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F. E. ALLEN & R. H. DANFORTH.

STEERING MECHANISM.

(Application filed Dec. 17, 1900.)

(No Model.)

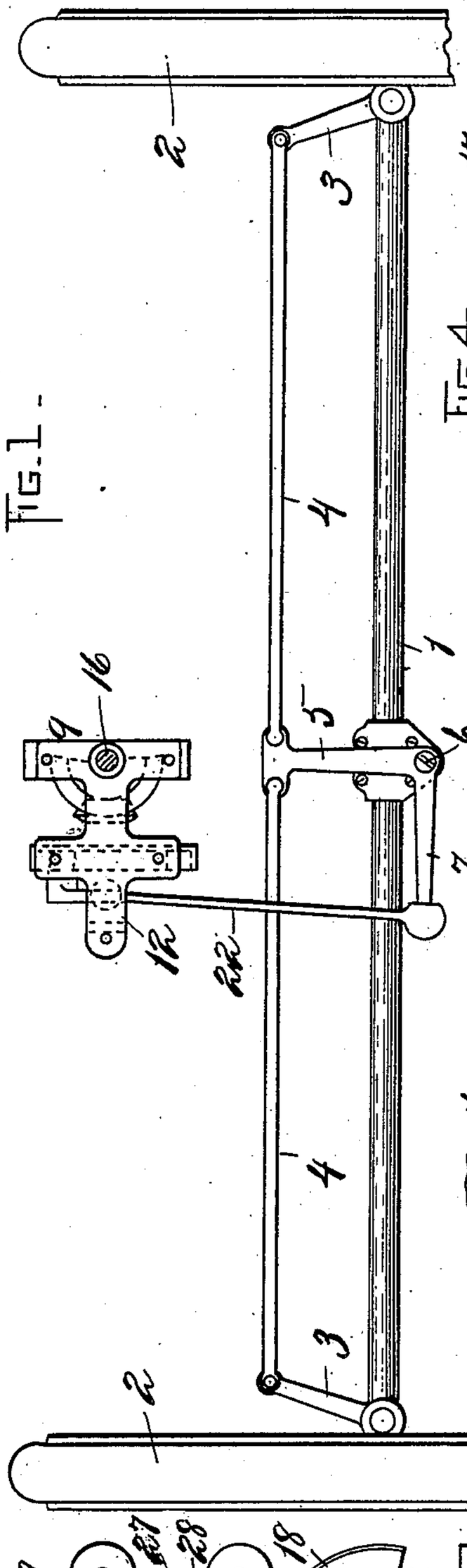

FIG. 1.

