Aug. 20, 1935. A. E. DENTLER 2,011,711

METHOD FOR TESTING DRAFT GEARS

Filed May 23, 1931 2 Sheets-Sheet 1

Fig.1

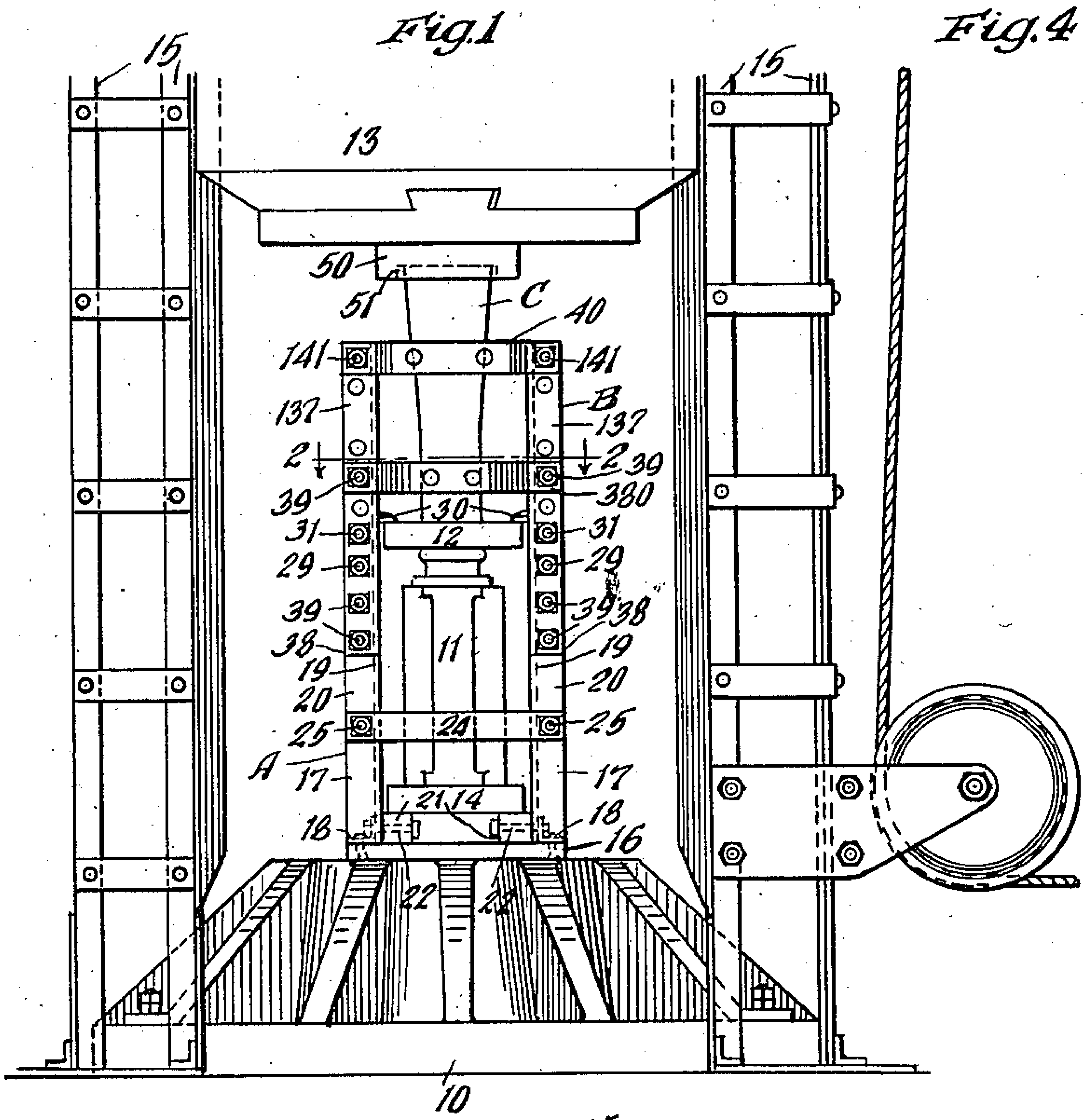


Fig.4

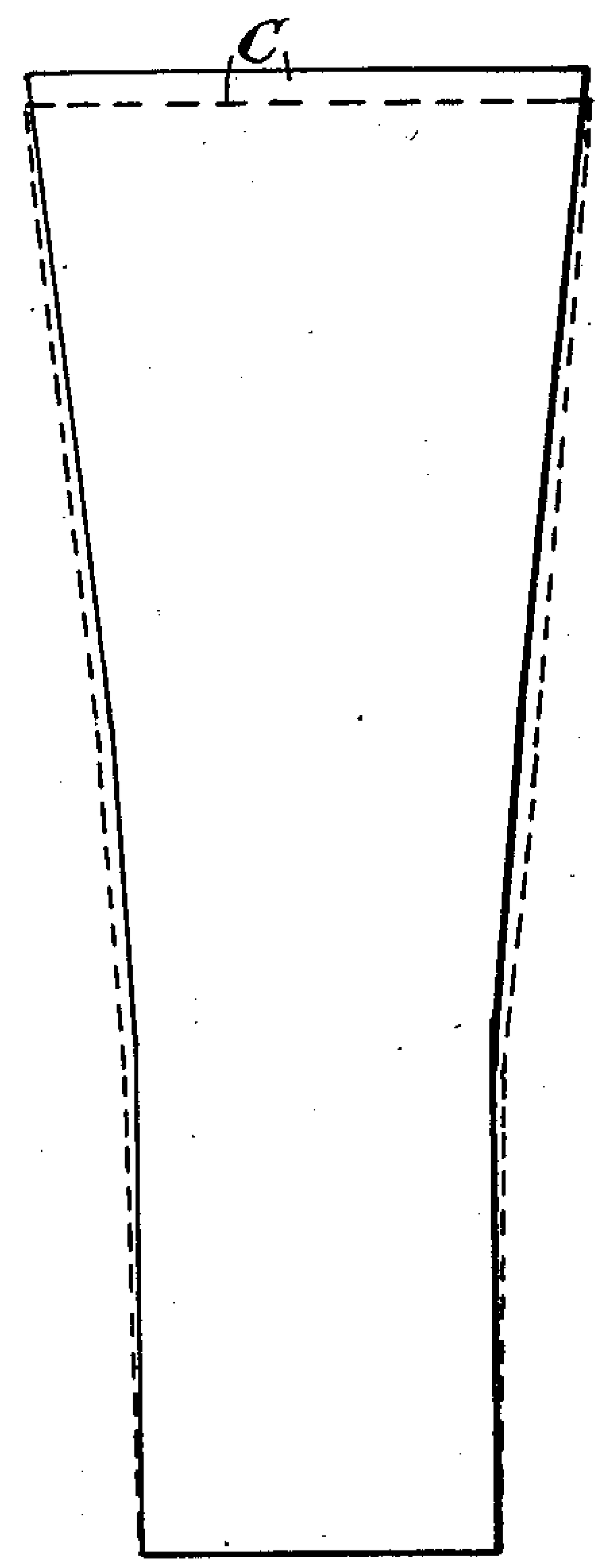


