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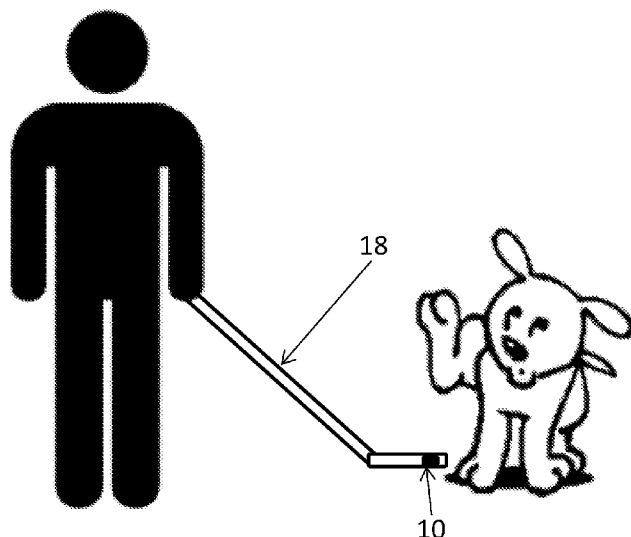


Figure 5

(57) Abstract: The present invention relates to non-invasive urinalysis portable devices, methods and systems for the collection and rapid analysis of animal urine, especially canine urine.

## **DEVICE FOR NON-INTRUSIVE AND AUTOMATED ANIMAL URINE TESTS**

### **FIELD OF THE INVENTION**

**[0001]** The present invention relates to devices, methods and systems for the collection and analysis of animal urine, especially canine urine. More particularly, the present invention provides devices, methods and systems for rapid on-the-spot and rapid point-of-care analysis of animal urine, especially canine urine.

### **BACKGROUND OF THE INVENTION**

**[0002]** Urine tests are a simple and effective tool for diagnosing multiple conditions and diseases in a patient- either human or non-human. Such conditions or diseases cause a change in the level of (increase or decrease), or the appearance of certain substances, and/or organisms, and/or biological/chemical biomarkers in the urine. In humans, urine tests are ordered for a multitude of reasons, ranging from periodic examinations, tracking during specific periods such as pregnancy, recuperation from various diseases, etc. The same basic idea holds true to urine tests in animals as well.

**[0003]** However, contrary to human, where urine collection is relatively easy, collecting urine from an animal is somewhat complicated: When one needs to collect a urine sample from an animal, one has three main options for collection: (a) cystocentesis- inserting a needle into the animal's bladder and pulling of a sample therefrom; (b) catheter- pulling a sample via a sterile tube inserted via the urinary passage; and (c) mid-stream- the most common and simplest option- entails capturing a urine sample while the animal urinates.

**[0004]** The above mentioned first two options provide the veterinarian a sterile sample by avoiding the lower urinary tract and possible exposure to the outside. However, both methods can be performed only by a skilled artisan within a sterile environment, such as a doctor's or veterinarian's office. On the contrary, the 3<sup>rd</sup> method, namely mid-stream, can be performed by any untrained pet/animal owner with the risk of getting a sample that is not free of outside contaminants, which in most cases and tests is not relevant or has little to no effect on the test

results. In addition, this mid-stream collection method is also unsanitary for the collector, which might come in contact with the animal's urine during the collection process.

**[0005]** According to the American Veterinary Medical Association, the recommended frequency for performing a urinalysis for a dog is every 6 months. The mid-stream option, being simpler and easier to perform by anyone, is more suitable for such a 6-month frequency. However, this method is somewhat complicated, scary, and messy for most dog owners, mainly since it requires collecting urine from a urinating dog which is rarely cooperative. This can be seen in the numerous instruments developed throughout the years to collect a urine sample from a dog along with reports and statistics showing that dog owners simply avoid such a urine collection.

**[0006]** The main development in this field for aiding pet owners to perform the test are urine collectors- the idea is to keep the pet, e.g. dog, on a short leash and approach it from behind without scaring it and placing a collection receptacle at the mid-stream. An example of such a urine collector is "P-Scoop", which is a simple ladle with a long handle. Another example which allows a pet to urinate indoor is the "ugodog" and other puppy-training pads / platforms.

**[0007]** However, these products and others enable only the collection of the urine and require the user to purchase an additional product for the urinalysis, such as sticks (Fig. 1). In addition, most of these products need to be washed before and after use in order to reach a certain level of sterility. In addition, some urine collectors, especially those requiring the pet to stand and urinate thereon, require first to train the pet to urinate specifically in that spot.

**[0008]** The present invention overcomes these drawbacks.

**[0009]** Table 1 below lists exemplary common elements that can be analyzed in a canine urinalysis and their usefulness:

| Test                                              | Usefulness                                                                                           |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Blood / Leukocytes / White blood cells / Nitrite  | Indicator of urinary tract infections                                                                |
| Glucose                                           | Indicator of diabetics or Cushing's disease                                                          |
| Ketones                                           | Indicator of Ketoacidosis (produced when fat is used for energy)                                     |
| Protein                                           | An early indicator of kidney disease                                                                 |
| Specific gravity (Urine concentration)            | Indicative of dehydration and general kidney function                                                |
| pH                                                | Changes due to several reasons such as nutrition and bladder inflammation (should be around 6.5-7.0) |
| Bilirubin / Uro-bilinogen                         | Indicative of liver problems                                                                         |
| Casts                                             | Indicative of kidney damage                                                                          |
| Bacteria                                          | Indicating a bladder infection                                                                       |
| Crystals                                          | Indicative of a bladder stone                                                                        |
| Creatinine / protein ratio                        | Indicative of proteinuria                                                                            |
| Cortisol / creatinine ratio                       | Indicative of hyperadrenocorticism                                                                   |
| Urine gamma-glutamyl transferase (GGT)            | Indicative of acute nephrotoxicity                                                                   |
| (N-acetyl- $\beta$ -d-glucosaminidase) NAG enzyme | Indicator of renal tubular injury, diabetes and renal damage                                         |
| Fractional excretion of potassium                 | Indicative of hypokalemia and renal damage                                                           |
| Fractional excretion of magnesium                 | Indicative of hypomagnesemia and renal damage                                                        |
| Fractional excretion of sodium and phosphorus     | Indicative of hypophosphaturia and renal damage                                                      |
| Pregnancy                                         | Indicating pregnancy                                                                                 |
| Cancer                                            | Indicator of various types of cancers                                                                |

**[0010]** As noted above, after collecting the urine mid-stream, several products were developed to enable the pet owner to perform urinalysis. Some products provide more targeted tests such as the "cranimals" PawCheck products, which detect the presence of blood, glucose, and proteins, and urinary tract infections; and the AlphaTrak diabetes/glucose level monitor. On the other end of the spectrum, tests that are more complete were developed, such as ThePetCheckup kit (Fig. 1) which screens for a multitude of issues and further provides an application for analyzing the visual indications obtained from the test results.

**[0011]** However, these analyzing products must be used only after collecting the urine with a dedicated urine collecting device as detailed above.

**[0012]** As such, a need exist for an easy and simple device and method for collecting an animal's urine mid-stream without mess and practice, and further for immediate analyzing the collected urine for different parameters. In addition, a need exist for a simple device that enables easy communication with the veterinarian and/or for the generation and updating of pet/animal electronic health records (EHR).

**[0013]** Attracting or influencing the behavior of animals, such as dogs, is not new: pheromones, chemicals and other attractants/repellants have been and are in use for multitude reasons, such as for controlling the pee area of adult dogs. Another example is puppy/dog training pads.

**[0014]** US 6,531,145 describes a method and device for luring, repelling and training animals by using scents. US 7,051,681 specifically describes an article useful for attracting canine. US 5,058,533 and US 5,415,131 disclose animal litter that is capable of attracting animals, e.g. for urinating and defecate at a specific area. US 5,287,826 describes a method and kit for encouraging dogs to urinate and defecate at a predetermined area using  $\beta$ -ionone.

