May 2, 1939. R. W. E. SPERRY 2,157,028

PIANO ACTION

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Fig. 1.

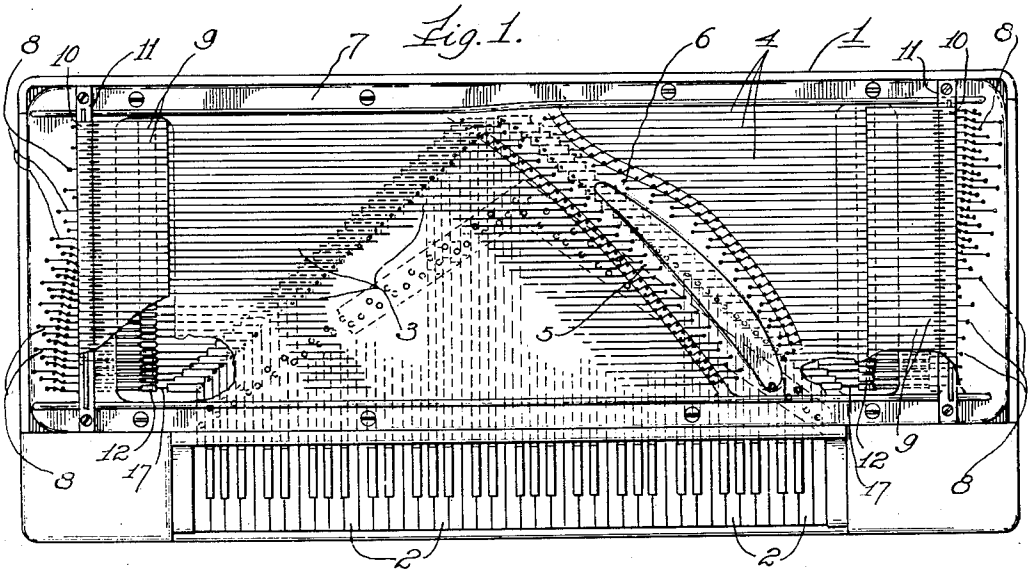
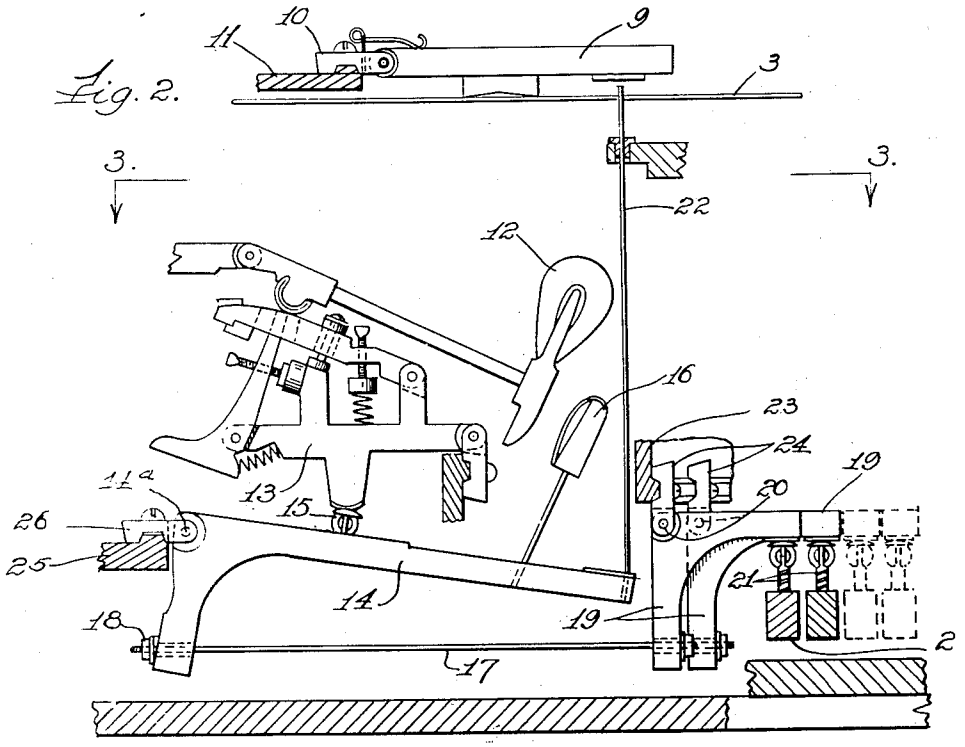


Fig. 2.