Fig.2

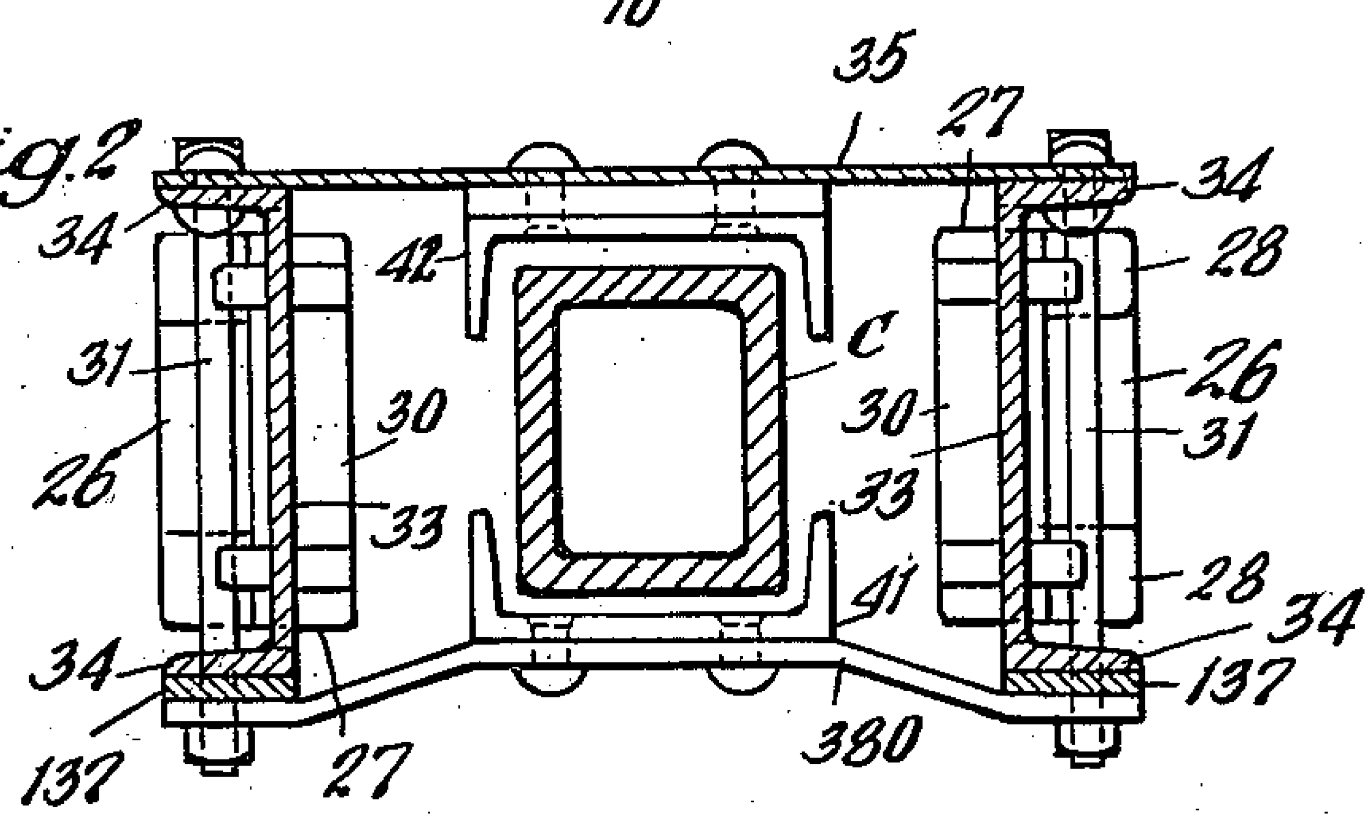
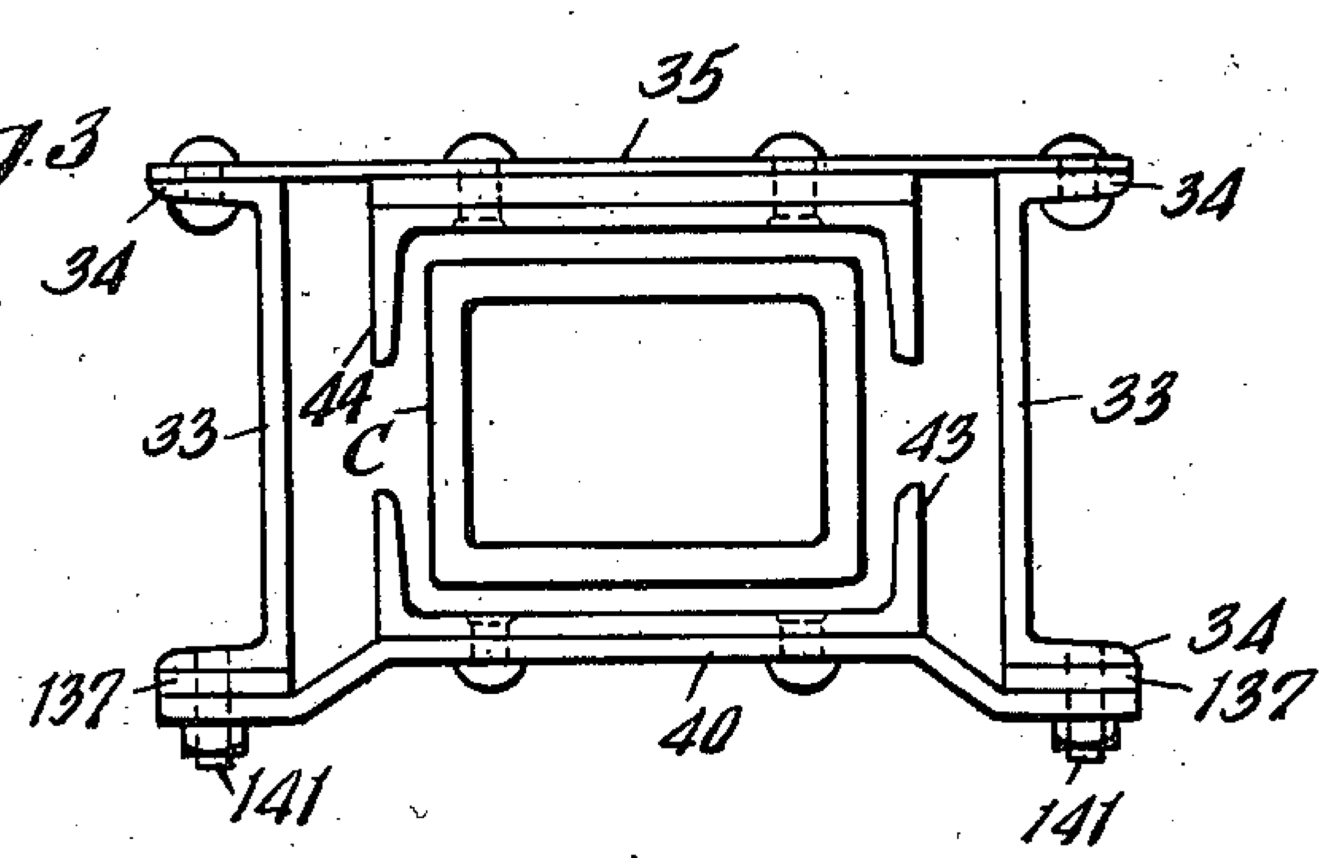


