DIXI

DIXI S.A. USINE I - LE LOCLE - SUISSE

DIXI MECHANICAL FUZE

SINGLE ACTION

MECHANICAL TIME

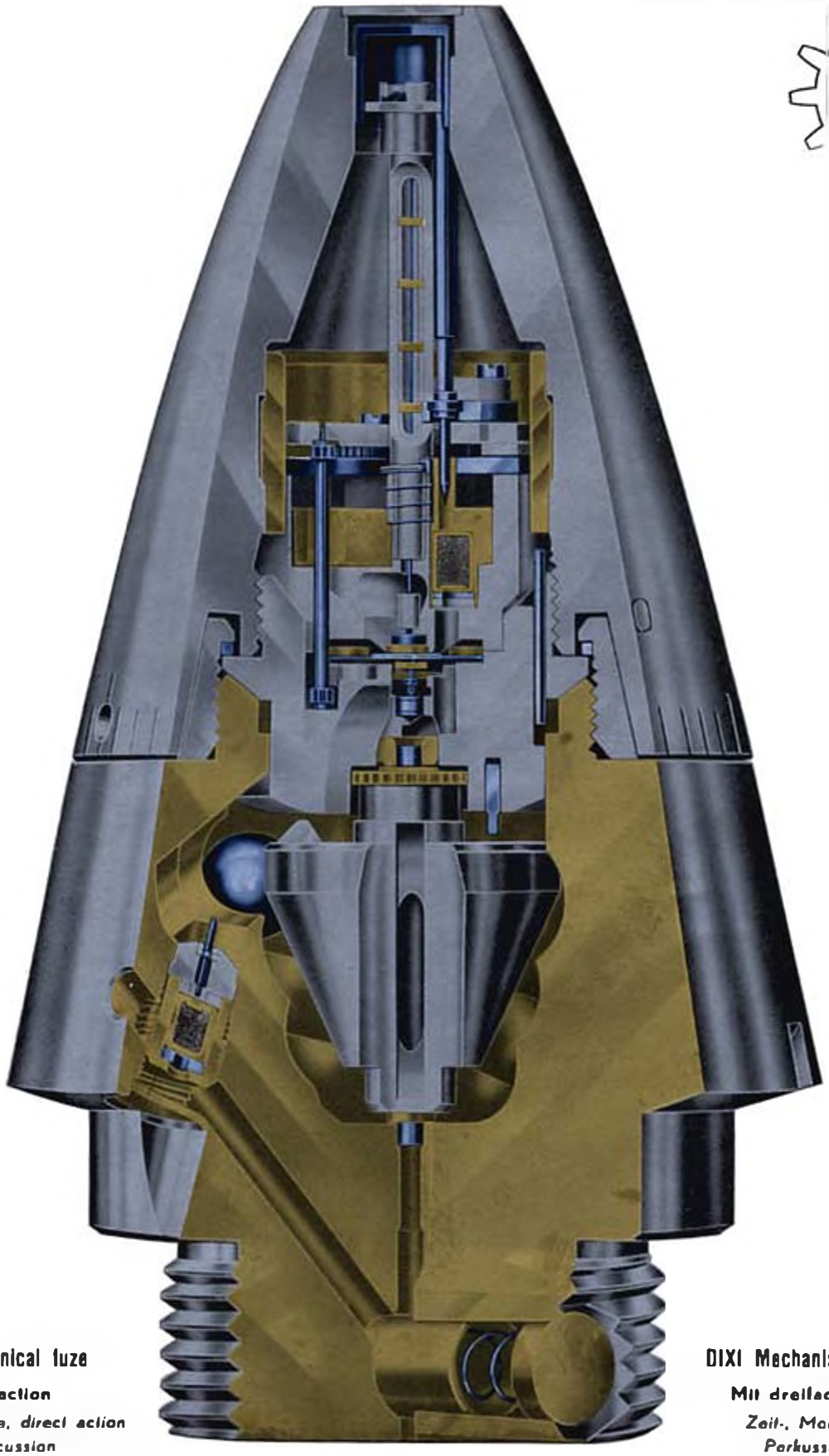
DOUBLE ACTION

MECHANICAL TIME
AND DIRECT ACTION

TRIPLE ACTION

MECHANICAL TIME, DIRECT ACTION
AND PERCUSSION

DIXI S.A. USINE I - LE LOCLE - SUISSE



DIXI mechanical fuze

Triple action

Mechanical Time, direct action and percussion

DIXI Mechanischer Zeitzünder

Mit dreifacher Wirkung

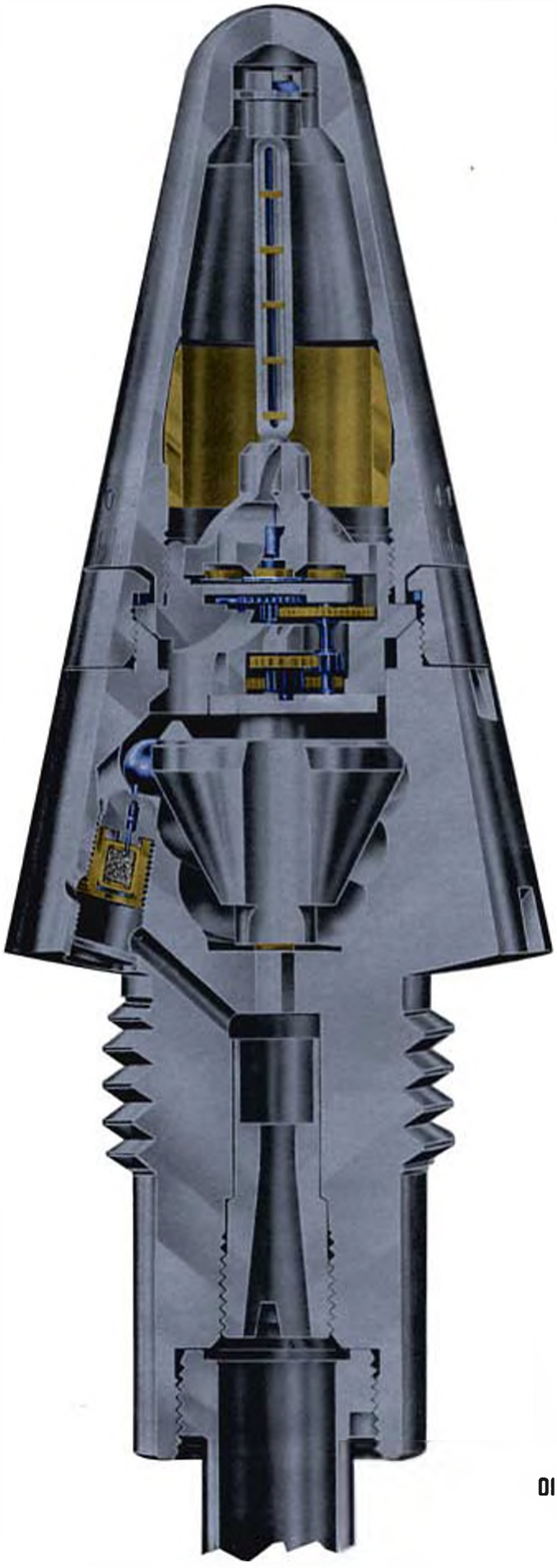
Zeit-, Momentan- und Perkussionszünder

Fusée mécanique DIXI

Triple effet

Fonctionnement à temps
Percutante instantanée
Percutante par inertie

DIXI



DIXI mechanical fuze

Single action

Mechanical Time

DIXI Mechanischer Zeitzünder

Mit einfacher Wirkung

Zeitzünder

Fusée mécanique DIXI

Simple effet

Fonctionnement à temps

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INTRODUCTION

Modern artillery shell of all types require fuzes of greater versatility than those formerly acceptable. Fuze timing and performance must be highly accurate and adaptable to various types of projectiles, regardless of the difference in acceleration and velocity, and of atmospheric conditions. Dependable safety principles must be incorporated to assure complete safety in handling, transportation, storage and firing. Such features are only attained through sound technical engineering and design.

The greatest advantage in a mechanical time fuze over other kinds is the fact that the elements of wind, air temperature, air density and humidity do not affect them during the flight of the projectile.

The characteristic features of the DIXI Mechanical Time Fuze satisfy all the requirements of modern artillery and far surpass those of any other design yet produced.

GENERAL FEATURES - CHARACTERISTICS

The DIXI Mechanical Time Fuze offers greater safety in transportation, storage handling and use because of the numerous principles ond devices incorporated in its design to assure this important requirement

The driving device is operated by centrifugal force. Since no spring is used, the mechanism remains inert until it reaches the maximum rotational velocity at the muzzle of the gun. This feature precludes objectionable spring breakage as ore found in fuzes of other design.
DIXI FUZES are available for various rotational speeds in three categories :

(1) For high speeds from 5,000 to 20.000 RPM
(2) For low speeds starting at 3,000 RPM ; or
(3) For the highest rotational speeds up to 40.000 RPM.

Timing mechanism

