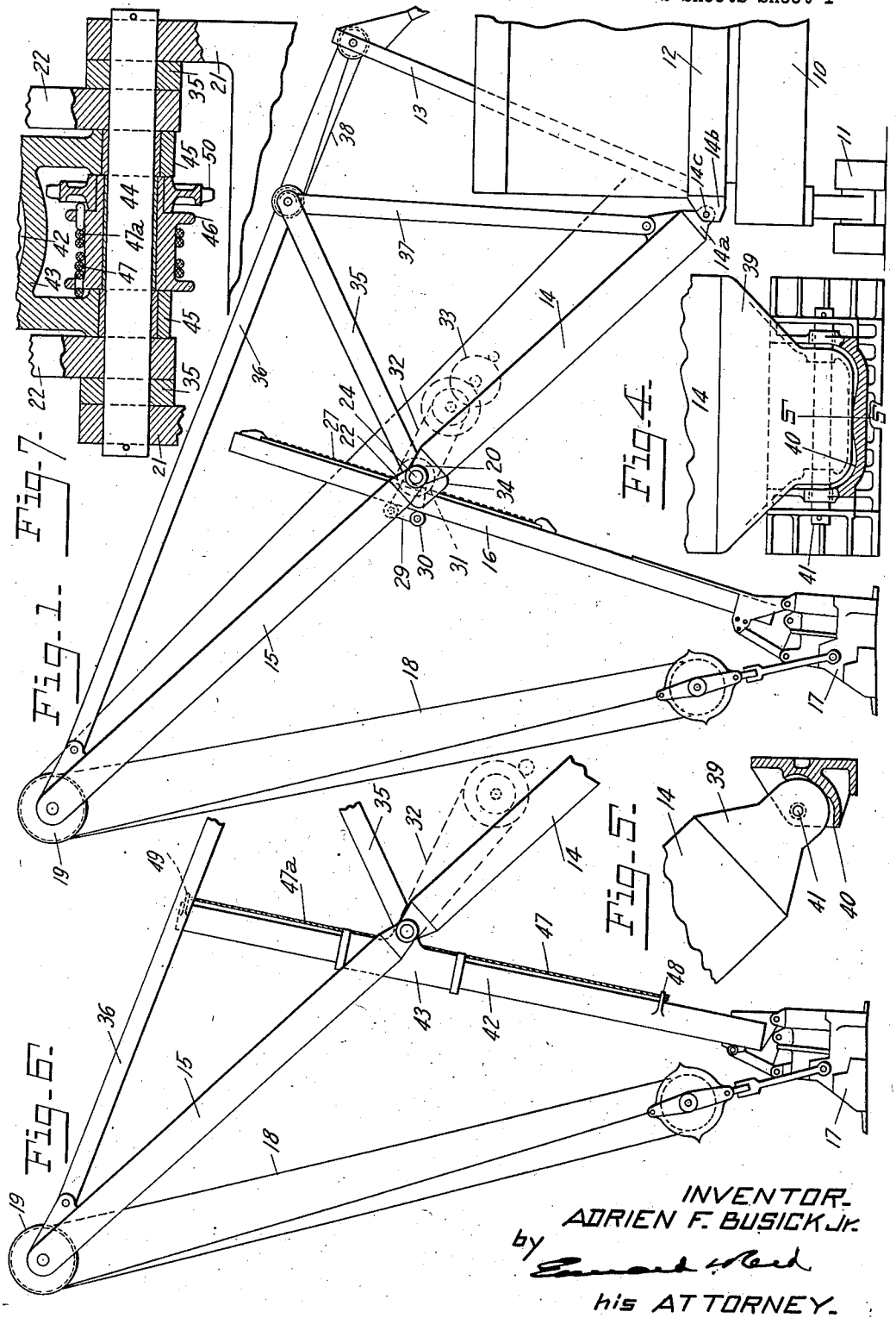
May 11, 1937. A. F. BUSICK, JR 2,080,163