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Fig 3.

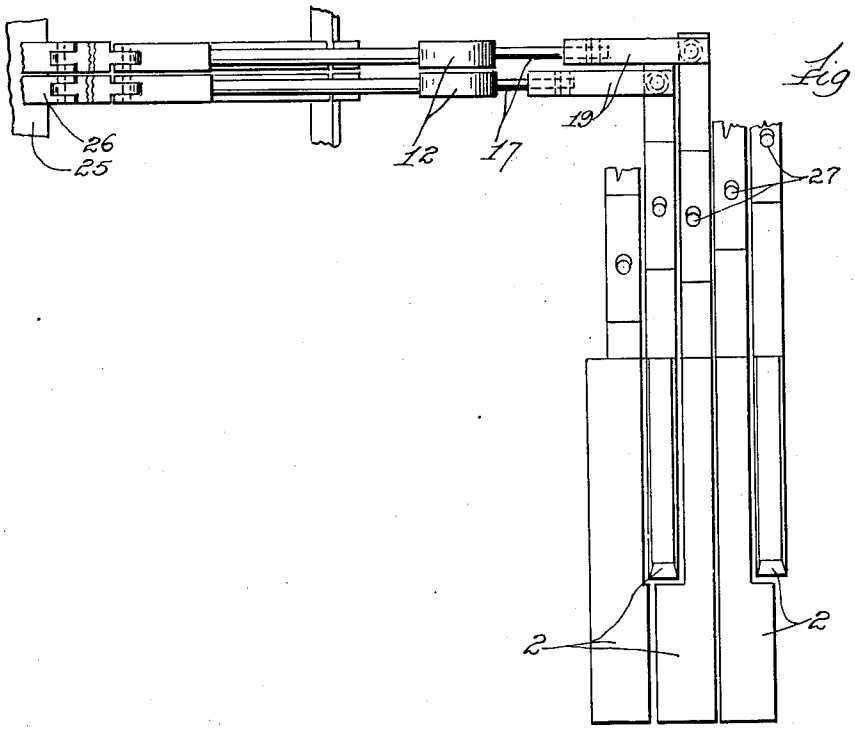
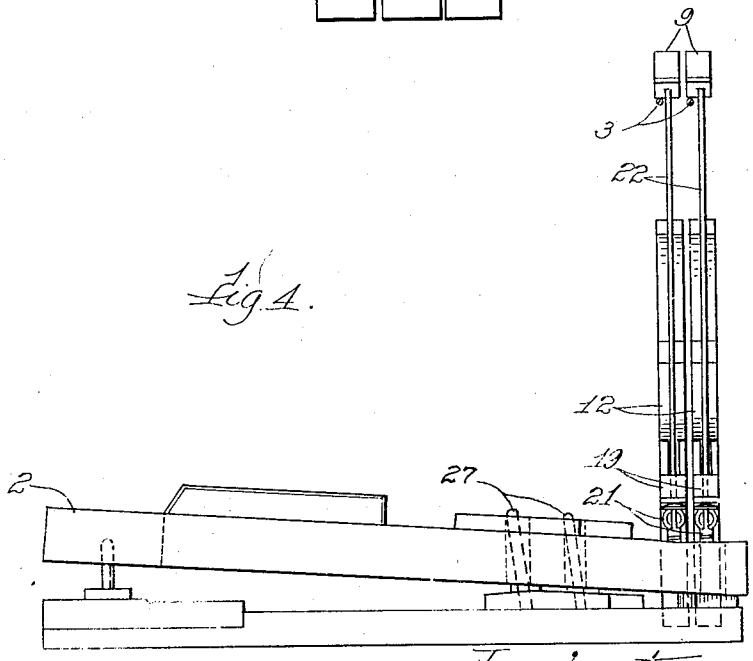


Fig 4.



