The invention relates to a stamping device for compacting soil. Said device comprises an upper body and a lower body which can be linearly moved counter to each other by means of a drive, a guiding element and an integrated spring system. Said device can be manually guided by means of a handle over a working area. In order to transfer as little oscillation as possible to the handle, said handle is connected to the upper body and the lower body by means of an intermediate element extending between the upper body and the lower body, in which area the movement or weight forces from the upper body and the lower body are extensively compensated.
STAMPER COMPRISING A LOW-OSCILLATION GUIDING HANDLE

[0001] The present invention relates to a stamping apparatus for soil compacting according to the preamble of patent claim 1, having an upper mass and a lower mass that can be moved in linear fashion and in opposite directions to one another by a drive, and that can be guided over a working area by hand using a grasping handle.

[0002] As a rule, the upper mass includes a drive motor and a crank mechanism. The lower mass includes a stamping plate and an integrated spring-mass system that amplifies the effect of the drive. The area of connection between the upper and lower mass is standardly outwardly sealed by bellows.

[0003] In devices of this type, the vibrating that occur in the area of the handle present a serious problem. The accelerations that are transmitted to the hand and arm of the operator must be kept as low as possible. It is standard to connect the handle with the upper mass of the apparatus, and to keep the hand-arm acceleration within the desired limits through suitable mass distribution at the handle, adjustment of lever lengths, varied shaping of damping elements, and through the selection of the position of the grasping area in relation to the center of gravity. The problem is further exacerbated by the fact that for certain kinds of work, such as pipe bedding compacting under pipes or compacting on an incline, the operator tends to leave the provided grasping area and to place himself at the side of the apparatus, and thus grasp the handle at places at which the allowable acceleration values are exceeded.

[0004] The underlying object of the present invention is to achieve a quite general reduction of the acceleration at the handle, independent of the point at which the handle is grasped.

[0005] This object is achieved by a stamping apparatus according to claim 1. Advantageous developments can be learned from the dependent Claims.

[0006] According to the present invention, the handle is connected with the upper mass and with the lower mass via an intermediate link that extends between the upper mass and the lower mass, in the area of which the movements or mass forces emanating from the upper mass and from the lower mass largely compensate one another.

[0007] Through the present invention, the handle is connected not to the upper mass, which has a relatively high oscillation amplitude, but rather to that area of the apparatus that exhibits the lowest oscillation amplitude, because at this point the oscillations of the upper and the lower mass, which act opposite one another, largely cancel one another out.

[0008] Preferably, the handle is connected with the intermediate element at both sides of the stamping apparatus.

[0009] Observations of the oscillation behavior of a stamping apparatus having a bellows with four folds have shown that relative to the soil surface, and thus relative to the operator standing on the ground and holding the apparatus by its handle, the second fold from the top represents the calmest point. Based on this observation, a first specific embodiment of the present invention uses the bellows extending between the upper and the lower mass as an intermediate element, such that, according to a useful construction, the fold connected with the handle is enclosed by a clamp that is adapted to the outer radius of the folds, to which there is connected a connecting element that participates in the movement of the handle.

[0010] Another very advantageous specific embodiment of the present invention consists in that the intermediate element is connected essentially fixedly with the handle, and the upper mass, as well as the lower mass, are each connected with the intermediate element so as to be capable of movement via rockers. In this way, it is not necessary to construct or to equip the bellows specially for its purpose as an intermediate element.

[0011] In a preferred construction, the rockers are situated on both sides of the upper mass, and the lower mass has a prolongation that extends into the area outside the upper mass, on which prolongation the rockers are mounted for the connection of the lower mass with the intermediate element. This prolongation can for example be realized in the form of rods or as an apron that protects the bellows.

[0012] Preferably, the rockers are mounted, at least at one end, via damping torsion elements.