**[0015]** Pheromones are chemicals produced by an animal (or plant) to affect the behavior or physiology of another member of the same species. Examples of known pheromones are aliphatic n-acetates, such as n-pentyl acetate; aliphatic n-fatty acids, such as n-butyric acid; alkyl hydroxybenzoates, such as methyl p-hydroxybenzoate and ethyl p-hydroxybenzoate; substituted phenols, such as 2, 6-dichlorophenol; benzoic acid derivatives, such as p-hydroxybenzoic acid, 4-hydroxy-3-n-ethoxybenzaldehyde and methylparaben; salicylates, such as methyl salicylate; and linoleic acid (i.e. omega-6 fatty acid).

**[0016]** Currently, "territory marking related" pheromones are used in house training (a.k.a. potty training) for puppies and adult dogs, see for instance US 4,263,873, US 5,415,131 and US 7,051,681, the contents of which is incorporated herein by reference.

**[0017]** Other pheromones have also been considered as possible dog attractants. For instance, sex hormones. In addition, anal sac excretion and urine comprise various active substances which have been shown to attract canines at different levels.

**[0018]** Some commercial puppy pads are treated with a fresh grass scent to encourage puppies to use them. Several compounds associated with such a grass scent have been suggested

to aid in canine attraction, such as  $\beta$ -ionone ( $C_{13}H_{20}O$ ), abietic acid or decarboxylated abietic acid, which are the active substances in rosin oil, and methyl salicylate.

[0019] The presence of urea, ammonia or its derivatives, at a certain point, indicates to the animal that other animals have urinated at that point before, and stimulates said animal to urinate at that specific spot.

[0020] As such, a need exist for an improved animal attraction composition, especially canine attraction composition for aiding in both potty training as well as for other training purposes, such as for attracting and stimulating the animal to urinate at a specific spot.

## SUMMARY OF THE INVENTION

[0021] In certain embodiments, the present invention provides a non-invasive urinalysis portable device **10** for the carrying out of rapid diagnostic tests on animal urine samples, comprising: (i) an analysis strip **13** for carrying out said diagnostic tests, on which test result can be read; (ii) at least one opening **14** for displaying said test results; and (iii) means **12** for the collection of said urine and forwarding same to said analysis strip **13**, wherein said analysis strip **13** comprises at least one testing reagent and/or sensor.

[0022] In specific embodiments, said non-invasive urinalysis device is designed to be placed onto any surface, to attract said animal to urinate thereon, to collect said animal's urine and for forwarding same to said analysis strip **13** for urinalysis.

[0023] In other embodiments, the present invention provides a method for rapid urinalysis of animal urine samples by using the non-invasive urinalysis device **10** of the invention, said method comprising: (a) placing and/or attaching said urinalysis device **10** at/on a desired location; (b) attracting said animal to said device **10** by releasing said animal attraction composition from said attractant component **15** if present; (c) collecting and directing said animal's urine to said analysis strip **13** for urinalysis; (d) reading the urinalysis test results through said at least one opening **14** and analyzing same; (e) optionally, determining whether said analyzed data is indicative of occurrence of a health condition; and (f) optionally, following up on test result with an action such as communicating with the veterinarian, scheduling a follow-up exam, etc.

[0024] In certain embodiments, the present invention provides a non-invasive urinalysis portable urinalysis system, said system comprising: (i) the non-invasive urinalysis portable device **10** of the invention; (ii) a mobile device comprising (i) a camera, (ii) one or more processors, and (iii) a memory; (iii) a database; and (iv) optionally, at least one illumination source.

[0025] In certain embodiments, the present invention provides a canine attraction composition comprising any combination of: (a) at least one pheromone; (b) at least one of ammonia and urea, or derivatives thereof; and (c) at least one of:  $\beta$ -ionone ( $C_{13}H_{20}O$ ); abietic acid; decarboxylated abietic acid; rosin oil; and methyl salicylate, wherein said composition is suitable for attracting canines and stimulate urination.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0026] **Fig. 1** is a picture of a urinalysis test stick of the prior art and analysis card thereof.

[0027] **Figs. 2A-2D** are schematic drawings of four possible configurations of the urinalysis device of the invention (upper view).

[0028] **Figs. 3A-3C** are schematic drawings of three possible configurations of the urinalysis device of the invention (bottom view).

[0029] **Figs. 4A-4D** illustrate four possible placement manners of the urinalysis device of the invention for an animal to urinate thereon.

[0030] **Fig. 5** illustrates one possible urine collection manner using the urinalysis device of the invention placed at the end of an elongated stick.

## DETAILED DESCRIPTION OF THE INVENTION

[0031] It is highly recommended by veterinarians to perform routine pet/animal urinalysis in order to monitor the pet's health condition. However, due to the complexity of urine collection, most pet/animal owners refrain or ignore such recommendations. As such, many developments have been made to assist pet/animal owners to collect the pet's urine and subsequently test it. Nevertheless, as explained above, the presently known devices require certain amount of practice from the pet/animal owner, as well as require multiple steps, including washing the urine

collection device before and after use. In addition, the known devices pose the risk of unintentional contact with the pet's urine. The present invention aims at solving all the disadvantages of the presently known devices and urinalysis kits. Thus, the present invention provides methods and devices for sampling pet's urine and immediate analysis thereof. The present invention further provides methods and devices for canine attraction and subsequent urination thereon in a dedicated location/spot, as well as for immediate analysis thereof.

**[0032]** In certain embodiments, the present invention provides a non-invasive urinalysis portable device **10** for the carrying out of rapid diagnostic tests on animal urine samples, without the need of collecting the urine and transferring it to a dedicated urinalysis unit, said device **10** comprises: (i) an analysis strip **13** for carrying out said diagnostic tests, on which test result can be read; (ii) at least one opening **14** for displaying said test results, said opening may be either a part of the device (see e.g. **14** in Fig. 2A) or the entire face of the device (see e.g. **14** in Figs. 2B & 2C); and (iii) means **12** for the collection of said urine and forwarding same to said analysis strip **13**, wherein said analysis strip **13** comprises at least one testing reagent and/or sensor, and wherein said non-invasive urinalysis device is designed to be placed onto any surface, to attract said animal to urinate thereon, to collect said animal's urine and for forwarding same to said analysis strip **13** for urinalysis. In a specific embodiment, said device **10** comprises multiple repetitive areas for performing the urinalysis, so that it is sufficient to contact only part of the device **10** with the urine in order to obtain complete urinalysis, thereby reducing the risk of the urine missing the testing area.

**[0033]** The term "collection" and its abbreviations, refers to the action of collecting and/or sampling any amount of urine by using the urinalysis device **10** of the invention itself. Such collection is performed without exposing the user to the risk of unintentionally touching the pet's urine.

**[0034]** In certain embodiments, the urinalysis portable device **10** of the invention further comprises a permeable upper surface **12** for enabling the urine to pass through and towards said analysis strip **13**. Said permeable upper surface may be made of any suitable material, such as cotton, polymer, plastic, nylon, etc. In a specific embodiment, said permeable upper surface may also direct the urine towards said analysis strip **13**.

[0035] In a specific embodiment, the perimeter of the urinalysis device **10** of the invention has lifted edges **19** enabling collecting and containing an amount of urine sufficient for performing the urinalysis.

[0036] The term "sufficient amount" as used herein means any amount of urine that is needed for performing the urinalysis. In specific embodiments, a sufficient amount is as little as 0.5 cc urine. In other embodiments, a sufficient amount is 1, 1.5, 2, 2.5, 3, 5, 7.5, 10 cc urine or more.