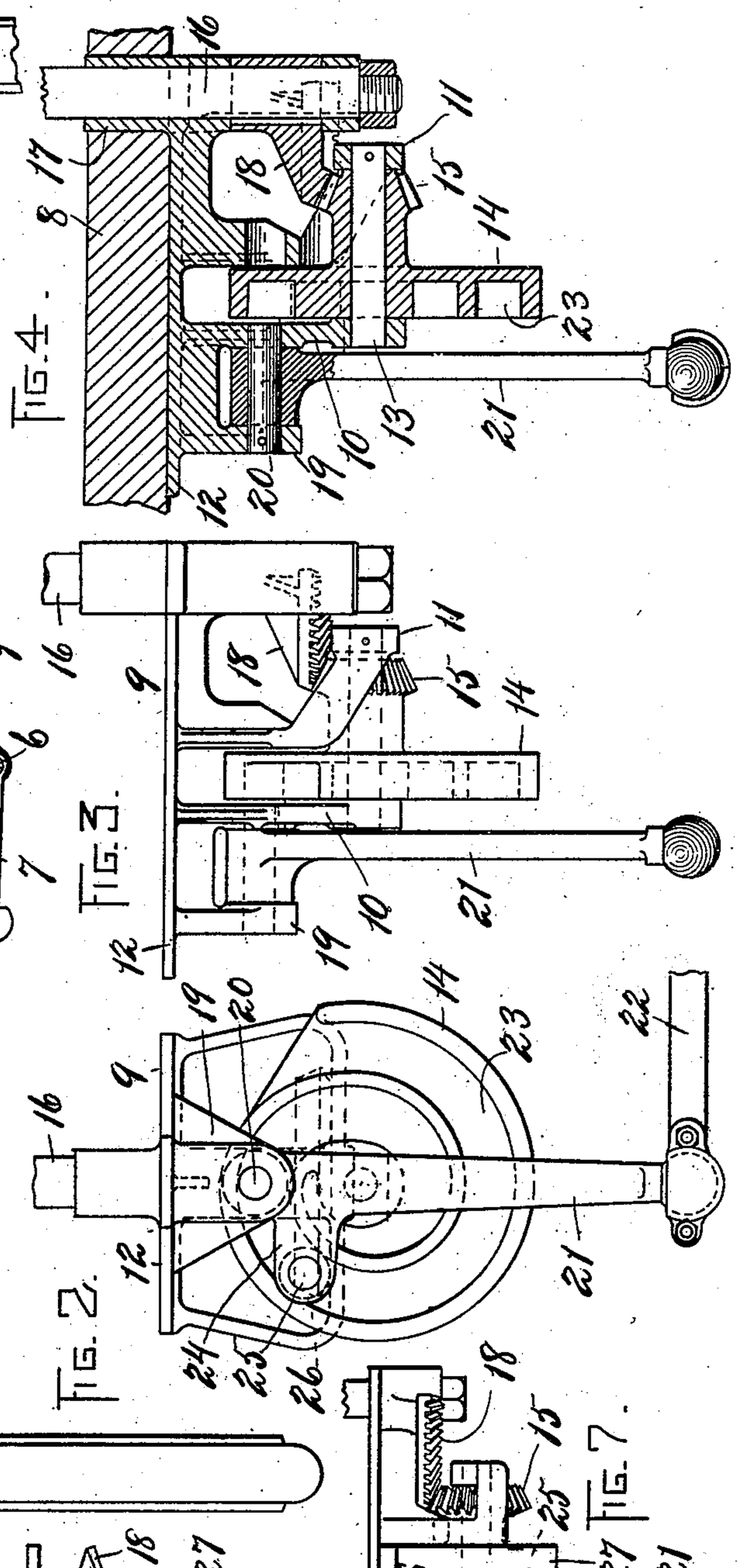

FIG. 4.

FIG. 3.

FIG. 2.

FIG. 7.

FIG. 5.

FIG. 6.

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UNITED STATES PATENT OFFICE.

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STEERING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 705,892, dated July 29, 1902.

Application filed December 17, 1900. Serial No. 40,068. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK E. ALLEN, of Boston, in the county of Suffolk, and RAYMOND H. DANFORTH, of Salem, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Steering Mechanism, of which the following is a specification.

This invention relates to steering mechanism of the non-reversing or locked type adapted to be applied to automobiles and other vehicles or to the rudders of boats.

The invention involves the use of a grooved convoluted locking and actuating cam operating upon a member which has a circular stud engaged with a single convolution only of the groove of said cam at a time, the mechanism being thereby distinguished from devices in which a worm or other gear coacting with a multitoothed complemental gear member is employed.

The present invention consists in certain novel features of construction and arrangement, which we will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a plan view of a steering mechanism organized in accordance with our invention. Fig. 2 represents a side elevation of a part mounted on the vehicle-body. Fig. 3 represents a front elevation of said part. Fig. 4 represents a transverse vertical section thereof. Fig. 5 represents a plan view showing another embodiment. Fig. 6 represents a front elevation thereof. Fig. 7 represents a side elevation.

The same reference characters indicate the same parts in all of the figures.

The principal objects of the invention are to enable the cam and associated parts when it is desired to locate the same upon the vehicle-body to be mounted close to the body, while at the same time maintaining their proper relation with the mechanism of the underframe of the vehicle, and also to prevent backlash and provide for different rates of movement of the member coacting with the cam in different portions of the stroke of the cam. It has been proposed heretofore to employ in a steering mechanism a cam of very steep pitch, so as to obtain the full range of movement of the steering-wheels in a partial rotation of the cam. It is difficult to make this form of mechanism sufficiently compact to render its use desirable on vehicles, and it is further necessary to make the pitch of the cam so steep that a uniform locking action, with absence of binding or cramping at all points of the stroke of the cam, is not easily attainable. Steering mechanisms using a worm or other form of locking-gear coacting with a multitoothed complemental gear are open to this limitation, among others, that the movement of the complemental member in each cycle or revolution of the locking-gear is a repetition of its movement in other cycles or revolutions, whereas it may be desired to obtain a different rate of movement at the ends of the stroke of the complemental member than in the intermediate portion of said stroke. Our invention being distinctly a convolute-cam mechanism enables us to obtain this difference of movement in different parts of the stroke, and the construction which we adopt further avoids backlash and overcomes friction.

Referring at first to Figs. 1 to 4, in which only as much of a vehicle is shown as to enable the relation of the steering mechanism to the vehicle to be understood, 1 represents the cross-frame, forming a part of the underframe of a vehicle and having the steering-wheels 2 2 mounted on the usual knuckles 3 3, which are pivoted or swiveled to the ends of said cross-frame. Rods 4 4 connect said knuckles with one arm 5 of a bell-crank lever whose stem 6 is vertically journaled in bearings on the cross-frame 1, the other arm 7 of the said lever projecting substantially at right angles to the arm 5. The vehicle-body, a portion of whose floor is represented at 8 in Fig. 4, is supported by means of springs upon the underframe in accordance with the common construction, so that said underframe is vertically movable with respect to the vehicle-body. On the under side of the

floor 8 of the vehicle-body is bolted the frame 9 of the cam mechanism, and in arms 10 11, projecting downwardly from the top plate 12 of said frame, is mounted a horizontal pintle 13, upon which is rotatively journaled a cam 14, having a small bevel-pinion 15 on its hub.

