



(51) International Patent Classification:

E01F 13/10 (2006.01) *E01F 13/06* (2006.01)
E01F 13/02 (2006.01)

(21) International Application Number:

PCT/SE2017/050422

(22) International Filing Date:

02 May 2017 (02.05.2017)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

1650590-1 02 May 2016 (02.05.2016) SE

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR,
KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,

(54) Title: ROADWORK SAFETY ARRANGEMENT

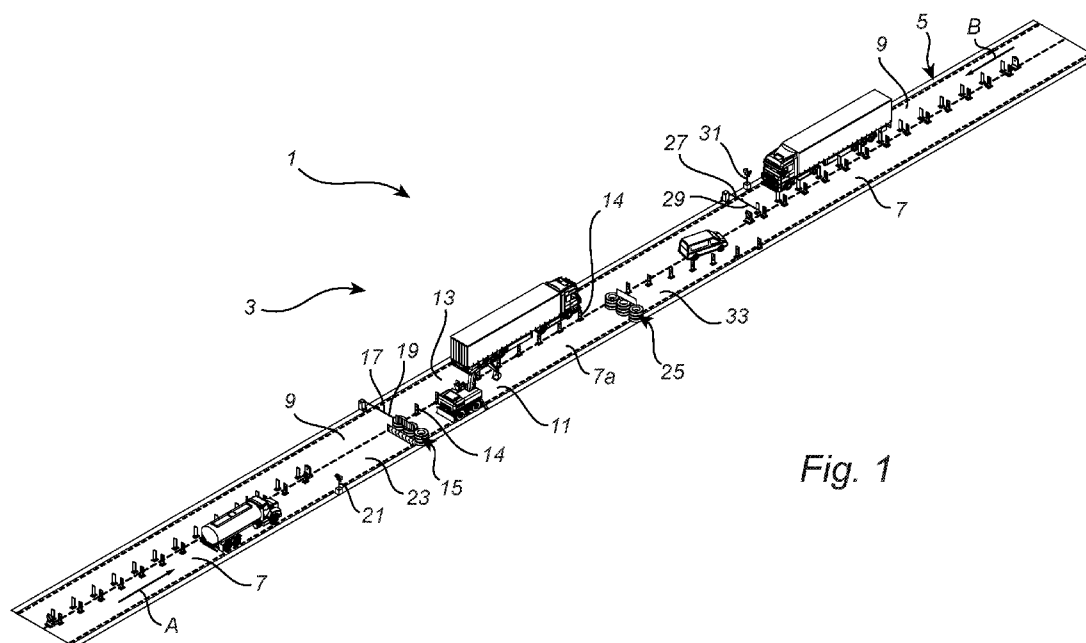


Fig. 1

(57) Abstract: The present invention relates to a roadwork safety arrangement (3) for directing traffic past a work zone (11) located in a closed lane portion (7a) of a first lane (7) of a road (5) via a traffic zone (13) located in an open lane (9) of the road (5). A first protection barrier (15) is located in the first lane (7) upstream the work zone (11) and a first traffic barrier (17) is located in the open lane (9) on the same side of the work zone (11) as the first protection barrier (15). The first traffic barrier (17) comprises an arm (19) being movable between a blocking position, in which it prevents vehicles to enter said traffic zone (13), and a non-blocking position, in which it permits vehicles to enter said traffic zone (13). The present invention also relates to a method of directing traffic past a work zone of a roadwork site.

UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

ROADWORK SAFETY ARRANGEMENT

Technical Field of the Invention

The present invention relates to a roadwork safety arrangement for directing traffic past a work zone located in a closed lane portion of a first lane of a road via a traffic zone located in an open lane of the road.

The present invention also relates to a method of directing traffic past a work zone of a roadwork site.

Background Art

At roadworks on roads with opposing traffic one lane is often closed. Then, traffic is typically alternated through a single lane past a work zone located in the closed lane. To improve the safety for road workers in the work zone traffic guards are commonly used to direct traffic past the work zone.

However, such traffic guards are exposed to the risk of being hit by a vehicle.

Summary of the Invention

It is an object of the present invention to provide a roadwork safety arrangement that provides a high level of safety for workers at roadworks.

These and other objects that will be apparent from the following summary and description are achieved by a roadwork safety arrangement according to the appended claims.

According to an aspect of the present disclosure there is provided a roadwork safety arrangement for directing traffic past a work zone located in a closed lane portion of a first lane of a road via a traffic zone located in an open lane of the road. A first protection barrier is located in the first lane upstream the work zone and a first traffic barrier is located in the open lane on the same side of the work zone as the first protection barrier, wherein the first traffic barrier comprises an arm being movable between a blocking position, in which it prevents vehicles to enter said traffic zone, and a non-blocking position, in which it permits vehicles to enter said traffic zone.

Entrance to the work zone, in which work on the road may be carried out, is thus blocked by the first protection barrier, which provides for a safe environment for workers in the work zone. The first protection barrier thus blocks entrance to the work zone and thereby prevents vehicles from entering the work zone and may even stop an impacting vehicle. Also, the protection barrier protects equipment and material in the work zone from being damaged.

The safety for workers in the work zone is further improved by the first traffic barrier, since it may prevent vehicles from entering not only the traffic zone but also the work zone. The first traffic barrier may thus, when in the blocking position, together with the first protection barrier block the whole width of the road, e.g. both lanes of a two-way road with two lanes, which, in an efficient and reliable manner, prevents vehicles from entering the work zone and thereby improves the safety for workers in the work zone. The whole width of the road on which the roadwork is carried out may thus be completely blocked at a time. Hence, the first protection barrier and the first traffic barrier are configured to, at a time, close the whole width of the road, since the first protection barrier is located in the first lane and the first traffic barrier is located in the open lane. The first protection barrier and the first traffic barrier are preferably located side-by-side.

Furthermore, the first traffic barrier enables a safety arrangement without traffic guards, since traffic may be directed using a traffic barrier in combination with one or more traffic lights and/or one or more traffic signs. A safety arrangement according to the present disclosure thus eliminates the need of traffic guards, also referred to as flagmen, at a roadwork site, which significantly reduces the risk of fatal injuries at a roadwork, since such traffic guards are exposed to the risk of being hit by a vehicle. Also, it may reduce costs to a great extent, since less people is needed at the roadwork site.

A flexible safety arrangement that allows for a high level of safety at roadworks may thus be provided.

Also, vehicle collisions within the traffic zone may be avoided, since the first protection barrier may prevent vehicles that, at a time, do not have access to the traffic zone from entering the traffic zone due to inattention.

Each of the first protection barrier, which is located in the first lane, and the first traffic barrier, which is located in the open lane, is thus located in front of the work zone, as seen in the direction of travel of the first lane of the road.