[0013] A further specific embodiment according to the present invention consists in that the intermediate element is formed by double-acting struts that are connected with the handle, the guide housing of said struts being attached on the upper mass, while two guide rods that can be moved relative to one another and to the guide housing are connected one after the other and with the guide housing by springs that are arranged in series and that simultaneously act as tension and compression springs, the one guide rod being connected with the handle while the other guide rod is connected with the lower mass.

[0014] Further advantageous and useful constructions result from the subclaims.

[0015] On the basis of the following description of preferred exemplary embodiments of the present invention shown in the Figures, the invention is now explained in more detail.

[0016] FIG. 1 shows a side view of a first specific embodiment of a stamping apparatus constructed according to the present invention,

[0017] FIG. 2 shows a side view of a second specific embodiment of a stamping apparatus constructed according to the present invention,

[0018] FIG. 3 shows a side view of a third specific embodiment of a stamping apparatus constructed according to the present invention,

[0019] FIG. 4 shows a side view of a fourth specific embodiment of a stamping apparatus constructed according to the present invention, and

[0020] FIG. 5 shows a section through the arrangement of the strut shown in FIG. 4.

[0021] Elements in the various Figures that correspond to one another are identified in the following by the same reference characters.

[0022] The depicted stampers include three essential assemblies: an upper mass 10, containing the drive in a known manner, a lower mass 12, guided so as to be capable of movement relative to upper mass 10 and capable of
up-and-down movement in opposite directions, and a handle 14 used to guide the apparatus.

[0023] Handle 14 carries a fuel tank 16 for supplying energy to the drive motor, which forms a component of upper mass 10. Moreover, handle 14 can be provided with a cover 18 and with a crane clip (not shown) for transporting the apparatus to a construction site. The drive connection between upper mass 10 and lower mass 12 takes place via a gear mechanism.

[0024] The gear mechanism, and/or a guide between the upper and the lower mass, are surrounded by a bellows 20 that is fastened to upper mass 10 by a clamp 22 and to lower mass 12 by a clamp 24. In the depicted exemplary embodiments, bellows 20 has four folds.

[0025] During operation, the stamper, guided via handle 14, can execute a movement essentially parallel to the soil surface, so that the direction of movement runs parallel to the plane of the drawing.

[0026] Observations of stampers of this type during operation have shown that the second fold from the top is the area of the apparatus at which the least movement occurs, relative to the ground on which the apparatus is supported and on which the person guiding the stamper via the handle is standing. For this reason, in the effort to transmit as little oscillation as possible to the hand and arm of the operator, in the stamper shown in FIGS. 1 and 2 the handle 14 is connected with the stamping assembly, made up of upper mass 10 and lower mass 12, in the area of the second fold (seen from above) 26 of bellows 20.

[0027] For this purpose, in the depicted exemplary embodiment a clamp 28 that surrounds bellows 20 externally is attached in the area of second fold 26. In relation to the direction of movement of the apparatus parallel to the soil surface, guide rods 30 are situated at both sides of the apparatus, which serve to transmit the guide forces exerted on handle 14 by the operator to the apparatus as a whole, said rods running in the direction of the stamping movement between upper mass 10 and lower mass 12, and being fastened on the one hand to clamp 28 and on the other hand to handle 14. Guide rods 30 are guided in the direction of the stamping movement by a guide 32 attached to upper mass 10. However, the guide can also be provided on lower mass 12, or on the upper and the lower mass. A plain bearing, a thrust ball bearing or a ball-type nipple, or also an elastic guide rod, can be used as a guide 32.

[0028] At the upper end, guide rods 30 are connected with handle 14 via connecting sleeves 34 having elastic intermediate elements 36, in order to dampen fine oscillations.

[0029] In order to place as little stress as possible on bellows 20, the assembly consisting of handle 14, fuel tank 16, cover 18, and guide rods 30 is constructed with as light a weight as possible.

[0030] In order to avoid bounce impacts, the distance between second fold 26 and the adjacent circumferential folds of bellows 20 is enlarged to twice the usual distance, as can be seen between the third and fourth fold from the top. Moreover, the rigidity of second fold 26, which accommodates clamp 28 and the load supported on this clamp, is designed to be somewhat more stable than is the case for the other movable folds.

