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(54) **Title:** LOCKABLE INTRAMEDULLARY PIN SYSTEM FOR ANIMALS

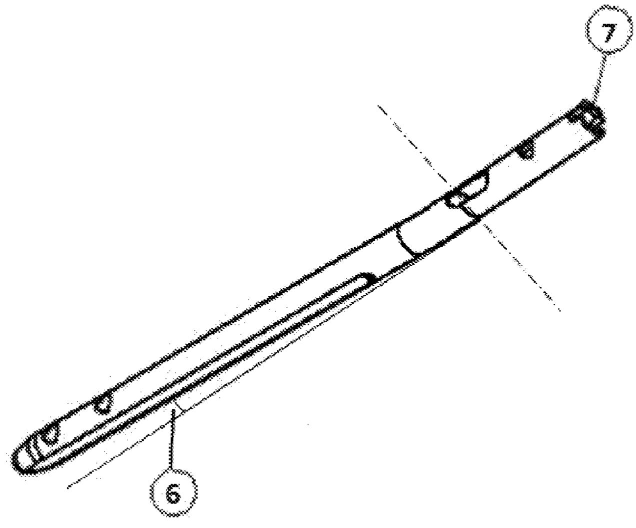

Figure – 7

(57) **Abstract:** The present invention relates to a lockable intramedullary pin system developed to be used in diaphyseal fractures occurring due to traumatic, pathological or congenital problems in animals. The present invention particularly relates to a lockable intramedullary pin system designed for the quadruped, and particularly for feline and canine animal groups, in order to fully compensate functionality losses originating from long bones.

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LOCKABLE INTRAMEDULLARY PIN SYSTEM FOR ANIMALS

Technical Field of the Invention

The present invention relates to a lockable intramedullary pin system developed to be used in diaphyseal fractures occurring due to traumatic, pathological or congenital problems in animals.

The present invention particularly relates to a lockable intramedullary pin system designed for the quadruped, and particularly for feline and canine animal groups, in order to fully compensate functionaliy losses originating from long bones.

Prior Art

The quadrupeds, and particularly feline and canine animal groups, occasionally suffer from diaphyseal fractures occurring due to traumatic, pathological or congenital problems.

In the state of the art, diaphyseal fractures observed in the quadrupeds around the world are tried to be healed by providing integrity by means of standard pin and plaquing methods. Using plaque and pin systems which are mainly designed for humans in animals yields no successful results due to differences between humans and animals in terms of linear treading angles of long bones, osseous cortex structures and biomechanical cell structure of animals. Therefore, it is unlikely to use pin systems produced for humans in animals. Additionally, animals are usually inclined to use their operated limbs shortly after the surgery. Moreover, it is unlikely to stabilize animals and/or limit their movements by using splints. Therefore, in order to ensure that the operated limb may be used immediately after the surgery, there is necessity towards a system that allows for tolerating all loads imposed on long bone in all directions and particularly by fully inhibiting the rotational movement in distal fragments, thereby eliminating all factors preventing the reunion of bones, and that is capable of carrying the entirety of the process passing until the union tissue is formed, thereby allowing animals to use their operated limbs immediately after the surgery.

In the state of the art, veterinary physicians generally utilize Steinmann or Schanz pins for the diaphyseal fractures of the quadrupeds. In addition to not permitting distal locking, these pins are also characterized by circular and straight-line forms. Because of their form they cannot ensure fixation in distal fragment and cannot be in the direction of biomechanical axis. Therefore, healing of fractures may not realize, or functionality losses may occur. Moreover, using these pins results in inevitable complications depending on areas in which they are applied, for instance if said pins are used in femur, they cause sciatic pressure, if they are used in tibia, they cause joint damage or if they are used in humerus, they cause bicep tendon damage. While complications cause delay in patient's bone healing, various processes such as limb loss may come into the picture due to the possibility of potential muscle atrophy or nerve and tendon injuries.