According to one embodiment the roadwork safety arrangement further
5 comprises a first traffic light located upstream the work zone and, preferably, a second traffic light located downstream the work zone. The first traffic light is a separate unit which is arranged to display a warning signal to vehicles approaching the work zone in the first lane. The first traffic light is preferably arranged at the roadside. The first traffic light is thus a separate unit, which
10 provides for a flexible arrangement allowing many different configurations together with the first protection barrier and the first traffic barrier. The first traffic light comprises at least one light source and is capable of displaying a warning signal, such as, e.g., flashing red lights.

If more than one traffic light is used, the traffic lights are thus separate
15 units, which provides for a flexible arrangement allowing many different configurations together with one or more protection barriers and one or more traffic barriers. Each of the traffic lights comprises at least one light source and is capable of displaying a warning signal, such as, e.g., flashing red lights.

20 According to one embodiment each traffic light comprises two light sources and is configured to display a warning signal in the form of flashing red lights that flash in a wig-wag pattern.

According to one embodiment the first traffic light is located at a distance of at least 25 meters, more preferably at least 60 meters, from the
25 first protection barrier.

According to one embodiment the first traffic lights is located on the right side of the first lane.

According to one embodiment each of the first and second traffic lights is located on the right side of the first lane and the second lane, respectively.

30 According to one embodiment the roadwork safety arrangement further comprises a second protection barrier located downstream the work zone, as seen in the direction of travel of the first lane of the road.

According to one embodiment the roadwork safety arrangement further comprises a second traffic barrier located downstream the work zone, as seen in the direction of travel of the first lane of the road, which second traffic barrier comprises an arm being movable between a blocking position, in
5 which it prevents vehicles to enter said traffic zone, and a non-blocking position, in which it permits vehicles to enter said traffic zone.

According to one embodiment a second protection barrier is located in the first lane downstream the work zone and a second traffic barrier is located in the open lane on the same side of the work zone as the second protection
10 barrier, wherein each of the first and second traffic barriers comprises an arm being movable between a blocking position, in which it prevents vehicles to enter said traffic zone, and a non-blocking position, in which it permits vehicles to enter said traffic zone. This allows the whole width of the road on which the roadwork is carried out to be completely blocked on each side of
15 the work zone.

According to one embodiment the first traffic barrier is configured to communicate wirelessly with a control device, preferably via two-way radio communication, in order to further improve the flexibility of the safety arrangement.

20 According to one embodiment the first and second traffic barriers are configured to communicate wirelessly with each other and/or with a control device, preferably via two-way radio communication, in order to further improve the flexibility of the safety arrangement. Especially, this is advantageous when the work zone extends a long distance and/or there are
25 one or more roads connecting to the road on which roadwork is carried out. It is thus appreciated that the work zone may extend up to several kilometers or longer. In case there is one or more connecting roads the safety arrangement preferably comprises at least a third traffic barrier.

According to one embodiment radio frequency technology with radio
30 frequencies that range from 403 MHz to 473 MHz is used, which provides for a reliable and cost-efficient solution.

According to one embodiment the safety arrangement comprises a control device to which the first traffic barrier is wirelessly connected.

According to one embodiment the safety arrangement comprises a control device to which each of the first and second traffic barriers is wirelessly connected. The control device may be located in one of the first and the second traffic barriers. For instance, the control device may be
5 accommodated in a stationary portion, such as a housing, of the first traffic barrier.

According to one embodiment the first and second traffic barriers are connected to a local independent network, preferably via radio two-way radio communication. A control device may then communicate with several units of
10 the safety arrangement simultaneously.

Furthermore, it is appreciated that one or more roads may connect to the road on which work is carried out at a roadwork site. Then, further units, such as further traffic barriers and traffic lights may be added. A very flexible safety arrangement capable of handling one or more connecting roads in an
15 efficient and safe manner, and that allows for a high level of safety for workers in the work zone, may thus be provided.

According to one embodiment the safety arrangement comprises a local independent radio network to which units, such as traffic barriers and traffic lights and remote controls, of the safety arrangement are connected.
20 The network allows communication between units of the safety arrangement and thus facilitates control thereof.

According to one embodiment the roadwork safety arrangement comprises a remote control unit for controlling at least the first and second traffic barriers and preferably several or all units of the safety arrangement.
25 The portable remote control unit may travel with an escort vehicle escorting vehicles pass the work zone. This embodiment has the advantage that the safety arrangement may be controlled by an operator, such as a driver of an escort vehicle, which further improves the flexibility of the arrangement. Furthermore, such a portable remote control unit provides for adaptability,
30 since the operator of the control unit may take prevailing traffic conditions into account.

According to one embodiment the safety arrangement further comprises an escort vehicle for escorting vehicles pass the work zone, which

further improves the safety for workers in the work zone. Furthermore, it provides for a flexible and adaptive arrangement.

According to one embodiment each of the first protection barrier and the first traffic barrier is mounted on a movable platform, such as a platform
5 with wheels. This embodiment has the advantage that the safety arrangement may be moved along a road, as the work zone is moved, in an efficient manner. The first protection barrier and the first traffic barrier may thus be mounted on a common movable platform.

According to one embodiment the arrangement comprises a third traffic
10 barrier and a third traffic light. This embodiment has the advantage that vehicle approaching the roadwork site on a road connecting to the road on which roadwork is carried out may be handled in an efficient manner.

According to another aspect of the present disclosure there is provided a method of directing traffic past a work zone located in a closed lane portion
15 of a first lane of a road via a traffic zone located in an open lane of the road, said method comprising: placing a first traffic barrier having a movable arm in the open lane at an entrance to the traffic zone, operating at least said first traffic barrier wirelessly from an escort vehicle using a portable remote control unit, and escorting vehicles pass the work zone via the traffic zone.

20 The control unit thus travels with the escort vehicle. The remote control unit operator, which may be the driver of the escort vehicle, may take the prevailing traffic conditions into account. The portable control unit thus allows the operator to decide e.g. when the arm of the first traffic barrier is to be moved from a non-blocking position to a blocking position, which provides for
25 flexibility and adaptability without the need for traffic guards at the entrance and/or exit of the traffic zone of a roadwork site.

Furthermore, such an operator-controlled directing of traffic past a work zone enables a high level of safety for workers in the work zone since vehicles are escorted by an escort vehicle that may travel at a predetermined
30 speed, thereby securing that no vehicles pass the work zone at a speed that would hazard the safety of workers in the work zone.

Said vehicles may thus be escorted at a predetermined speed. Preferably, the vehicles are escorted at a speed of 30 km/h or less. The

escort vehicle may thus force the escorted vehicles to travel at a speed below a speed limit, which secures that vehicles pass the work zone at a speed that provide a high level of safety for workers in the work zone and thus enables to maintain a high level of safety for workers in the work zone.