BOOM FOR EXCAVATING MACHINES OR THE LIKE

Filed Jan. 29, 1936 2 Sheets-Sheet 1



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BOOM FOR EXCAVATING MACHINES OR THE LIKE

Filed Jan. 29, 1936 2 Sheets-Sheet 2

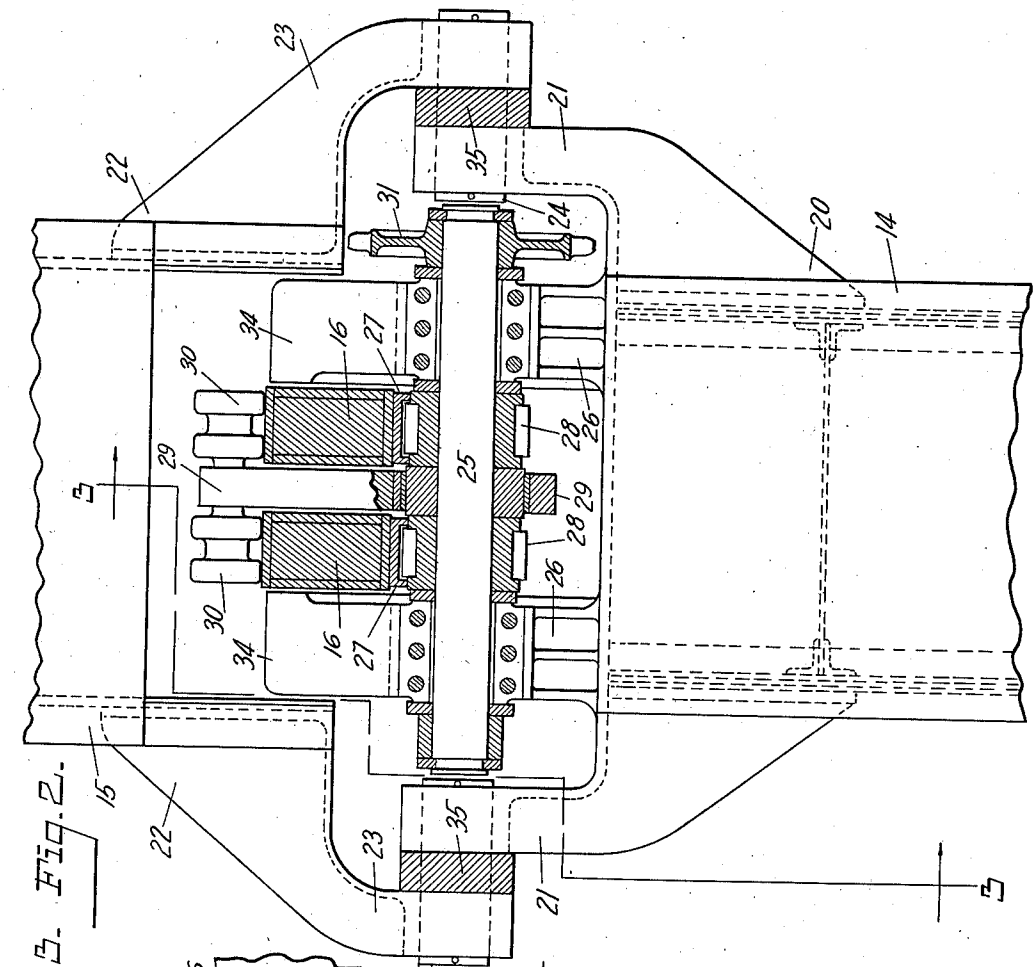


FIG. 2.