Fig.3



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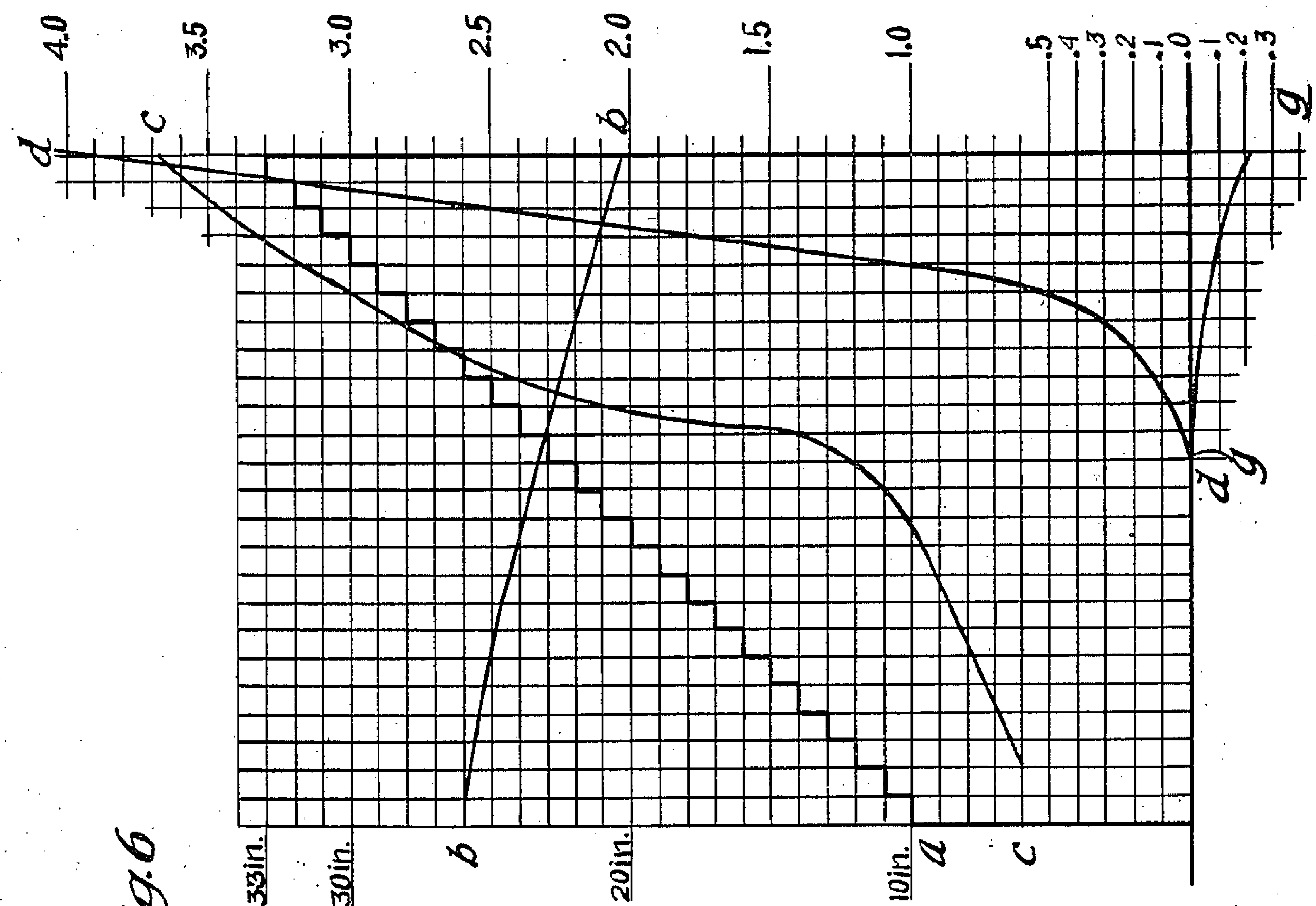