5 According to one embodiment the method comprises placing a first protection barrier in the first lane upstream the work zone.

 According to one embodiment the method comprises placing a first traffic light at an entrance to the traffic zone and a second traffic light at an exit of the traffic zone.

10 According to one embodiment the method comprises connecting the first traffic barrier to a local independent network via radio communication, preferably via two-way radio communication. Also, traffic lights capable of displaying a warning signal, such as a stop signal, may be connected to the local indepent radio network. This embodiment has the advantage that an
15 operator, e.g. the driver of the escort vehicle, may fully control some or all units of a safety arrangement at a roadwork site.

 These and other aspects of the invention will be apparent from and elucidated with reference to the claims and the embodiments described hereinafter.

20

Brief Description of the Drawings

 The invention will hereafter be described in more detail and with reference to the appended schematic drawings.

25 Figs. 1-2 are perspective views and illustrate a road work safety arrangement according to an embodiment of the present disclosure.

 Figs. 3a-f illustrates the function of the road work safety arrangement shown in Figs. 1-2 and a method of directing traffic past a work zone of a roadwork site.

30 Detailed Description of Preferred Embodiments of the Invention

 Fig. 1 shows a road work site 1 and illustrates a road work safety arrangement 3 according to an embodiment of the present disclosure. The road 5 at the roadwork site 1 is a two-way road with one lane in each direction. The direction of travel of the first lane 7 of the road 5 is indicated by

arrow A and the direction of travel of the second lane 9 of the road 5 is indicated by arrow B. The safety arrangement 3 is arranged to direct traffic past a work zone 11 located in a closed lane portion 7a of the first lane 7 via a traffic zone 13 located in the second lane 9 of the road 5.

- 5 A first protection barrier 15, which e.g. may comprise a concrete element, is arranged in the first lane 7 upstream the work zone 11. The first protection barrier 15 blocks the first lane 7 and prevents vehicles approaching the work site 1 in the first lane 7 from entering the work zone 11. Road cones 14 are arranged between the work zone 11 and the traffic zone 13.
- 10 Beside the first protection barrier 15 there is arranged a first traffic barrier 17 which is configured to control traffic by preventing or permitting vehicles to enter the traffic zone 13. To this end the traffic barrier 17 has a movable arm 19, in the form of a pivotable arm, which is movable between a blocking position, in which it prevents vehicles to enter the traffic zone 13, and
- 15 a non-blocking position, in which it permits vehicles to enter the traffic zone 13. In the blocking position the first traffic barrier 17, together with the first protection barrier 15, blocks the whole width of the road 5, i.e. both lanes 7, 9 of the road 5.

 In this embodiment the first protection barrier 15 and the first traffic
20 barrier 17 are thus arranged side by side. The side-by-side configuration of the first protection barrier 15 and a the first traffic barrier 17 allows the whole width of the road 5 to be blocked and thereby effectively prevent vehicles from entering the work zone 11, which improves the safety for workers in the work zone 11 significantly.

25 In the blocking position, illustrated in Fig. 1, the first protection barrier 15 and the traffic barrier 17 thus together extend over the whole width of the road 5, thereby preventing entrance to the work zone 11.

 A first traffic light 21 is arranged at the right side of the first lane 7 upstream the first protection barrier 15.

30 As shown in Fig. 1 the first traffic light 21 is located at a distance from the first protection barrier 15, whereby a buffert zone 23 is formed between the first protection barrier 15 and the first traffic light 21. The first traffic light 21 is thus separated from the first traffic barrier 15, which allows for great

flexibility, since units of the safety arrangement 3 may be arranged in several different configurations.

A second protection barrier 25 is arranged in the closed lane portion 7a downstream the work zone 11. The second protection barrier 25 prevents
5 vehicles from the other side of the work site 1, i.e. vehicles approaching the work site 1 in the second lane 9, from entering the work zone 11.

A second traffic barrier 27, which is of the same type as the first traffic barrier 15, is arranged in the second lane 9 upstream the traffic zone 13, as seen in the direction of travel B of the second lane 9. The second traffic
10 barrier 27 thus also has a movable arm 29 which is pivotable between a blocking position, in which it prevents vehicles in the second lane 9 from entering the traffic zone 13, and a non-blocking position, in which it allows vehicles to enter the traffic zone 13.

A second traffic light 31 is arranged on the right side of the second lane
15 9 upstream the second traffic barrier 27, as seen in the direction of travel B of the second lane 9 of the road 5.

Between the second protection barrier 25 and the second traffic barrier 27, as seen in the longitudinal direction of the road 5, there is arranged a taper 33 in the first lane 7. The taper 33 serves to direct vehicles that
20 approached the roadwork site 1 in the first lane 7, i.e. vehicles that travels in the first direction of travel A, back to the first lane 7 from the traffic zone 13 after passing the work zone 11.

Hence, the first protection barrier 15 prevents vehicles approaching the roadwork site 1 from one direction to enter the work zone 13 and the second
25 protection barrier 25 prevents vehicles from an opposite direction to enter the work zone 13.

Furthermore, in the blocking position, the first traffic barrier 17 prevents vehicles approaching the roadwork site 1 from one direction to enter the traffic zone 13 and the second traffic barrier 19 prevents traffic from an opposite
30 direction to enter the traffic zone 13.

Each of the first and second protection barriers 15, 25 is adapted to form an obstacle that prevent vehicles from entering the work zone 11 and, if needed, stop vehicles. It is thus appreciated that each of the protection

barriers 15, 25 has a significant weight and/or is anchored to the ground, so as to be capable of stopping an impacting vehicle.

Each traffic light 21, 31 comprises two light sources and is configured to display a warning signal, such as a stop signal, that prohibits vehicles from
5 proceeding. In this embodiment each traffic light 21, 31 is configured to display a warning signal in the form of flashing red lights that flash in a wig-wag pattern, although other types of warning signals are possible.

The safety arrangement 3 further comprises a control device (not shown) for controlling the separate units 17, 27, 21, 31 of the safety
10 arrangement 3. The control device may be configured to be remote-controlled in order to enable the safety arrangement 3 to be controlled from a remote location, e.g. from a traffic management centre, by an operator or worker at the roadwork site or by a driver of an escort vehicle.

The control device is configured to communicate wirelessly with each
15 of the two traffic barriers 17, 27 and each of the two traffic lights 21, 31 via two-way radio communication, as illustrated by arrows C in Fig. 2. To this end each of the traffic barriers 17, 27 and each of the traffic lights 21, 31 is provided with a two-way radio transmitter/receiver (not shown) for transmitting and receiving a RF signal.