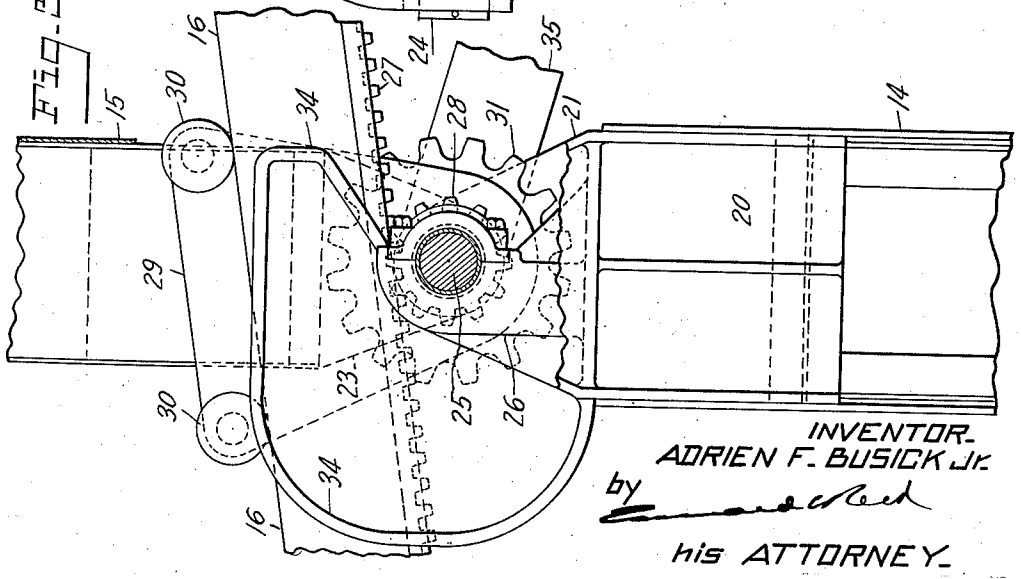


FIG. 3.

INVENTOR.
ADRIEN F. BUSICK JR.
by
his ATTORNEY.

Patented May 11, 1937 2,080,163

UNITED STATES PATENT OFFICE

2,080,163

BOOM FOR EXCAVATING MACHINES OR THE LIKE

Adrien F. Busick, Jr., Marion, Ohio, assignor to The Marion Steam Shovel Company, Marion, Ohio, a corporation of Ohio

Application January 29, 1936, Serial No. 61,357

11 Claims. (Cl. 214—135)

This invention relates to a boom for an excavating machine or the like and one object of the invention is to provide a boom of simple construction and of light weight with relation to the load which it is to handle, and which will have ample strength.

In excavating machines of large capacity, such as stripping shovels having a dipper capacity of from fifteen to thirty yards, the boom is necessarily of great length and must have sufficient strength not only to support the dipper load but to withstand the dipper thrust and swinging strains to which it is subjected. Heretofore such booms have been constructed much along the lines of standard boom construction, the parts being increased in size and additional parts being added to secure the required strength. Such a boom is of more or less complicated construction, is expensive to build and is of great weight. Further, the intermediate portion of the boom has a tendency to flex under the thrust of the dipper handle and the repeated flexing of the boom tends to weaken the same and may eventually destroy the boom.

A further object of the invention is to provide a boom which will strongly resist any tendency to flex under the thrust of the dipper handle and which will not be adversely affected by any flexing which may occur.

A further object of the invention is to provide such a boom which may have a limited rolling movement about a longitudinal axis during the swinging of the load.

Other objects of the invention may appear as the boom is described in detail.

In the accompanying drawings Fig. 1 is a side elevation of a boom embodying my invention, showing the same mounted on a stripping shovel; Fig. 2 is a plan view of the pivotal connection between the two sections of the boom, showing the shipper shaft and its associated parts in section; Fig. 3 is a longitudinal section taken on the line 3—3 of Fig. 2; Fig. 4 is a sectional detail view of a modified form of foot mounting for the boom; Fig. 5 is a transverse section taken on the line 5—5 of Fig. 4; Fig. 6 is a side elevation of a portion of the boom showing modified means for mounting and actuating the dipper handle; and Fig. 7 is a sectional view taken through the pivotal connection of the two sections of the boom of Fig. 6 and through the actuating mechanism for the dipper handle.