A minimum number of timing gears is employed, affording by this simplicity the desirable feature of facilitating production. As a result, the benefits of reduced material are gained in more accurate machining and strength of such components as gear teeth, an entirely original escapement with free amplitude which is capable of withstanding the acceleration and centrifugal force concomitant with high muzzle velocities. The maximum timing desired determines the type of timing gear employed. Standard fuzes ore designed for maximum timing from 30 to 75 seconds. *Other types are available for longer or shorter intervals.*

Regulating component

The regulating component incorporates a balance suspended on a torsion wire mounted on a shock absorber. The escapement, constructed to operate at high frequency and great amplitude, absorbs wide variations in driving power without effect upon its operating precision.

The detonator is fired by the action of centrifugal force rather than by a spring-held firing pin, thus providing another important safety feature, similar to that obtained with the DIXI driving device.

Fuze setting is done by rotating the entire nose of the fuze. The total radial angle is limited to about 340° by pin stops which determine minimum and maximum time settings.

SPECIAL FEATURES

Either superquick point detonation or delay functioning may be added to the basic features of the DIXI Time Fuze.

Safety features

1. The driving device remains inert until reaching maximum acceleration at the muzzle of the weapon.
2. The regulating component is blocked between two safety devices which cannot be freed without the successive actions of high acceleration and centrifugal force.
3. The detonator is provided with a safety device which resists the effects of maximum acceleration and which is immune to centrifugal force.
4. A minimum time of functioning is assured by the pin stops.
5. When point detonating or superquick actions are provided, safety in the bore of the weapon and within a specified distance beyond the muzzle is attained by means of a special bolting system controlled by the timing mechanism.

Storage

DIXI MECHANICAL TIME FUZES are constructed to resist ambient humidity and all kinds of weather conditions. When prolonged storage is necessary, it is essential that water tight and air tight containers be used for packaging in order to safeguard the fuze against the effects of excessive dampness, tropical climates and immersion.

Transportation

Due to the safety and operating features of their design, the DIXI MECHANICAL TIME FUZE components will withstand all handling shocks and transport vibrations without sustaining damage.

Adaptability

By altering the contour and weight of the DIXI FUZE, various types can be produced which will meet the ballistic requirements for any projectile or weapon.

1

Single-action type fuze (Mechanical time)

Description

The following list is to be used in conjunction with Fig. 1, page 9 and Figs. 2 a and 2 b, page 10.