20 As illustrated by dotted lines in Fig. 2 the work zone 11 may extend a long distance. In fact, the length D1, illustrated in Fig. 2, of the work zone 11 may be up to several kilometers or even more.

The control device may be located in one of the previously described units, e.g. in the first traffic barrier 17, of the safety arrangement 3 or may
25 form a separate unit thereof. The control device may be a portable remote control unit which is connected to units of the safety arrangement 3.

The safety arrangement 3 may thus comprise a portable remote control unit (not shown) which is, directly or via a control device, connected to one or more separate units of the safety arrangement 3. The portable remote control
30 unit may, e.g., be used by a driver of an escort vehicle, which further improves the safety for workers in the work zone 11, since the speed of vehicles passing the work zone 11 then may be maintained below a prescribed speed limit.

The first and second traffic barriers 17, 27 and the first and second traffic lights 21, 31 are thus configured to communicate with each other and/or with a control device, such as a portable remote control unit, via two-way radio communication. For this purpose radio frequency technology with radio frequencies that range from 403 MHz to 473 MHz may be used.

The safety arrangement 3 may comprise a local independent network (not shown) to which separate units, such as traffic barriers 17, 27, traffic lights 21, 31 and a portable remote control unit, of the safety arrangement 3 are wirelessly connected via two-way radio communication, which provides for a flexible and reliable safety arrangement.

With reference to Figs. 3a-f the function of the safety arrangement 3 and a method of directing traffic past a work zone 11 of a roadwork site 1 will be described hereinafter.

Fig. 3a illustrates a state where each of the first and the second traffic barriers 17, 27 is in the blocking position and where there is no vehicles in the traffic zone 13. Two vehicles 37 wait to pass the work zone 11. An escort vehicle 35, also referred to as a pilot vehicle, which is prepared to enter the traffic zone 13 and, at a predetermined speed, escort the waiting vehicles 37 pass the work zone 11 via the traffic zone 13 is located between the first traffic light 21 and the first traffic barrier 17. The first traffic barrier 17 may be operated, e.g. via a remote control unit, by the pilot vehicle driver, by a worker at the roadwork site 1, by an operator at traffic management centre or automatically by a control system. In this case the units of the safety arrangement 3 are operated by the pilot vehicle driver.

The traffic barrier 17 is thus moved from the blocking position to the non-blocking position by the pilot vehicle driver, as illustrated in Fig. 3b. Simultaneously, or shortly thereafter, a warning signal displayed by the traffic light 21 is turned off whereby the vehicles 37 waiting at the traffic light 21 are allowed to follow the pilot vehicle 35 into the traffic zone 13.

When a number of vehicles 37 has entered the traffic zone 13, or after a predetermined time period, the first traffic barrier 17 is moved back to the blocking position and the first traffic light 21 is turned red. Escorted by the

pilot vehicle 35 the vehicles 37 thus drive into the traffic zone 13 and pass the work zone 11, as illustrated in Fig. 3c.

After passing the work zone 11 the pilot vehicle 35 pull over and the escorted vehicles 37 returns to the first lane 7 and proceed along the road, as
5 illustrated in Fig. 3d.

The pilot vehicle 35 then turns, as illustrated by arrow D in Fig. 3e, and prepares to escort vehicles 39 in the opposite direction, i.e. in the direction of travel B of the second lane 9. When the pilot vehicle 35 is prepared to escort vehicles in this direction the second traffic barrier 27 is moved to the non-
10 blocking position and a warning signal displayed by the second traffic light 31 is turned off. Vehicles 39, that has been waiting at the second traffic light 31, are then allowed to enter the traffic zone 13. When a number of vehicles has entered the traffic zone 13, or after a predetermined time period, the second traffic barrier 27 is moved to the blocking position and a warning signal of the
15 second traffic light 31 is turned on. Escorted by the pilot vehicle 35 the vehicles 39 then drive into the traffic zone 13 and pass the work zone 11, as illustrated in Fig. 3f. When the pilot vehicle 35 is approaching the first traffic barrier 17, the arm 19 of the first traffic barrier 17 is moved to the non-blocking position, e.g. by the pilot vehicle driver or automatically, so as to
20 allow the escorted vehicles 39 to leave the traffic zone 13 and proceed along the road.

Hence, a method of directing traffic past a work zone 11 at a roadwork site 1 according to the present disclosure comprises placing a first traffic barrier 17 having a movable arm 19 in the open lane 9 at an entrance to the
25 traffic zone 13, placing a second traffic barrier 27 having a movable arm 29 in the open lane 9 at an exit of the traffic zone 13, operating at least said first traffic barrier 17, 27 wirelessly from an escort vehicle 35 using a portable remote control unit, and escorting vehicles 39 pass the work zone 11 via the traffic zone 13.

30 The method may comprise placing a first protection barrier 15 in the first lane 7 upstream the work zone 11 and a second protection barrier 25 in the first lane 7 downstream the work zone 11. Such protection barriers 15, 25 prevent unauthorized vehicles from entering the work zone 11.

The method may comprise placing a first traffic light 21 capable of displaying a warning signal at an entrance to the traffic zone 13 and a second traffic light 23 capable of displaying a warning signal at an exit of the traffic zone 13.

5 The method may comprise connecting each of the first and second traffic barriers 17, 27 to a local independent network via radio communication, preferably via two-way radio communication. By connecting units of the safety arrangement 3 to a local network high flexibility and adaptability is achieved, as discussed hereinbefore.

10 It is realized by a person skilled in the art that features from various embodiments disclosed herein may be combined with one another in order to provide further alternative embodiments.

 With reference to Fig. 1 a safety arrangement with two traffic barriers, one each side of the traffic zone, has been described. It is however
15 appreciated that there may be one or more roads connecting to the road on which roadwork is carried out, which may require further units, such as further traffic barriers and/or further traffic lights, at the roadwork site. Hence, the safety arrangement may comprise further separate units. For instance, the roadwork site may comprise one connecting road 41, as illustrated in Fig. 3a.
20 Then, a third traffic barrier 43 having a movable arm 45 and third traffic light 47 may be added, as illustrated in Fig. 3, and connected to the control device of the safety arrangement 3.

 Figs. 3a-f illustrate a situation where an escort vehicle 35 is involved in directing traffic. However, the safety arrangement 3 may direct traffic to pass
25 the work zone 11 without involving such an escort vehicle 35. If no escort vehicle is involved, e.g. in evenings when there is no work carried out in the work zone, traffic may be directed automatically by a control device of the safety arrangement 3.

 The safety arrangement 3 according to the present disclosure may
30 thus be operated manually by an operator, such as e.g. a driver of an escort vehicle, an operator of a traffic management centre or a worker at the roadwork site, partially manually or automatically by a traffic control system.

