Applicant: Chandigarh University **No of Sheet-01**
Application No: **Sheet No-01**

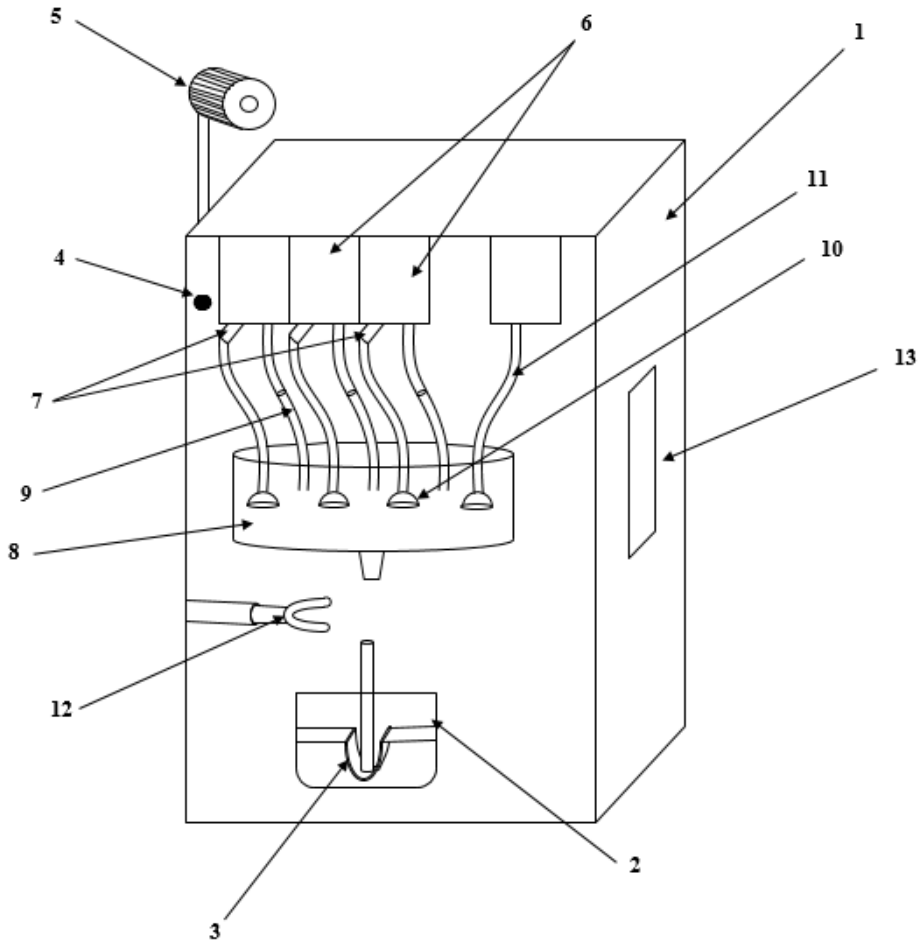


Figure 1

Dated this 05th March 2022

Kunal Setiya
INPA-2570
Agent for the Applicant(s)

FORM 2

THE PATENTS ACT, 1970
(39 of 1970)

&

THE PATENT RULES, 2003

COMPLETE SPECIFICATION
(See Section 10; rule 13)

INK REFILLING DEVICE

APPLICANT(S)
NAME: Chandigarh University
NATIONALITY: Indian
ADDRESS: National Highway 95, Chandigarh-Ludhiana Highway, Mohali, Punjab 140413, India.

The following specification particularly describes the invention and the manner in which it is to be performed:

FIELD OF THE INVENTION

[0001] The present invention relates to an ink refilling device which allows the user to refill ink into the marker in an automated manner when determined that the concerned marker is emptied with the ink with least user intervention and avoid the wastage of the ink while refiling.

BACKGROUND OF THE INVENTION

[0002] The humans interact with each other for various day to day tasks and other need and requirements. There are many communions mode which enables the humans to communicate among themselves where different modes include verbal talking, writing, audio call or video calls. Writing is a medium of human communication that involves the representation of a language through a system of physically inscribed, mechanically transferred, or digitally represented symbols. Writing is the most traditional means to share the information among the humans from to another using the written letters. The equipments required for witting included a varying range of pen, pencils, marker and alike.