A corresponding effect can also be achieved by using a support or guide ring made of plastic having good gliding properties, provided on the inside in the area of second fold 26. Such a ring can prevent the collapsing of fold 26, but can also prevent wearing of the inner fold at the guide cylinder between the upper and the lower mass, for which purpose the ring (not shown) is placed in bellows 20.

In order to fasten guide rods 30 to bellows 20, according to a variant (not shown) fold 26 can consist of a circumferential bulge having a corresponding undercut, on which the fold is squeezed with a type of bellows protector, made e.g. of wear-resistant plastic, and on which handle 14, with its load, is accommodated by means of a linkage made of tubes or of spring band steel.

FIGS. 2 shows a variant in which guide 32 (shown in FIG. 1) of guide rods 30 on upper mass 10 is replaced by a torsion collar 38 having a rocker 40 that is mounted therein and that extends to guide rod 30, so that the torsion forces that occur when rocker 40 is pivoted additionally dampen the oscillations transmitted via guide rods 30.

The support of guide rods 30 on bellows 20 is avoided in the exemplary embodiments shown in FIGS. 3 to 5.

In the construction according to FIG. 3, guide rods 30, which are connected with handle 14 in the manner already described and are guided in guides 32, are not connected with bellows 20, but rather are coupled, via two rocker pairs 42 and 44, with upper mass 10 on the one hand and with lower mass 12 on the other hand. Preferably, rocker pairs 42 and 44 are situated on both sides of the upper mass, for which reason lower mass 12 has a prolongation 66 that is guided into the area outside upper mass 10. These can be, as shown, rods; however, the prolongation can also for example also be formed by an apron that covers bellows 20 in protective fashion.

During the operation of the stamper, the movement of upper mass 10 and the movement of lower mass 12 with the integrated spring-mass system, relative to guide rods 30, can cancel one another out. Intermediate positions of rocker pairs 42, 44 are shown in broken lines.

The example shown assumes that the vertical movement of rocker pair 42 coupled to upper mass 10 is half as large as the stroke of lower mass 12 coupled to lower rocker pair 44. Rocker pairs 42 and 44 can be mounted on upper mass 10 or lower mass 12 in torsion elements 46 and 48 having different hardess, in order to compensate the different paths. Alternatively, rockers of different lengths can also be used.

The connection between rocker pairs 42 and 44 and guide rods 30 can take place via simple pivot points 50 or 52, or likewise via torsion elements. Given a correct design of the rocker system, in the first phase of movement, when lower mass 12 moves upward and upper mass 10 moves downward, handle 14 is hardly loaded, and will therefore move very little. In the second phase of movement, when lower mass 12 strikes the ground, upper mass 10 is forced to move upward, so that the forces are again canceled, and handle 14 likewise undergoes very little loading and very little movement.

FIGS. 4 and 5 show a variant, in which instead of the damping rocker pairs 42 and 44 with associated torsion
elements 46 and 48, and, if warranted, 50 or 52, a pair of double-acting struts 54 is provided.

[0040] A guide housing 56 of strut 54 here contains two spring plates 58 and 60. Spring plate 58 is connected with a first guide rod 62 that protrudes upward from one end of housing 56, and second spring plate 60 is connected with a second guide rod 64 that protrudes downward. Between first spring plate 58 and the upper end of housing 56 there is situated a first spring 68 that acts as a tension and compression spring, while a second spring 70 of this sort is situated between first spring plate 58 and second spring plate 60.

[0041] Guide housing 56 is connected with upper mass 10, first guide rod 62 is connected with handle 14, and second guide rod 64 is connected with lower mass 12, so that the forces acting opposite one another compensate one another during the movements in opposite directions of lower and upper mass 10, 12 in the area of struts 54, and remaining oscillations are kept away from handle 14 by the damping effect of springs 68 and 70.