Currently, a lockable pin system for animals is not available around the world. Existing systems are developed for humans, and the present invention introduces differences in terms of system of operation, dimensional transitions and biomechanical design characteristics.

Consequently, many different surgical treatment methods are utilized in diaphyseal fractures as disclosed above. However, no systems like the inventive intramedullary pin system for animals which allows them to return to their active lives in a short span of time or patent applications in respect thereof were determined as a result of the searches conducted in the related literature.

Objects of the Invention

In order to deliver solutions to problems existing in the state of the art as disclosed above, the present invention relates to a lockable intramedullary pin system for animals, and for feline and canine animal groups in particular, wherein the inventive lockable intramedullary pin system for animals ensures the reunion of bones by fixating them in segmental or nonsegmental fractures in long bones of quadrupeds, and it is fully compatible with biomechanical and static load forces of animals.

The object of the inventive lockable intramedullary pin system for animals is to ensure that animals may use their operated limbs immediately after the surgery and return to their active lives through healing diaphyseal fractures thereof by balancing biomechanical and static load forces by means of the fully compatible structure of the present invention.

Another object of the present invention is to fully compensate functionality losses particularly stemming from long bones by means of the method utilized.

Thus, integrity of segmental or nonsegmental fractures occurring in long bones of quadruped animals will be provided in a faster and more efficient manner and functionality losses will be prevented by means of the present invention.

Detailed Description of the Invention

In order to achieve the objects of the present invention, the inventive lockable intramedullary pin system and components thereof developed for animals, and designed to be used in the reconstruction of diaphyseal defects occurring for any reason in quadrupeds, and particularly in feline and canine animal groups, are illustrated in annexed figures,

wherein;

FIGURE 1 illustrates the lateral view of the femur pin.
FIGURE 2 illustrates the intramedullary channel angulation at femur and humerus pin.
FIGURE 3 illustrates the intramedullary feeding channel of femur and humerus.
FIGURE 4 illustrates the bottom oblique view of femur and humerus pin.
FIGURE 5 illustrates the anteroposterior angle at the tibia pin.
FIGURE 6 illustrates the intramedullary feeding channel in tibia pin.
FIGURE 7 illustrates the crista rotation angle at tibia pin.

Reference Numerals

1. Locking Compression Screw Hole
2. Intramedullary Channel Angulation
3. Intramedullary Feeding Channel
4. Intramedullary Channel Contact Surface

5. Tibia Anteroposterior Angle
6. Crista Rotation Angle
7. Eminentia Lock Screw Area

The inventive lockable intramedullary pin system developed for animals primarily comprises the elements of locking compression screw hole (1), intramedullary feeding channel (3) and eminentia lock screw area (7). The inventive lockable intramedullary pin system for animals renders the use of said pin system in femur and humerus bones possible by means of comprising intramedullary channel angulation (2) illustrated in Figure 2, and intramedullary channel contact surface (4) illustrated in Figure 4, and further renders the use of said pin system in tibia possible by means of comprising tibia anteroposterior angle (5) illustrated in Figure 5, and crista rotation angle (6) illustrated in Figure 7.

Locking compression screw hole (1) which is located on femur, humerus and tibia pins, is situated on pins in order to allow the use of locking compression screw that ensures the fracture line compression. Upon mounting the locking compression screw to locking compression screw hole (1), the fracture line is entirely fixated during surgery, and accordingly all loads imposed on femur are transferred from one cortex to another. Intramedullary channel angulation (2) which is the angulation between femur or humerus entry point and the line, varies between the range of 7° and 9°. Intramedullary feeding channel (3) which is situated on femur, humerus and tibia pins, ensures the flow of the bone marrow fluid within the bone. Intramedullary channel contact surface (4) located on femur and humerus pins allows said pins to be accurately positioned in the inner surface of the bone. Said intramedullary channel contact surface (4) which is hardened using 0.2 µm titanium coating and roughened accordingly, is the intraosseous retaining area. Anteroposterior tibia angle (5) which is situated on the tibia pin, is the angulation between the joint surface of the tibia and the shaft and is in the range of 9° and 13°. Crista rotation angle (6) on the tibia pin is unique to the quadrupeds, and represents the outward rotation angle made by tibia, wherein said angle is in a range between 2.55° and 3.45°. Anatomically, intercondylaris eminentia is the location at the anterior and lateral portion of anterior tibial spine and is together with anterior cruciate ligament (ACL). The inventive lockable intramedullary pin system for animals comprises an eminentia lock screw area (7) which allows for engaging femur, humerus and tibia pins with eminentia.