[0037] In certain embodiments, in the urinalysis device **10** of the invention, the urine is forwarded to said analysis strip **13** for urinalysis, by any suitable autonomous means, either passive or active. Non-limiting examples of such autonomous passive means are a layer of absorbing material **12**, or a layer of micro-tubes. Alternatively, one may use active means, i.e. power-activated means, such as pumps and vacuum. Accordingly, in certain embodiments, the urinalysis device **10** of the invention further comprises a component or layer designed to direct the urine towards said analysis strip **13**, such as microtubules, microfilaments, channels, etc. In a specific embodiment, the urinalysis device **10** of the invention may further comprise an active urine means for polling or pushing the urine towards said analysis strip **13**, such as a pump sucking or pushing the urine.

[0038] In a specific embodiment, the urinalysis portable device **10** of the invention is disposable, and is designed for a single use.

[0039] In certain embodiments, the urinalysis portable device **10** of the invention further comprises an attractant component **15** containing an animal attraction composition. In a specific embodiment, said attractant component **15** is not an integral part of said urinalysis device **10**, but an add-on. Such an add-on may be in any suitable form, such as a sticker. Alternatively, said add-on may be a completely separate component, such as a breakable vial which its content is spilled onto said device **10** upon breakage of the vial; a spray canister, which is sprayed onto said device **10**; or an ointment which is rubbed against or applied on said urinalysis device **10**.

[0040] In certain embodiments, the urinalysis device **10** of the invention further comprises an adhesive layer **16** or attachment means **17** for placing said device onto any surface or location and in any angle. Said adhesive layer **16** may cover the entire back surface of said urinalysis device **10** (see e.g. Fig. 3A) or may be located at specific points thereon (see e.g. Fig. 3B). Non-

limiting examples of such an adhesive layer which enable attaching said urinalysis device **10** onto any surface, either smooth or rough, and in any angle and configuration, are: adhesives, glue, two-sided scotch tape, etc. Alternatively, one may use attachment means such as magnets, for attaching said device **10** to metal surfaces such as fire hydrate; nails/pins for attaching said device **10** to wood surfaces such as trees, wood floors, etc.; or stakes for attaching said device **10** to the soil/ground. As illustrated in Figs. 4A-4D, the urinalysis device **10** of the invention may be used in various situations. For instance, it may simply be placed onto the ground (Fig. 4A); leaned on designated attachment means **17** (Fig. 4B); adjusted to curved or bent surfaces such as stairs (Fig. 4C); or vertically attached to a wall or tree (Fig. 4D). In a specific embodiment, illustrated in Fig. 5, the urinalysis device **10** of the invention may further comprise as an integral part, or an add-on, a dedicated elongation device/unit **18**, which enable the user to hold the urinalysis device **10** at any desired angle and location underneath the urinating animal/dog, thereby collecting its urine. One example of such an elongation device/unit **18** is a stick configuration (Fig. 5).

[0041] Accordingly, in certain embodiments, the urinalysis device **10** of the invention is configured to enable the user to attach it onto a designated elongation device **18**, thereby enabling the user to place said device **10** beneath the urinating animal from a distance for collection of urine mid-stream. In a specific embodiment, the urinalysis device **10** comprises as an integral part thereof said elongation device **18**. In yet another specific embodiment, said elongation device **18** is extractable, thus enabling easy carrying around when folded, and simple opening, i.e. extraction to full length, before use.

[0042] In a specific embodiment, the urinalysis device **10** of the invention is designed to test canine urine. In another specific embodiment, the urinalysis device **10** of the invention is designed to test feline urine. In another specific embodiment, the urinalysis device **10** of the invention is designed to test ungulate urine, such as horses, cattle and pigs. In another specific embodiment, the urinalysis device **10** of the invention is designed to test weasel urine.

[0043] In certain embodiments, the analysis strip **13** in the urinalysis device **10** of the invention comprises at least one testing reagent and/or sensor designed to detect the presence and/or amount of and/or analyze at least one of: blood, leukocytes, white blood cells, nitrite,

glucose, ketones, protein, specific gravity (urine concentration), pH, bilirubin, casts, bacteria, and crystals.

[0044] In certain embodiments, the urinalysis device **10** of the invention further comprises a power source and a transmitter for transmitting the urinalysis data to, e.g., a mobile device or to a remote computer, or both. In a specific embodiment, the urinalysis device **10** of the invention further comprises a processor and a memory for analyzing the urinalysis data. Said analyzed data can then be either displayed onto said device **10**, or transmitted to e.g., a mobile device or to a remote computer, or both.

[0045] In certain embodiments, the urinalysis device **10** of the invention further comprises an indicator configured to indicate proper loading and/or sufficient amount of collected urine sample, and/or that the urinalysis has concluded. This enables the user to verify that the animal has urinated on the device and that sufficient amount of urine has been collected for analysis, and that the urinalysis is complete, thereby reducing to a minimum the possibility of misreading's due to insufficient urine for analysis. In another embodiment, the urinalysis device **10** of the invention further comprises an indicator configured to indicate the presence of at least one faulty test in said analysis strip **13**, thereby enabling the user to avoid faulty test results arising due to a bad analysis strip. In a specific embodiment, said indicator may indicate the user that the device **10** is faulty prior to its use, thereby enabling the user to return and replace the device **10**.

[0046] In yet another specific embodiment, the urinalysis device **10** of the invention further comprises a “timer” test designed to let the pet/animal owner that the urinalysis in the analysis strip **13** has been concluded and that it is possible to scan the results for analysis.

[0047] The present invention also provides rapid urinalysis of animal urine samples methods by using a urinalysis device **10** according to the invention. Thus, in certain embodiments, the present invention provides a method for rapid urinalysis of animal urine samples by using a non-invasive urinalysis device **10** of the invention, said method comprising: (a) placing and/or attaching said urinalysis device **10** at or on a desired location, wherein said location may be flattened such as a pavement (see, e.g., Fig. 4A), curved or bent such as un-even ground, or may be vertical such as a tree (see, e.g., Fig. 4D), horizontal such as the ground or in any angle such as stairs or slope (see, e.g., Figs. 4C and 4B); (b) optionally attracting said animal to said device **10** by releasing said animal attraction composition from said attractant component **15** if present,

according to said component **15**, i.e. if said component is a vial- by breaking the vial, if said component is a spray canister- by spraying, if said component is wrapped- by removing the plastic wrapper therefrom, if said component is a can- by opening the can, etc.; (c) collecting and directing said animal's urine to said analysis strip **13** for urinalysis. This collection and direction of the urine can be done either by passive means such as gravity or capillary force, or by active means such as pumps; (d) reading the urinalysis test results through said at least one opening **14** and analyzing same; and (e) determining whether said analyzed data is indicative of occurrence of a health condition. It should be noted that the reading and analyzing of the test results may be done by the user by any suitable means, e.g. by simple comparison, i.e. by visually comparing the results shown in said opening **14** to a data sheet or results-table which interpret the visual results into a prognosis. Alternatively, said reading and analyzing may be carried out by using a computer/smartphone after capturing or scanning an image of the results, e.g., with a camera or scanner of a mobile device or a camera and comparing the captured or scanned image with a database, wherein said database may be, e.g., on a cloud or in the mobile device itself, e.g. in a dedicated application. In a specific embodiment, the collected results data and/or the analyzed data may also be sent to a veterinarian for further analysis and or follow-up and console.

**[0048]** In certain embodiments, said scanned results show up on the mobile device's screen and may be sent to cloud based hosts for incorporation in the pet's health records and overall statistics. In another embodiment, said scanned test results and/or the analyzed test results are sent to the pet's veterinarian, urgently in case something was found.