Fig. 6

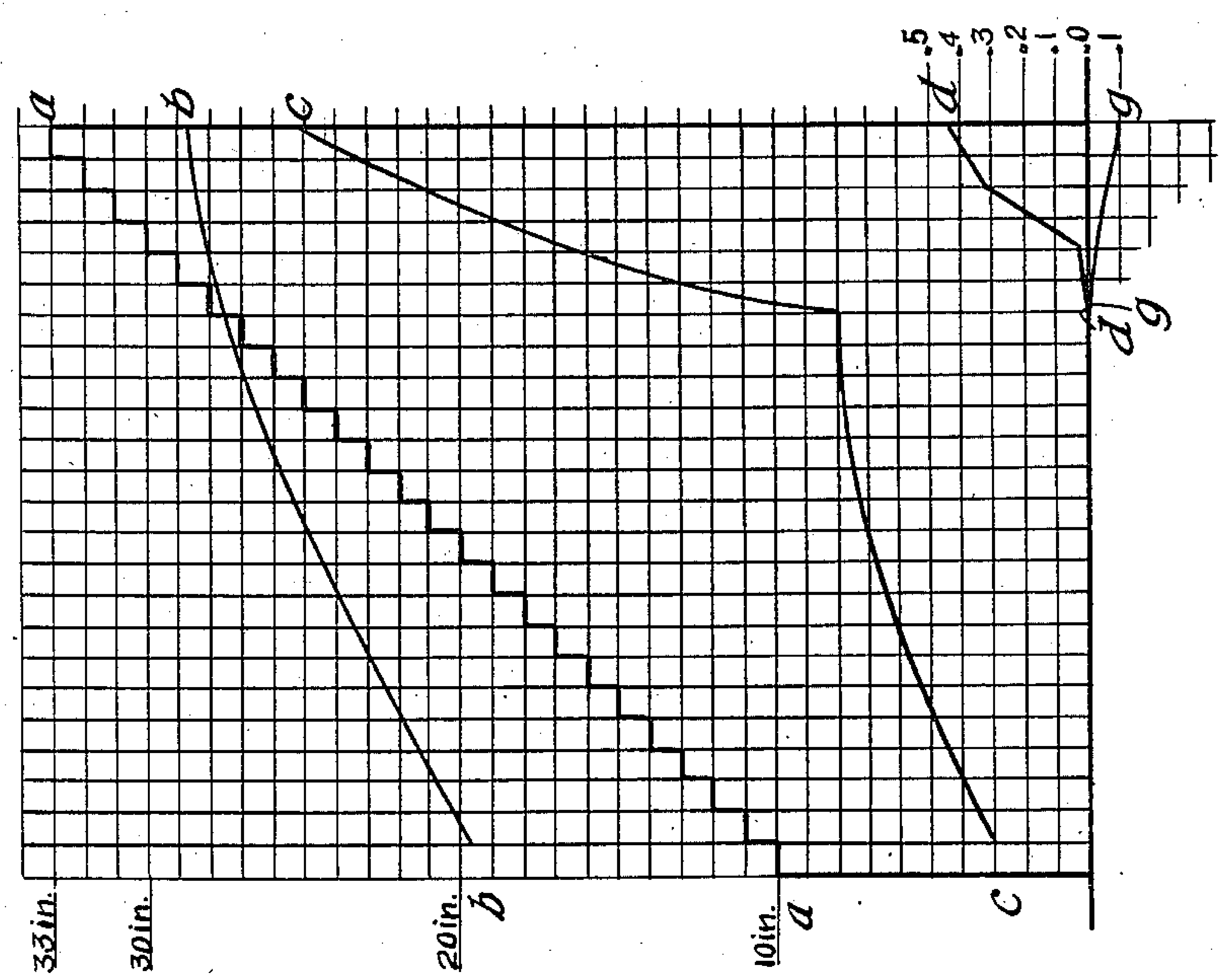

Fig. 5

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Patented Aug. 20, 1935

2,011,711

UNITED STATES PATENT OFFICE

2,011,711

METHOD FOR TESTING DRAFT GEARS

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Application May 23, 1931, Serial No. 539,513

2 Claims. (Cl. 265—13)

This invention relates to improvements in method for testing draft gears.

This application is a continuation in part of applicant's Patent No. 1,829,128, dated October 27, 1931, granted on application, Serial No. 188,076, filed May 2, 1927.

As is well known to those skilled in the railway art, draft gears are machines for dissipating energy and preventing high stress in coupler and railway car structure. Certain tests have been devised for determining the efficiency and durability of such gears.

In making such tests, it is the common practice to employ a drop hammer which is elevated to different heights and dropped from each height a number of times upon a draft gear supported on a suitable anvil. Data are thus obtained which are an indication of the performance, efficiency, and durability of the gear. In order to obtain from the data thus procured the desired information regarding the ability of the gear to prevent unduly high stress, complicated calculations are necessary, and in many cases the ability of the gear to protect the usual coupler in actual service is not clearly indicated.

It is the main object of my invention to provide an improved testing method whereby a direct indication of the actual performance of the draft gear is obtained, which is independent and in addition to the usual data hereinbefore referred to, and which further shows the actual amount of coupler set induced, thereby clearly disclosing the ability of the gear to protect the coupler.

A more specific object of the invention is to provide a method of testing draft gears wherein a column member having known characteristics is employed for transmitting the impacting force imparted by a drop hammer to the draft gear in a series of drop hammer tests, and calibrations of the column member are made throughout the test to determine the amount of set, thus giving directly complete information as to the performance of the draft gear in actual service with respect to its ability to protect the coupler and car underframe structure from damage.

Another object of the invention is to provide a method of testing draft gears by means of a drop hammer, including the following steps: Supporting the draft gear on the anvil member of a drop hammer; superimposing a follower member on the gear; interposing a column member having known characteristics between the follower and the hammer; elevating the hammer to different heights and dropping the same on the column member a predetermined number of times from each height to compress the gear; measuring the overall length of the column member at predetermined intervals during the testing operation to determine the coupler set; and measuring the overall length of the gear at corresponding intervals to determine the gear set.

Other objects of the invention will more clearly appear from the description and claims hereinafter following.

In the drawings, forming a part of this specification, Figure 1 is a front elevational view of the lower section of a drop hammer, such as is commonly employed in testing railway draft gears, illustrating certain improvements in connection therewith which are made use of in carrying out my improved method of testing. Figure 2 is a horizontal sectional view on an enlarged scale, corresponding substantially to the line 2—2 of Figure 1, the drop hammer structure being omitted, and a certain column member being shown in section. Figure 3 is a top plan view of the structure shown in Figure 2. Figure 4 is a front elevational view, in full lines, of a column member employed in connection with my improved method, the set or shortened condition of the column member after a certain number of impacts of the hammer thereon being indicated in dotted lines in said figure. And Figures 5 and 6 are two diagrams or graphs produced from data obtained in testing two different draft gears by my improved method.

In said drawings, referring first to Figures 1 to 4 inclusive, 10 indicates the anvil of the drop hammer upon which is supported a testing frame A described in detail in Patent No. 1,829,128, hereinbefore referred to. The draft gear 11 to be tested is contained within the frame A. A follower plate 12 is superimposed on the gear 11. The gear is preferably further supported by a follower plate 14. Such follower plate may obviously be dispensed with in case the gear is provided with an integral rear follower. The plates 12 and 14 correspond in size and characteristics to the standard front and rear follower plates employed in connection with the draft riggings of railway cars. The usual weight 13 of the drop hammer is mounted between upright heavy guide members 15—15 forming side sections of the framework of the drop hammer, between which the weight or hammer proper 13 is guided and drops freely. As will be understood, the weight 13 is lifted by suitable hoisting mechanism and dropped as desired.

The frame A includes an upper section B which forms a guide for a column member C hereinafter more fully described. The section B of the frame A is preferably detachably connected to the lower or main body portion of the frame. The lower portion includes a base plate in the form of a relatively heavy substantially rectangular plate 16 having upright channel members 17—17 rigidly secured thereto through the medium of reinforcing angle plates 18—18, the latter being fixedly secured to the base plate 16 by any suitable means, preferably rivets as shown.