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2,157,028

UNITED STATES PATENT OFFICE

2,157,028

PIANO ACTION

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Application September 29, 1937, Serial No. 166,377

18 Claims. (Cl. 84—174)

This invention relates to pianos of the type in which the strings are located in a horizontal plane, and its purpose is to provide an arrangement of the strings and special features of the hammer action by which the entire piano may be housed in a case of substantially rectangular form, and of relatively limited depth from the front of the keys to the rear of the case. The invention therefore consists in certain features and elements of construction and arrangement herein shown and described, as indicated by the claims.

In the drawings:

Figure 1 is a somewhat diagrammatic top plan view of a piano embodying this invention, showing the manual keyboard and the strings, but with the latter partially broken away to disclose the location of the hammer action.

Figure 2 is taken as a vertical section through the case and shows a single hammer action with its connections to the corresponding key, together with a few adjacent parts.

Figure 3 is a detail plan view taken substantially as a section, as indicated at line 3—3 on Figure 2.

Figure 4 is a detail elevation showing two of the keys and mechanism associated therewith for actuating the hammers.

As shown in Figure 1, this piano includes a rectangular case, 1, of oblong form, having the manual keys, 2, arranged along one of its longer sides, and with the strings extending substantially parallel to the longer sides of the case. To secure this arrangement of the strings they are divided into two sections, the left-hand section consisting of strings, 3, which comprise mainly the base register, and the right-hand section consisting of the strings, 4, constituting most of the treble range of the piano. As shown, the strings are anchored to suitable portions, 5 and 6, of the frame, 7, which is of generally rectangular outline, and the opposite ends of the strings extend to tuning pins, 8, disposed in two groups at opposite ends of the frame respectively. In Figure 1 each of the strings is represented by a single line, whereas it will be understood that, in accordance with the standard practice, many of the tones, particularly in the treble register, will be produced by two or three strings. For each string or group of strings corresponding to a given tone, I provide a damper, 9, pivotally carried above the strings by a "flange", 10, secured to a suitable supporting rail, 11.

The hammers, 12, are shown mounted below the plane of the strings, and each of them is provided with a substantially standard or typical grand piano action, as shown in Figure 2. The hammer actions are disposed in two groups, one at each end of the case, as seen in Figure 1, so that each hammer action stands in a plane substantially at right angles to the plane of the manual key, 2, by which it is operated. With this arrangement I provide, in addition to the usual action and its key, a pair of levers and a connecting link through which motion is transmitted from the key, 2, to the wippen, 13, of the hammer action. A bell crank lever, 14, is fulcrumed at 14a, with its longer arm extending under the wippen, and with a suitable capstan, 15, engaging with the latter. The longer arm of the lever, 14, carries the back-check, 16, in proper relation to the hammer, 12, and the shorter arm is engaged by a wire link, 17, which passes through it, and is provided with a suitable adjusting nut, 18, on its threaded end. The other end of the wire, 17, is engaged with a second bell crank lever, 19, shown as having two arms of approximately equal length, and pivotally mounted at 20. The other arm of the lever, 19, extends over one of the keys, 2, and is engaged by the capstan screw, 21, of the key. Thus, when the outer end of the key is depressed and the inner end carrying the capstan screw, 21, rises, the engaged arm of the lever, 19, is lifted, swinging the vertical arm of the lever, and moving the link, 17, whereby the lever, 14, is swung in a direction to carry its longer arm upwardly, lifting the wippen of the hammer action and causing the striking movement of the hammer, 12. The outer end of the arm, 14, carries a damper wire, 22, which serves to lift the damper, 9, before the hammer, 12, reaches the string, and then lowers the damper when the key returns to normal position.

In order that each key may have a corresponding bell crank, 19, engaged by its capstan screw, 21, the capstan screws are mounted close to the inner ends of the keys, and the keys themselves are made of different lengths, arranged in a graduated series so that their inner ends are staggered, as seen in Figure 1. The supporting rail, 23, for the flanges or brackets, 24, which carry the individual pivots, 20, of the levers, 19, thus extends obliquely in the case; but the rails, 25, to which are secured the flanges, 26, carrying pivots, 14a, for the levers, 14, may extend across the case substantially parallel to the keys themselves, with the levers, 14, in planes substantially perpendicular to the strings. For convenience and economy, the levers, 14, may be substantially all alike in dimensions, if desired, and, likewise, the