1. A stamping apparatus for soil, comprising: an upper mass and a lower mass that can be moved in linear fashion and in opposite directions to one another by a drive, and that are connected with one another by a bellows and can be guided over a working area by hand using a grasping handle wherein the handle is connected with the upper mass and with the lower mass via an intermediate element that extends between the upper mass and the lower mass, in the area of which the movements emanating from the upper mass and from the lower mass largely compensate one another.

2. The stamping apparatus as recited in claim 1, wherein the handle is connected with the intermediate element at both sides of the stamping apparatus.

3. The stamping apparatus as recited in claim 2, wherein the handle is guided so as to be capable of movement relative to the upper mass by guide rods, of which one end is connected with the handle and the other end is connected with the intermediate element, and which are guided on the upper mass so as to be at least approximately capable of longitudinal movement.

4. The stamping apparatus as recited in claim 1, wherein the intermediate element is the bellows that extends between the upper mass and the lower mass.

5. The stamping apparatus as recited in claim 4, wherein the part of the bellows connected with the handle is a fold that is largely free of oscillation during operation of the stamper.

6. The stamping apparatus as recited in claim 5, wherein the bellows has four folds, and the handle is connected with the second fold following the upper mass.

7. The stamping apparatus as recited in claim 4, wherein the fold connected with the handle is surrounded by a clamp that is adapted to the outer radius of the fold, and to which a connecting element is connected that participates in the movement of the handle.

8. The stamping apparatus as recited in claim 5, wherein inside the bellows the fold connected with the handle has a greater distance to the folds adjacent thereto.

9. The stamping apparatus as recited in claim 5, wherein inside the bellows, the fold connected with the handle has an increased rigidity.

10. The stamping apparatus as recited in claim 5, wherein a support and/or guide ring is allocated to the fold connected with the handle.

11. The stamping apparatus as recited in claim 10, wherein the support and/or guide ring is placed in the interior of the fold.

12. The stamping apparatus as recited in claim 11, wherein the support and/or guide ring is made of a plastic having good gliding properties.

13. The stamping apparatus as recited in claim 3 wherein the guide rods are guided by ball-type nipples on the upper mass.

14. The stamping apparatus as recited in claim 3, wherein the guide rods are guided by rockers on the upper mass.

15. The stamping apparatus as recited in claim 14, wherein the rockers have rotating joints at least on one end, which are fashioned as damping torsion elements.

16. The stamping apparatus as recited in claim 1, wherein the intermediate element is connected essentially fixedly with the handle, and the upper mass and the lower mass are each connected with the intermediate element so as to be capable of movement, via rockers.

17. The stamping apparatus as recited in claim 16, wherein the intermediate element is formed by guide rods that are connected with the handle.

18. The stamping apparatus as recited in claim 16, wherein the rockers are situated on both sides of the upper mass and the lower mass has a prolongation that protrudes into the area of the upper mass on which the rockers are mounted for connecting the lower mass with the intermediate element.

19. The stamping apparatus as recited in claim 16, wherein the rockers are mounted at least on one end via damping torsion elements.

20. The stamping apparatus as recited in claim 16, wherein the intermediate element is guided on the upper mass so as to be capable of longitudinal movement.

21. The stamping apparatus as recited in claim 1, wherein the intermediate element is formed by double-acting struts that are connected with the handle, the guide housing of each of these struts being attached on the upper mass, while two guide rods that can be moved relative to one another and to the guide housing are connected one under the other and with the guide housing by springs that are arranged in series and that simultaneously act as tension and compression springs, the one guide rod being connected with the handle, and the other guide rod being connected with the lower mass.

22. The stamping apparatus as recited in claim 21, wherein each guide rod is connected with a spring plate that can be displaced in the housing, and the first spring is situated between the spring plate of the one guide rod and the end surface, through which this guide rod passes, of the housing, and the second spring is situated between the two spring plates.

23. The stamping apparatus as recited in claim 1, wherein the intermediate element is connected to the handle via elastic intermediate elements.