Each of the upright channel members 17—17 comprises a relatively wide plate-like section or web 19 having outwardly projecting flanges 20—20 at the opposite vertical side edges thereof. Anvil blocks 21—21 are provided and are directly supported on the base plate 16 and are secured to the side members 17—17 by bolts 22—22 which extend through the blocks 21—21, the channel members 17—17, and the vertical flanges of the corresponding angle members 18—18. The channel members 17—17 are spaced apart a distance corresponding substantially to the standard spacing between the usual channel-shaped center draft sills of a railway car underframe, and the anvil blocks 21—21 correspond to the usual rear stop lugs of the draft sills. The channel members 17—17 are rigidly united by the rear tie plate, not shown, and the front tie strap 24. The tie strap 24 is in the form of an elongated rectangular bar and has its opposite ends secured to the corresponding flanges 20—20 at the forward sides of the members 17—17. The opposite ends of the tie strap 24 are preferably secured to the flanges 20—20 by bolts 25—25. It will thus be seen that the tie plate 24 is detachable upon removal of the bolts to thereby permit insertion of a draft gear through the front of the testing apparatus.

At the upper end each channel member 17 is provided with a hinge bracket plate 26 suitably secured to the corresponding web section 19 of the member 17 by means of a pair of screws. To each hinge plate 26 is hinged one of the retaining lugs 27—27, each lug being provided with a pair of hinge eyes 28—28 adapted to accommodate a hinge bolt 29 which extends through an eye formed in the hinge plate 26, the bolts 29—29 being utilized in connecting the detachable guide frame B to the main body of the frame A, in a manner hereinafter described. Each of the displaceable retaining lugs 27 is preferably in the form of a hook member, as most clearly shown in Figures 1 and 2, the hook portion 30 of each lug being adapted to overhang the inner side of the corresponding side member and simulate the usual corresponding front stop lug of the draft rigging. In order to lock the retaining lugs 27 in operative fixed position, each member 17 is provided with a detachable retaining bolt 31 at the upper end thereof, the flanges of the member 17 being provided with opening to accommodate the bolts 31—31, and each bolt in turn being adapted to engage and bear on the outer side of the corresponding retaining lug 27. To insert the gear into the frame A the locking bolts 31 are removed and the retaining lugs 27—27 swung outwardly to inoperative position after which the tie plate 24 is removed and the gear entered through the front of the frame. The follower plate on which the gear is supported rests on the blocks 21—21, while the follower plate 12 is placed on top of the gear. The retaining lugs 27 are then swung inwardly to overhanging position with reference to the follower plate 12, the tie plate replaced, and the locking bolts reinserted.

The guide frame B is adapted to be detachably connected to the main body of the frame A, the frame B being of such character that when the same is in position, it is adapted for the reception of a dummy coupler or pressure-transmitting column member C which is movably guided into contact with the draft gear follower when held by the main frame. The frame B comprises channel members 33—33 which form the side walls thereof, and provide what are in effect continuations of the side walls of members 17—17 of the main body of frame A, the walls 33 being suitably recessed to permit the operation of the pivoted retaining lugs 27—27, the lower ends of the members 33—33 being adapted to rest upon the top edges of the members 17—17 when the parts are in position. The members 33—33 are provided with flanges 34—34 which are connected together in spaced relations by a rear plate 35, the edges of which are secured to said flanges by rivets. The plate 35 extends downwardly beyond the lower ends of the channel members 33—33 and is connected to the flanges of the members 17—17 by removable bolts. The flanges 34—34 of the members 33—33 at the forward portion of the apparatus have secured thereto, by means of rivets, bars 137—137, said bars terminating flush with the upper ends of the flanges 34—34, and extending downwardly below the lower ends of said members a suitable distance, as indicated at 38, the extensions 38 being secured to the flanges of the members 17—17 by detachable bolts 39. At the front of the frame at a point spaced inwardly from the upper end thereof is a cross bar 380, said bar being secured to the flanges 34—34 of the side members 33—33 by means of threaded members 39—39. At the top of the frame B at the forward side thereof is a cross bar 40 having its ends secured to the forward flanges of the members 33—33 by threaded members 141—141, as best shown in Figure 3. The intermediate portions of the bars 380 and 40 are inwardly offset, as best shown in Figures 2 and 3, and secured to the inner side of the lower bar 380 at a point intermediate its ends is a channel-shaped guide member 41. Oppositely disposed to the guide member 41 is a channel member 42 of a similar character which is secured to the plate 35, as best shown in Figure 2. The upper bar 40 is provided with a channel-shaped member 43 having its flanges inwardly disposed, this member having its flanges spaced apart a greater distance than those of members 41 and 42, the member 43 being secured to the inner surface of the bar 40 by means of rivets. An oppositely disposed guide member 44, similar to the member 43, is secured to the plate 35 by rivets, the members 41—42, 43 and 44 being adapted to provide guide means for the dummy coupler or column C which is interposed between the drop hammer 13 and the follower 12 of the draft gear. The frame B is readily detachable and attachable by removal or application of the bolts 39 and 31 and the bolts connecting the plate 35 and the members 17—17.

The column member C which I employ in connection with my improved method may be in the form of a hollow casting, a tube of rolled metal, or a solid bar, but is preferably in the form of a hollow casting conforming in shape, size, and physical characteristics to the usual standard cast steel coupler shank. In actual practice I employ a standard coupler, the head of which is cut off, thereby providing the cast steel column member C having a flat upper end, as shown most clearly in Figure 4. This flat upper end provides a face for receiving the impact of the drop hammer. In actual practice in testing, a block 50 is placed on top of the column to directly receive the blow from the hammer. The block 50 has a pocket 51 within which the upper end of the column C is telescoped, thereby protecting the end of the column from the blows of the hammer and preventing spreading and distortion of the same. A supply of such column members is kept at hand, each being identical with the other as to dimensions and physical characteristics, care being especially exercised that they are all of the same uniform length or height.