[0003] The pen is a common writing instrument that applies ink to a surface, usually paper, for writing or drawing. A marker pen, fine liner, marking pen, felt-tip pen, flow marker, sign pen, vivid, sketch pen and alike is a pen which has its own ink source and a tip made of porous, pressed fibers such as felt. A marker pen consists of a container and a core of an absorbent material. Various type of pen and markers are available which have either the refills that is attached within the concerned marker or the pan and replaced with new one after the refill which is attached with pen or marker is emptied. Some markers have refill ink which is often filled with the desired ink again and again which makes the task very tedious and time consuming. Several inventions have been developed which helps the user in refilling the desired fluid in their concerned device/equipment.

[0004] **KR20050104416A** discloses about a refill for correction pen excelling in solvent resistance and moldability and, during use or over time, permitting to easily visually check, as its content, the correction liquid whose main solvent is methylcyclohexane and the remaining amount thereof. In particular, the refill is comprised of a molding of polyamide resin obtained from a monomer having an aromatic ring or a naphthenic ring, a molding of a blend of two or more varieties of polyamide resins, or a molding of multilayer structure having two or more layers wherein the innermost layer in contact with the correction liquid is constituted of a material of polyamide resin. The application part of a refill unit to be mounted in a ballpoint pen type applicator having pressurization means interlocked with knock operation is fixed by forcing the back end of a ballpoint pen tip rotatably fitted with a ball into the front-end mounting part of an ink reservoir tube and by forcing a metal tube into, and simultaneously covering therewith, the circumferential part of the front-end mounting part of the ink reservoir tube having the ballpoint pen tip forced there into.

[0005] **JP3064291U** discloses about a Refill set of ink for marking pen which has a gap around the pen tip and makes it impossible to write on the marking pen of a container with an ink absorbing body when the ink becomes low or the ink is faded. The present invention provides a refillable (recyclable) refill set of marking pen ink by simply and easily refilling the same pen with the same ink. A small-diameter portion of a marking pen with a cap removed in a configuration including a marking pen having a gap around a pen tip and containing an ink occluding body with reduced ink and a replenishing container or a replenishing cylinder. Then, the replenishing container or the replenishing cylinder is closely fitted to replenish the ink.

[0006] As per the discussed prior art, the inventions are more focused on refilling the ink using the various means that requires a complicated machinery with refilling the pens in lot. The inventions are not focused on controlling the amount of refilling and subsequently the wastage of ink while refilling and the process

involves the trained individual to carry out the task of refilling.

[0007] In order to overcome the aforementioned drawbacks, there is a need to develop a device that allows the user to refill the marker with the desired color ink along with provision to create the multicolor inks in an automated manner wit least user interventions and controlling the refill amount to avoid the wastage of the ink while refilling.

OBJECTS OF THE INVENTION

[0008] The principal object of the present invention is to overcome the disadvantages of the prior art.

[0009] An object of the present invention is to develop a device which help the user in refilling the ink into the maker in an automated manner with least user interventions.

[0010] Another object of the present invention is to develop a device which monitors the level of refilling required in the concerned marker to avoid the wastage of the ink while refilling.

[0011] Another object of the present invention is to develop a device which is enabled with means to provide the desired color of ink along with varying mixed color of ink for refilling

[0012] Yet another object of the present invention is to develop a device which provided with illuminating means that is handy in the darker regions.

[0013] The foregoing and other objects, features, and advantages of the present invention will become readily apparent upon further review of the following detailed description of the preferred embodiment as illustrated in the

accompanying drawings.

SUMMARY OF THE INVENTION

[0014] The present invention relates to an ink refilling device which allows the user to refill the marker with the desired color ink as well as multicolor ink in automated manner with least interventions of the user avoiding the wastage of the ink while refilling.