As described hereinabove with reference to e.g. Fig. 1 a second traffic barrier may be located in the open lane at the exit of the traffic zone downstream the work zone, as seen in the direction of travel of the first lane. It is however appreciated that a second traffic barrier, which is located

5 downstream the work zone as seen in the direction of travel of the first lane, may instead be located in the first lane of the road.

CLAIMS

1. Roadwork safety arrangement (3) for directing traffic past a work zone (11)
5 located in a closed lane portion (7a) of a first lane (7) of a road (5) via a traffic
zone (13) located in an open lane (9) of the road (5),
c h a r a c t e r i z e d by
a first protection barrier (15) located in the first lane (7) upstream the
work zone (11), and
10 a first traffic barrier (17) located in the open lane (9) on the same side
of the work zone (11) as the first protection barrier (15),
wherein the first traffic barrier (17) comprises an arm (19) being
movable between a blocking position, in which it prevents vehicles to enter
said traffic zone (13), and a non-blocking position, in which it permits vehicles
15 to enter said traffic zone (13).
2. A roadwork safety arrangement (3) according to claim 1, further comprising
a first traffic light (21) capable of displaying a warning signal and located on
one side of the work zone (11) and a second traffic light (31) capable of
20 displaying a warning signal located on the other side of the work zone (11), as
seen in the direction of travel (A) of the first lane (7) of the road (5).
3. A roadwork safety arrangement (3) according to claim 2, wherein the first
traffic light (21) is located at a distance of at least 25 meters, more preferably
25 at a distance of at least 60 meters, from the first protection barrier (15).
4. A roadwork safety arrangement (3) according to any one of the claims 2-3,
wherein each of the first and second traffic lights (21, 31) is located on the
right side of the first lane (7) and the second lane (9), respectively.
30
5. A roadwork safety arrangement (3) according to any of the preceding
claims, further comprising a second protection barrier (25) and a second

traffic barrier (27), each of which is located downstream the work zone (11), as seen in the direction of travel (A) of the first lane (7) of the road (5).

6. A roadwork safety arrangement (3) according to any one of the preceding
5 claims, wherein at least the first traffic barrier (17, 27) is configured to wirelessly communicate with a control device, preferably via two-way radio communication.
7. A roadwork safety arrangement (3) according to claim 6, wherein at least
10 the first traffic barrier (17, 27) is connected to a local independent network via radio communication, preferably via two-way radio communication.
8. A roadwork safety arrangement (3) according to any one of the preceding
claims, wherein the safety arrangement (3) comprises a portable remote
15 control unit for operating at least one of the first and second traffic barriers (17, 27).
9. A roadwork safety arrangement (3) according to any one of the preceding
claims, further comprising an escort vehicle (35) for escorting vehicles (37,
20 39) pass the work zone (11).
10. A roadwork safety arrangement (3) according to any one of the preceding
claims, wherein each of the first protection barrier (15) and the first traffic
barrier (17) is mounted on a movable platform, such as a platform with
25 wheels.
11. A roadwork safety arrangement (3) according to any one of the preceding
claims, wherein the arrangement (3) comprises a third traffic barrier (43)
located on a connecting road (41).
30
12. A roadwork safety arrangement (3) according to any one of the preceding
claims, wherein the arrangement (3) comprises a third traffic light (47) located
on a connecting road (41).

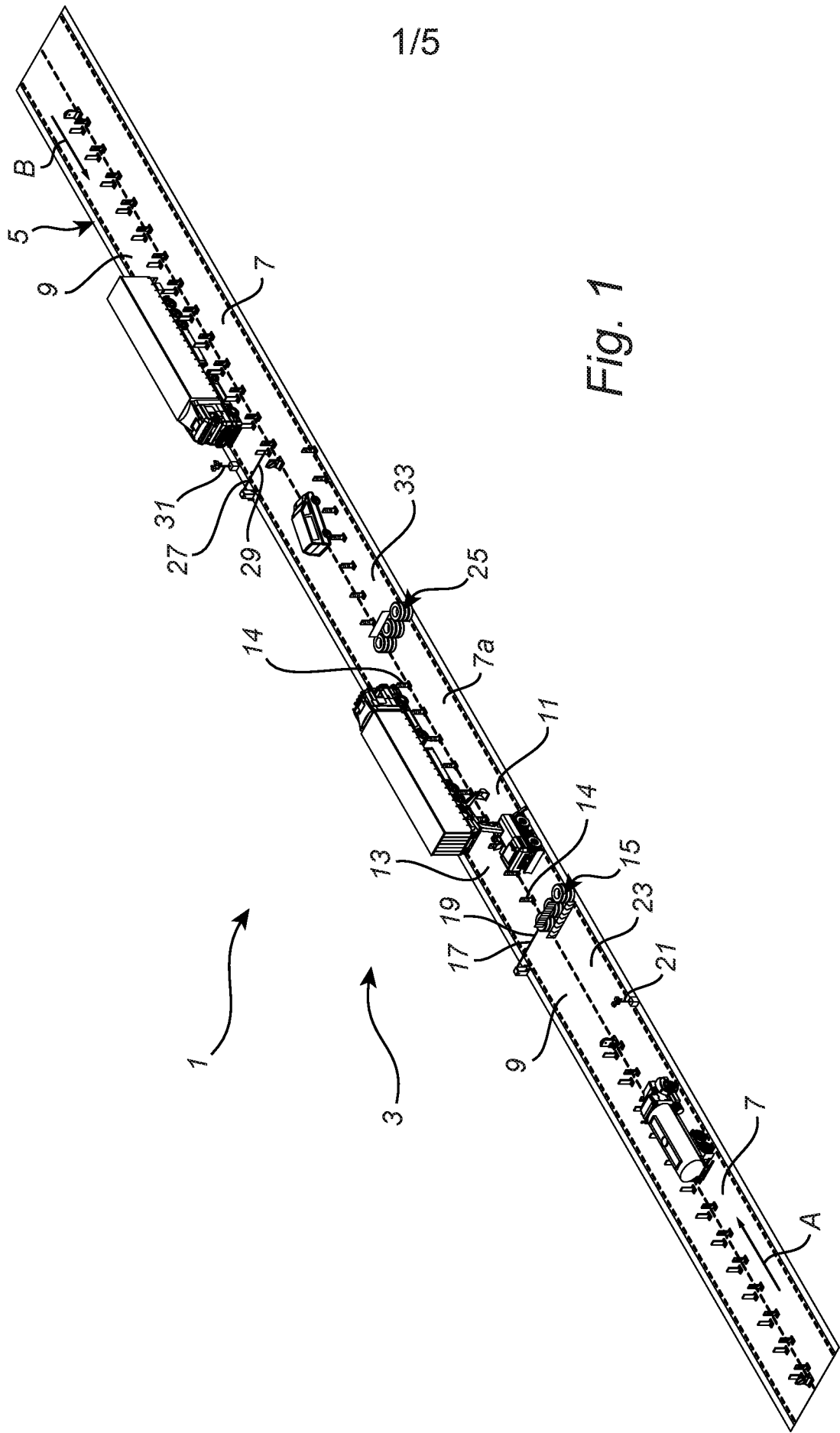
13. Method of directing traffic past a work zone (11) located in a closed lane portion (7a) of a first lane (7) of a road (5) via a traffic zone (13) located in an open lane (9) of the road (5), said method comprising:

- 5 placing a first traffic barrier (17) having a movable arm (19) in the open lane (9) at an entrance to the traffic zone (13),
 operating at least said first traffic barrier (17) wirelessly from an escort vehicle (35) using a portable remote control unit, and
 escorting vehicles (39) pass the work zone (11) via the traffic zone
10 (13).