1. NOSE which is screwed onto the ESCAPEMENT HOUSING (11).
2. UPPER COLLET which anchors the upper end of the TORSION WIRE (6).
3. UPPER COLLET HOUSING, which secures the UPPER COLLET (2) in a stationary position.
4. TORSION WIRE TUBE, which contains the TORSION WIRE GUIDES (8) and fits into the UPPER COLLET housing (3).
5. BALANCE, which is hung on the TORSION WIRE (6) and driven by the ESCAPEMENT (38) and ESCAPEMENT WHEEL (37).
6. TORSION WIRE, which determines the oscillation frequency of the BALANCE (5).
7. INTERMEDIATE GEAR, which drives the ESCAPEMENT WHEEL (37).
8. TORSION WIRE GUIDES, which keep the TORSION WIRE (6) within the geometrical axis of the fuze.
9. ADDITIONAL GEAR, which connects the DRIVING GEAR (28) to the ESCAPEMENT GEAR (7).
10. SET-BACK WEIGHT, which, during the acceleration of the projectile, strikes the LOCKING-PINS (13).
11. ESCAPEMENT HOUSING, in which the timing mechanism and regulating component are housed.
12. LOWER COLLET, which anchors the TORSION WIRE (6) to the BALANCE (5).
13. LOCKING PINS (usually three), which, upon being struck by the set-back WEIGHT (10) secure the set position by locking the ESCAPEMENT HOUSING (11) and BODY (26) to the NOSE (1).
14. BALANCE BRIDGE, on which the BALANCE (5) pivots, and on which the TORSION WIRE TUBE (4) is fixed.
15. DRIVING CONE, which transmits the driving power of the DRIVING BALLS (17) to the gear train.
16. ADAPTER RING, which secures the ESCAPEMENT HOUSING (11) to the BODY (26).

17. DRIVING BALLS, which by centrifugal force furnish the power to rotate the DRIVING DEVICE (15). One of these balls, the PERCUSSION BALL, is eventually ejected into the PERCUSSION CHANNEL (19) where it hits the STRIKER (21) at the proper time.
18. SPRING RING, the tension of which determines the torque which must be applied to the NOSE (1) in order to obtain a desired time setting.
19. PERCUSSION CHANNEL, into which the PERCUSSION BALL (17) escapes to hit the STRIKER (21).
20. MOBILE STOP PIN, wich is secured to the ESCAPEMENT HOUSING (11) and limits rotation of the NOSE (1). Together with the STATIONARY STOP PIN (22), the MOBILE STOP PIN establishes the minimum and maximum time settings.
21. STRIKER.
22. STATIONARY STOP PIN, which is anchored to the BODY (26).
23. STRIKER WASHER, which secures the STRIKER (21) in position against the effects of accelleration and handling shocks.
24. DRIVING CONE STOP, which anchors the DRIVING CONE (15) to the ESCAPEMENT HOUSING (11).
25. STRIKER HOUSING, within which the STRIKER (21) secured by the STRIKER WASHER (23) is held.
26. BODY, which connects the entire fuze mechanism to the projectile.
27. DETONATOR HOUSING, which contains the DETONATOR (29).
28. DRIVING GEAR, the initial gear in the gear train, which is secured to the DRIVING CONE (15).
29. DETONATOR.
30. CONICAL WORM GROOVES, through which the DRIVING BALLS move on their way to the PERCUSSION CHANNEL (19).
31. FLASH CHANNEL, which transmits the flash of the DETONATOR (29) to the BOOSTER (not shown).
32. LOWER PIVOT, on which the DRIVING CONE (15) rotates.
33. BODY THREAD, by which the fuze is assembled to the projectile.
34. BALANCE LOCK PIN SPRING GUIDE.
35. BALANCE LOCK PIN which assures the locking of the BALANCE (5) until acted upon by set-back force during acceleration in the bore of the weapon.
36. RELEASE CAM, which first blocks and then initiates oscillation of the BALANCE (5) under the effect of centrifugal force.
37. ESCAPEMENT WHEEL.
38. ESCAPEMENT.
39. ROLLER FINGER, which transmits the motion of the BALANCE (5) to the ESCAPEMENT (38).

Functioning of the single-action type fuze prior to firing

The lack of centrifugal force at this time plus the various safety devices render all components immobile.

Setting of fuze

The DRIVING CONE (15) is restrained from clockwise movement by the DRIVING CONE STOP (24) which is attached to the ESCAPEMENT HOUSING (11), into which the NOSE (1) is threaded. By turning the NOSE (1) counter-clockwise in relation to the body (26), the DRIVING BALLS are moved through the CONICAL WORM GROOVES (30).

By turning the NOSE (1) counter-clockwise from the safe position (maximum setting) to the desired setting, the PERCUSSION BALL (17) is moved toward the opening in the PERCUSSION CHANNEL (19). When the desired setting has been established on the graduated scale on the exterior of the NOSE (1), the distance between the PERCUSSION BALL (17) and the opening in the PERCUSSION CHANNEL (19) exactly corresponds to the time required for the PERCUSSION BALL (17) to reach the opening of the PERCUSSION CHANNEL (19) traveling at a rate of speed established by the rotation of the DRIVING CONE (15).

Behaviour in the barrel

When the gun is fired, initial acceleration causes the set-back WEIGHT (10) to press against the LOCKING PINS (13) which fit into a recess between the BODY (26) and the ESCAPEMENT HOUSING (11), thus preventing the NOSE (1) from rotating in relation to the BODY (26).

At the same time, the BALANCE LOCK PIN (35) is moved by set-back force in the direction indicated by arrowhead A (Fig. 2 a, page 10), after which the effect of centrifugal force moves it toward E (Fig. 2 b, page 10), in which position it is unaffected by changes in acceleration.

Due to clockwise rotary inertia, the DRIVING CONE STOP (24) prevents the DRIVING CONE (15) from undergoing any rotational stress, thereby also preventing displacement of the DRIVING BALLS (17) until the TIMING MECHANISM is set into motion.