[0015] According to an embodiment of the present invention, an ink refilling device comprises of a pen stand fixed with a slot positioned at base of a housing adapted to accommodate a pen to be refilled where a nip of the pen is positioned on the slot in an inverted position, a proximity sensor in synchronization with an artificial intelligence image capturing module is installed within the housing for detecting presence of the pen and real time ink present in the pen where a microcontroller linked with the sensor and module processes combined signals of the pen location, amount of ink and determines color and amount of ink required to be refilled within the pen, multiple electronically controlled valve (ECV) are mapped on the housing to dispense the determined amount and color of ink where the valve (ECV) is individually connected to particular chamber specific for storing a specific type of color, a receptacle configured beneath the chambers for collecting the dispensed colored ink via a pipe connected to the valve (ECV) where a stirrer is installed within the receptacle to mix the colors for obtaining the determined color that in turn is dispensed into a barrel of the pen via an electronic nozzle connected at base of the receptacle.

[0016] According to another embodiment of the present invention, the proposed device further comprises of a suction unit installed within each of the chamber and connected to the receptacle via a hose to absorb color remaining within the receptacle that pass through the hose into respective chambers after re-filling of the pen for reutilization in accordance to images processed by the module, a c-

shape clamp is connected to the housing via a telescopic rod removal and insertion of cap of the pen while filling of the ink, an automatic lightening unit with a flame torch is installed on the barrel for producing light in case of darkness detected by a Light Dependent Resistor (LDR) sensor installed on the barrel and a cleaning unit is assembled within the stand to dispense a chemical solution after re-filling of the pen to removes ink stains from the outer body of the pen.

[0017] While the invention has been described and shown with particular reference to the preferred embodiment, it will be apparent that variations might be possible that would fall within the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] These and other features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims, and accompanying drawings where:

Figure 1 illustrates a perspective view of an ink refilling device.

DETAILED DESCRIPTION OF THE INVENTION

[0019] The following description includes the preferred best mode of one embodiment of the present invention. It will be clear from this description of the invention that the invention is not limited to these illustrated embodiments but that the invention also includes a variety of modifications and embodiments thereto. Therefore, the present description should be seen as illustrative and not limiting. While the invention is susceptible to various modifications and alternative constructions, it should be understood, that there is no intention to limit the invention to the specific form disclosed, but, on the contrary, the invention is to cover all modifications, alternative constructions, and equivalents falling within the spirit and scope of the invention as defined in the claims.

[0020] In any embodiment described herein, the open-ended terms "comprising," "comprises," and the like (which are synonymous with "including," "having" and "characterized by") may be replaced by the respective partially closed phrases "consisting essentially of," consists essentially of," and the like or the respective closed phrases "consisting of," "consists of, the like.

[0021] As used herein, the singular forms "a," "an," and "the" designate both the singular and the plural, unless expressly stated to designate the singular only.

[0022] The present invention relates to an ink refilling device which allows the user to refill the marker with the desires color ink where the device is installed with means to regulate the amount to be refilled thus reducing the chances of wastage of ink while refilling and installed with mean to illuminate in the darker areas to aid the user in various manners.

[0023] Referring to Figure 1, illustrating a perspective view of an ink refilling device which comprises of a pen stand **2** fixed with a slot **3** positioned at base of a housing **1** with a proximity sensor **4** in synchronization with an artificial intelligence image capturing module **5**, multiple electronically controlled valve (ECV) **7** connected to particular chamber **6** installed within the housing **1**, a receptacle **8** configured beneath the chamber **6** via a pipe **9**, suction unit **10** installed within each of chamber **6** and connected to the receptacle **8** via a hose **11**, a c-shape clamp **12** is connected to the housing **1** and a display panel **13** installed over the housing **1**.

[0024] The device comprises of a housing **1** which is installed with a pen stand **2** that is crafted with a slot **3** to allow the user to place the pen in inverted position making the barrel of the pen facing the top from where the refilling operation is carried out. The slot **3** is vertically placed inside the pen stand **2** and the slot **3** in fabricated with polyester which enables better gripping of the pen and is easily cleanable. The housing **1** is installed with a proximity sensor **4** which is installed

in synchronization with an artificial intelligence image capturing module **5**.

[0025] The proximity sensor **4** which is able to detect the presence of nearby objects without any physical contact. The proximity sensor **4** often emits an electromagnetic field or a beam of electromagnetic radiation, and looks for changes in the field or return signal. The proximity sensor **4** determines the presence of the pen placed inside the slot. The artificial intelligence image capturing module **5** which comprises of a camera lens and a processor, wherein the rotatable camera captures multiple images of the pen and then the processor carries out a sequence of steps including pre-processing, feature extraction and segmentation.