In these drawings, for the purpose of illustration, I have shown one embodiment of my invention and have shown the same as mounted on a stripping shovel comprising a base 10 carried by traction devices 11 and a platform 12 rotatably mounted on the base 10 and provided with the usual boom supporting structure or gantry 13.

The boom proper comprises an inner section 14 supported at its lower or inner end upon the rotating platform 12, and an outer section 15 arranged substantially in line with and pivotally connected with the inner section 14. A dipper handle 16 extends transversely to the boom and carries at its lower end the usual dipper 17 which is connected by a cable 18 with sheaves 19 at the outer end or point of the outer section of the boom, the cable 18 extending rearwardly to the usual hoisting mechanism on the rotatable platform. In the side elevation of Fig. 1 the illustration of the boom structure is more or less diagrammatic as the several elements entering into that construction may take various forms. Usually the boom sections 14 and 15 will each comprise parallel members rigidly connected one to the other in any suitable manner, as shown in Fig. 2. It may be noted that the stripping shovel for which this particular boom was designed is capable of handling a dipper having a capacity of from twenty to thirty yards, this depending in part upon the type of a dipper used, and the boom has an overall length of approximately ninety-five feet and a width of approximately ten feet, and the dipper handle being approximately sixty feet in length.

The adjacent ends of the inner and outer boom sections may be pivotally connected one to the other in any suitable manner. In the construction here illustrated the inner section 14 has rigidly secured to its outer end a bracket 20 provided on the respective sides of the boom with outwardly extending arms 21 which project beyond the end of the boom section. The outer boom section 15 has rigidly secured to its inner end a bracket 22 provided with rearwardly extending arms 23 which project rearwardly beyond the end of the boom section and are arranged on the outside of and overlap the outer ends of the arms 21 of the bracket 20. The arms of each pair, on the respective sides of the boom, are pivotally connected one to the other by pivot pins 24.

The shipper shaft 25, which imparts longitudinal movement to the dipper arm, is mounted on the upper end portion of the inner boom section 14 and is here shown as mounted on one of the brackets and as arranged in substantial alinement with the pivot pins 24. In this particular construction the bracket 20 on the inner section

of the boom is provided with bearings 26 which may, if desired, be formed integral therewith and which extend into the space between the two brackets, the shipper shaft 25 being mounted in these bearings. The dipper handle 16, which is here shown as comprising two parallel members, extends through the boom between the bracket 22 on the outer boom section and the shipper shaft, and each section of the dipper handle is provided with a longitudinal toothed rack 27, which racks mesh respectively with pinions 28 rigidly secured to the shipper shaft between the bearings 25. An arm 29 is mounted on the shipper shaft between the pinions 28, extends forwardly between the two members of the dipper handle and carries rollers 30 which engage the forward edges of the two members of the dipper handle to retain the latter in mesh with the pinions 28 and at the same time to permit the dipper handle to swing about the axis of the shipper shaft under the influence of the hoisting cable 18. Rigidly secured to the shipper shaft is a sprocket wheel 31 which is connected by a sprocket chain 32 with a crowding engine 33. This crowding engine, or motor, may be of any suitable type and may be mounted in any suitable position upon the boom or upon the adjacent portion of the rotating platform 12. Rigidly secured to the bracket 20, on the inner boom section, and, if desired, formed integral therewith, are two members 34 which extend transversely beyond the lower surface of the boom and then upwardly between the shipper shaft and the bracket 22 on the outer section of the boom where they extend along the respective sides of the dipper handle and serve to hold the latter against lateral displacement, the arms 34 being preferably provided with wear plates to engage the dipper handle. It will be noted in Fig. 3 that these arms do not extend across the upper sides of the shipper shaft, thus leaving this space open to permit of the removal of the bearing caps.