**[0049]** In certain embodiments, said database may be a remotely located database located in a cloud or a remote computer, and may further contain data of previous test results, of the tested animal as well as of other animals of the same species, for statistical comparison, and generation and updating of pet/animal electronic health records (EHR). Accordingly, in certain embodiments, the urinalysis method of the invention may further comprise a step of sending a response from said remote computer or smartphone to the user showing statistical analysis and/or health recommendations, and/or send alerts due to specific possible health conditions. For instance, if the urine pH level is too high or low, the application may instruct the user to take the animal to the veterinarian and/or perform immediate precautions measures. Another example

may be when an abnormal results is obtained, the application may contact the veterinarian for council and/or arrange for an emergency (or regular) appointment.

**[0050]** As noted above, said urinalysis device **10** of the invention may comprise a power source and a transmitter, thereby enabling transmitting the test results to the user's mobile device or a remote computer or cloud for analysis, or directly to the animal's veterinarian, which can then send instructions to the pet/animal owner regarding recommendations for nutrition changes, recommendations to perform additional follow-up tests, setting up an appointment with the veterinarian, etc.

**[0051]** In certain embodiments of the method of the present invention, the term "reading" of the urinalysis test results means capturing an image of said analysis strip **13** with a camera or scanner of a mobile device. Non-limiting examples of such mobile devices are smartphone, tablet, laptop, and a digital camera. In certain embodiments, said captured image is processed using one or more processors contained in the mobile device, e.g. using a dedicated application; or said captured image is transferred to a remote computer/cloud with a processor and a memory for processing; or said captured image is processed using a combination of one or more processors contained in the mobile device and a remote computer/cloud with a processor and a memory for processing.

**[0052]** In a specific embodiment, the urinalysis device **10** may comprise at least one processor and memory, and the test results are processed within the device **10** and the analyzed results are either displayed thereon or transmitted, e.g., to the user's computer or mobile device and/or to the pet's veterinarian. In certain embodiments, the method of the invention further comprises transmitting data regarding geographical location and time-stamp data of the urinalysis test results. Accordingly, in certain embodiment, the rapid urinalysis method of the invention further comprises a step of processing the transferred test results in said remote computer and returning the processed test results to the user's mobile device or computer, or to the veterinarian's computer/email, via any suitable manner, e.g. via wireless telecommunication.

**[0053]** In another embodiment, the rapid urinalysis method of the invention further comprises a step of statistical analysis of the test results, e.g. for identifying anomalies.

**[0054]** In certain embodiments, the urinalysis device **10** and method for rapid urinalysis of animal urine samples according to the invention are based on passive communication, such as a

barcode or specific test color arrangement that is scanned or photographed by a camera, e.g., of a mobile device or a digital camera. Alternatively, they may be based on active communication, such as a transmitter located within said urinalysis device **10** that sends the test results to, e.g. said mobile device or a remote computer having a processor and a memory. In both cases, the analysis may be based on a comparison with an external database located, e.g., on a cloud, on said remote computer, or on said mobile device. In a specific embodiment, the urinalysis device **10** and method for rapid urinalysis of animal urine samples according to the invention will provide immediate and visible response/results, e.g., by changing the color of said analysis strip **13** or any other detector therein.

**[0055]** In certain embodiments, the present invention further provides a non-invasive urinalysis portable urinalysis system, said system comprising: (a) a non-invasive urinalysis portable device **10** of the invention; (b) a mobile device comprising (i) a camera, (ii) one or more processors, and (iii) a memory; (c) a database; and (d) optionally, at least one illumination source. In certain embodiments, said camera is used to capture an image of the test results as appearing in said analysis strip **13**.

**[0056]** In certain embodiments, said mobile device in the system of the invention is a laptop computer, a smartphone, a tablet, a digital camera or any other device having a camera, a processor and a memory.

**[0057]** As explained above, said database may be located either on said mobile device or in a cloud or a remote computer, and may comprise additional statistical data and prior results of both the tested animal and other animals of the same species.

**[0058]** In certain embodiments, the urinalysis methods, devices and systems according to the present invention utilize three main types of canine attractants: pheromones, attractive grass like scent, and urine simulating smell (including ammonia). Accordingly, in certain embodiments, the present invention provides a canine attraction composition comprising any combination of: (a) at least one pheromone; (b) at least one of ammonia and urea, or derivatives thereof; and (c) at least one of the following grass scent compounds:  $\beta$ -ionone ( $C_{13}H_{20}O$ ); abietic acid; decarboxylated abietic acid; rosin oil; and methyl salicylate, wherein said composition is suitable for attracting canines and optionally also stimulate urination.

**[0059]** In certain embodiments, said at least one pheromone in the canine attraction composition of the invention is: aliphatic n-acetates; aliphatic n-fatty acids; alkyl hydroxybenzoates; phenol and substituted phenols; benzoic acid and derivatives thereof; salicylates; linoleic acid; androgens; estrogens; dimethyl disulphide; hexanal; acetic acid; propanoic acid; 2-methylpropanoic acid; n-butanoic acid; 2-methylbutanoic acid; 3-methylbutanoic acid; n-pentanoic acid; 4-methylpentanoic acid; 2-piperidone; pyrrole; acetophenone; 2-furanmethanol; acetamide; formamide; n-hexanoic acid; dimethyl sulfone; 2-pyrrolidinone; indole; benzeneacetic acid; n-tetradecanoic acid; 1-methyl-2,4-imidazolidinedione; n-hexadecanoic acid; n-octadecanoic acid; acetic anhydride; or N,N-dimethylurea; and 2-methyl-2-propenoic acid, or any analog thereof. In a specific embodiment, said at least one pheromone is benzeneacetic acid, 3-methylbutanoic acid or acetic acid.

**[0060]** In certain embodiments, said at least one ammonia or urea in the canine attraction composition of the invention is: ammonia, ammonium ion ( $\text{NH}_4^+$ ), or bicarbonate ion ( $\text{HCO}_3^-$ ).

**[0061]** In a specific embodiment, the canine attraction composition of the invention comprises (a) at least one of benzeneacetic acid, 3-methylbutanoic acid or acetic acid; (b) at least one of ammonia, ammonium ion ( $\text{NH}_4^+$ ), and bicarbonate ion ( $\text{HCO}_3^-$ ); and (c) at least one of  $\beta$ -ionone, abietic acid, decarboxylated abietic acid, and methyl salicylate.

**[0062]** The canine attraction composition of the invention may be used as the canine attractant composition of the urinalysis device of the invention, if present.

**[0063]** As explained above, the canine attraction composition of the invention may be manufactured in any suitable form, such as liquid, ointment, emulsion, or cream. In addition, the canine attraction composition of the invention may be used or applied onto or together with the urinalysis device of the invention in any suitable way, including, but not limited to spraying from a pressure spray canister, spreading an ointment or cream, breaking a vial containing the liquid composition, etc.

**[0064]** In a specific embodiment, the present invention provides a non-invasive urinalysis portable device **10** for the carrying out of rapid diagnostic tests on animal urine samples, comprising: (a) an analysis strip **13** for carrying out diagnostic tests comprising at least one testing reagent and/or sensor designed to detect the presence and/or amount of at least one of: blood, white blood cells, nitrite, glucose, ketones, protein, pH, bilirubin, bacteria, and crystals,

wherein said test results can be read from said analysis strip **13**; (b) at least one opening **14** for displaying said test results; (c) means **12** for the collection of said urine and forwarding same to said analysis strip **13**; and (d) an elongation means **18**, optionally as a separate unit to which said device **10** is attached; wherein said non-invasive urinalysis device is designed to be placed underneath said animal as it urinates to collect its urine without disturbing the animal's routine, for forwarding same to said analysis strip **13** for urinalysis, and for analyzing and displaying the urinalysis test results. In yet another specific embodiment, the user may use a smartphone or any other mobile device with a dedicated application for scanning / photographing and subsequently analyzing the urinalysis test results.