[0026] The images captured by the artificial intelligence image capturing module **5** are send to the microcontroller which processes the images to determine real time ink present in the pen. The microcontroller determines the pen location, amount of ink and the color of ink to be filled inside the pen. Based on the determined color and amount of ink to be filled inside the pen, the microcontroller actuates the multiple electronically controlled valve (ECV) **7** which are map over the chamber **6** installed within the housing **1**.

[0027] The chamber **6** which are installed within the housing **1** stores the ink of different primary colors that is a single color including red, blue, green and alike or a mixture of color which are used for filling the pen. The housing **1** is installed with a c-shape clamp **12** though a telescopic rod utilized for removing the cap of the pen while filling of the ink. The electronically controlled valve (ECV) **7** is used to control fluid flow by varying the size of the flow passage as directed by a signal from a microcontroller. This enables the direct control of flow rate and the consequential control of process quantities such as pressure, temperature, and liquid level.

[0028] The electronically controlled valve (ECV) **7** dispenses the required amount

of ink into the pen of specified color and the operation is controlled by the microcontroller. The housing **1** is installed with a receptacle **8** placed beneath the chamber **6** filled with different colors. A receptacle **8** is container like entity which one that receives and contains something. The desired colored ink from the chamber **6** is dispensed into the receptacles **8** though pipe **9** installed between electronically controlled valves (ECV) **7** and the receptacle **8**.

[0029] When the mixed colored ink is to be filled into the pen then the respective color of ink is dispensed into the receptacles **8** then the ink in stirred using the stirrer. The stirrer is a laboratory device that employs a rotating magnetic field to cause a stir bar immersed in a liquid to spin very quickly, thus stirring it. The stirrer to mix the colors for obtaining determined color that in turn is dispensed into a barrel of the pen.

[0030] The base of the receptacle **8** is installed with an electronic nozzle is a short tube with a taper or constriction used (as on a hose) to speed up or regulate the flow of a fluid operated using a DC (Direct Current) motor. The electronic nozzle dispenses the required amount of ink into panel through the barrel portion of pen to enable refilling of the pen.

[0031] The extra left out ink in the receptacle **8** is collected into chambers **6** storing the specific color of ink though the suction unit **10**. The suction unit **10** works by atmospheric pressure where the piston is raised thus creating a partial vacuum enabling the atmospheric pressure from outside is forced into the cylinder. The suction unit **10** is installed with the chamber **6** and receptacle **8** using a hose **11** which is a flexible hollow tube designed to carry fluids from one location to another.

[0032] Based on the color of the ink as determined by the image capturing module **5**, the suction unit absorb the specific-colored ink remaining within the receptacle **8** which in turn passes though the hose **11** into respective chambers **6**

for reutilization. When a mixture of color is present in receptacle **8**, then the suction unit **10** absorbs the ink and stores it in the container installed in the housing **1**.

[0033] After the successful re-filling of the pen the microcontroller generates notification on a display panel **13** which is a basically a liquid-crystal display is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. The display panel **13** placed on the housing notifies the user to input commands regarding re-utilization of ink mixture stored within the container and chambers.

[0034] The stand **2** is installed with a cleaning unit which involves the process of removing unwanted substances, such as dirt, infectious agents, and other impurities, from an object or environment. The cleaning unit dispense a chemical solution after re-filling of the pen to removes ink stains from the outer body of the pen.

[0035] Furthermore, the barrel portion of the pen is installed with a Light Dependent Resistor (LDR) sensor which comprises of a photodiode, wherein the photodiode is capable of measuring intensity of illuminance as when beam of sunlight strike the photodiode, then the photodiode has a tendency to loosen electrons causing an electric current to flow. When the Light Dependent Resistor (LDR) sensor determines the darkness, the automatic lightening unit, specifically a flame torch is actuated to provide the user with required light.

[0036] Overall, the present inventions determine the level of refilling required and accordingly refill the marker with the desired color ink along with means to provide the multicolor ink in a regulated manner by controlling the amount of ink to be filled into the marker in an automated manner with least user intervention.