In carrying out my improved method, the draft gear to be tested, indicated by 11, is placed on the anvil of the drop hammer within the testing frame A, together with the follower plate 12, the column C, and the block 50 superimposed thereon as hereinbefore pointed out. The draft gear is thus held in position under conditions identical with those encountered in actual practice, and the column member C is actuated and guided as is the standard coupler in service. The particular draft gear illustrated is of the friction type and includes the usual friction casing having interior friction surfaces with which a friction system, comprising shoes and a wedge block, cooperates. The casing also contains a spring resistance which opposes inward movement of the shoes.

With the gear in position on the anvil of the drop hammer, the hammer is first dropped a number of times from a given predetermined height. The length of the column member C is measured at selected intervals during this part of the testing operation to determine the set of the same, if any. The same measurement is made of the gear itself. The identical operations are then repeated by dropping the hammer the same number of times from each of a series of progressively increasing heights, measurements of the coupler shank and gear being made in a similar manner during each stage of the operations. In case the set of the column member C at any time during the test amounts to ½ inch in length, the same is discarded and a new column member substituted during the remainder of the test, this substitution being repeated each time the set of the column approximates ½ inch. As will be evident, the amount of set of the column at any time gives directly an indication of the ability of the draft gear to protect the coupler of a railway draft rigging. Further, a coupler set in excess of ½ inch indicates that the particular draft gear being tested has reached the limit of ability to protect the coupler. Comparisons may thus be made between the efficiency of different gears by noting the amount of coupler set of each draft gear under identical testing conditions. Further, a set of the column amounting to ½ inch is an indication that the same amount of set will be produced by this particular gear under similar conditions in a standard coupler when the gear is in service on a railway car. In a coupler having this amount of set, the coupler head will deliver the impact directly to the striking casting, the standard clearance between the coupler head and the striking casting of a car being approximately ½ inch.

The data obtained as to the amount of gear set as compared with the amount of coupler set are also of importance in my method of testing, as the same gives an indication of the column strength and ruggedness of the gear in actual service.

The diagram shown in Figure 5 is illustrative of the data obtained by my improved method of testing and shows graphically the coupler set and gear set produced at different stages in the testing of an efficient draft gear which properly protects the coupler and the underframe structure and body of the car. In this diagram, stepped heavy line *a—a* indicates the height from which the hammer is dropped at successive stages in the testing operation, line *b—b* the capacity of the gear, line *c—c* the sill pressure, line *d—d* the coupler set which corresponds to the set of the column employed, and line *g—g* the gear set. With reference to the line *a—a*, the height measured along the vertical axis of the diagram indicates in inches the vertical distance the hammer is dropped, each space between two horizontal lines of the diagram corresponding to 1 inch. The distance from left to right measured along the horizontal axis of the diagram indicates the successive stages of the testing operation, the vertical line one space from the left edge of the diagram indicating the first stage, the next line to the right indicating the second stage, and the other line successively indicating the stages which follow. The height measured along the vertical axis indicates the pressure in pounds with reference to the lines *b—b* and *c—c*, each space between two horizontal lines indicating 25,000 pounds and the first horizontal line at the bottom of the diagram indicating a pressure of 100,000 pounds. Thus the successive intersections of the horizontal lines with the vertical axis reading from the bottom to the top of the diagram indicate 100,000 pounds, 125,000 pounds, 150,000 pounds, etc. The line *b—b*, representing the capacity of the gear, is obtained by measuring on each vertical line, in accordance with the scale of pounds hereinbefore set forth, the gear capacity at the height the hammer is dropped at the stage of the testing operation indicated by that particular vertical line and marking the point found. The points thus obtained on the successive vertical lines corresponding to the successive stages of the testing operation are then connected to produce the line *b—b*. The line *c—c*, representing the sill pressure, is produced in the same manner as the line *b—b*, the sill pressure in pounds being measured successively along the vertical lines representing the successive stages of the testing operation. With reference to the lines *d—d* and *g—g*, the heights measured along the vertical axis of the diagram in Figure 5 by the horizontal lines indicate in each instance the amount of set or shortening of either the coupler shank or the draft gear, each division representing $\frac{1}{16}$ inch. These measments are designated at the right-hand side in the diagram in Figure 5. To obtain the lines *d—d* and *g—g*, the amount of set at each stage of the testing operation is measured along the corresponding vertical line, and the points thus obtained are connected. In obtaining the data given by this diagram, a 9,000-pound hammer is employed, and the steps of my improved method are performed in the following manner: The hammer is first dropped on the column member C superimposed on the gear 11 from a height of 10 inches, as indicated by the first step in the line *a—a*. The hammer is dropped twenty-five times from this height and both the column member and the gear are measured at intervals during this stage of the test. However, as there is no coupler set of the column and no set of the gear at this stage, there is no indication of the same on this part of the diagram. At the next stage of the testing operation, the hammer is dropped twenty-five times from a height of 11 inches. This is indicated by the second step in the line *a—a*. The measuring of the column member and gear is also repeated at this stage. The same procedure is repeated at successive stages of the test, the drop of the hammer being progressively increased one inch at each succeeding stage, as indicated by the stepped line *a—a*. As shown by the lines *d—d* and *g—g*, the gear set and coupler set are first indicated by measurement when the hammer is dropped from a height of 28 inches. In this diagram each space between the horizontal lines represents a set or shortening of $\frac{1}{10}$ inch. At the succeeding stages of the testing operation, as the hammer is dropped from greater heights the coupler set and gear set both gradually increase, the coupler set being slightly over $\frac{3}{10}$ inch when the hammer is dropped from a height of 33 inches. The gear set as shown by the line *g—g* of this diagram amounts to approximately $\frac{1}{10}$ inch at this stage of the operations. As indicated by the line *b—b*, the capacity of this particular gear gradually increases during the tests, the capacity at the last stage being over 23,000 foot pounds, assuming the use of a 9,000-pound hammer and a gear travel of 2½ inches. The sill pressure line *c—c* also indicates a gradual increase until coupler set begins, whereupon the increase is more rapid and at the final stage is slightly in excess of 700,000 pounds. The data as to capacity of the gear and sill pressure are obtained by calculations founded on data obtained during testing, the manner and method of obtaining the same not forming a part of my invention.