14. Method according to claim 13, comprising placing a first protection barrier (15) in the first lane (7) upstream the work zone (11).

- 15 15. Method according to any one of the claims 13-14, comprising placing a first traffic light (21) capable of displaying a warning signal at an entrance to the traffic zone (13) and a second traffic light (31) capable of displaying a warning signal at an exit of the traffic zone (13).

- 20 16. Method according to any one of the claims 13-15, comprising connecting the first traffic barrier (17) to a local independent network via radio communication, preferably via two-way radio communication.



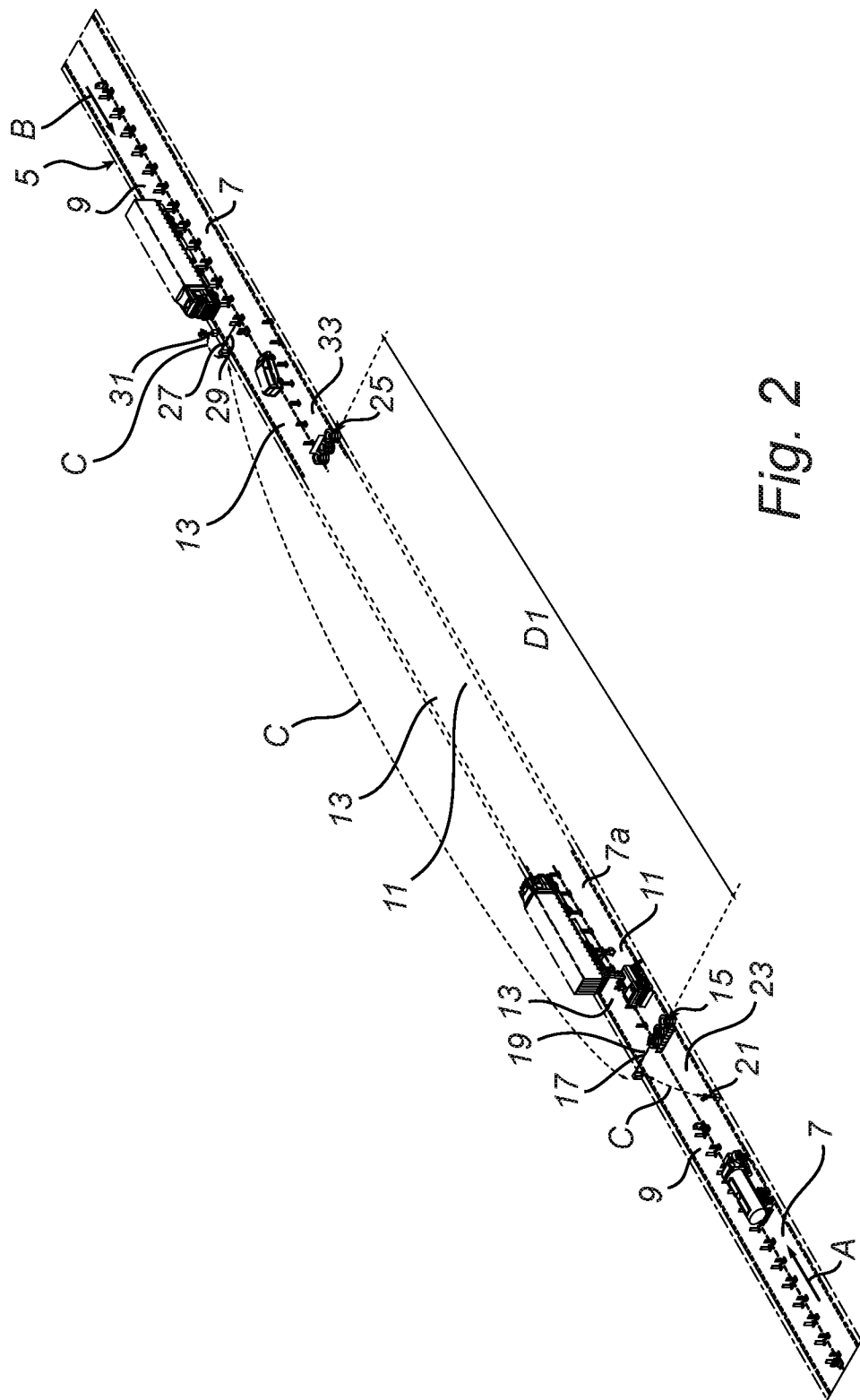


Fig. 2

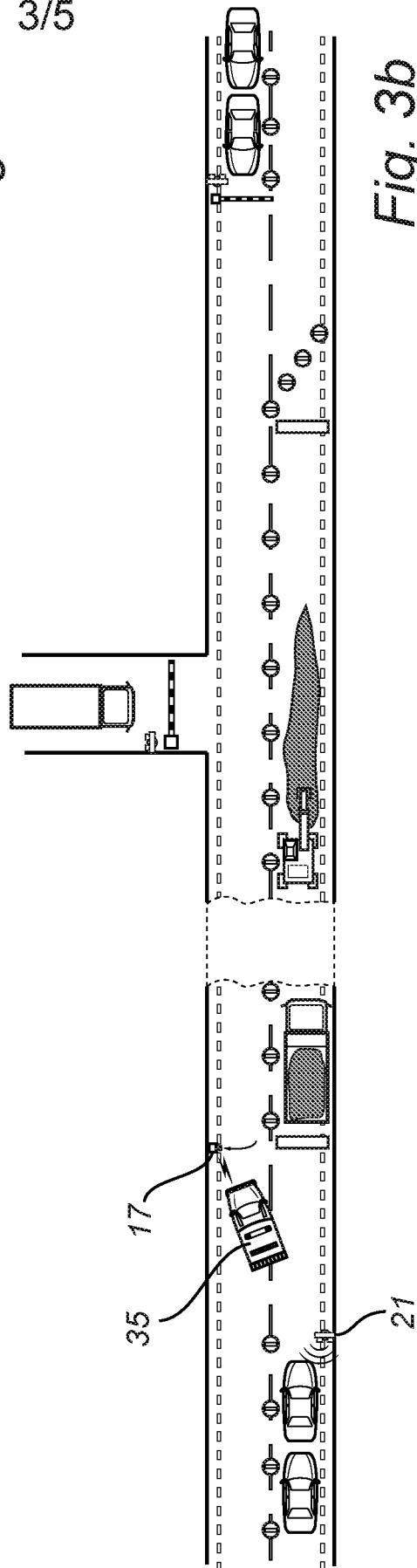
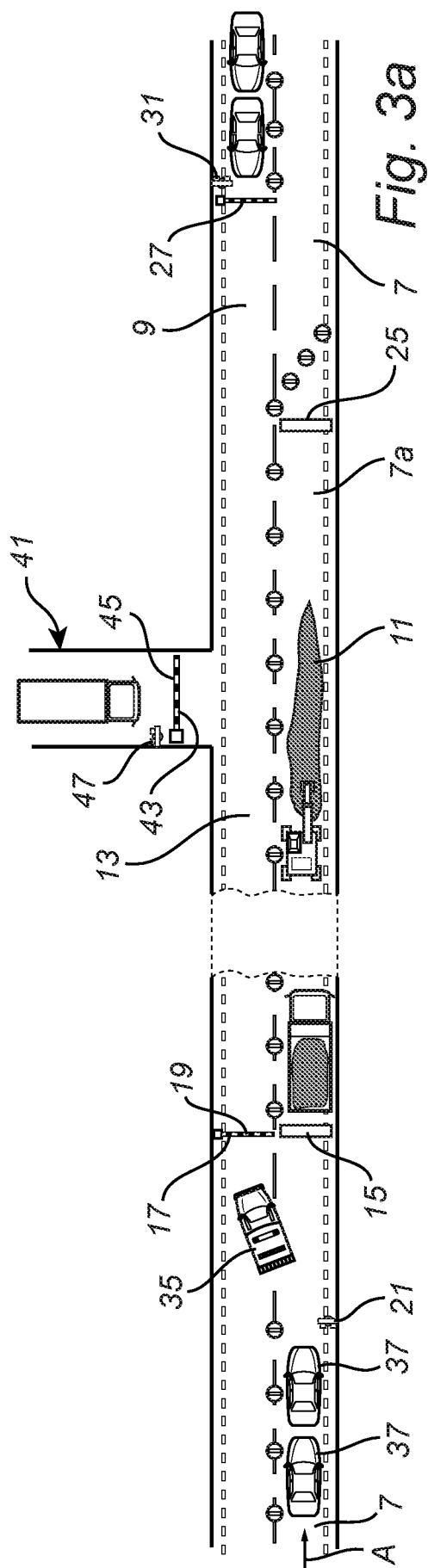
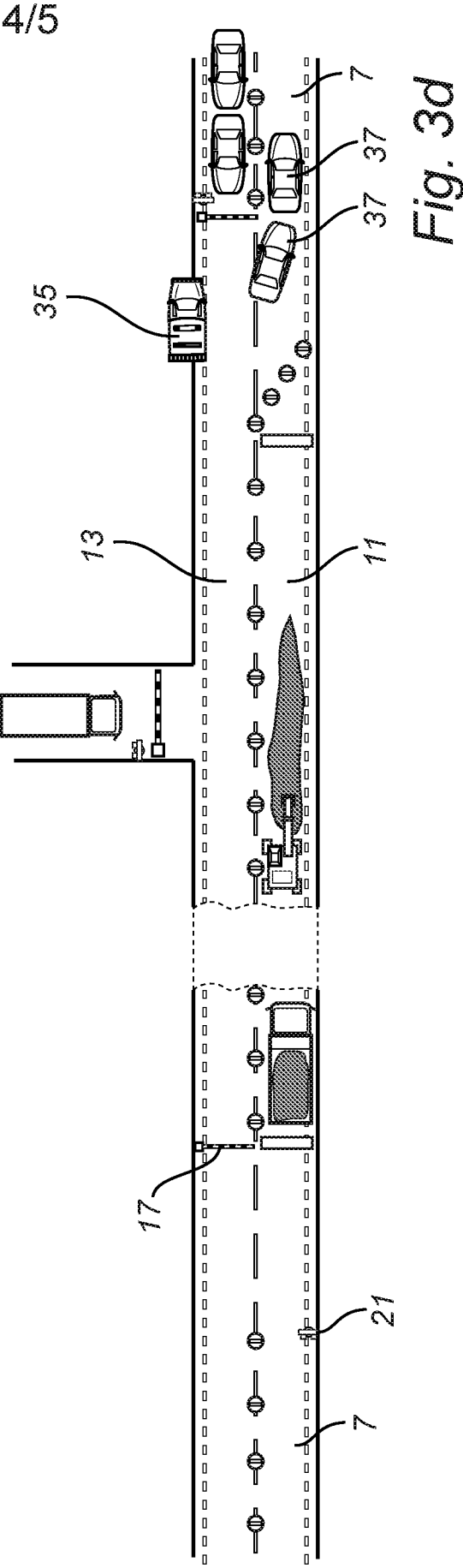
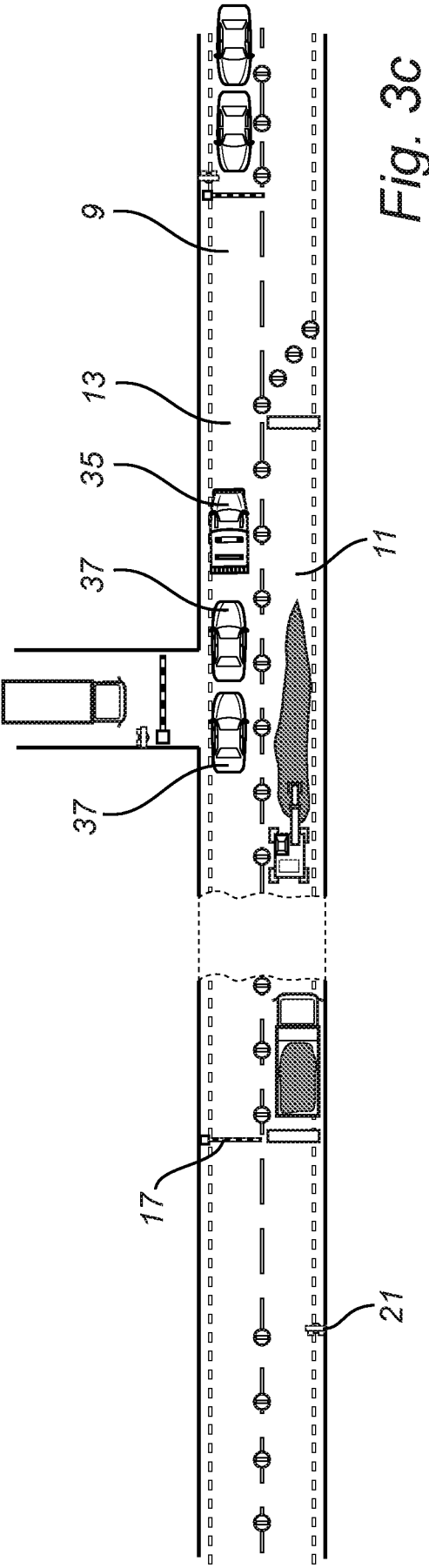