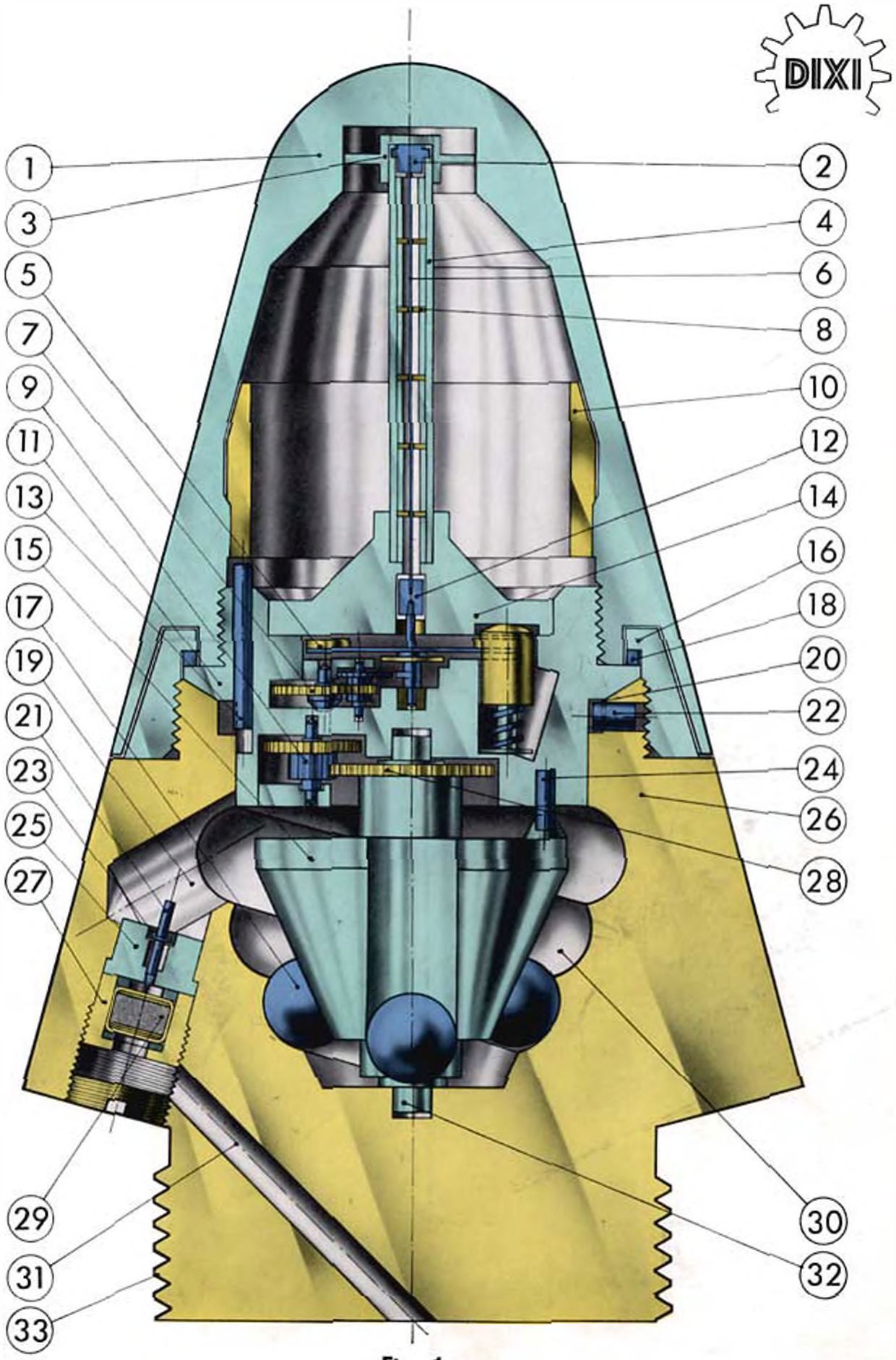


Fig. 1

DIXI mechanical fuze

Single action

Mechanical Time

Fusée mécanique DIXI

Simple effet

Fonctionnement à temps

DIXI Mechanischer Zeitzünder

Mit einfacher Wirkung

Zeitzünder

Double-action type fuze

1. **Mechanical time**
2. **Direct action** (Point-detonating)

Characteristics

The characteristics of the DIXI Mechanical Single Action Fuze (Fig. 1, page 9) as described on pages 3 to 5, are equally valid for the DIXI Mechanical Time Double Action Fuze, as the point detonating mechanism is merely an addition to the single-action type.

Special features

The point-detonating mechanism is extremely sensitive and is actuated only by contact with the target. It is independent of time and is incapable of being actuated while in the barrel during the acceleration period. During flight, the mechanism is unaffected by wind, rain, or other weather conditions.

Safety features

During acceleration and flight

The firing pin is rendered immobile by :

a. A FIRING PIN LOCKING LEVER which physically prevents the firing pin from reaching the point-detonating primer.

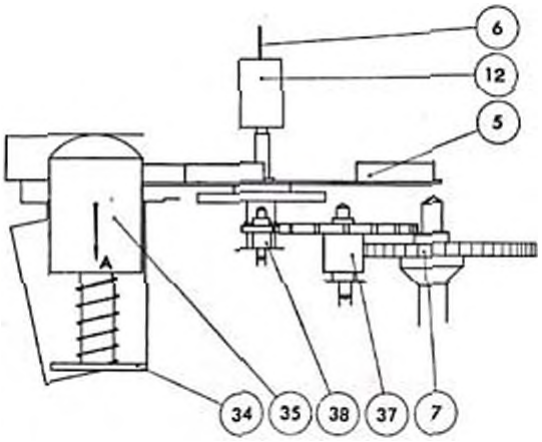
b. A FIRING PIN WASHER which holds the firing pin in position above the firing pin locking lever and which resists the effects of acceleration and handling.

Construction

The point - detonating mechanism is positioned above the escapement housing and exerts absolutely no influence over the accuracy, properties or functioning of the timing mechanism.