16 is a steering-stem, to the upper end of which the steering-handle is attached, said stem being journaled in a bearing 17 on the frame 9 and having secured to its lower end a large bevel gear-segment 18, meshing with the bevel-pinion 15, whereby when the stem or spindle 16 is rotated in its bearing the cam 14 will be revolved, the relation of the gears 15 18 being such that a partial rotation of the spindle 16 imparts one or more complete rotations to the cam.

In the upper portion of the arm 10 and in a second arm 19, projecting downwardly from the top plate 12, is mounted a horizontal pintle 20, upon which is journaled a downwardly-projecting arm or lever 21, whose lower end is connected by a rod or link 22 with the arm 7 of the steering connections on the underframe. The length of the downwardly-projecting portion of lever 21 is such that the link 22 in normal position will be substantially horizontal, this being desirable in order to obtain a straight push or pull from lever 21 to the arm 7 and, furthermore, to avoid disturbing the position of the steering-wheels 2 by the vertical movement of the underframe 1. A like result could be obtained by mounting the lever 21 and cam 14 in a horizontal position and dropping the whole cam mechanism down to the level of the underframe 1; but this would expose the cam mechanism more than in the arrangement illustrated and would involve the use of additional supports, whereas by the arrangement illustrated the cam mechanism can be made very compact and mounted directly upon the floor of the vehicle-body.

The cam 14 is provided with a groove 23, which constitutes the acting portion or course of said cam, said groove being a continuing or non-returning one of uniform width throughout, having a number of complete turns or convolutions. The lever 21 is provided with a short laterally-projecting arm 24, having a single stud or tooth 25 occupying the cam-groove 23 and provided with an antifriction-roller 26, constituting a circular stud, engaging the sides of the groove. This single stud is made to fit the groove accurately in all portions of the operating length of said groove, thereby doing away with backlash. The single roller-stud also operates with less friction than would the ordinary gear-teeth of a gear-segment in mesh with a worm or other convoluted gear or even than a multi-toothed member having roller studs or teeth in mesh with more than one convolution of the locking-gear at a time.

In the middle position of the steering-wheels the stud 25 is in an intermediate portion of the cam-groove 23, and the vehicle is steered to one side or the other by rotating the steering-spindle 16 and throwing the stud 25 into one or the other of the end portions of the cam-groove, thereby oscillating the lever 21 on either side of a middle position. The path of movement of the stud 25 is an arc having the pintle 20 as a center and is at all portions of the stroke of the cam substantially normal to the direction of the cam-groove 23, so that the reversing strain or tendency to oscillate the lever 21, due to irregularities in the roadway encountered by the steering-wheels 2, is unable to effect the rotation of the cam 14, and the lever 21 is accordingly locked in all portions of the stroke of the cam. The cam-groove being in the form of a coil or series of convolutions, its pitch is gradual and allows for an effective locking action at all points in the stroke of the cam, while at the same time keeping the size of the parts at a minimum and avoiding any binding or cramping action or any undue strains. The use of the single-toothed member 21, as distinguished from a multitoothed or gear member engaging more than one convolution at a time of the cam-course, enables us to give the cam-course any direction desired in different parts of its length, so long as its pitch is not made so steep as to destroy the locking action. A uniform movement of the steering-lever can therefore be made to result in an increase or decrease in the relative rate of turning of the steering-wheels in different parts of the stroke of the steering-lever.

Figs. 5 to 7 illustrate an embodiment of our invention in which a barrel cam 27 is employed in place of the flat cam shown in the preceding figures, said barrel cam being rotated from the steering-spindle by bevel-gearing 11 18, as before, and having a multiconvoluted groove 28, occupied by a roller-stud 25 upon a lever 21, mounted in the same manner as before explained. The arc of movement of the stud 25 during the rotation of the barrel cam is very nearly parallel to the axis of said cam. In this form of construction the groove 28 is rectangular in shape, and there is the same absence of backlash and capability of imparting a different pitch to different parts of the cam-groove as in the former embodiment, the only difference in construction being that the groove of the barrel cam is a coil of general helical form, while that of the flat cam 14 is a coil of general spiral form.

We claim—

1. In a steering mechanism, the combination of a guiding or steering member, a rotary cam having one or more complete turns or convolutions of a coiled or non-returning groove of uniform width, a movable cam-engaging member connected with said guiding member and having a single circular stud closely fitting said groove at all points in the operating length thereof and movable in a path which remains substantially normal to

the groove through one or more complete rotations of the cam whereby the cam-engaging member is locked against movement when the cam is stationary, and means to rotate the cam and thereby impart a steering movement to the cam-engaging member.

2. In a steering mechanism, the combination of a vehicle-body, an underframe movable vertically with respect thereto, a steering wheel or wheels swiveled on said underframe, steering connections mounted on said frame, and a controlling and locking mechanism mounted on the body and including a rotary cam-like locking member, a downwardly-projecting arm connected with said member and movable by its rotation, and a substantially horizontal link connecting the lower end of said arm with the said steering connections.

In testimony whereof we have affixed our signatures in presence of two witnesses.

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RAYMOND H. DANFORTH.

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