Pins designed for femur may be manufactured in different dimensions in compliance with structures of aforementioned bones, wherein pins designed for femur may have a diameter range of 3 mm - 4 mm - 6 mm - 8 mm, and a length range of 70 mm - 90 mm - 110 mm - 130 mm - 150 mm - 170 mm - 190 mm - 210 mm - 220 mm - 230 mm. Pins designed for femur have a slope of 5 degrees towards the anteroposterior direction at the 1/3 distal femur of quadrupeds, and feline and canine animal groups in particular, and perfectly correspond to anatomic axis in femora. Distal and proximal locking systems are compatible with varying dimensions of nails and are processed in body form having the maximum load carrying capacity.

Pins designed for humerus may be manufactured in different dimensions in compliance with the structure of humerus bone, wherein pins designed for humerus bone may have a diameter range or 3 mm - 4 mm - 6 mm - 8 mm and a length range of 70 mm - 90 mm - 110 mm - 130 mm - 150 mm - 170 mm. Humerus pin is scaled in compliance with humerus cyclic intramedullary structures of quadrupeds, and for feline and canine animal groups in particular. While the humerus pin is capable of performing a rotation of 4 degrees, it is also angulated by 3 degrees in anteroposterior direction in distal area of 20 mm.

Pins designed for tibia may be manufactured in different dimensions in compliance with the structure of tibia bone, wherein pins designed for humerus bone may have a diameter range or 3 mm - 4 mm - 6 mm - 8 mm and a length range of 70 mm - 90 mm - 110 mm - 130 mm - 150 mm - 170 mm. With regards to tibia pins, the angulation between the tibia entry point and medullary line of feline and canine animal groups, is 7° and this angle transition is situated at 1/3 proximal of the nail. Distal and proximal locking systems are compatible with varying dimensions of nails and are processed in body form having the maximum load carrying capacity.

The tibia pin is designed to be manufactured in different dimensions in compliance with the osseous structure of tibia, wherein the diameter of said tibia pin is in a range of 3 mm - 4 mm - 6 mm - 8 mm, and the length of said tibia pin is in a range of 70 mm - 90 mm - 110 mm - 130 mm - 150 mm - 170 mm. With regards to tibia pins, the angulation between the tibia entry point and medullary line of feline and canine animal groups in particular, is 7° and this angle transition is situated at 1/3 proximal of the nail. Distal and proximal locking systems are compatible with varying dimensions of nails and are processed in body form having the maximum load carrying capacity.

CLAIMS

1. A lockable intramedullary pin system developed for animals **characterized in that**, it comprises; at least one locking compression screw hole (1), and at least one eminentia lock screw area (7).
2. A lockable intramedullary pin system developed for animals according to Claim 1 **characterized in that**, it comprises at least one intramedullary channel angulation (2), and at least one intramedullary channel contact surface (4) wherein said contact surface is an intraosseous retaining area that is both hardened and roughened.
3. A lockable intramedullary pin system developed for animals according to Claim 1 **characterized in that**, it comprises at least one tibia anteroposterior angle (5), and at least one crista rotation angle (6).
4. Intramedullary channel angulation (2) according to Claim 2 **characterized in that**, it is in range between 7° and 9°.
5. Tibia anteroposterior angle (5) according to Claim 3 **characterized in that**, it is in a range between 9° and 13°.
6. Crista rotation angle (6) according to Claim 3 **characterized in that**, it is in a range between 2.55° and 3.45°.