**[0065]** In a specific embodiment, the present invention provides a non-invasive urinalysis portable device **10** for the carrying out of rapid diagnostic tests on canine's urine samples, comprising: (a) an attractant component **15** containing a canine attractant composition as defined above; (b) an analysis strip **13** for carrying out diagnostic tests comprising at least one testing reagent and/or sensor designed to detect the presence and/or amount of at least one of: blood, white blood cells, nitrite, glucose, ketones, protein, pH, bilirubin, bacteria, and crystals, wherein said test results can be read from said analysis strip **13**; (c) at least one opening **14** for displaying said test results; (d) means **12** for the collection of said urine and forwarding same to said analysis strip **13**; and (e) an adhesive layer **16** or attachment means **17**; wherein said non-invasive urinalysis device is designed to be placed onto any surface and at any angle, to attract said canine to urinate thereon, to collect said canine's urine and for forwarding same to said analysis strip **13** for urinalysis, without disturbing the canine routine.

## **EXAMPLES**

### **Example 1**

#### **Preliminary preparations**

**[0066]** Several of-the-shelf canine attractant sprays and materials were purchased and tested for their efficiency in canine attraction and/or urination stimulation. Then, preferred materials which demonstrated the most promising results were analyzed, e.g., by high pressure liquid

chromatography (HPLC), gel chromatography (GC), and/or liquid chromatography-mass spectroscopy (LC-MS) to identify the exact components therein.

**[0067]** In addition, real canine urine and artificial urine in several aging stages were tested for their efficiency in canine attraction and/or urination stimulation, and further analyzed as above, e.g., by high pressure liquid chromatography (HPLC), gel chromatography (GC), and/or liquid chromatography-mass spectroscopy (LC-MS) to identify the exact components therein.

**[0068]** After determining the exact components of each material and/or urine, the pure chemical compounds were purchased or synthesized and were used to prepare different combinations of a canine attractant composition to be tested for their efficiency in attracting canines as well as testing their efficiency in stimulating canine urination.

## **Example 2**

### **Determining the components of the attraction composition**

**[0069]** Several mixtures comprising a combination of the following three types of canine attractants were prepared:

a) pheromones, selected from: aliphatic n-acetates, such as n-pentyl acetate; aliphatic n-fatty acids, such as n-butyric acid; alkyl hydroxybenzoates, such as methyl p-hydroxybenzoate and ethyl p-hydroxybenzoate; substituted phenols, such as 2, 6-dichlorophenol; benzoic acid derivatives, such as p-hydroxybenzoic acid, 4-hydroxy-3-n-ethoxybenzaldehyde and methylparaben; salicylates, such as methyl salicylate; linoleic acid (i.e. omega-6 fatty acid); and sex hormones such as naturally occurring and synthetic androgens and estrogens, and their analogs; dimethyl disulphide; hexanal; acetic acid; propanoic acid; 2-methylpropanoic acid; n-butanoic acid; 2-methylbutanoic acid; 3-methylbutanoic acid; n-pentanoic acid; 4-methylpentanoic acid; 2-piperidone; pyrrole; acetophenone; 2-furanmethanol; acetamide; formamide; n-hexanoic acid; dimethyl sulfone; phenol; 2-pyrrolidinone; benzoic acid; indole; benzeneacetic acid; n-tetradecanoic acid; 1-methyl-2,4-imidazolidinedione; n-hexadecanoic acid; n-octadecanoic acid; acetic anhydride; N,N-dimethylurea; and 2-methyl-2-propenoic acid; From the above examples, benzeneacetic acid, 3-methylbutanoic acid and acetic acid, the last two found in both anal sac excretion and urine, seem to have high attraction potential.

- b) attractive grass-like scent, selected from:  $\beta$ -ionone ( $C_{13}H_{20}O$ ); abietic acid; decarboxylated abietic acid; rosin oil; and methyl salicylate; and
- c) urine simulating smell, selected from: ammonia; ammonium ion ( $NH_4^+$ ); and bicarbonate ion ( $HCO_3^-$ ).

### Example 3

#### Preparing a sticker

[0070] One configuration of the “hands free”, home administered canine urine test sticker of the invention was prepared, comprising three main elements:

1. A sticker which can be placed / stuck onto a multitude of surfaces; and
2. An analysis strip **13** positioned in a way that enables easy visualization by a camera, said analysis strip **13** comprises a set of reagents testing for elements in the collected urine sample.

[0071] After the canine urinated on the sticker, an image of the test results was captured by a camera, e.g. of a mobile device, and analyzed by, e.g., a mobile application or a computer program.

### Example 4

#### Preparing a sticker with an attractant

[0072] A canine urine test sticker of the invention was prepared as described in Example 1 above, with the addition of a canine attractant to incentivize the canine to urinate directly onto the sticker.

### Example 5

#### Urinalysis

[0073] The current recommendation is to conduct urinalysis for canines every 6 months. However, this is mainly due to the troubles such as test entails. Accordingly, due to the simplicity and low cost of the present urinalysis device, it will be possible to conduct such urinalysis tests every three months or even every month.

**[0074]** Per test, the canine owner will take one or more of the urinalysis devices of the invention when walk their dog. Once arriving a suitable location, the canine owner can stick or place one urinalysis device onto a suitable platform, such as a wall, a tree, or any other surface, that the dog tends to / is comfortable urinating on. After placing/sticking the urinalysis device, the dog owner releases or applies the canine attractant on the device, if present, to incentivize the dog to urinate specifically on the device.

**[0075]** Alternatively, when using the urinalysis device with an elongation means, the canine owner can simply extends the device under the urinating dog as it urinates.

**[0076]** A “timer” test will also exist on the device to let the dog owner know when the urinalysis is complete and it is possible to scan the results. Once scanned, the result will show up on the mobile device's screen and may also be sent to cloud based hosts for incorporation in the dog's health records and overall statistics. Optionally, the test results will also be sent to the dog's veterinarian, urgently in case something was found.

**CLAIMS**

1. A non-invasive urinalysis portable device for the carrying out of rapid diagnostic tests on animal urine samples, comprising:

- an analysis strip for carrying out said diagnostic tests, on which test result can be read;
- at least one opening for displaying said test results; and
- means for sampling/collecting said urine and forwarding same to said analysis strip,

wherein said analysis strip comprises at least one testing reagent and/or sensor, and

wherein said non-invasive urinalysis device is designed to be placed onto any surface, and/or be attached to an elongation device that will enable the collection of a sufficient amount of said animal's urine and for forwarding same to said analysis strip for urinalysis.

2. The urinalysis device of claim 1 further comprising an elongation device, or configured to be attached onto such an elongation device, for enabling placing said device beneath said urinating animal without the risk of touching the urine.

3. The urinalysis device of claim 1 further comprising an adhesive layer or attachment means for placing said device onto any surface or location and in any angle.

4. The urinalysis device of any one of claims 1 to 3, wherein the tested urine is canine urine.

5. The urinalysis device of any one of claims 1 to 4, wherein said analysis strip comprises at least one testing reagent and/or sensor designed to detect the presence and/or amount of and/or analyze at least one of: blood, leukocytes, white blood cells, nitrite, glucose, ketones, protein, specific gravity (urine concentration), pH, bilirubin, casts, bacteria, and crystals.

6. The urinalysis device of claim 1 further comprising an attractant component containing an animal attraction composition.