The boom is provided with a truss-like structure to reinforce the same against flexing and to impart the desired strength thereto and, as here shown, a strut 35 is mounted on the boom adjacent to the pivotal connection between the two sections thereof and extends upwardly and rearwardly from the boom approximately in the line of thrust of the dipper handle, it being understood that the direction of thrust of the dipper handle depends upon the particular position in which it is supported while the dipper is being crowded into the bank which is being excavated. This strut may be of any suitable character and may be connected with the boom in any suitable manner but in the arrangement shown it comprises two parallel members arranged at the respective sides of the boom and these members are mounted at their lower ends on the respective pivot pins 24 which connect the two sections of the boom, the strut members being here shown as arranged between the arms 21 and 23 on the respective sides of the boom. At its other or upper end this strut 35 is connected by a longitudinal strut 36 with the outer section 15 of the boom, the point of connection being preferably near the outer end, or point, of the boom section. A third and upright strut 37 is connected at its upper end with the connected ends of the struts 35 and 36 and is connected at its lower end with the revolving platform 12 near the foot of the boom, and preferably this strut 37 is connected with the inner section 14 of the boom near the foot thereof. The connected ends of the three struts may be connected in any suitable manner with the gantry 13 to support the boom in an inclined position but preferably this connection is formed of cables 38 in the usual manner so that the boom will be held normally in a stationary position but may be adjusted to vary the angle of its inclination. Thus the boom is held normally against any movement about the pivotal connection between the two sections thereof, the truss structure serving to strongly resist any movement of the pivotal connection under the thrust of the dipper handle and should any pivotal movement or flexing occur it will in no way injure or weaken the boom.

The inner section of the boom may be mounted on the platform 12 in any suitable manner and as shown in Fig. 1 it is provided with a foot casting 14a, which is mounted in a socket 14b for adjustment about a fixed horizontal axis 14c. However, in an excavating machine of this type the boom is subjected to severe torsional strains during the swinging of the heavily loaded dipper to dumping position, due to the inertia of the dipper and its load, and it is sometimes so mounted that it may have a limited rolling movement about a longitudinal axis to relieve these strains. In Figs. 4 and 5, the boom is shown as mounted for such rolling movement and, as there shown, the inner section 14 of the boom has at its inner end a foot casting 39, the bearing portion of which is of oblong shape and is seated in an oblong socket 40 secured to the revolving platform 12, the contacting surfaces of the foot casting and of the socket being so shaped as to permit the foot casting and boom to turn about a longitudinal axis in the socket. This turning or rolling movement is limited and the foot casting is retained in the socket by means of a pin 41 which extends loosely through apertures in both the foot casting and the socket and is of smaller diameter than these apertures to permit of the desired rolling movement. When the present boom is swung with the platform 12 the flexible connection 38 between the truss structure and the gantry will permit the boom structure as a whole to roll slightly in the foot socket 40. This rolling movement may tend to slightly lift the point of the boom but this is immaterial as it will not appreciably affect the operation of the machine.

It will be obvious that the means for mounting and actuating the dipper handle may take various forms without affecting the boom and in Figs. 6 and 7, I have shown a slightly modified form of mechanism for actuating the same. As there shown the dipper handle is round, or tubular, in cross section, as shown at 42, and is slidably mounted in a sleeve 43 which is pivotally mounted on the boom adjacent to the pivotal connection between the two sections thereof. As shown in Fig. 7, the two sections of the boom are connected by the brackets 21 and 23 as above described but instead of employing separate pivot pins at each side of the boom a single pivot pin 44 extends for the entire width of the boom and through both pairs of bracket arms. The sleeve 43 is provided on its inner side with lugs terminating in bearings 45 which are journaled on the pivot pin 44, these bearings being spaced one from the other. Rotatably mounted on the boom and in the present instance mounted on the pivot pin 44, between the bearing lugs, is a cable drum 46, adapted to receive and actuate a cable or cables. In the arrangement shown, two cables, 47 and 47a, are wound about and secured to the