VERROUILLAGE DU MÉCANISME A TEMPS
SAFETY DEVICES OF THE TIME MECHANISM
SICHERHEITSVORRICHTUNG DES ZEITMECHANISMUS

Position des sécurités :
Position of safety devices :
Lage der Sicherheiten :



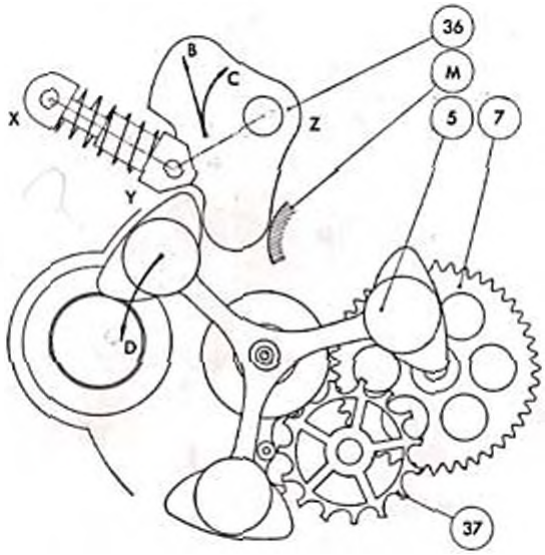
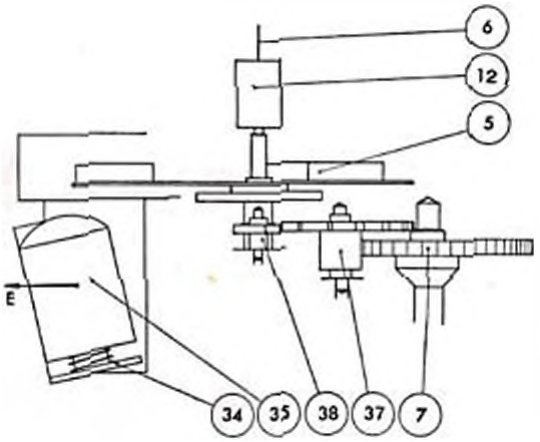


Fig. 2 a

avant le tir
before firing
vor dem Schiessen



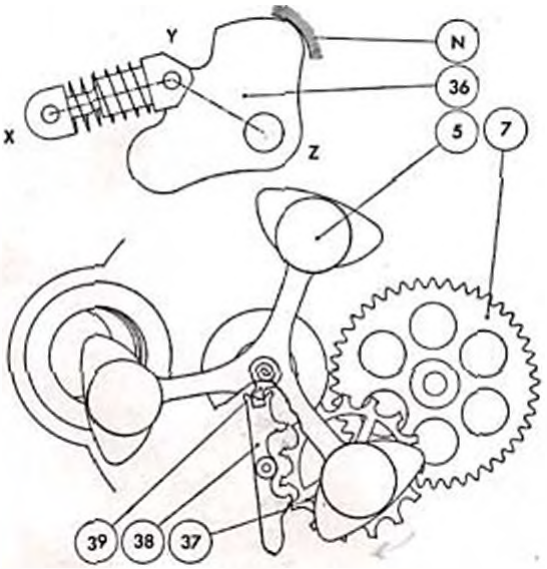


Fig. 2 b

pendant la trajectoire
during the trajectory
während dem Durchlaufen der Flugbahn

Double-action type fuze

Description

1. **Mechanical time**
2. **Direct action** (Point-detonating)

The following list is to be used in conjunction with Fig. 3, page 15 and Fig. 4, page 16.

7. INTERMEDIATE GEAR.
9. ADDITIONAL GEAR.
14. DRIVING CONE.
40. CLOSING DISC, which affords safety and protection against water, and which is ruptured by the shock of impact with the target.
41. STRIKER SHAFT, which transmits the impact shock from the STRIKER (42) to the FIRING PIN (45).
42. STRIKER which transmits the shock of impact from the CLOSING DISC (40) to the STRIKER SHAFT (41).
43. FIRING PIN WASHER which holds the FIRING PIN (45) in position above the FIRING PIN LOCKING LEVER (44) and which secures the FIRING PIN (45) in position against the effects of acceleration and handling.
44. FIRING PIN LOCKING LEVER, the fork of which completely secures the FIRING PIN (45) against the effects of acceleration and handling and which prevents contact between the FIRING PIN (45) and the POINT-DETONATING PRIMER (47).
45. FIRING PIN, the upper part of which is recessed in the STRIKER SHAFT (41) and the lower part of which is released by the movement of the FIRING PIN LOCKING LEVER (44) at the proper time and by overcoming the restraining force of the FIRING PIN WASHER (43) so that the POINT-DETONATING PRIMER (47) may by struck upon impact.
46. FIRING PIN LOCKING LEVER PINION, the upper part of which is geared to the FIRING PIN LOCKING LEVER (44) and the lower part to the INTERMEDIATE GEAR (7).
47. POINT-DETONATING PRIMER.
48. LOWER FLASH CHANNEL, which posses axially through the DRIVING CONE (15) and connects with the UPPER FLASH CHANNEL (49).
49. UPPER FLASH CHANNEL which connects the POINT-DETONATING PRIMER (47) to the LOWER FLASH CHANNEL (48).

Functioning of the double-action type fuze

Point-detonating mechanism

Prior to firing

The FIRING PIN (45) is held in position by the FIRING PIN WASHER (43) above the FIRING PIN LOCKING LEVER (44) which bars access to the POINT-DETONATING PRIMER (47). These two safety devices render the point-detonating system inoperative until, at the end of a predetermined time setting, the timing mechanism releases the FIRING PIN LOCKING LEVER (44) from contact with the FIRING PIN (45).

Behaviour in the barrel

The FIRING PIN WASHER (43) and the FIRING PIN LOCKING LEVER (44) render the fuze completely bore-safe.

Behaviour during flight

Under the effect of centrifugal force, the time mechanism is set into motion. The DRIVING CONE (15) transmits a moment through the gear train to the INTERMEDIATE GEAR (7) which drives the FIRING PIN LOCKING LEVER PINION (46). At the end of a predetermined time, the FIRING PIN LOCKING LEVER PINION (46) drives the FIRING PIN LOCKING LEVER (44) off its gear, allowing the latter to swing clear of the FIRING PIN (45), thereby arming the fuze.