7. The urinalysis device of claim 6, wherein said attractant component is not an integral part of said urinalysis device, but an add-on.
8. A method for rapid urinalysis of animal urine samples by using a non-invasive urinalysis device of any one of the preceding claims, said method comprising:
- a) placing and/or attaching said urinalysis device at/on a desired location;
  - b) attracting said animal to said device by releasing said animal attraction composition from said attractant component if present;
  - c) collecting and directing a sufficient amount of said animal's urine to said analysis strip for urinalysis;
  - d) once the urinalysis test is complete, reading the urinalysis test results through said at least one opening and analyzing same;
  - e) optionally, determining whether said analyzed data is indicative of occurrence of a health condition; and
  - f) optionally, following up on test result with an action such as communicating with the veterinarian, scheduling a follow-up exam, etc.
9. The method of claim 8, wherein said reading the urinalysis test results means capturing an image of said analysis strip with a camera or scanning it with scanner of a mobile device.
10. The method of claim 9, wherein said captured or scanned image is processed using one or more processors contained in the mobile device, optionally via a dedicated application or program.
11. The method of claim 9, wherein said captured or scanned image is transferred to a remote computer with a processor and a memory for processing.

12. The method of claim 9, wherein said captured or scanned image is processed using a combination of one or more processors contained in the mobile device and a remote computer with a processor and a memory for processing.
13. The method of claim 11 or 12, further comprising processing the transferred test results in said remote computer and returning the processed test results to the user's mobile device.
14. The method of claim 13, further comprising a step of identifying anomalies, e.g. by statistical analysis of the test results.
15. A non-invasive urinalysis portable urinalysis system, said system comprising:
- a non-invasive urinalysis portable device as defined in any one of claims 1-7;
  - a mobile device comprising a camera or scanner and optionally one or more processors and a memory;
  - a database; and
  - optionally, at least one illumination source.
16. The system according to claim 15, wherein said camera or scanner is used to capture an image of the test results in said analysis strip.
17. The system of claim 15, wherein said mobile device is a smart phone, a laptop computer, a tablet or any other device having a camera, a processor and a memory.
18. A canine attraction composition comprising any combination of:
- a) at least one pheromone;
  - b) at least one of ammonia and urea, or derivatives thereof; and
  - c) at least one of:  $\beta$ -ionone ( $C_{13}H_{20}O$ ); abietic acid; decarboxylated abietic acid; rosin oil; and methyl salicylate,
- wherein said composition is suitable for attracting canines and stimulate urination.

19. The urinalysis device of any one of claim 6, wherein said canine attractant composition is the composition of claim 18.

20. A non-invasive urinalysis portable device for the carrying out of rapid diagnostic tests on animal urine samples, comprising:

a) an analysis strip for carrying out diagnostic tests comprising at least one testing reagent and/or sensor designed to detect the presence and/or amount of at least one of: blood, white blood cells, nitrite, glucose, ketones, protein, pH, bilirubin, bacteria, and crystals, wherein said test results can be read from said analysis strip;

b) at least one opening for displaying said test results;

c) means for the collection of said urine and forwarding same to said analysis strip; and

d) an elongation means optionally as a separate unit to which said device is attached;

wherein said non-invasive urinalysis device is designed to be placed underneath said animal as it urinates, to collect its urine without disturbing the animal's routine, for forwarding same to said analysis strip for urinalysis, and for analyzing and displaying the urinalysis test results.

|                  |        |               |                                        |                    |                 |                             |
|------------------|--------|---------------|----------------------------------------|--------------------|-----------------|-----------------------------|
| LEU-KOCCYTE      | 2 MIN  | NEGATIVE      | TRACE<br>15                            | SMALL<br>70        | MODERATE<br>125 | LARGE<br>500                |
| NITRITE          | 60 sec | NEGATIVE      | POSITIVE (ANY DEGREE OF PINK COLOR)    |                    |                 |                             |
| URO-BILINOGEN    | 60 sec | NORMAL<br>0.1 | 2                                      | 4                  | 8               |                             |
| PROTEIN          | 60 sec | NEGATIVE      | TRACE<br>30                            | ++<br>100          | +++<br>300      | >2000<br>++++               |
| pH               | 60 sec | 5.0           | 6.0                                    | 6.5                | 7.0             | 7.5 8.0 8.5                 |
| BLOOD            | 60 sec | NEGATIVE      | NON-HEMOLYZED<br>TRACE                 | HEMOLYZED<br>TRACE | SMALL<br>+      | MODERATE<br>++ LARGE<br>+++ |
| SPECIFIC GRAVITY | 45 sec | 1.000         | 1.010                                  | 1.020              | 1.030           | 1.040 1.050 1.060           |
| KETONE           | 40 sec | NEGATIVE      | TRACE<br>5                             | SMALL<br>15        | MODERATE<br>40  | LARGE<br>80 160             |
| BILIRUBIN        | 30 sec | NEGATIVE      | SMALL<br>+ MODERATE<br>++ LARGE<br>+++ |                    |                 |                             |
| GLUCOSE          | 30 sec | NEGATIVE      | 100                                    | 250                | 500             | 1000 >2000                  |