Fig. 3b



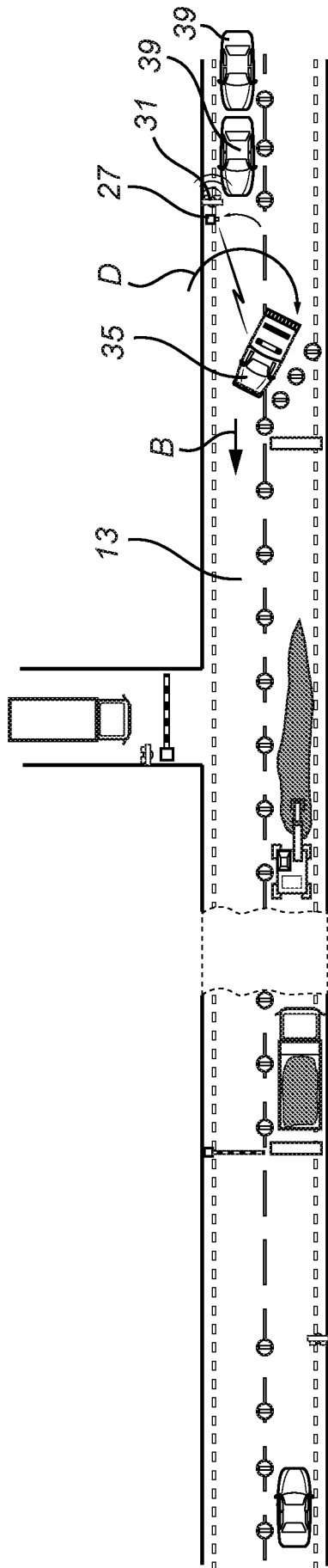


Fig. 3e

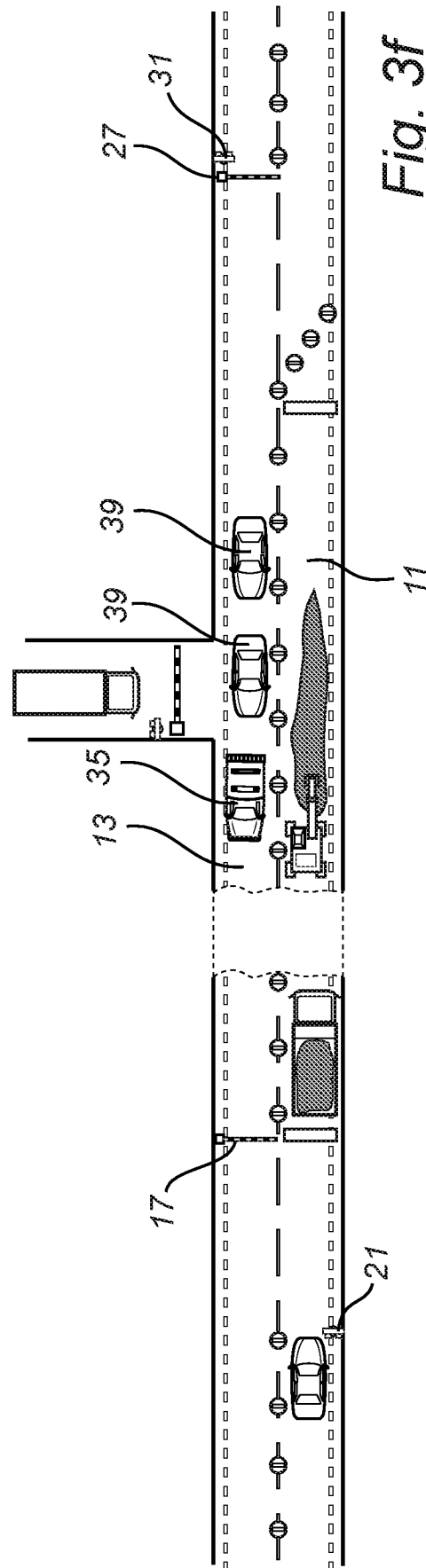


Fig. 3f

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2017/050422

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: E01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE, DK, FI, NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2000030188 A (SHINYOO KOGYO KK ET AL), 28 January 2000 (2000-01-28); paragraph [0025]; figures 1,4,8; WPI and EPO abstract --	1-16
A	US 5097790 A (MASSEY ROBERT L), 24 March 1992 (1992-03-24); abstract; column 1; column 9, line 35 - column 9, line 42; figure 1 --	1-16
A	TRVR Apv, 2012-05-07, ISBN 978-91-7467-271-8 Retrieved from internet [Retrieved 2017-07-03]: < http://www.trafikverket.se/contentassets/9d3e9519f5d445fc9c094f51f41006d5/trafikverkets_tekniska_rad_for_arbete_pa_va_g_.pdf >; page 28, heading 4.1.6 --	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

06-07-2017

Date of mailing of the international search report

07-07-2017

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2017/050422

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Article in HD, "Fjärrstyrd vägbom löser trafikproblem?". retrieved from internet[Retrieved 2017-07-03]: < http://www.hd.se/2005-07-08/fjarrstyrd-vagbom-loser-trafikproblem >, [published 2005-07-08] --	1-16
A	JP 11315517 A (SHINYOO KOGYO KK), 16 November 1999 (1999-11-16); abstract; figures 1,11; WPI abstract --	1-16
A	TW 406156 B (SHINYOO KOGYO K K), 21 September 2000 (2000-09-21); abstract; figures 1,11; WPI abstract --	1-16
A	EP 2362020 A1 (GIVASA S A), 31 August 2011 (2011-08-31); abstract; paragraph [0014]; figure 1; claim 1 -- -----	1-16

Continuation of: second sheet

International Patent Classification (IPC)

E01F 13/10 (2006.01)

E01F 13/02 (2006.01)

E01F 13/06 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2017/050422

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US	5097790 A	24/03/1992	NONE		
JP	11315517 A	16/11/1999	NONE		
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EP	2362020 A1	31/08/2011	NONE		