38 (2017.05)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC - 101/35; 101/41; 101/44; 101/492 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,069,954 A (COLE et al) 03 December 1991 (03.12.1991) entire document	1-32
A	US 3,255,695 A (JOHNSON et al) 14 June 1966 (14.06.1966) entire document	1-32
A	US 5,937,754 A (SCOTT et al) 17 August 1999 (17.08.1999) entire document	1-32
A	US 4,473,008 A (HEYMAN) 25 September 1984 (25.09.1984) entire document	1-32

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

27 June 2017

Date of mailing of the international search report

13 JUL 2017

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