Figure 1

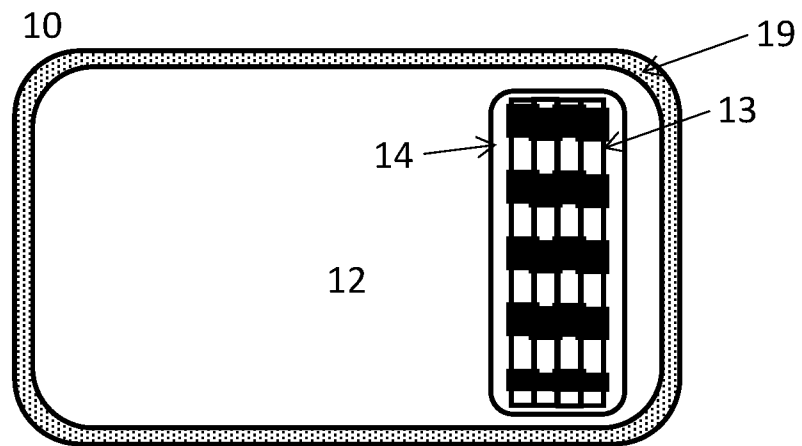


Figure 2A

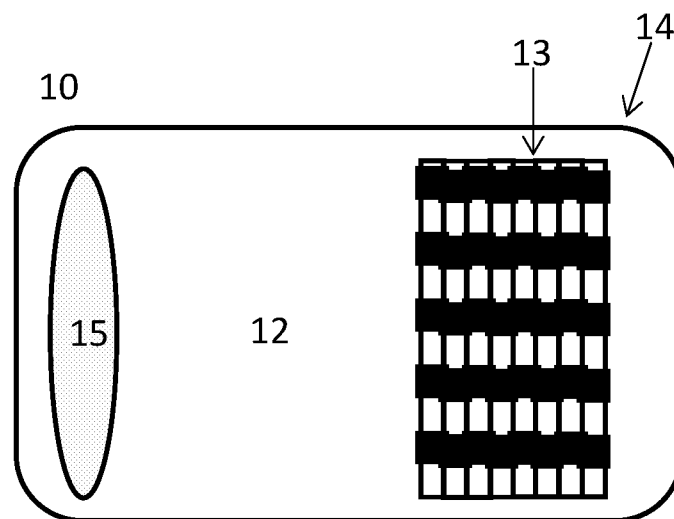


Figure 2B

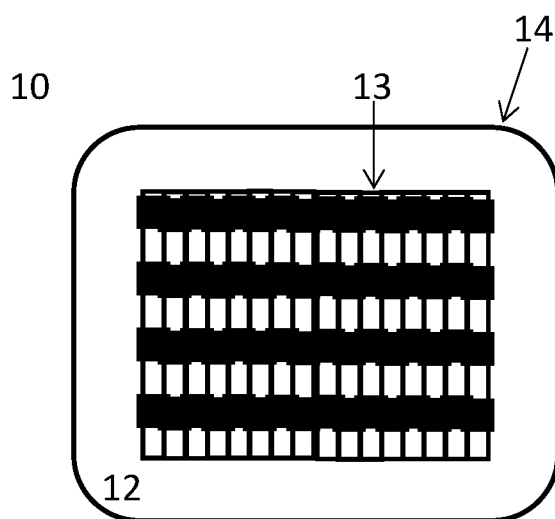


Figure 2C

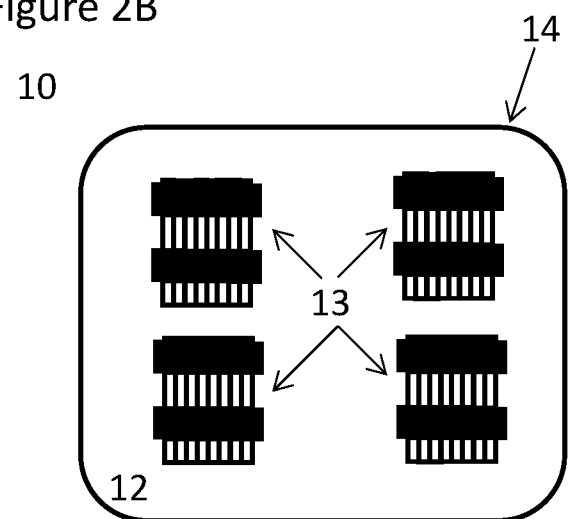


Figure 2D

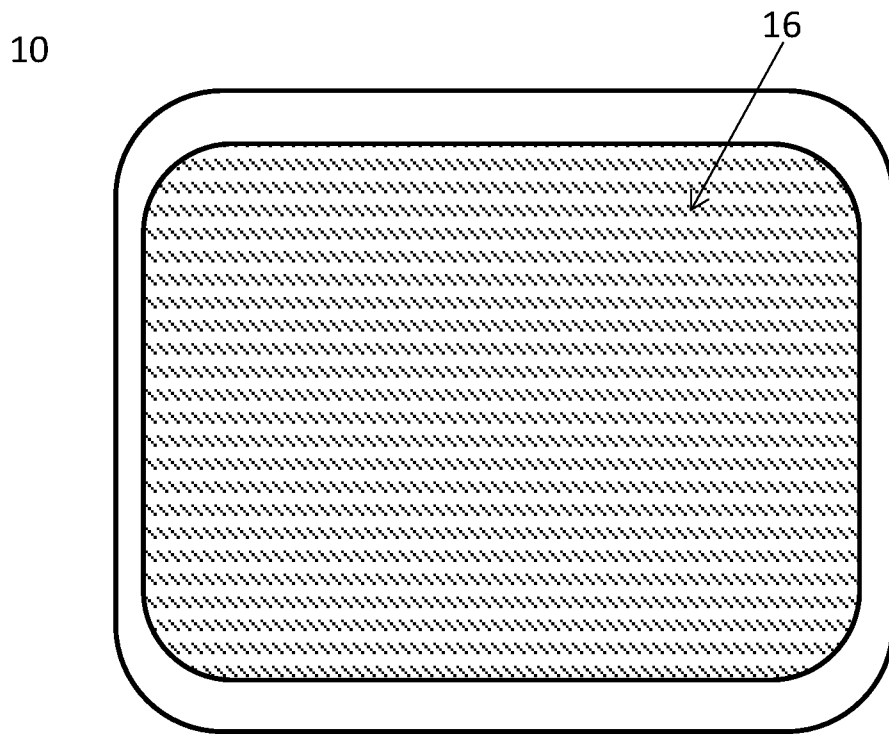


Figure 3A

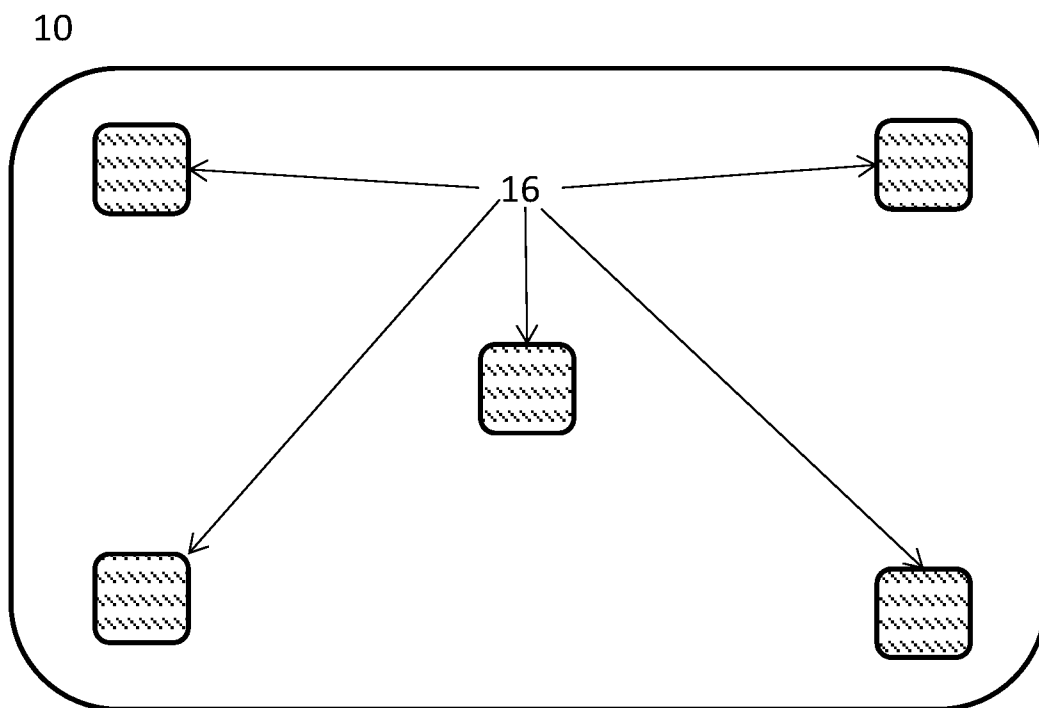


Figure 3B

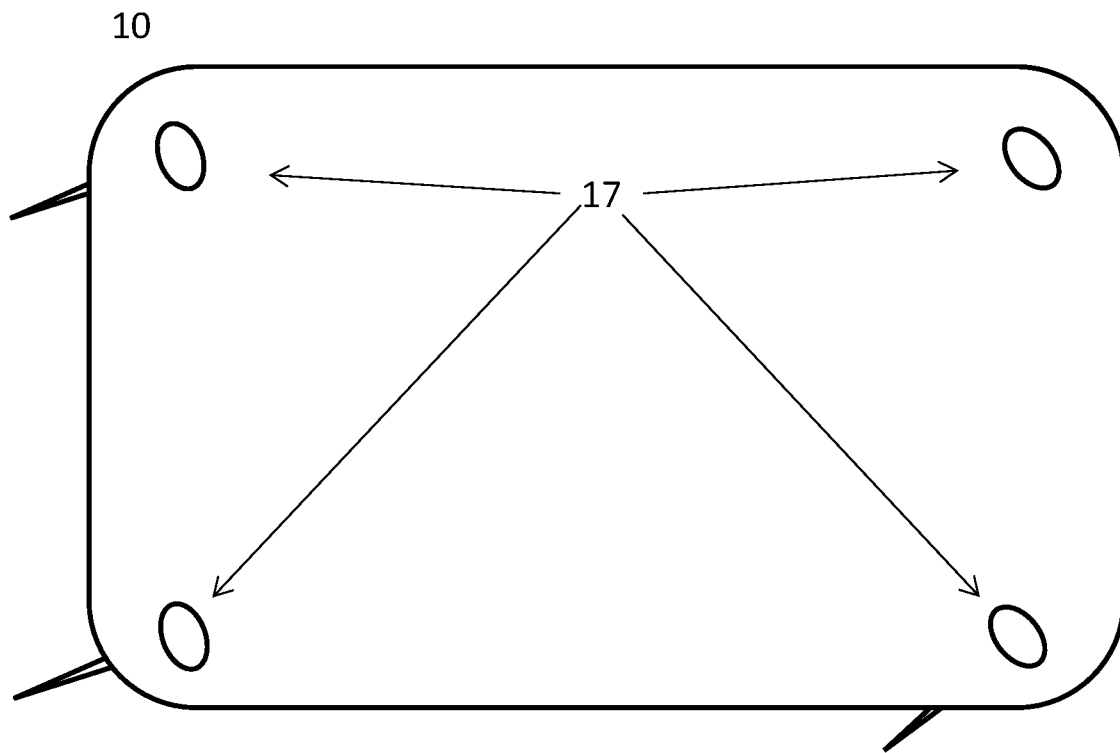


Figure 3C

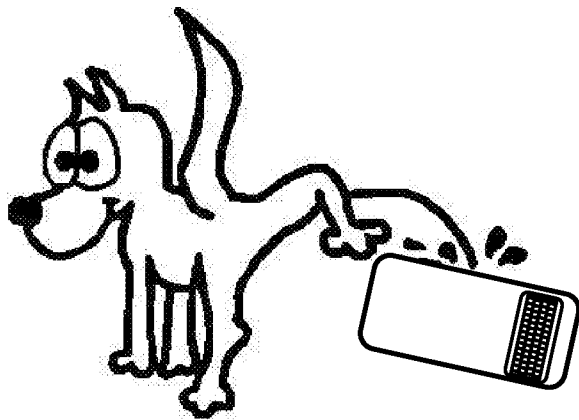


Figure 4A

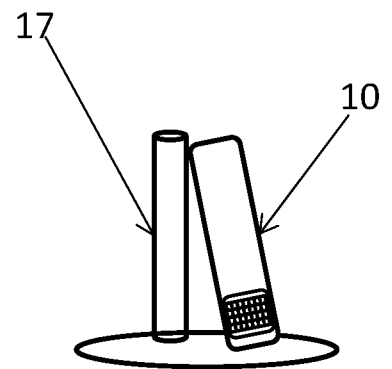


Figure 4B

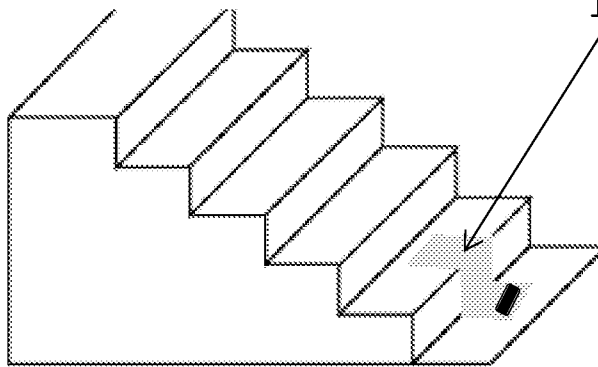


Figure 4C

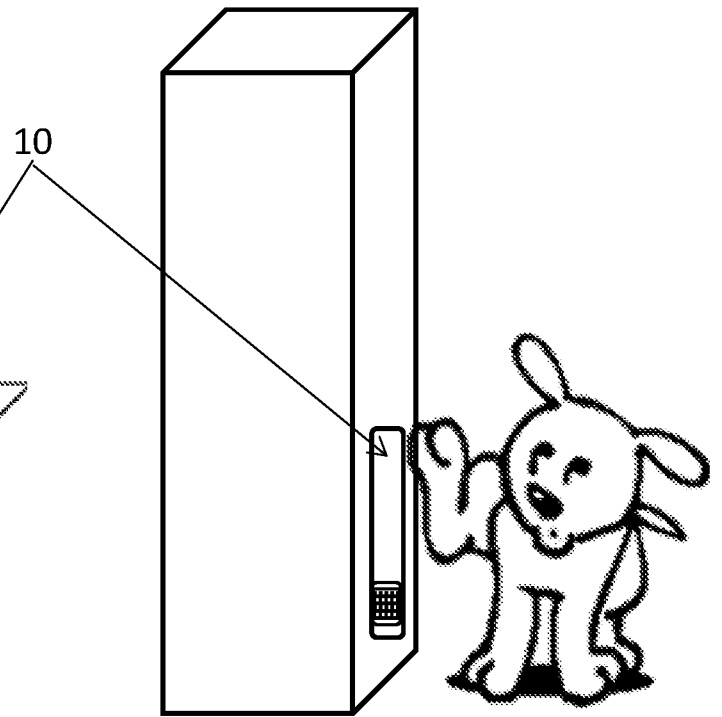


Figure 4D

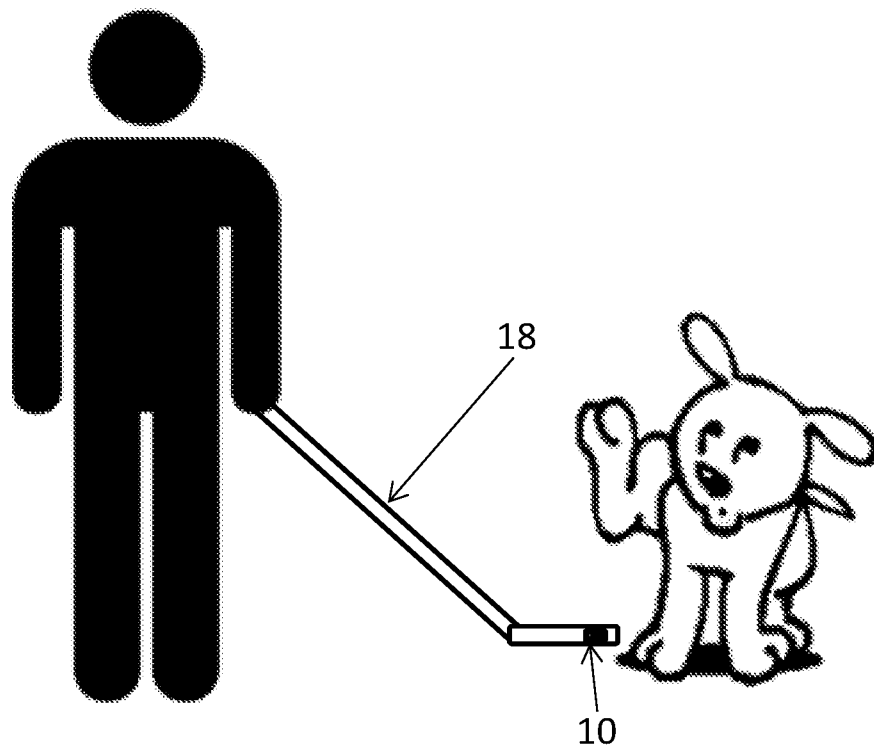


Figure 5

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL2016/050815

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>IPC (2016.01) A01K 29/00<br><br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                |                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <b>B. FIELDS SEARCHED</b><br><br>Minimum documentation searched (classification system followed by classification symbols)<br>IPC (2016.01) A01K<br><br>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br><br>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>Databases consulted: Esp@cenet, Google Patents, Google Scholar, FamPat database                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                |                                                                                   |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                |                                                                                   |
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| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"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<br>"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<br>"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<br>"&" document member of the same patent family |                                                                                                |                                                                                   |
| Date of the actual completion of the international search<br>21 Nov 2016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                | Date of mailing of the international search report<br>21 Nov 2016                 |
| Name and mailing address of the ISA:<br>Israel Patent Office<br>Technology Park, Bldg.5, Malcha, Jerusalem, 9695101, Israel<br>Facsimile No. 972-2-5651616                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                | Authorized officer<br>ORENSHTEIN-VILENSKY Liya<br><br>Telephone No. 972-2-5651662 |

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International application No.

PCT/IL2016/050815

| C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                   |                       |
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