[0037] In an alternate embodiment of the present invention the device may be

installed with a moisture sensor to determine the level of moisture present in the housing which in turn may lead to thinning of the ink and subsequently alert the user regarding the level of moisture to help refilling the ink with the required moisture content.

[0038] Although the field of the invention has been described herein with limited reference to specific embodiments, this description is not meant to be construed in a limiting sense. Various modifications of the disclosed embodiments, as well as alternate embodiments of the invention, will become apparent to persons skilled in the art upon reference to the description of the invention.

We Claim:

1) An ink refilling device, characterized in that:

i) a pen stand **2** fixed with a slot **3** positioned at base of a housing **1** adapted to accommodate a pen to be refilled, wherein a nip of said pen in positioned on said slot **3** in an inverted position;

ii) a proximity sensor **4** in synchronization with an artificial intelligence image capturing module **5** installed within said housing **1** for detecting presence of said pen and real time ink present in said pen, wherein a microcontroller linked with said sensor **4** and module **5** processes combined signals of said pen location, amount of ink and determines color and amount of ink required to be refilled within said pen;

iii) multiple electronically controlled valve (ECV) **7**mapped on said housing **1**, wherein a specific valve (s) (ECV) **7**activates to dispense said determined amount and color of ink, wherein said valve (ECV) **7** is individually connected to particular chamber **6** specific for storing a specific type of color;

iv) a receptacle **8** positioned beneath said chambers **6** for collecting said dispensed colored ink via a pipe **9** connected to said valve (ECV) **7**, wherein a stirrer is installed within said receptacle **8** to mix said colors for obtaining said determined color that in turn is dispensed into a barrel of said pen via an electronic nozzle connected at base of said receptacle **8**; and

v) a suction unit **10** installed within each of said chamber **6** and connected to said receptacle **8** via a hose **11**, wherein a suction unit **10** specific to said color activates to absorb color remaining within said receptacle **8** that pass via said hose **11** into respective chamber **6 6** after re-filling of said pen for reutilization in accordance to images processed by said module **5**.

2) The device as claimed in claim 1, wherein opening and closing of said valve is controlled by said microcontroller to dispense said required amount of color within said receptacle **8**.

3) The device as claimed in claim 1, wherein a c-shape clamp **12** is connected to said housing **1** via a telescopic rod removal and insertion of cap of said pen while filling of said ink.

4) The device as claimed in claim 1, wherein said color may be a single color or a mixture of color based on which said microcontroller regulates function of said valve (ECV).

5) The device as claimed in claim 1, wherein a container is installed in said housing **1** for collecting a mixture of color if present in receptacle **8** absorbed by said suction unit **10** connected to said container.

6) The device as claimed in claim 1, wherein after re-filling of said pen, said microcontroller generates notification on a display panel **13** to notify said user, where said panel is also accessed by said user to input commands regarding re-utilization of ink mixture stored within said container.

7) The device as claimed in claim 1, wherein an automatic lightening unit, specifically a flame torch is installed on said barrel for producing light in case of darkness detected by a Light Dependent Resistor (LDR) sensor installed on said barrel.

8) The device as claimed in claim 1, wherein a cleaning unit is assembled within said stand **2** to dispense a chemical solution after re-filling of said pen to removes ink stains from the outer body of said pen.

9) The device as claimed in claim 1, wherein said slot **3** is fabricated with a polyester.



Dated this 05th March 2022

Kunal Setiya
INPA-2570
Agent for the Applicant(s)

ABSTRACT

INK REFILLING DEVICE

The present invention relates to an ink refilling device comprises of a pen stand **2** fixed with a slot **3** to accommodate a pen to be refilled is positioned in an inverted position, a proximity sensor **4** in synchronization with an artificial intelligence image capturing module **5** for detecting presence of pen and real time ink present in pen, multiple electronically controlled valve (ECV) **7** dispenses determined amount and color of ink from a particular chamber **6** specified for storing a specific type of color, a receptacle **8** for collecting dispensed colored ink through a pipe **9** where a stirrer mixes colors for obtaining determined color, ink is dispensed into a barrel of pen via an electronic nozzle, and a suction unit **10** connected to receptacle **8** via a hose **11** to absorb color remaining within receptacle **8** and into respective chambers **6** for re-filling of pen.

Ref. Figure 1