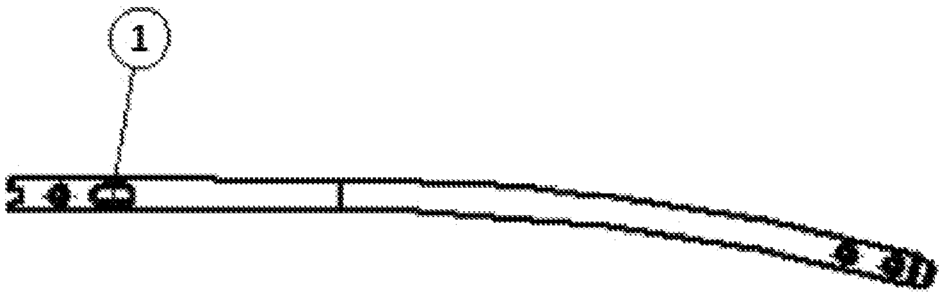

Figure – 1

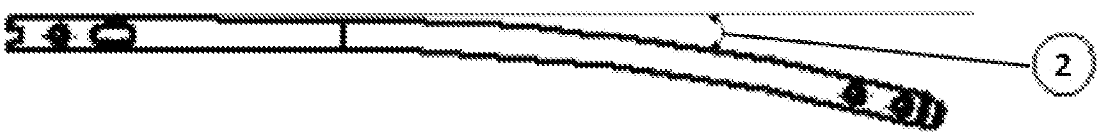

Figure – 2

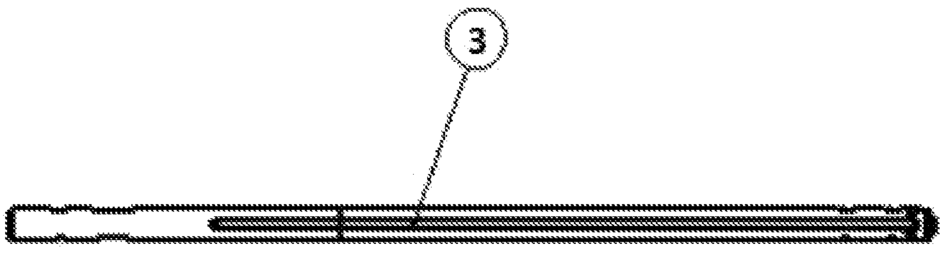

Figure – 3

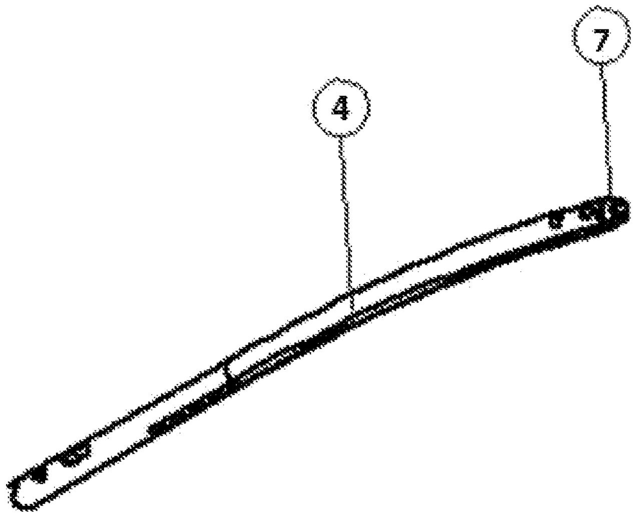

Figure – 4

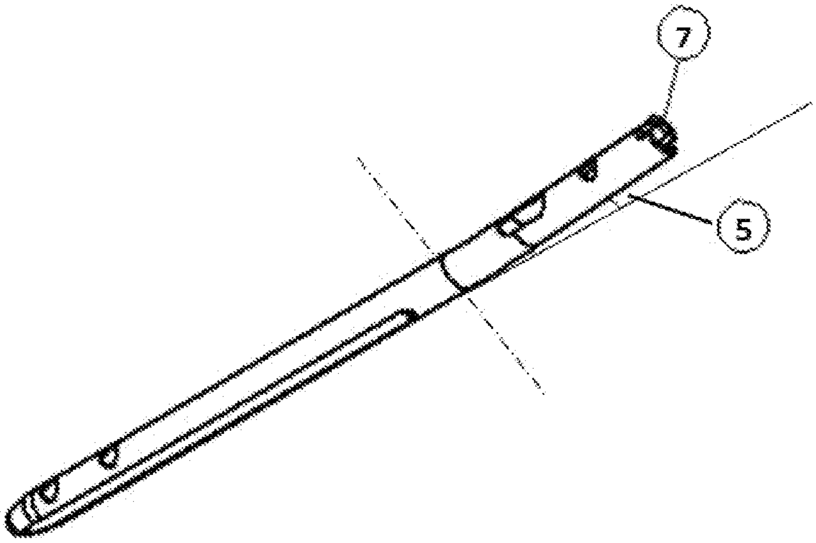

Figure – 5

Figure – 6

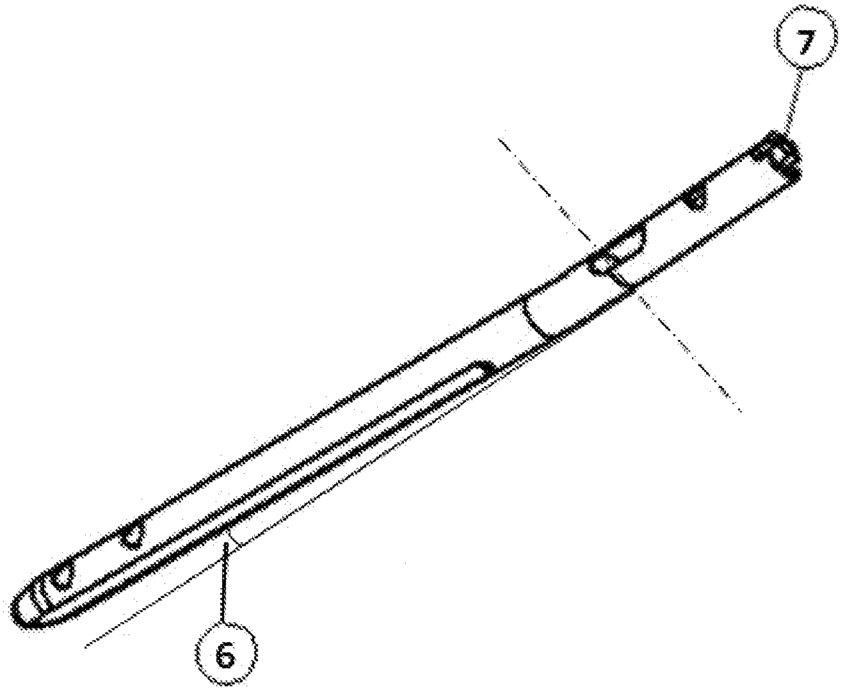

Figure – 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/TR2020/050290

A. CLASSIFICATION OF SUBJECT MATTER

A61B 17/72 (2006.01)i

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)

A61B 17/72

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006084997 A1 (MICHIGAN STATE UNIVERSITY A MI [US]) 20 April 2006 (2006-04-20) Abstract, par.0009, 0145-0175 figure 1 -17	1-6
X	US 5489284 A (SMITH & NEPHEW RICHARDS INC [US]) 06 February 1996 (1996-02-06) Abstract, col.6-8 figure 1 -3	1-6
X	US 2002111629 A1 (PHILLIPS JONATHAN [US]) 15 August 2002 (2002-08-15) Abstract, par. 0010-0047; Figure 1-13	1-6
X	US 2008125818 A1 (SIDEBOTHAM CHRISTOPHER G [US]) 29 May 2008 (2008-05-29) Abstract, par. 0032-0054, figure 1-9	1-6

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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