drum. The cable 47 extends downwardly from the drum and is connected with the lower portion of the dipper handle, as shown at 48, and the cable 47a extends upwardly from the drum and is connected with the upper portion of the dipper handle, as shown at 49. Thus the rotation of the drum 46 in one direction will tend to elevate the dipper handle and its rotation in the other direction will tend to lower the dipper handle. The drum may be rotated in any suitable manner but it is here shown as provided with a sprocket wheel 50 by means of which it is connected with a suitable crowding motor, such as that shown in Fig. 1.

While I have shown and described one embodiment of my invention, together with a minor modification thereof, I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an excavating machine having a revolving part, a gantry carried thereby, a boom comprising an inner section mounted on said revolving part for limited movement about a longitudinal axis and an outer section substantially in a line with said inner section and pivotally connected therewith, means for mounting a dipper handle on said boom adjacent to said pivotal connection and for actuating the same, a strut connected at one end with said boom adjacent to said pivotal connection and extending therefrom approximately in the line of thrust of said dipper handle, a second strut connecting the other end of the first mentioned strut with the outer boom section near the outer end of the latter, and a third strut connecting the adjacent ends of the two first mentioned struts with the inner boom section near the foot thereof, and a flexible connection between said gantry and the connected ends of the three struts for supporting said boom in an inclined position and permitting said movement about said longitudinal axis.

2. In an excavating machine having a revolving part, a boom comprising an inner section mounted on said revolving part for limited movement about a longitudinal axis, an outer section substantially in line with said inner section and pivotally connected therewith on a longitudinal axis, means for mounting a dipper handle on said boom adjacent to said pivotal connection and for actuating the same, a rigid strut connected at one end with said boom adjacent to said pivotal connection and extending therefrom approximately in the line of thrust of said dipper handle, a second rigid strut connecting the other end of the first mentioned strut with the outer boom section near the point thereof, and a third rigid strut connecting the adjacent ends of the two first mentioned struts with the inner section of said boom near the foot thereof, and a cable connected with said struts to support said boom in an inclined position and permit the movement of said boom about said longitudinal axis.

3. A boom comprising inner and outer sections arranged substantially in alinement and pivotally connected one with the other on a horizontal axis, means for mounting a dipper handle on said boom adjacent to said axis and for actuating the same, a rigid strut connected at one end with said boom adjacent to said pivotal connection and extending transversely thereto, a longitudinal rigid strut connecting the other end of the first mentioned strut with the outer boom section, and an upright rigid strut connecting said other end of said first mentioned strut with the inner boom section, said struts forming a truss to hold said boom sections normally against movement about said pivotal connection and permit a slight relative movement of said boom sections under heavy transverse stresses.

4. A boom comprising inner and outer sections arranged substantially in alinement and pivotally connected one with the other, means for mounting a dipper handle on said boom adjacent to said axis and for actuating the same, a strut connected at one end with said boom adjacent to said pivotal connection and extending transversely thereto, a longitudinal strut connecting the other end of the first mentioned strut with the outer boom section near the point thereof, and an upright strut connecting said other end of said first mentioned strut with the inner boom section near the foot thereof, said struts being pivotally connected one with the other and with said boom to form a truss which will permit slight relative movements of the boom sections about their pivotal connections.

5. A boom comprising inner and outer sections arranged substantially in alinement, means for pivotally connecting said sections one to the other, a strut mounted at one end on said connecting means and extending transversely to said boom, a longitudinal strut connecting the other end of the first mentioned strut with the outer boom section, and an upright strut connecting said other end of said first mentioned strut with the inner boom section.