levers, 19, may be all made of the same pattern; but the wire links, 17, are of different lengths to compensate for the differences in distance between the levers, 19, and the levers, 14, which they actuate. Since the keys, 2, are of various lengths, depending upon their respective positions in the manual, their fulcrums, 27, are located at different distances from the ends of the keys, but in each instance the fulcrum divides the key length in the proper ratio, so that a given depression of the outer end of any key will cause the same lift at the capstan screw, 21, on the inner end. As shown, the levers, 14 and 19, are all substantially alike. Hence, a given key movement will produce approximately the same hammer stroke in any part of the action. However, if, for any reason, it is not feasible to place the key fulcrums so as to divide the keys all in the same ratio, or, if any other change in the individual hammer actions should prevent absolute uniformity in the several mechanisms, it is a simple matter to make the bell cranks, 14 and 19, of different proportions such that each key mechanism will produce the proper hammer stroke.

The location of the tuning pins, 8, in two groups adjacent the shorter sides of the case, renders them readily accessible for tuning adjustment when required. However, it will be evident that, if desired, the hitch pins for the strings may be located at the extreme ends of the frame adjacent the shorter sides of the case, and the tuning pins may be positioned in the oblique portions, 5 and 6, of the frame. And it may be understood that the end panels of the case, which constitute its shorter sides, may be made removable, or may be hinged so that each section of the hammer action may be withdrawn, if desired, for inspection or repair, without disturbing the keys or the transmitting levers, 14 and 19. Similarly, the key manual may be arranged to be withdrawn as a unit without, in any way, disturbing the hammer actions or the levers.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the invention, and that the same is not limited to the particular form herein shown and described, except in so far as indicated by the appended claims.

I claim:

1. A piano having a set of manual keys, a horizontal string frame with all the strings extending substantially parallel to the key manual and perpendicular to the individual keys thereof, said strings being arranged in two groups disposed end to end, hammer actions each disposed substantially in the vertical plane of the string to which it pertains, said actions being arranged in two groups respectively adjacent the opposite ends of the string frame, and means operatively connecting each key with one of said hammer actions.

2. A piano having a set of manual keys, a horizontal string frame of substantially rectangular shape with all the strings extending substantially parallel to the key manual and perpendicular to the individual keys thereof, said strings being arranged in two groups, disposed end to end, with the shortest string of the treble group substantially aligned with the longest string of the bass group, hammer actions each disposed substantially in the vertical plane of the string to which it pertains, said actions being arranged in two groups respectively adjacent opposite ends of the string frame, and means operatively connecting each key with one of said hammer actions.

3. A piano having a rectangular case with a set of manual keys disposed along one of its longer sides, a horizontal string frame with all the strings extending substantially parallel to said longer sides of the case and arranged in two groups extending toward each other from the shorter sides of the case respectively, and hammer actions each disposed substantially in the vertical plane of the string to which it pertains and operatively connected with one of the keys.

4. A piano having a rectangular case with a set of manual keys disposed along one of its longer sides, a horizontal string frame with all the strings extending substantially parallel to said longer sides of the case and arranged in two groups extending toward each other from the shorter sides of the case respectively, and hammer actions each disposed substantially in the vertical plane of the string to which it pertains, said actions being arranged in two groups each corresponding to one of said groups of strings.

5. A piano having a rectangular case with a set of manual keys disposed along one of its longer sides, a horizontal string frame with all the strings extending substantially parallel to said longer sides of the case and arrranged in two groups extending toward each other from the shorter sides of the case respectively, each group comprising substantially half of the total range of the piano, and hammer actions arranged in two groups each corresponding to one of said groups of strings, each of said actions being disposed substantially in the vertical plane of the string to which it pertains.

6. A piano having a rectangular case with a set of manual keys disposed along one of its longer sides, a horizontal string frame with all the strings extending substantially parallel to said longer sides of the case and arranged in two groups extending toward each other from the shorter sides of the case with tuning pins for said groups disposed adjacent said shorter sides of the case respectively, and hammer actions each positioned substantially in the vertical plane of the string to which it pertains and operatively connected with one of the keys.

7. A piano having a set of manual keys, a horizontal string frame and strings thereon all extending substantially parallel to the key manual and perpendicular to the individual keys thereof, the said strings being arranged in two groups with tuning pins for said groups disposed end to end at opposite ends of the frame respectively, hammer actions each disposed substantially in the vertical plane of the string to which it pertains, said actions being arranged in two groups respectively adjacent said opposite ends of the string frame, and means operatively connecting each key with one of said hammer actions.