Behaviour upon impact

Upon hitting an obstacle, the impact ruptures the CLOSING DISC (40) and is transmitted by means of the STRIKER (42) to the STRIKER SHAFT (41) which strikes the FIRING PIN (45), causing it to hit the POINT-DETONATING PRIMER (47) and thereby producing a flash.

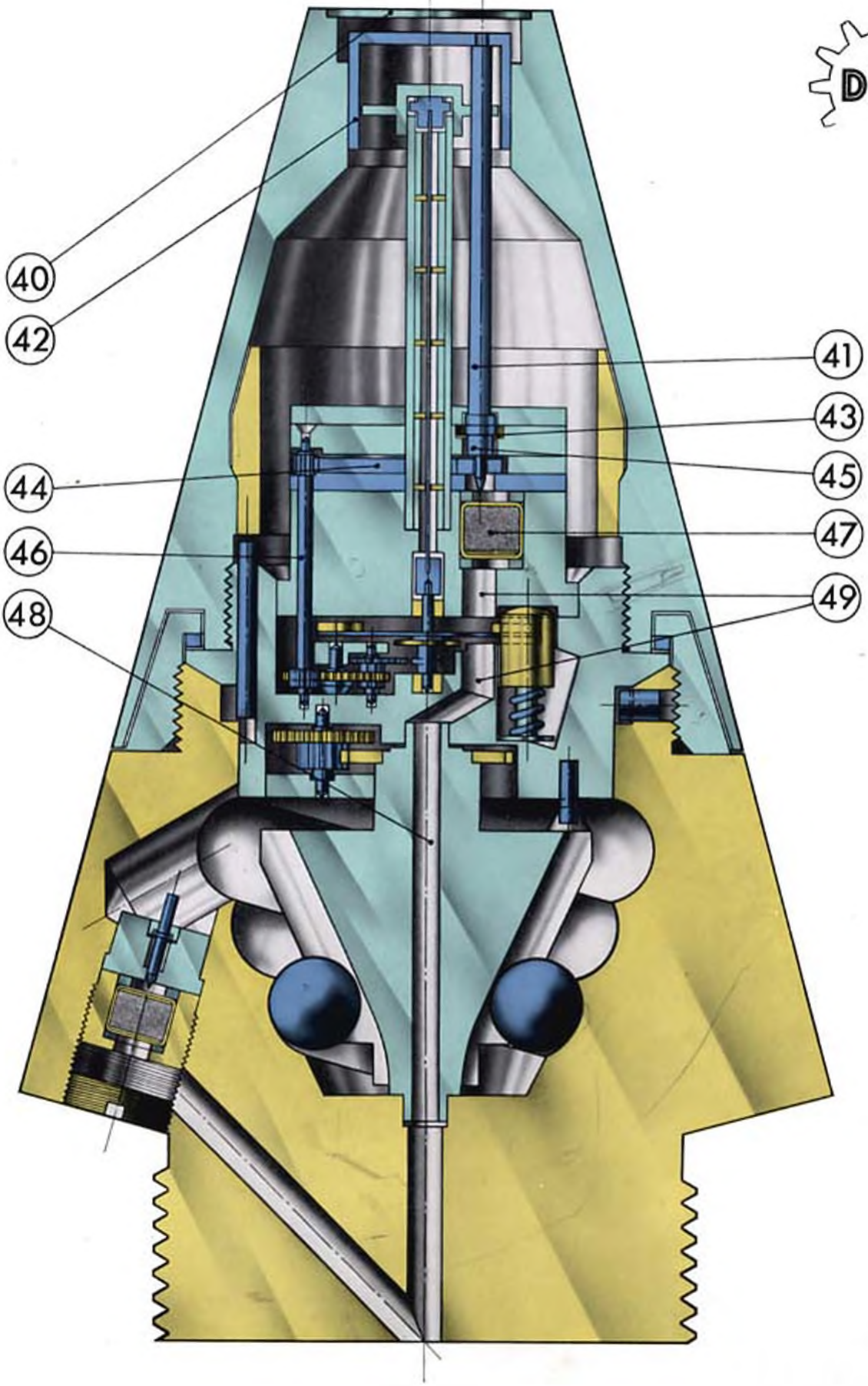


Fig. 3

DIXI mechanical fuze

Double action

Time and direct action

Fusée mécanique DIXI

Double effet

Fonctionnement à temps

Percutante instantanée

DIXI Mechanischer Zeitzünder

Mit zweifacher Wirkung

Zeit- und Momentanzünder

Triple-action type fuze

1. **Mechanical time**
2. **Direct action** (Point-detonating)
3. **Percussion**
   (Instantaneous detonation by abrupt decelleration)

Characteristics

The characteristics of the DIXI Mechanical Single and Double Action Type Fuzes, as previously described are also valid for the DIXI Mechanical Triple Action Fuze. The point-detonating and delay mechanism are additions to the single ation type fuze.

Special features

The delay feature is an addition to the point detonating mechanism and is actuated only by a sudden decelleration.

Safety systems

The safety systems as described for the double action fuze on page 5 simultaneously render both the point-detonating and the delay mechanisms inoperative.

Construction

The point-detonating and delay mechanisms are positioned above the ESCAPEMENT HOUSING (11) and exert no influence whatever upon the accuracy, properties, or functioning of the time mechanism.

Triple-action type fuze

Description

1. **Mechanical time**
2. **Direct action** (Point-detonating)
3. **Percussion**
   (Instantaneous detonation by abrupt decelleration)

The following list is to be used in conjunction with Fig. 5, page 21.