The diagram of Figure 6 is produced in the same manner as the diagram in Figure 5 and shows the data obtained by my method of testing in connection with a different gear which is incapable of properly protecting the coupler shank and car structure. The procedure in testing this gear is precisely the same as that in connection with the gear referred to in the discussion of Figure 5, the hammer being dropped in stages from heights progressively increasing from 10 inches to 33 inches. This diagram is to the same scale as the diagram in Figure 5 and shows a very rapid increase in sill pressure, a rather early coupler and gear set, and excessively great coupler and gear set at a hammer drop of 33 inches. The coupler set begins at a hammer drop of 23 inches and reaches the excessive amount of about 4 inches at a hammer drop of 33 inches. In testing this gear it thus becomes necessary to renew the column member C a number of times and this is a clear direct indication of the inability of the gear to protect the coupler and car proper. The column, being shortened ½ inch (which is the limit allowed) during the testing at 28 inches drop of the hammer, is replaced by a new column C, which in turn must be replaced before the hammer is dropped from a height of 30 inches, as indicated by the line *d—d* of this diagram. Thus when the stage is reached when the hammer is dropped 33 inches, seven column members have been used. This fact, without any calculations, shows the failure of this particular gear to fulfill requirements.

Further comparison of the number of column members employed in each instance in testing several gears directly gives the comparative value of the gears as to efficiency and capacity. Further, when one column member suffices to complete a test of a gear it is a true indication that the gear will fully meet all requirements in actual service. In other words, the column element employed in my improved testing method is an accurate gauge for the draft gear, showing clearly the relative amount of protection afforded by various types of draft gears.

Indications as to the comparative value of different gears are also obtained by employing only a single column member in testing each gear, carrying on the test of each gear until the column is shortened ½ inch, and comparing the number of drops of the hammer required to produce the ½-inch set in each case. In following this procedure, the test of the gear, the performance of which is indicated by the diagram in Figure 5, would be carried on to a stage where the hammer is dropped from a height exceeding 33 inches, while in connection with the gear, the performance of which is indicated in Figure 6, the test would be terminated at a hammer drop of 29 inches. This alone is a clear indication of the inferiority of the latter gear as compared with the former.

From the preceding description taken in connection with the drawings, it will be evident that I have provided an exceedingly simple and efficient method of testing draft gears, which gives direct indication as to the performance of the gear and further gives the more vitally important information as to the ability of the gear to protect the coupler and body structure of railway cars.

I have herein shown and described what I now consider the preferred manner of carrying out my invention, but the same is merely illustrative and I contemplate all changes and modifications that come within the scope of the claims appended hereto.

I claim:

1. A method of testing the shock absorbing qualities of railway draft gears adapted to cushion shocks, including the following steps; buttressing a draft gear against a rigid support; superimposing a column member of hard metal of predetermined length, having the known physical characteristics of a standard railway car coupler on said gear; delivering a predetermined number of blows to said draft gear through the medium of said column member by means of a drop hammer dropped directly on said column member from different predetermined heights while said column is being cushioned by said draft gear, thereby successively compressing said draft gear through the medium of said column member thereby subjecting the column member to compression forces, measuring the overall length of said column member at predetermined intervals throughout the testing operation, and comparing said measurements in length with the original predetermined length of the column member, thereby obtaining an indication of the performance of said gear as a shock absorbing means.

2. A method of testing the shock absorbing qualities of railway draft gears adapted to cushion shocks, including the following steps, buttressing a draft gear against a rigid support; supporting a column member of hard metal of predetermined length, having the known physical characteristics of a standard railway coupler on said gear; delivering a plurality of blows to said draft gear

through the medium of said column member by means of a drop hammer, dropped directly on said column member while said column member is being cushioned by said draft gear, thereby successively compressing said draft gear and subjecting the column member to compression forces, said hammer being dropped from different predetermined heights and from each height a predetermined number of times to deliver a predetermined number of blows during the complete testing operation of said gear, measuring the length of said column member at predetermined intervals during the testing operation, comparing said measurements in length with the original predetermined length of the column member to determine the amount of shortening of said column member at the time each measurement is taken; continuing said testing operation after each measurement has been taken; discarding said column member and substituting a like column member therefor if any measurement taken shows the column member as having been shortened to a predetermined extent corresponding to the permissible maximum shortening of a standard coupler in service; and continuing said testing operation of said draft rigging in a like manner until the test has been completed, thereby obtaining, through the count of the number of column members employed during said completed test, an indication of the performance of said gear as a shock absorbing means.

ARNOLD E. DENTLER.