8. A piano having a set of manual keys, a horizontal string frame with all the strings extending substantially parallel to the key manual and perpendicular to the individual keys thereof, hammer actions each disposed substantially in the vertical plane of the string to which it per-

tains, and means operatively connecting each key with one of said hammer actions.

9. In the combination defined in claim 8, said connecting means including a lever pivoted to swing in a vertical plane transversely of the key with an arm overhanging the inner end of the key and operatively engaged therewith, and means actuated by the other arm of said lever for transmitting its motion to the hammer action.

10. In the combination defined in claim 8, said connecting means including a lever pivoted to swing in a vertical plane with one arm directly under the wippen of the hammer action in operative engagement therewith, and means connecting the other arm of said lever with the inner end portion of a key for actuation thereby.

11. In the combination defined in claim 8, said connecting means including a lever pivoted to swing in a vertical plane transversely of the key, and having an arm overhanging the inner end of the key and operatively connected therewith, a second lever pivoted to swing in a vertical plane and having one arm directly under the wippen of the hammer action in operative engagement therewith, together with a link connecting the other arm of said lever with the other arm of said first mentioned lever for transmitting motion from the latter to the former and to the hammer action.

12. In the combination defined in claim 8, said connecting means including a bell crank lever pivoted to swing in a vertical plane transversely of the key, with one arm extending horizontally over the inner end of the key and operatively engaged therewith, and a link connected to the other arm of the lever arranged for transmitting its motion to the hammer action.

13. In the combination defined in claim 8, said connecting means including a bell crank lever pivoted to swing in a vertical plane with one arm extending horizontally under the wippen of the hammer action in operative engagement therewith, and a link extending horizontally from the other arm of the lever and arranged for actuation by the inner end portion of a key for transmitting the key movement to the hammer action.

14. In the combination defined in claim 8, said connecting means including a bell crank lever pivoted to swing in a vertical plane transversely of the key, with one arm extending horizontally over the inner end of the key and operatively connected therewith, a second bell crank lever pivoted to swing in a vertical plane with one arm directly under the wippen of the hammer action in operative engagement therewith, together with a link connecting the vertical arms of said levers for transmitting motion from the key to the hammer action.

15. In the combination defined in claim 8, said connecting means including a lever of the first class pivoted to swing in a vertical plane transversely of the key and having one arm overhanging the inner end of the key for operative connection therewith, a second lever of the first class pivoted to swing in a vertical plane with one arm directly under the wippen of the hammer action in operative engagement therewith, the other arms of said levers being operatively connected for transmitting motion from the key to the hammer action.

16. A piano having a set of manual keys, a horizontal string frame with all the strings extending substantially parallel to the key manual and perpendicular to the individual keys thereof, hammer actions each disposed substantially in the vertical plane of the string to which it pertains, the keys being of different lengths arranged in a graduated series and each extending inward substantially to the vertical plane of the hammer which it actuates, and means operatively connecting the inner end of each key with its said hammer.

17. A piano having a set of manual keys, a horizontal string frame with all the strings extending substantially parallel to the key manual and perpendicular to the individual keys thereof, hammer actions each disposed substantially in the vertical plane of the string to which it pertains, the keys being of different lengths arranged in a graduated series and each extending inward substantially to the vertical plane of the hammer which it actuates, and means operatively connecting the inner end of each key with its said hammer comprising a bell crank lever pivoted to swing in a vertical plane transversely of the key with one arm extending horizontally over the inner end of the key for operative engagement therewith, a second bell crank lever pivoted to swing in a vertical plane with one arm directly under the wippen of the hammer action, and a horizontally extending link connecting the other arms of said levers for transmitting motion through them from the key to the hammer action, the hammer actions being disposed in a row extending substantially perpendicular to the direction of the strings, and the links being of different lengths corresponding to the distances of the respective keys from the actions which they operate.

18. In the combination defined in claim 17, individual fulcrums for the keys disposed at different distances from their ends but dividing the key lengths all in the same ratio, the bell crank levers engaging the keys being all alike and the bel crank levers engaging the wippens being all alike.

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