60. CLOSING DISC.

61. STRIKER SHAFT.

62. STRIKER.

63. FIRING PIN SUPPORT, which acts as a support for the FIRING PIN (69) when the delay mechanism functions.

64. FIRING PIN LOCKING LEVER.

65. FIRING PIN WASHER.

66. FIRING PIN LOKING LEVER PINION.

67. FIRING PIN WASHER PLATE, in which the FIRING PIN WASHER (65) is set.

68. PRIMER BLOCK SPRING, which maintains the PRIMER BLOCK (70) in its initial position during flight.

69. FIRING PIN.

70. PRIMER BLOCK, a cylindrically shaped weight in which the POINT-DETONATING PRIMER (71) is housed.

71. POINT-DETONATING PRIMER.

72. LOWER FLASH CHANNEL.

73. UPPER FLASH CHANNEL.

Functioning of the triple-action fuze

Direct action (Point-detonating) **and percussion** (Instantaneous detonation by abrupt decelleration) **mechanisms**

Prior to firing

The FIRING PIN (69) is held in its initial position by the FIRING PIN WASHER (65). Should this washer rupture prematurely, the FIRING PIN LOCKING LEVER (64), which is inserted between a shoulder of the FIRING PIN (69) and the PRIMER BLOCK (70), will prevent détonation.

Behaviour in the barrel

The fuze is rendered bore-safe by the presence of the FIRING PIN WASHER (65), and the FIRING PIN LOCKING LEVER (64), which is connected to the timing mechanism, prevents contact between the FIRING PIN (69) and the POINT-DETONATING PRIMER (71).

Behaviour during flight

During flight, the mechanisms of the Triple - Action Fuze function in identically the same manner as in the case of the Double-Action Fuze, as described on page 7.

Behaviour upon impact

Upon impact the point-detonating mechanism functions in exactly the same manner as in the case of the Double Action Fuze, as described on page 7.

Should the point-detonating mechanism fail to function for any reason such as a poor angle of impact, the nature of the obstacle, or mechanical faults, the percussion mechanism will be activated by the effect of sudden decelleration causing the PRIMER BLOCK (70) to be thrown forward. This inertial effect causes the POINT-DETONATING PRIMER (71) to be struck against the FIRING PIN (69), resulting in detonation.

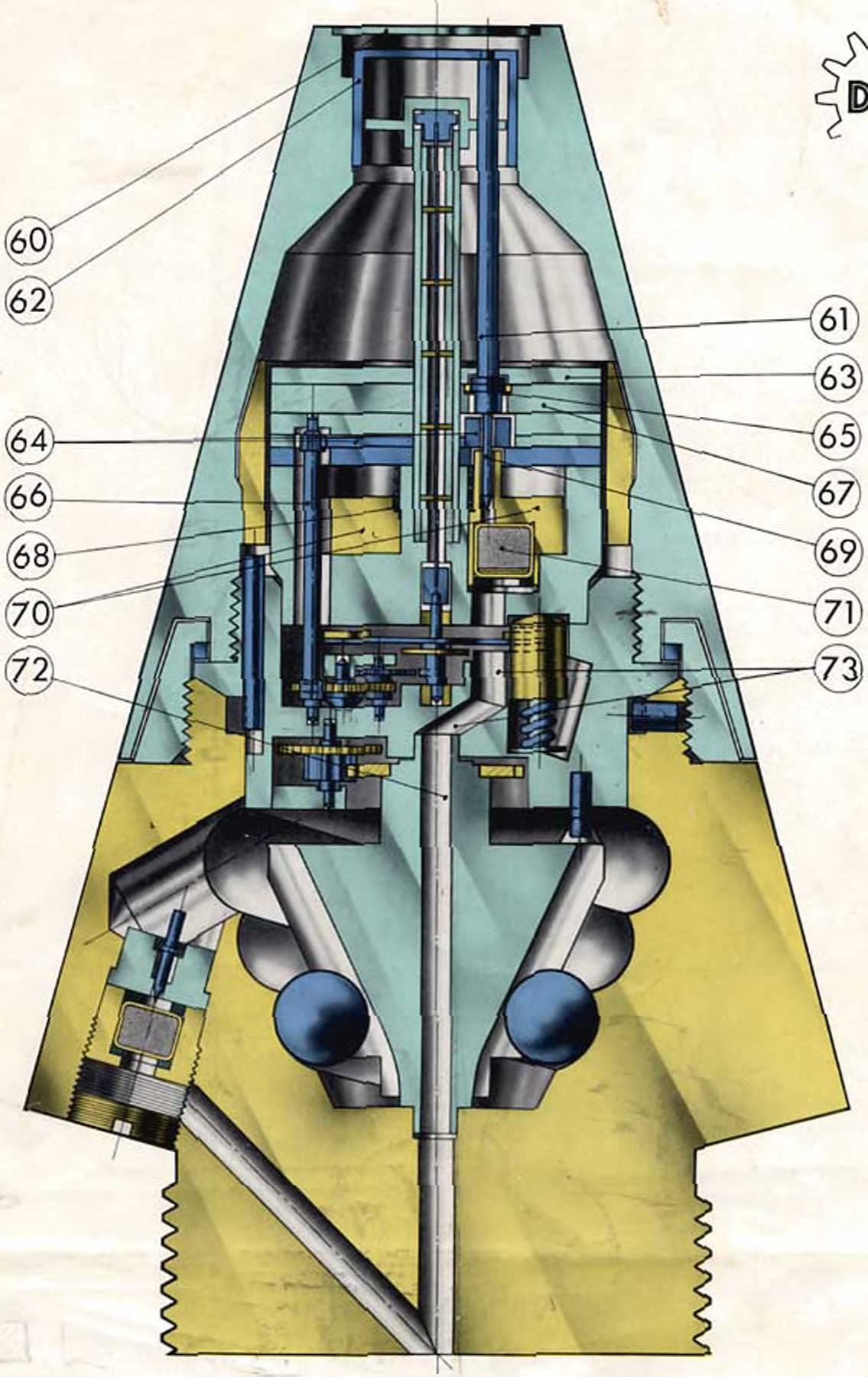


Fig. 5

DIXI mechanical fuze

Triple action

Time, direct action and percussion

Fusée mécanique DIXI

Triple effet

Fonctionnement à temps

Percutante instantanée

Percutante par inertie

DIXI Mechanischer Zeitzünder

Mit dreifacher Wirkung

Zeit-, Momentan- und Perkussionszunder

Technical data required for fuze design

Single-action type fuze

TECHNICAL INFORMATION (refer to Fig. 6, page 25).