6. A boom comprising inner and outer sections arranged substantially in alinement, brackets secured to the adjacent ends of said sections and having overlapping parts at the respective sides of said boom, pivot pins connecting the overlapping parts of said brackets, a strut having spaced parts mounted on the respective pivot pins, said strut extending transversely to said boom, a longitudinal strut connecting the other end of said first mentioned strut with the outer boom section, and an upright strut connecting said other end of said first mentioned strut with the inner boom section.

7. A boom comprising inner and outer sections arranged substantially in alinement, brackets secured to the adjacent ends of said sections and pivotally connected one to the other, bearings carried by one of said brackets, a shipper shaft journaled in said bearings, means associated with said shaft for actuating a dipper handle, a strut connected at one end with said boom adjacent to said pivotal connection and extending transversely to said boom, a longitudinal strut connecting the other end of said first mentioned strut with the outer boom section, and an upright strut connecting said other end of said first mentioned strut with the inner boom section.

8. A boom comprising inner and outer sections arranged substantially in alinement, brackets secured to the adjacent ends of said sections and pivotally connected one to the other, bearings carried by one of said brackets, a shipper shaft journaled in said bearings, means for rotating said shaft, a pinion mounted on said shaft, a dipper handle extending between said brackets and having a toothed rack meshing with said pinion, a strut having one end connected with said boom adjacent to the pivotal connection between said brackets and extending transversely to said boom, a longitudinal strut connecting

the other end of the first mentioned strut with the other boom section, and an upright strut connecting said other end of said first mentioned strut with the inner boom section.

9. A boom comprising inner and outer sections arranged substantially in alinement, brackets secured to the adjacent ends of said sections and pivotally connected one to the other, bearings carried by one of said brackets, a shipper shaft journaled in said bearings, means for rotating said shaft, a pinion mounted on said shaft, a dipper handle extending between said brackets and having a toothed rack meshing with said pinion, guide members carried by said brackets, extending about said shipper shaft, and arranged on opposite sides of said dipper handle, a strut having one end connected with said boom adjacent to the pivotal connection between said brackets and extending transversely to said boom, a longitudinal strut connecting the other end of the first mentioned strut with the outer boom section, and an upright strut connecting said other end of said first mentioned strut with the inner boom section.

10. A boom comprising inner and outer sections arranged substantially in alinement, brackets secured to the adjacent ends of said sections and having overlapping parts at the respective sides of said boom, means for pivotally connecting the overlapping parts on the respective sides of said boom, bearings carried by one of said brackets and arranged between the two pairs of overlapping parts, a shipper shaft journaled in said bearings substantially in line with the pivotal connection between said brackets, means for rotating said shaft, pinions mounted on said shaft between said bearings, a dipper handle extending between said brackets on that side of said shaft opposite the bracket having the bearings, said dipper handle having toothed racks meshing with said pinions, arms carried by the bracket having the bearings and extending about said shaft and arranged on opposite sides of said dipper handle, a strut connected at one end with said boom adjacent to the pivotal connection between said brackets and extending transversely to said boom, a longitudinal strut connecting the other end of the first mentioned strut with the outer boom section, and an upright strut connecting said other end of said first mentioned strut with the inner boom section.

11. In an excavating machine having a revolving part, a boom comprising an inner section mounted on said revolving part, and an outer section substantially in line with said inner section, brackets secured to the adjacent ends of said boom sections and having overlapping parts at the respective sides of said boom, a single pin pivotally connecting the overlapping parts of said brackets on both sides of said boom, a dipper handle extending between said brackets on one side of said pin, a rotatable member mounted on said pin and operatively connected with said dipper handle, means for rotating said member, a strut connected at one end with said boom adjacent to the pivotal connection between said brackets and extending transversely to said boom, a longitudinal strut connecting the outer end of the first mentioned strut with the other boom section near the point thereof, and an upright strut connecting said other end of said first mentioned strut with said rotatable part of said machine near the foot of said boom, and means connected with the adjacent ends of said struts for supporting said boom in an inclined position.

ADRIEN F. BUSICK, JR.