1. Side view drawing of the entire fuze.
2. Detailed drawing of the THREAD.
3. Maximum and minimum height limits of the NOSE.
4. Detailed drawing of fuze-detonator thread.
5. Side view of the TIME PRIMER, when furnished by customer.
6. Detailed drawing of the TIME PRIMER, with thickness dimensions and details as to the nature of the percussion surface.
7. Detailed data on any safety device required between the TIME PRIMER and the detonator.

Miscellaneous and ballistic data

8. Composition and weight of powder to be used in any proposed relay.
9. Maximum and minimum time settings.
10. Maximum and minimum values of initial linear velocity (Vo).
11. Maximum value of the initial speed of rotation and minimum value of the speed of rotation at the end of the trajectory.
12. Maximum and minimum accelerations corresponding to linear velocities.
13. Caliber of gun in which fuze is to be used.
14. Maximum chamber pressures corresponding to linear velocities.
15. Weight of projectile without fuze.

16. Detailed data as to the character of barrel rifling.

17. Fuze weight without detonator.

18. Program of preliminary trials and proof firing.

19 a. Information concerning type of graduated time setting scale, with or without Vernier scale.

19 b. Information as to whether fuze is to be set clockwise or counter-clockwise and whether it is to be set from maximum to minimum or from minimum to maximum.

20. Position and size of holes for fuze setter or fuze wrench.

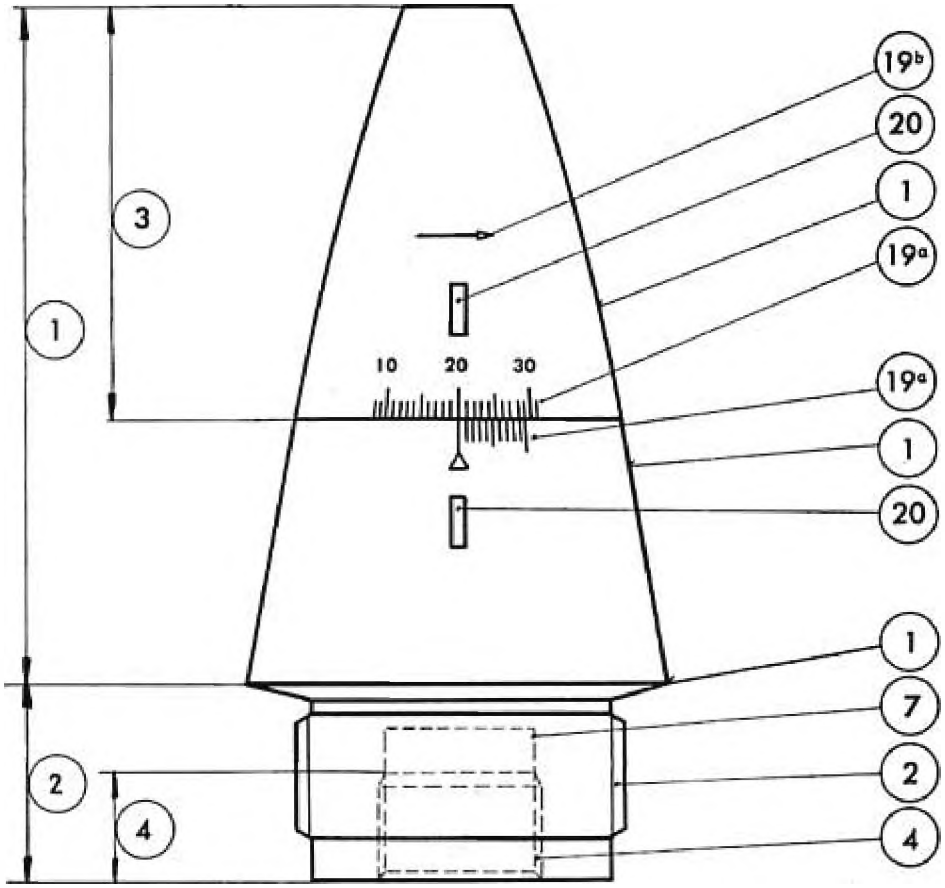
Additional information required for double or triple action fuzes

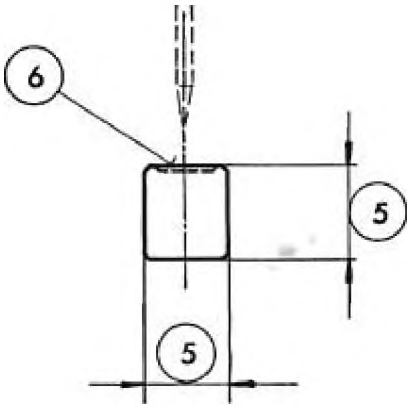
21. Minimum safety distance desired beyond the muzzle and the corresponding linear velocity.

22. Side drawing of POINT DETONATING PRIMER, when furnished by customer.

23. Detailed drawing of POINT DETONATING PRIMER, including thickness dimensions and data as to the nature of the percussion surface.

Program of preliminary trials and firing.

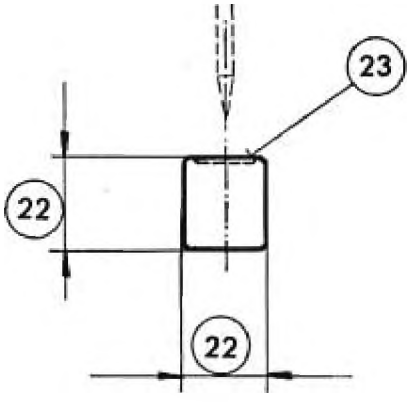




Amorce à temps

Time action primer

Zeitzündung - Zündhütchen



Amorce instantanée

Direct action primer

Momentanzündung - Zündhütchen

Fig. 6